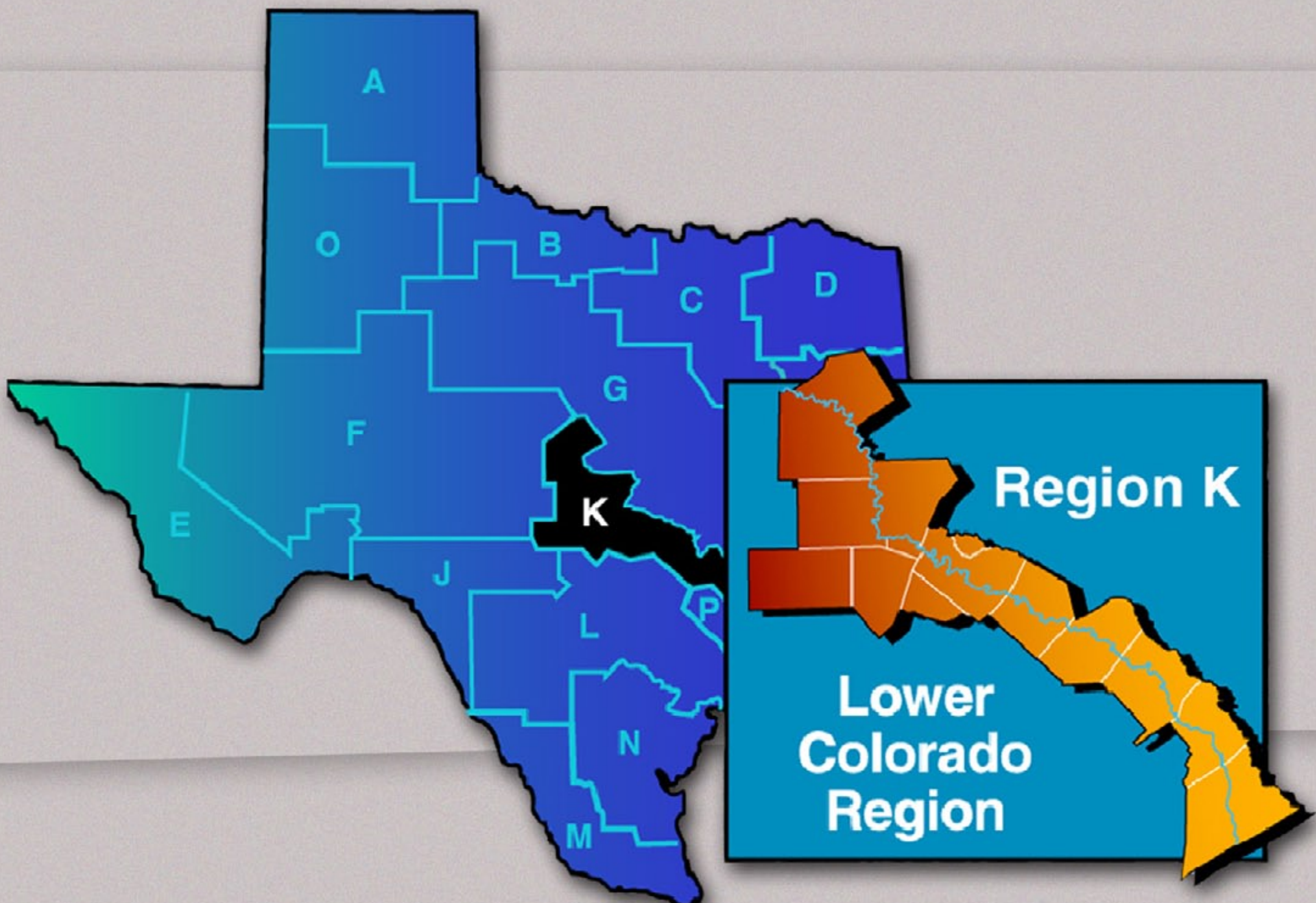
Adopted

Region "K" Water Plan for the Lower Colorado Regional Water Planning Group

Volume I



prepared by

Lower Colorado Regional Water Planning Group
with funding assistance from the Texas Water Development Board

prepared for

Texas Water Development Board

with assistance from

Turner Collie & Braden

in association with

Alan Plummer Associates, Inc.
Group Solutions RJW

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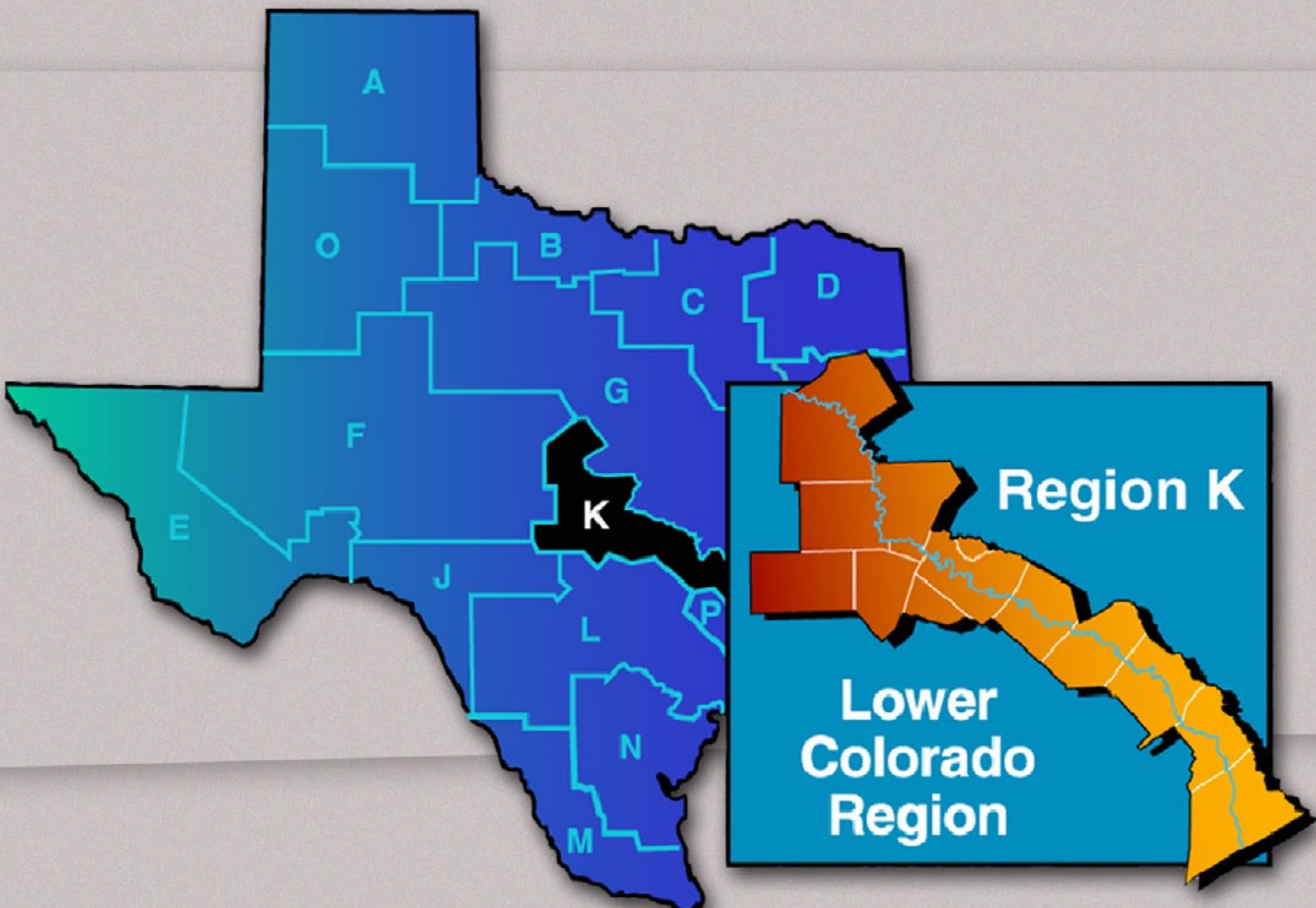
Volume II



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2006 Region "K" Water Plan
for the
Lower Colorado Regional Water Planning Group

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The Lower Colorado Regional Water Plan is dedicated in memory of the following individuals:

Mark Smith
Planning Group Member 1998-2002

Quentin Martin
Planning Group Member 1998-2003

Stanley G. Reinhardt
Planning Group Member 1998-2005

FOREWORD

The development of a reconnaissance level water plan such as the one that follows this forward serves several purposes. First and foremost, it applies the best available information to determine the water demands that will have to be met, and the available supplies to meet those demands. The difference between available supplies and demand for each water user group, or WUG, is either a surplus or a need. Needs are estimated for each decade so planners and city officials know when additional water is needed. Once the needs are determined, a listing of potential alternative strategies to meet those needs is assembled. These strategies are reviewed to determine how long it takes to implement them, what they will cost, to the extent that they are currently known or predicted, what will be the environmental impacts, etc. With that information, the planning groups make decisions about relative merits of different alternative strategies and combinations of strategies to try and come up with a plan that has strategies that can be built in time to meet the need, and which appear to have the most reasonable cost and the fewest environmental impacts. Again, much of the information that is used comes from existing studies, which are often in progress with only preliminary results available.

It is also important to distinguish what this regional plan is not. The level of detail in this plan is not sufficient for supporting any permitting decision before the Texas Commission on Environmental Quality. None of the alternatives proposed for inclusion in the plan have complete studies, fully know environmental impacts, and other features. Few alternatives, if any, have determined actual pipeline routings, placements for major plant facilities, locations of discharges, etc. In fact, few of the projects have the required local sponsors, financing, or any of a myriad of other requirements. All of that remains to be done during the permitting processes, during preliminary and final design, and during the financing and construction phases. These processes require a far greater level of detail and analysis and require the expenditure of far greater sums to achieve the level of accuracy needed to support a permitting action plan review or financing action. The purpose of this portion of the process is to try not to overlook something that might become a viable strategy. Further, the plan develops reconnaissance level costs with similar levels of accuracy so that projects that are obviously too costly or which have serious negative effects on the environment can be screened out and the serious permitting and design monies spent on projects with a greater likelihood of implementation.

For you, the reader, please be assured that the Lower Colorado Regional Water Planning Group, or LCRWPG, has many remaining concerns about the management strategies that are listed in this plan. The LCRWPG will continue to collect and review the results of additional studies, refine the analyses done with that information, seek to eliminate those strategies which cannot be implemented without significant detriment to the environment, and evaluate new strategies. Your participation and comments on this process are an integral part of ensuring that needs are met and environments are protected.

LCRWPG Water Plan

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Executive Summary

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ES. EXECUTIVE SUMMARY

ES.1 OVERVIEW

Following the guidelines set forth in SB 2, the Lower Colorado Regional Water Planning Group (LCRWPG) prepared this *Adopted Regional Water Plan* for the Lower Colorado Regional Water Planning Area (LCRWPA) (Region K) covering the 2000 to 2060 time period (2006 Plan). This plan has been submitted to the Texas Water Development Board (TWDB) for review and integration into a statewide water plan. The Plan includes a description of the region, population and water demand projections, water supply analyses, water management strategies for ensuring supplies during drought-of-record (DOR) conditions, water conservation and drought management plans, consistency with the state's long-term resource protection goals, policy recommendations related to improving water management and preserving the environment, and public involvement activities.

It should be noted that local plans that are consistent with the regional water supply plan are also eligible to apply for TWDB financial assistance even though they have not been specifically recommended in this plan. The plan is comprised of the following ten chapters:

Chapter 1: Introduction and Description of the Lower Colorado Regional Water Planning Area

Chapter 2: Population Projections and Water Demand Projections

Chapter 3: Identification of Currently Available Water Supplies

Chapter 4: Identification, Evaluation, and Selection of Water Management Strategies Based on Need

Chapter 5: Impacts of Water Management Strategies on Key parameters of Water Quality and Impacts of Moving Water From Rural and Agricultural Areas

Chapter 6: Water Conservation and Drought Management Plans

Chapter 7: Regional Plan Consistency with State's Long-Term Resource Protection Goals

Chapter 8: Additional Recommendations (Including Unique Ecological Stream Segments and Reservoir Sites, Legislative Issues, and Regional Policy Issues)

Chapter 9: Water Infrastructure Financing Recommendations

Chapter 10: Public Involvement Activities

The LCRWPG, representing the 11 TWDB-required interest groups and two additional regional interest groups (*Table ES.1*), was responsible for the development of the Lower Colorado Regional Water Plan.

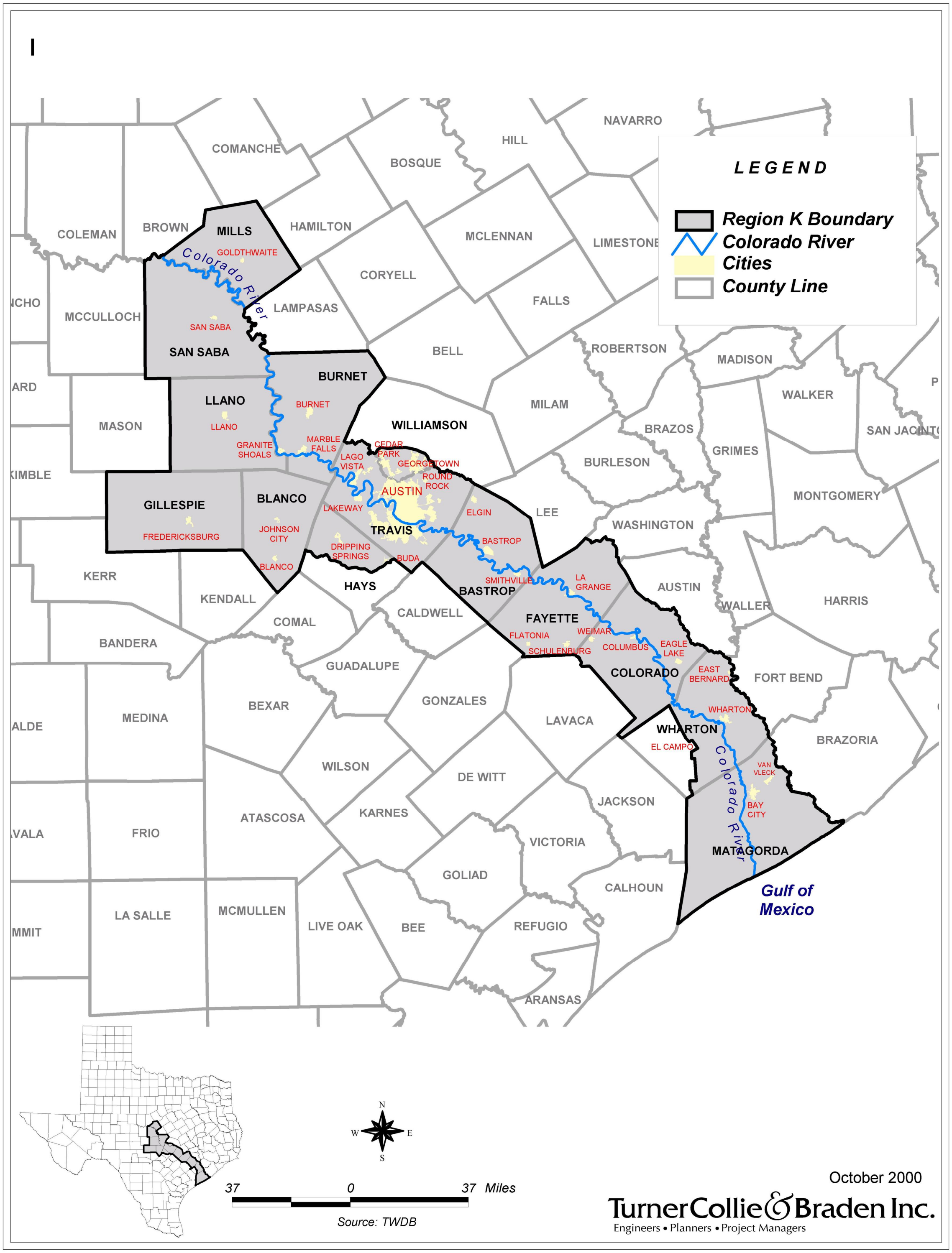
Table ES.1 The Lower Colorado Regional Water Planning Group Voting Board Members

Interest	Name	Entity	County	Contact
Public	Julia Marsden	League of Women Voters	Travis	512-306-1325
Counties	Chris King	Wharton County Commissioners Court	Wharton	979-335-7541
	Bill Neve	Burnet County Commissioners Court	Burnet	512-756-4729
	Billy Roeder	Gillespie County. Commissioners Court	Gillespie	830-997-7502
	James Sultemeier	Blanco County Commissioners Court	Blanco	830-868-4471
Municipalities	Dennis Jones	City of Lago Vista	Travis	512-267-7565
	Teresa Lutes	City of Austin	Williamson	512-972-0179
Industries	Barbara Johnson	Austin Area Research Organization, Inc.	Travis	512-477-4000
Agricultural	Bill Miller	Rancher	Llano	325-247-4074
	Haskell Simon	Rice Industry Rep. and Farmer	Matagorda	979-245-1708
Environmental	Jim Barho	Protect Lakes Inks, Buchanan	Burnet	512-756-8080
	Ron Fieseler	Blanco-Pedernales GCD	Hays	830-868-9196
	Jennifer Walker	Sierra Club, Lone Star Chapter	Travis	512-477-1729
Small Businesses	Ronald Gertson		Wharton	979-234-3130
	Harold Streicher	Assistant Fayette County Attorney	Fayette	979-968-8402
Electric. Generating Utilities	Rick Gangluff	STP Nuclear Operating Company	Matagorda	361-972-7879
River Authorities	Mark Jordan	LCRA	Travis	512-473-4023
Water Districts	Paul Tybor	Hill Country UWCD	Gillespie	830-997-4472
Water Utilities	John Burke	Aqua WSC	Bastrop	512-303-3943
Other(s)	Roy Varley		Mills	325-648-2333
	Bob Pickens		Colorado	979-732-5058
Recreation	Del Waters	The Ski Dock	Travis	512-918-2628

ES.2 INTRODUCTION AND BACKGROUND

The Lower Colorado Region—designated by the TWDB as Region K—consists of all or parts of 14 counties roughly consistent with the Lower Colorado River Basin (see *Figure ES.1*).

Figure ES 1: Lower Colorado Regional Water Planning Area (Region K)



This area relies primarily on the Colorado River; the Gulf Coast, Carrizo-Wilcox, Edwards, Trinity, and Edwards-Trinity (Plateau) aquifers; and several minor aquifers for its water supply. Small portions of the Brazos, Guadalupe, and Lavaca River Basins also lie within the region. In total, about 27 percent of dependable yield water supplies during DOR conditions come from groundwater, while the remaining 73 percent are provided by surface water.

The region stretches from arid and rocky Hill Country counties that receive an average of 24 inches of rainfall annually to the humid Coastal Plain, which receives an average of 44 inches of rain per year. Average annual stormwater runoff ranges from about 350 acre-feet per square mile (ac-ft/sq mi) near the mouth of the Colorado River to less than 50 ac-ft/sq mi in the western portion of the region. During the 1950s drought, used as the DOR for calculation purposes in Region K's Plan, both of these average annual runoff values declined by about 75 percent.

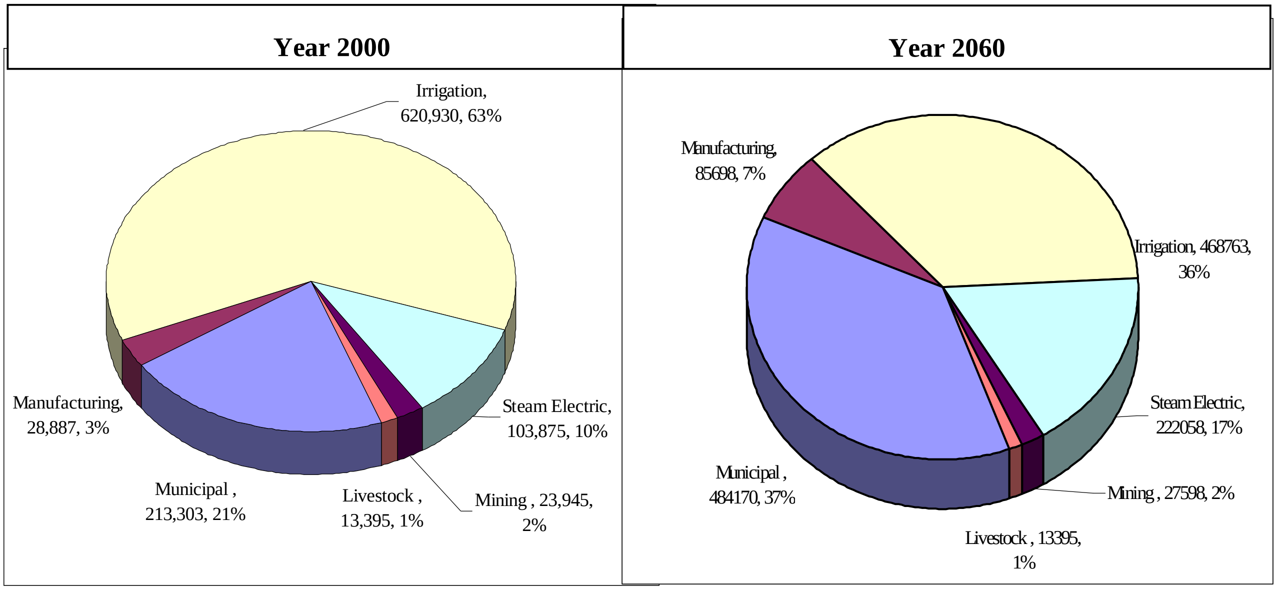
The system of Highland Lakes administered by the Lower Colorado River Authority (LCRA) is a major hydrologic feature of the region that provides flood control, power generation, water storage, and recreational benefits.

ES.3 POPULATION AND WATER DEMANDS

About 77 percent of the region's population of approximately 1.1 million is currently concentrated in the rapidly growing Austin metropolitan area, which includes Travis and parts of Williamson and Hays Counties. By 2060, the population of the region as a whole is projected to more than double (2.7 million). Each of the 14 counties in the region are projected to grow significantly over the planning period, with Travis County continuing to account for nearly 75 percent of the total population for the region. The vast majority of the population growth is expected in the geographic "middle" counties (i.e., Blanco, Burnet, Hays, Travis, Williamson, Bastrop, and Fayette Counties).

The region's population now consumes about 1.0 million ac-ft of water each year, with 64 percent used for agricultural and livestock purposes, 21 percent put to municipal use, 5 percent devoted to mining and manufacturing, and the remaining percentage to electric power generation (see *Figure ES.2*). As *Figure ES.2* shows, this pattern of use is expected to change over the planning period, such that the volume of irrigation use will decrease slightly, and the proportion of total use it represents will decline significantly. The total regional water demand is projected to increase to approximately 1.3 million ac-ft/yr by the year 2060. Chapter 2 includes details concerning the population and water demands projections and how they were developed.

Figure ES.2: LCRWPA Water Demands (ac-ft/yr) – Year 2000 and Year 2060



ES.4 WATER SUPPLIES

Water supplies in the LCRWPA are available from 10 aquifer systems and alluvial groundwater and 6 river and coastal basins. The Colorado River Basin makes up the single largest source of surface water for the region with large volumes of water available from both run-of-river (ROR) diversion rights and water stored in reservoirs. Water available in the LCRWPA was found to total nearly 1,300,000 ac-ft/yr, of which over 73 percent is from surface water sources.

Initial surface water supplies for DOR conditions for the Colorado River Basin were developed using the Texas Commission on Environmental Quality (TCEQ) November 2004 WAM (Water Availability Model) Run 3. This conservative model predicts water availability under DOR conditions and assumes maximum surface water diversions with no return flows to streams. However, review of the model results demonstrated a shortage of firm yield water in reservoirs in Region F. Region F requested a meeting with Region K and presented the issue to the LCRWPG. The key issue is that downstream water rights holders with more senior rights have the ability to "call" on inflows from the upper reaches of the Colorado River watershed. This "call" would mean that flows from the watershed that come into the upper reservoirs would have to be passed through even if the upper reservoirs were nearly empty, in order to meet the priority calls from downstream water rights holders. TWDB staff noted that the plans would be in conflict if Region F showed water being impounded upstream and Region K included that amount in its supply determination. The two regions were requested to try to work out the potential conflict. The result was the development of a WAM that was modified to include a planning assumption whereby upstream water to meet downstream priority rights would not be released until some portion of the upstream needs were satisfied. This "No Call" assumption does not have legal standing and does not impact the seniority of owner's rights. This is a planning level assumption only that was agreed to by the LCRWPG solely to avoid a potential conflict with Region F. Region K supports efforts over the interim period before the next planning round to investigate the technical issues related to the WAM as described in Sections 3.2.1.2.6 and 3.2.1.2.7. This model produced firm yields for the Colorado River Basin that would be used by both Planning Regions in order to avoid conflict in later phases of the planning process.

Information from WAM Run 3 runs were used when available for determining firm supplies in other basins of the LCRWPA. Local supplies (stock ponds, etc.) were assumed to be consistent with numbers previously evaluated in the 2001 Plan.

Groundwater supplies were developed from the best information available from Groundwater Availability Models (GAMs), local information from Groundwater Conservation Districts (GCDs), or information from the previous LCRWPA Plan (2001). Both surface water and groundwater availability for the LCRWPA are shown in *Table ES.2*.

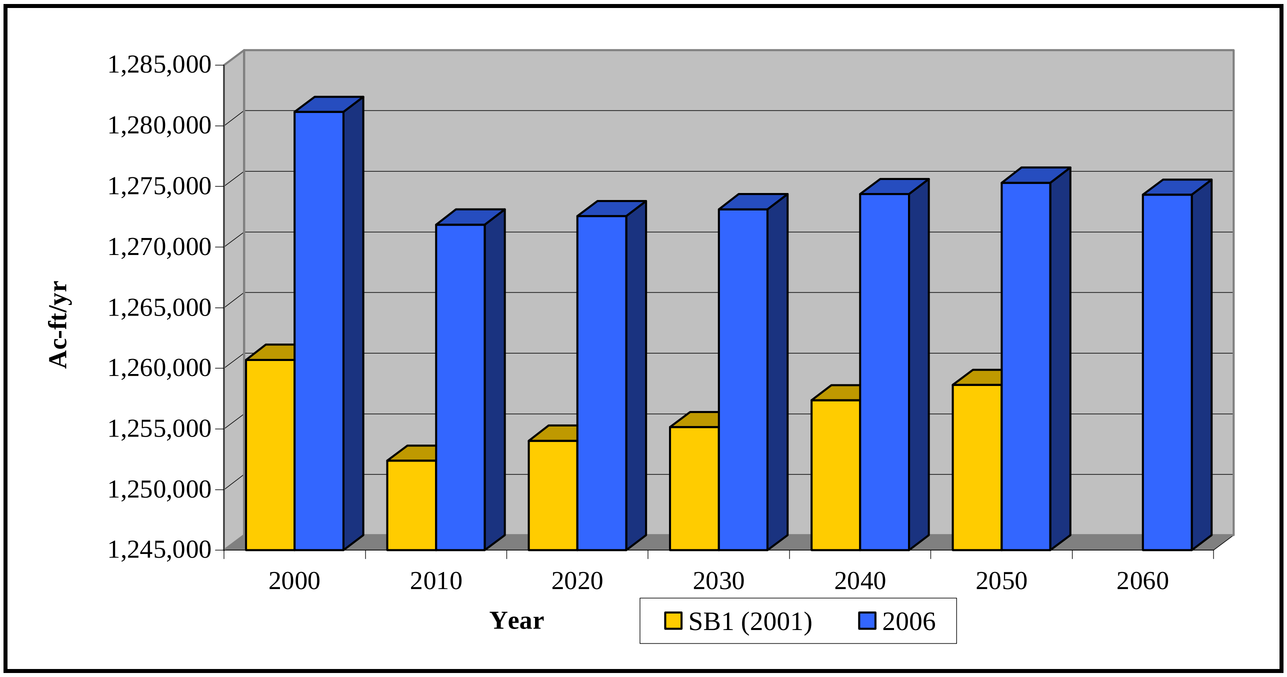
Table ES.2 Groundwater and Surface Water Supplies Available to the LCRWPA

Supply Source	Available Supply (acre-feet per year)		
	Year 2000	Year 2030	Year 2060
Groundwater			
Gulf Coast Aquifer	198,425	198,425	198,425
Carrizo-Wilcox Aquifer	28,400	28,400	28,400
Edwards Aquifer (Balcones Fault Zone)	8,375	8,375	8,375
Trinity Aquifer	16,782	16,440	15,717
Edwards-Trinity (Plateau) Aquifer	1,657	1,657	1,659
Hickory Aquifer	27,380	27,380	27,380
Queen City Aquifer	3,991	3,991	3,991
Sparta Aquifer	9,889	9,889	9,889
Ellenburger-San Saba Aquifer	23,574	23,574	23,574
Marble Falls Aquifer	18,305	18,305	18,305
Other Aquifer [1]	13,558	13,611	13,632
Groundwater Subtotal	**350,336**	**350,047**	**349,347**
Surface Water [2]			
Brazos River Basin	566	566	566
Brazos-Colorado Coastal River Basin [3]	9,649	9,787	9,894
Colorado River Basin [4]	910,730	902,857	904,652
Colorado-Lavaca Coastal River Basin	4,289	4,289	4,289
Lavaca River	4,671	4,671	4,671
Guadalupe River Basin [5]	903	903	903
Surface Water Subtotal	**930,808**	**923,073**	**924,975**
Supplies From Other Regions [6]	**2,127**	**713**	**1,041**
TOTAL LCRWPA Water Availability	**1,283,271**	**1,273,833**	**1,275,363**

[1] Other Aquifer refers to alluvial aquifer water supplies.
[2] Includes local supplies determined from 2001 Plan.
[3] Includes a water right from the San Bernard River with unconfirmed reliability.
[4] Includes firm supplies determined from "No Call" Colorado River WAM for reservoirs and run-of-river water rights.
[5] Includes firm supplies determined from Guadalupe River Basin WAM.
[6] Includes groundwater and surface water from the Brazos, Colorado, and Guadalupe River Basins.

In comparison to water availability in each decade described in the 2001 Plan, total water availability for every decade in this Plan (2006) is higher. *Figure ES.3* shows a comparison of the water availability used in developing the 2001 Plan to the water availability for the 2006 Plan (supplies from other regions were not included in this comparison).

Figure ES.3: LCRWPA Water Availability – 2001 vs 2006



The total amount of water supply for the water user groups (WUGs) in Region K is less than the total available water to the region presented in *Table ES.2*. This condition exists because WUGs generally balance current needs with cost of water and provide additional supplies as they are needed throughout the planning period. As an example, a WUG on groundwater with a current need of 1 million gallons per day (mgd) will not drill wells to provide 10 mgd to meet its future needs. The water may still be available in the aquifer, but the WUG only has the capability to serve its current needs plus some adequate factor of safety. In general, water supplies for the WUGs are responsive to current needs, location relative to the source, and infrastructure limitations. There is water available in Region K that is not currently being used by WUGs because they do not have the needs right now, or they do not have the means to utilize the source at this time.

ES.5 IDENTIFIED SHORTAGES

The water supplies (Chapter 3) and projected demands (Chapter 2) for each WUG were compared to determine where shortages, or "needs," are expected to occur. The comparison identified 99 WUGs that would have projected water deficits by the year 2030 under DOR conditions. An additional 19 WUGs are shown with projected water deficits arising between 2030 and 2060.

The estimated water need under DOR conditions for all of Region K is approximately 281,000 ac-ft/yr in 2030 and 557,000 ac-ft/yr in 2060. This identified shortage is based on availability estimates, which exclude water available from LCRA on an interruptible basis and water available as a result of return flows to the Colorado River. In addition, per TWDB rules, the identified shortages include those where contracts for water with a wholesale water provider (WWP) expire during the planning period. Contract renewals for LCRA alone provide 341,370 ac-ft/yr for meeting shortages identified through contract expirations. Water needs have been identified in all of the six water use categories, as shown in *Figure ES.4*, which illustrates the distribution of the number of WUGs with identified water needs in the years 2030 and 2060. *Figure ES.5* shows the magnitude of the identified needs by water use category for the years 2030 and 2060.

Note in *Figures ES.6* and *ES.7* that the category with the largest number of user groups with potentially unmet needs and the greatest total 2060 regional shortage is in the category of municipal users. Irrigation shortages, which are expected to be the largest shortage in 2030, are reduced in 2060.

Figure ES 4: Number of LCRWPA Water User Groups With Needs

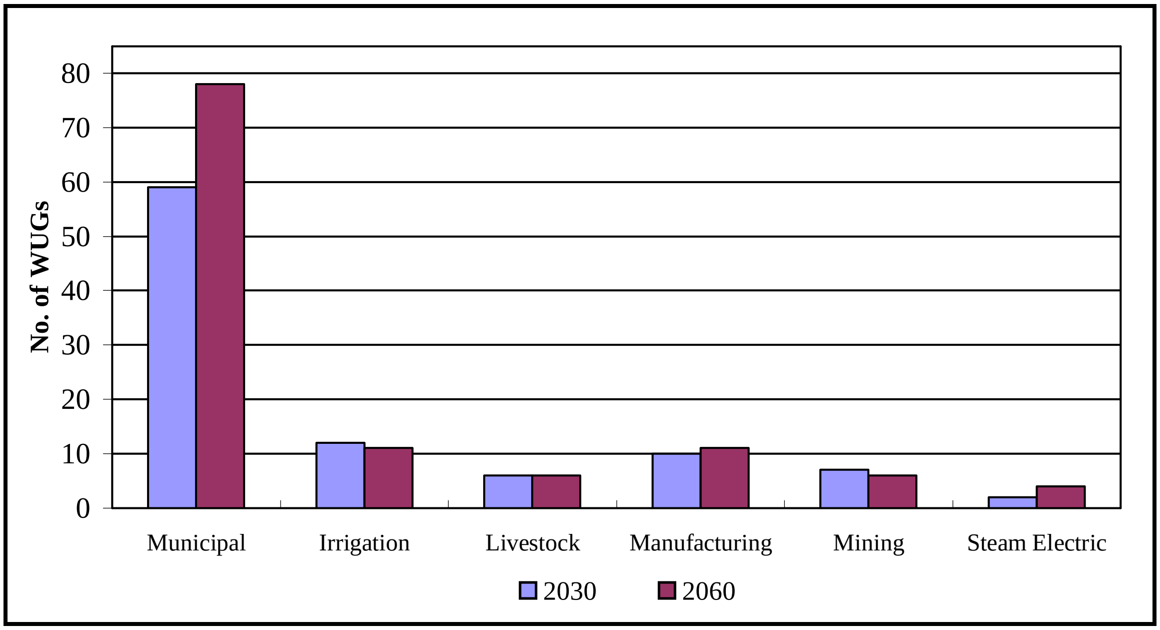
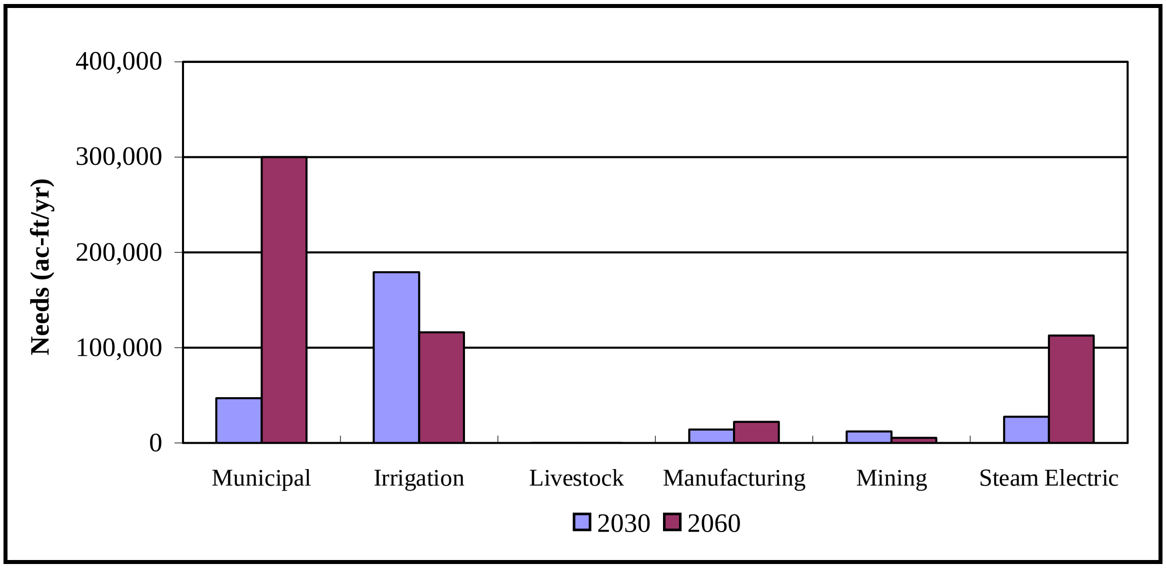


Figure ES 5: LCRWPA Identified Water Needs by Category of Use



ES.6 MANAGEMENT STRATEGIES AND IMPACTS

Several management strategies were assembled to provide for the unmet water needs identified above. Many of the shortages were met with the extension of existing contracts, new contracts, or allocation of existing supplies. Other strategies are more extensive and will require the implementation of conservation measures or the construction of additional infrastructure.

ES.6.1 Utilization of Return Flows

Approximately 60 percent of all municipal diversions by the City of Austin (COA) and others are currently returned to the Colorado River as effluent discharges. Unless otherwise authorized by permit, once discharged to the river, this water is subject to diversion under existing water rights' permits. Further, state law currently allows a water right holder to directly reuse all of its effluent unless its permit restricts such use. As recognized elsewhere in this Plan, control and ownership of these return flows is the subject of litigation. The November 2004 version of the WAM for the Colorado River that was used for this round of planning (with the "No Call" modifications) excludes all sources of return flows in the model.

This exclusion of return flows in the model leads to identification of water shortages for entities that currently use and rely upon the return flows. For purposes of this plan, the strategies considered projected return flows discharged by the COA, the City of Pflugerville, and Aqua Water Supply Corporation. Strategies related to COA's reuse of treated effluent are described in Chapter 4. This plan assumed projected levels of effluent to be discharged by the City of Pflugerville and Aqua Water Supply Corporation of 60 percent of the total projected demand for raw water in 2060, or about 10,000 ac-ft/yr. Effluent not being reused by Austin as a strategy and these other projected levels of effluent were made available to water rights according to the prior appropriation doctrine. Therefore, return flow assumptions for purposes of developing LCRA's water strategies set forth herein incorporate and reflect the COA's proposed strategies of direct reuse of effluent to meet municipal demand and demand at the Sand Hill Energy Center in Travis County and indirect reuse of effluent to meet the City's demands at the Fayette Power Project. These assumptions were included for planning purposes only and are not intended to lend support for or constitute a waiver of any arguments in any pending litigation. *Table ES.3* shows the estimated amount of return flows that would be released to the river.

Table ES.3 Estimated Return Flows (ac-ft/yr)

Return Flows	2000	2010	2020	2030	2040	2050	2060
Projected COA Effluent minus reuse	96,167	90,701	99,974	102,902	104,423	112,406	117,464
Projected Pflugerville and Aqua WSC Effluent				1,000	4,000	7,500	10,000

ES.6.2 Wholesale Water Provider (WWP) Management Strategies

LCRA and COA provide water to a large portion of the LCRWPA. Management strategies implemented at the WWP level are capable of alleviating the majority of the shortages within the LCRWPA. *Table ES.4* shows the strategies associated with each of these WWPs and the amounts of water made available to meet the needs of WUGs with shortages.

Table ES.4 WWP Water Management Strategies

WWP	Strategy	Supply From WMS (acre-feet per year) 2000	2010	2020	2030	2040	2050	2060
LCRA [2]	Irrigation Water Right Amendments [1]	(24,000)	(43,000)	(47,000)	(55,000)	(65,000)	(65,000)	(106,600)
	New Contracts	0	0	290	6,833	7,756	8,401	9,115
	Contract Renewals and Amendments [3]	0	7,576	25,974	60,331	108,015	160,296	352,764
	Contract Reductions [4]	0	(22,392)	(22,493)	(22,594)	(22,695)	(22,796)	(27,898)
City of Austin	Conservation	2,000	7,600	13,000	18,800	25,000	29,500	33,537
	Reuse (Municipal & Manufacturing)	2,000	7,600	13,000	18,800	25,000	29,500	33,537
	Reuse (Steam Electric) Fayette	0	9,810	10,004	13,418	21,272	21,386	27,411
	Reuse (Steam Electric) Travis	0	1,680	2,881	7,083	8,285	12,486	13,690
	LCRA Contract Renewal (Municipal)	0	0	0	0	0	0	140,323
	LCRA Contract Renewal (Steam Electric)	0	0	0	3,500	3,500	3,500	35,165
	Contract Renewals	0	2,399	2,355	5,557	5,441	5,388	5,388

[1] These amendments are proposed to meet increased municipal and industrial demand within the lower Colorado River Basin and are also a necessary component of the LSWP.

[2] LCRA's irrigation strategies are discussed in Section ES.6.5.

[3] Includes 140,323 and 31,665 ac-ft/yr contract renewals to COA in 2060. These values are also counted below as a COA strategy.

[4] Reduction in LCRA commitments due to improved efficiency at Ferguson and COA steam electric power strategies.

ES.6.2.1 LCRA Management Strategies

LCRA proposes the use of portions of its Garwood, Pierce Ranch, Lakeside, and Gulf Coast Irrigation Districts' irrigation rights as well as the Highland Lakes as a system for meeting municipal and industrial needs throughout the basin. These amendments to the existing water rights would be made possible through conservation and other programs to reduce overall irrigation demands in the lower basin as part of the Lower Colorado River Authority-San Antonio Water System (LCRA-SAWS) Water Project (LSWP). These ROR rights could be reallocated by incorporating them into a system operation yield through the use of off-channel reservoirs to capture unused firm yield water as well as some peak flows. An amount of the additional yield created by the LSWP, totaling 150,000 ac-ft/yr, is intended for use by Region L in meeting their needs on a temporary basis until up to 2090. In addition, the LCRA is seeking a permit for the remaining unappropriated flows in the Colorado River Basin to help meet future water needs in this basin and in San Antonio.

A portion of this water would be available to expand existing contracts within the basin and provide water to new customers. The Plan also recommends the amendment of existing contracts to better allocate supplies to needs in the LCRWPA.

ES.6.2.2 COA Management Strategies

The COA plans to meet its future needs with a combination of conservation, municipal effluent reuse, and additional contract water from LCRA. The COA conservation program has been successful at making significant impact upon peak and average water demands, and this strategy aims to further reduce demands placed on the city's supplies by continuing these efforts. Reclaimed water will be used, either directly or indirectly, to provide for municipal, manufacturing, and steam electric demands, and this resource will be used in a continuously greater capacity through the decades of the planning period. These supplies, along with increased supplies from LCRA, will allow COA to meet its own demands and the needs of its wholesale customers, including contract extensions for six current customers.

ES.6.3 Regional Water Management Strategies

For municipal WUGs with shortages, water conservation was considered before these regional strategies. Amounts of water produced from conservation strategies are show in *Table ES.10*.

The strategies selected to provide for unmet needs on a regional basis include expansion of current groundwater supplies, development of new groundwater supplies, and the transfer or allocation of water from WUGs that have an anticipated surplus through 2060. The expansion of current groundwater supplies involves the pumpage of additional water from groundwater sources by WUGs already served by groundwater. WUGs that are recommended to develop new groundwater supplies will need to construct new well fields to obtain the additional supplies. The transfer and allocation of water is intended to utilize water that is in excess of a WUG's anticipated demands through the 2060 decade. Temporary aquifer overdrafting was recommended for a few WUGs in the LCRWPA, to be carried out only when maximum demands corresponded with minimum anticipated supplies.

Table ES.5 lists aquifers recommended for expansion of current groundwater supplies and the amount of additional water supplies obtained from each. This strategy will provide supplies to WUGs in Bastrop, Burnet, Colorado, Fayette, Hays, Llano, Matagorda, Mills, Travis, and Wharton Counties.

Table ES.5 Expansion of Current Groundwater Supplies

Aquifer	Water Management Strategies (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Carrizo-Wilcox	6	4,301	4,644	6,317	3,895	7,984	12,891
Edwards-BFZ	0	17	110	207	305	422	513
Ellenburger-San Saba	19	38	61	90	122	152	243
Gulf Coast	222	4,502	4,277	3,670	2,584	1,212	1,456
Hickory	62	62	62	62	261	261	261
Marble Falls	437	681	756	788	836	1,143	1,591
Queen City	321	98	40	40	31	24	17
Sparta	59	188	208	129	129	129	129
Trinity	755	945	1,166	1,423	1,404	1,439	1,393
Other Aquifer	0	0	0	0	0	300	791
TOTAL	**1,881**	**10,832**	**11,324**	**12,726**	**9,567**	**13,066**	**19,285**

The strategy to develop new groundwater supplies will require the construction of new well fields to deliver groundwater to WUGs in Bastrop, Colorado, Fayette, Hays, and Llano Counties. The new supplies from this strategy are shown in *Table ES.6*.

Table ES.6 Development of New Groundwater Supplies

Aquifer	Water Management Strategies (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Carrizo-Wilcox	0	0	0	0	0	23	1,012
Ellenburger-San Saba	478	478	478	478	442	386	334
Trinity	0	0	394	869	1,354	1,932	2,224
Other Aquifer	22	4,291	4,291	4,370	4,582	4,839	5,180
TOTAL	**500**	**4,769**	**5,163**	**5,717**	**6,378**	**7,180**	**8,750**

The transfer strategy was utilized for WUGs with shortages that are located in multiple counties or basins. This strategy moves the surplus from the county/basin with the surplus to the one with the shortage. The WUGs receiving the transferred supplies are shown in *Table ES.7*.

Table ES.7 Transfer Water Strategy

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Creedmoor-Maha WSC	Bastrop	Colorado			3	8	12	19	30
Manville	Bastrop	Colorado						7	52
Lee County WSC	Fayette	Colorado			48	117	171	232	319
Goforth WSC	Travis	Colorado		3	14	23	30	38	43
TOTAL			**0**	**3**	**65**	**148**	**213**	**296**	**444**

The allocate water strategy typically moves water from a County-Other WUG to various WUGs with shortages in the same county. The supplies that are being reallocated were estimated in the 2001 Plan. The water demands have changed and the number of WUGs included in County-Other has changed since the last plan; therefore, this strategy involves adjusting the 2001 supply allocation estimates to better represent the current plan conditions. The WUGs receiving the allocated supplies from this strategy are shown in *Table ES.8*.

Table ES.8 Allocate Water Strategy

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Manufacturing	Blanco	Colorado	1	1	1	1	1	1	1
Manufacturing	Llano	Colorado	2	3	3	3	3	3	3
Orbit Systems Inc	Matagorda	Colorado-Lavaca	2	2	2	2	2	2	2
Brooksmith SUD	Mills	Colorado				7	7	7	7
Manufacturing	Mills	Colorado	1	1	1	1	1	1	1
Irrigation	Travis	Guadalupe	68	124	114	105	97	89	82
TOTAL			**74**	**131**	**121**	**119**	**111**	**103**	**96**

Temporary aquifer overdrafting was found to be the most cost-effective strategy for four WUGs in the LCRWPG. During drought, these WUGs would use groundwater in excess of the sustainable yield of the aquifer to meet their needs. This strategy would only be required to meet drought shortages and would not pose a long-term impact on the aquifer. *Table ES.9* lists the WUGs that this strategy has been recommended for and the supplies expected to be pumped in excess of the groundwater sustainable yield.

Table ES.9 Temporary Overdraft of Aquifers

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Irrigation	Bastrop	Brazos	34	21	10				
Manufacturing	Hays	Colorado				6	126	234	333
Manufacturing	Matagorda	Colorado							47
Llano	Llano	Colorado	176	176	97	27			
TOTAL			**210**	**197**	**107**	**33**	**126**	**234**	**380**

ES.6.4 Municipal Water Management Strategies

Various municipal water management strategies were selected in addition to the regional management strategies recommended above. Water conservation was a general strategy and was applied to a number of WUGs throughout the LCRWPA, while other strategies were intended for individual WUGs or groups of WUGs.

Conservation was recommended as the first strategy for all municipal WUGs within the LCRWPA that were expected to have a shortage and had a per capita demand in excess of 140 gallons per capita per day (gpcd). The LCRWPG recommends a 1 percent reduction in per capita use annually for all municipal WUGs with shortages and per capita usage above 140 gpcd. *Table ES.10* shows the total reduction in water demand in each WUG by decade and county.

Table ES.10 Municipal Water Conservation by County

County	Supply From Conservation (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Bastrop	0	185	295	481	682	813	991
Burnet	0	265	626	1,041	1,501	2,037	2,676
Fayette	0	21	43	68	81	83	90
Hays	0	105	294	483	558	666	755
Llano	0	279	544	771	906	1,039	1,166
Mills	0	48	94	137	174	206	238
San Saba	0	13	22	19	15	14	15
Travis	0	1,910	4,107	6,166	7,909	9,844	11,843
Wharton	0	41	29	18	8	4	4
Williamson	0	80	50	21	0	0	0
TOTAL	**0**	**2,947**	**6,104**	**9,205**	**11,834**	**14,706**	**17,778**

Other strategies to reduce needs for specific WUGs can be categorized into three types of strategies:

- Water transmission strategies
- Reservoir strategies
- Other strategies

Table ES.11 lists each strategy and WUG with its associated supply of water it would receive from the strategy.

Table ES.11 Municipal Water Management Strategies

Strategy	WUGs	Supply From WMS (ac-ft/yr)						
		2000	2010	2020	2030	2040	2050	2060
Water Transmission								
Canyon Lake WS to Blanco County	Blanco, Blanco County-Other	225	225	825	825	825	833	863
GBRA Hays County Pipeline	Buda, Hays County-Other		2,800	2,800	2,800	2,800	2,800	2,982
Purchase SW From COA	Hays County-Other		1,100	1,100	1,100	1,100	1,100	1,100
HB 1437	Chisolm Trail SUD, Round Rock	3	144	277	393	484	607	731
Reservoir Strategies								
Goldthwaite Channel Dam	Goldthwaite	0	0	0	0	0	0	0
Goldthwaite Off-Channel Reservoir	Goldthwaite	0	0	0	0	0	0	0
Other Strategies								
Onion Creek Recharge Dams	Hays County-Other				4,000	4,000	4,000	5,043
TOTAL		**228**	**4,269**	**5,002**	**9,118**	**9,209**	**9,340**	**10,719**

ES.6.5 Irrigation Water Management Strategies

Rice irrigators in Colorado, Wharton, and Matagorda Counties have the greatest anticipated needs and would be expected to experience a shortage in every decade if the DOR were repeated. For this reason, irrigation management strategies were selected with the interests of these growers in mind. *Table ES.12* shows each recommended water management strategy (WMS) for rice irrigation and the anticipated yield of each strategy.

Table ES.12 Rice Irrigation Water Management Strategies

Rice Irrigation Strategies	2000	2010	2020	2030	2040	2050	2060
Continued Use of Austin Return Flows	14,603	17,163	19,723	22,283	24,842	27,402	29,962
Continued Use of Downstream Return Flows [1]			0	150	600	1,125	1,500
Water Management Plan-Interruptible Water Supply	241,607	238,156	162,892	123,534	84,176	44,819	5,461
On-Farm Conservation			36,519	36,519	36,519	36,519	36,519
Irrigation District Conveyance Improvements			46,184	46,184	46,184	46,184	46,184
Conjunctive Use of Groundwater			62,000	62,000	62,000	62,000	62,000
Development of New Rice Varieties			35,297	35,297	35,297	35,297	35,297
Firm up ROR With Off-Channel Reservoir							47,000
HB 1437	0	4,000	4,000	4,000	4,000	14,800	25,000
Supply Reduction due to LSWP							(71,381)
Transfer ROR Supply to Municipal and Industrial	(24,000)	(38,769)	(42,769)	(50,769)	(57,769)	(67,769)	(90,487)
TOTAL	**232,210**	**220,550**	**323,846**	**279,198**	**235,849**	**200,377**	**127,055**

[1] The downstream return flows are from Pflugerville and Aqua WSC.

For Irrigation WUGs with shortages outside of Colorado, Matagorda, and Wharton Counties, the following regional WMSs were selected:

- Expansion of current groundwater supplies
- Transfer/Allocate water from WUGs with surplus
- Temporary overdraft of aquifer

ES.6.6 Livestock and Mining Water Management Strategies

The expansion of current groundwater supplies and the development of new groundwater supplies were selected to meet the minor shortages expected for mining and livestock uses. *Table ES.13* shows the supplies for each category that were used to meet these shortages. These strategies were also discussed in the regional strategy section.

Table ES.13 Livestock and Mining Water Management Strategies

Category	Supply to Meet Shortages (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Livestock	188	188	188	188	188	188	188
Mining	437	13,550	13,146	12,366	6,972	5,574	5,843
TOTAL	**625**	**13,738**	**13,334**	**12,554**	**7,160**	**5,762**	**6,031**

ES.6.7 Manufacturing Water Management Strategies

Shortages for manufacturing WUGs were met through contract extensions and a combination of regional strategies listed below:

- Expansion of current groundwater supplies
- Transfer/Allocate water from WUGs with surplus
- Temporary overdraft of aquifer

These strategies were also discussed in the regional strategy section and in detail in Chapter 4.

ES.6.8 Steam Electric Water Management Strategies

Several strategies were selected to meet shortages in steam electric power demands including the regional strategy of expanding current groundwater supplies. This strategy is described in further detail above. Additional strategies were recommended that would be carried out by LCRA, COA, and STP Nuclear Operating Company (STPNOC).

LCRA has selected the use of water taken from the current Garwood water right to provide for steam electric demands at the Fayette Power Project. Both the Fayette facility and the Garwood Irrigation District are operated by LCRA. The reallocation of this supply is described above in Section ES.6.2 and explained in detail in Chapter 4.

COA expects to meet the needs of steam electric facilities in Fayette and Travis Counties through the City's ROR rights, LCRA firm water supplies, and effluent reuse. These strategies are shown below in *Table ES.14* with the anticipated supplies from each.

Table ES.14 COA Steam Electric Water Management Strategies

COA Strategies	Supply to Meet Shortages (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Supplies							
COA Run-of-River	9,613	9,477	9,341	9,205	9,069	8,933	8,795
LCRA Contracts	34,360	34,494	34,628	31,262	31,396	31,530	
Strategies							
Indirect Reuse		9,810	10,004	13,418	21,272	21,386	27,411
Direct Reuse		1,680	2,881	7,083	8,285	12,486	13,690
LCRA Contract Renewal				3,500	3,500	3,500	35,165
Town Lake Surplus		(17,392)	(17,493)	(17,594)	(17,695)	(17,796)	(17,898)
TOTAL	**43,973**	**38,069**	**39,361**	**46,874**	**55,827**	**60,039**	**67,163**

STPNOC will continue to meet its demands with a variety of supplies from ROR rights, existing off-channel reservoirs, and groundwater. Several strategies have also been included to meet deficits that cannot be met with these current supplies. These strategies include, but are not limited to:

- Contract renewal
- Brackish groundwater desalination
- Rainwater harvesting

ES.7 MANAGEMENT STRATEGY IMPACTS

The impacts associated with water management strategies were considered throughout the selection process, and strategies that imposed minimal impacts on the environment existing resources were weighted more favorably than less desirable strategies. The LCRWPG considered impacts to a number of resources, including:

- Water quality
- Existing water rights
- Instream flows
- Bay and estuary freshwater inflows
- Sustainable aquifer yield
- Agricultural water resources
- Threatened and endangered species
- Wildlife habitat
- Public lands

While reuse is projected to increase, municipal return flows are also projected to increase over the planning period. When available, downstream water rights can continue to divert, in seniority order, these return flows. Because the exact amount of reuse and downstream diversion cannot be determined, the amount of return flow available for environmental purposes is uncertain.

The construction of a channel dam on the Colorado River at Goldthwaite would have minor impacts on instream flows but would not affect downstream water rights, as the right for this reservoir would be junior to all existing permits. Although the dam would reduce compliance with target bay and estuary freshwater inflows, it would allow for storage and release of water during typically dry periods and increase compliance with critical inflows. The construction of an off-channel reservoir alongside the Colorado River at Goldthwaite was determined to have minor impacts on instream flows and no impacts on existing water rights or bay and estuary inflows.

The transfer of water anticipated under HB 1437 would constitute an inter-basin transfer to the Brazos River Basin. With this distinction comes the potential for environmental impacts from the introduction of invasive species and issues resulting from mixing water supplies from multiple sources. The greatest potential impacts on the Colorado River Basin would result from the reduced streamflow resulting from the transfer. It is difficult to quantify the impacts of this strategy on environmental conditions at this planning stage. A diversion point to the Brazos River Basin will have to be determined, as well as the specific strategies of the Ag Fund for creating no net loss in surface water, before these impacts can be modeled. However, it can be assumed that there would be a reduction in instream flows downstream from the point of diversion to the Brazos River Basin to the point at which the Ag Fund strategies are implemented. However, LCRA will continue to meet the environmental flow requirements as specified in its Water Management Plan (WMP). The magnitude of these effects will have to be determined once these details become available.

The 2002 State Water Plan included a proposal to temporarily transfer up to 150,000 ac-ft/yr of water from the Lower Colorado River Basin to the Region L water planning area. The objective of this proposal was and is to satisfy long-term water shortages in both Region K and Region L. In 2001, the Region K planning group also considered and passed a nine-point policy to be considered by the regional planning group in evaluating the proposed inter-basin transfer of this water to Region L (refer to Chapter 8 Section 8.2.1).

In 2004, LCRA entered into an agreement with SAWS to effectuate this proposal. Prior to finalizing the agreement with SAWS, specific legislation was enacted that imposes several restrictions and requirements on the LSWP (Texas Water Code § 222.030). Specifically, the LCRA Board must find that the contract:

1. Protects and benefit the Lower Colorado River watershed and the authority's water service area, including municipal, industrial, agricultural, recreational, and environmental interests
2. Is consistent with regional water plans filed with the Texas Water Development Board on or before January 5, 2001
3. Ensures that the beneficial inflows remaining after any water diversions will be adequate to maintain the ecological health and productivity of the Matagorda Bay system
4. Provides for instream flows no less protective than those included in the authority's WMP for the Lower Colorado River Basin, as approved by the commission
5. Ensures that, before any water is delivered under the contract, the municipality has prepared a drought contingency plan and has developed and implemented a water conservation plan that will result in the highest practicable levels of water conservation and efficiency achievable within the jurisdiction of the municipality
6. Provides for a broad public and scientific review process designed to ensure that all information that can be practicably developed is considered in establishing beneficial inflow and instream flow provisions
7. Benefits stored water levels in the authority's existing reservoirs

These and additional requirements contained in the legislation and final agreement between LCRA and SAWS mirror many of those contained in the nine-point policy of the 2001 Plan. For example, the goals of the proposed LSWP project are the transfer is temporary; it benefits both regions by substantially reducing projected water shortages in Region K and meeting municipal shortages in Region L; the system operation necessary for the project maximizes use of inflows available below Austin; and the project will be designed to have minimal detrimental environmental, social, economic and cultural impacts and provides benefits to lake recreation over what would occur without the project.

Regional strategies such as conservation, expanded use of groundwater, and development of new groundwater resources are thought to have minimal effects on the environment and natural resources. Preserving a sustainable level of groundwater resources and specifically spring flows is important in maintaining endangered species habitat. Information concerning the impacts of specific strategies can be found in Chapter 4. It should be noted, however, that questions about the validity of the "No Call" model for accessing the impacts of WMSs remain. Chapter 5 discusses the impacts of strategies on water quality and rural areas. Finally, Chapter 7 includes information about the overall impacts of the Plan on water, agricultural, and natural resources of the State.

ES.8 WATER CONSERVATION AND DROUGHT MANAGEMENT

Water conservation is recommended for all water user groups, although it is calculated and applied in the tables only for WUGs with shortages. Drought management plans are required for all WUGs to address brief periods of water shortage, but are not recommended as long-term management strategies. Drought management plans typically force conservation over a limited period of time. To achieve a sustained reduction in demand, water conservation strategies must be implemented, so that water users do not perceive the required changes as being temporary. Sample water conservation and drought management plans are included in Chapter 6.

ES.9 POLICY RECOMMENDATIONS

The regional water planning process provides for RWPGs to make any recommendations they see as desirable regarding regulatory, administrative, or legislative changes to foster wise water planning and water use. Planning Group members deliberated at length about such changes and adopted a series of resolutions reflecting the recommendations outlined below.

ES.9.1 Management of Surface Water Resources

The LCRWPG recognizes the growing need for use of surface water resources from regions with more plentiful supplies to meet the demands of regions with insufficient water supplies through inter-basin transfer (IBT). However, as this need grows, there is also a growing need for implementing policies that are aimed at protecting the state's surface water supplies. The LCRWPG proposed three major points of policy on protection of surface water resources in order to meet this challenge.

The LCRWPG previously devised and adopted a nine point policy for transporting water outside the Colorado River Basin in the last planning round. These points have been revised and are, again, adopted for this Plan. These guidelines directly impact the proposed water transfers to the South Central Texas RWPG but would also apply to other potential customers for surface water supplies from the LCRWPA.

The LCRWPG also recommended the development of models that will be capable of estimating the interaction between groundwater and surface water. Studying the linkage between these two resources will provide a better understanding of how the complete system behaves when impacted by significant events such as droughts or flooding and would be especially important in areas with close groundwater and surface water interaction. Estimates of the impacts of pumpage on aquifers were in some cases determined by maintaining a percentage of spring flow contributing to a surface resource, so the LCRWPG is already moving in this area.

The conjunctive use of groundwater and surface water was also recommended by the LCRWPG. The combined use of these two resources would be conducted in a way which would minimize the use of groundwater when surface water was available and manage aquifers for sustainable yield.

ES.9.2 Environmental Flows

Maintaining streamflows to lower reaches and, ultimately, bay and estuary systems is recognized as a major goal for the regional water planning process. Many authorized water diversions were issued prior to the addition of restrictions to protect environmental flows. The LCRWPG recommends legislative changes to protect instream flows by issuing permits with thorough mitigation plans that would assure the maintenance of appropriate environmental flows, and that existing water rights be converted to environmental uses through a voluntary sale or lease of underutilized water rights. In places where unpermitted water is available, the State should set aside water in order to assure critical flows and include provisions in all new permits that would further protect these flows.

ES.9.3 Environmental-Sustainable Growth

The LCRWPG recognizes the complexities and the seemingly insurmountable political obstacles that prevent the adoption of growth management plans. Therefore, it is the LCRWPG's recommendation that the issue of sustainable growth be addressed primarily through educational efforts. The LCRWPG strongly supports the proposed state-wide Water IQ public education campaign and encourages that this campaign be saturated with information regarding the finite nature of water resources and the inescapable trade-offs that inevitably must occur when water use in a given geographic area or economic sector increases. Care must be taken in such a program to highlight the need for a balance to be sought among competing water uses that would ensure the maintenance of:

- Healthy riparian, riverine, estuarine, and hardwood bottomland ecosystems
- Historic cultural resources
- Regional economic opportunities
- Agricultural development
- Preservation of rural communities

ES.9.4 Groundwater

Groundwater is an important resource throughout the state of Texas for many communities with no reasonable means of alternative water sources. The role of protecting these supplies has been given to GCDs which are able to manage groundwater with an insight into local needs and concerns. The LCRWPG supports the power of the GCDs to modify the Rule of Capture in order to preserve groundwater quality and quantity but recognizes the authority of the Rule of Capture in locations where no GCD exists. The LCRWPG also supports the creation of a GCD within the LCRWPA if the need arises for such an entity at the local level.

As noted above, the LCRWPA supports the management of groundwater resources at the sustainable level wherever possible. Sustainability is defined as balancing groundwater withdrawals with natural recharge and replenishment to maintain long-term stability in regional or local groundwater supplies. GCDs should incorporate the best available information to assure that this is done.

LCRWPG recommends establishing coordination between water marketing proposals with local GCDs and RWPGs and requiring state agencies to comply with all local GCD rules and state-certified groundwater management plans and all state and regional water plans. LCRWPG also recommends requiring all groundwater export or water marketing projects to coordinate with local GCDs and RWPGs.

LCRWPG supports the funding needs of the TWDB in order to continue maintaining state-wide groundwater databases.

ES.9.5 Protection of Agricultural and Rural Water Resources

The view of the LCRWPG is that agricultural industries and rural areas are vital to the State. Accordingly, water transfers to serve unmet needs in more urbanized areas should be based on more factors than simply market-driven conditions. Water resources in these areas should be protected through strengthening of GCDs, encouraging the interaction of agricultural and rural users to those in the water market and planning arenas, and protecting IBT source basins.

ES.9.6 Agricultural Water Conservation

The LCRWPG supports further efforts to promote agricultural conservation practices. The large magnitude of agricultural demands indicates a strong potential for making a major reduction in overall demand through conservation. In particular, the LCRWPG supports increased funding of programs such as the Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) and future cooperation between municipalities and farmers as in the LSWP.

ES.9.7 Reuse

The LCRWPG supports reuse as a water management strategy but acknowledges that the practice has many complex issues that may have long-term impacts. The LCRWPG looks to continue monitoring of legislative activity involving reuse and supports further review of planned reuse projects.

ES.9.8 Public Involvement

The LCRWPG supports the bottom-up approach to planning originally set forth in SB 1 and has implemented several measures to maximize public involvement in the water planning process. The LCRWPG does not recommend any changes to the public participation currently prescribed by the State but recommends that efforts are made to ensure that the planning process continues this commitment to public involvement.

ES.9.9 Education

Because public involvement is an important part of the planning process, public education is vital for assuring that constituents are aware of planning issues and their role in the planning process. The LCRWPG has set forth seven goals to increase public awareness of the regional water planning process in the LCRWPA. In addition, the LCRWPG moved to support the recommendations of the Water Conservation Implementation Task Force to the Legislature to increase awareness of the importance of water conservation and the protection of the state's water resources.

ES.9.10 Brush Control

The LCRWPG has chosen to adopt a policy to recommend and promote voluntary brush control in the LCRWPA and recommend that state and federal funds be made available to support this effort.

ES.9.11 Recommended Improvements to Regional Planning Process

Six recommendations were made by the LCRWPG to improve and strengthen continued regional water planning efforts. These include the following points:

- The State should work to coordinate water quantity planning along with water quality planning in the form of the Texas Clean Rivers Program.
- The State should continue funding for data collection that is essential for decisions made in the water planning process.
- The State should continue to provide assistance to the RWPGs in the form of public information materials and administrative support.
- The State should continue the commitment to diversity set forth by the State by improved representation by women and minorities.
- The State should structure the planning process to include and plan for environmental needs.
- The State should provide adequate and timely funding for the regional water planning process to aid in developing effective and environmentally responsible strategies to meet future water needs.

ES.9.12 Other Policy Recommendations

The LCRWPG also made the following recommendation:

- The State should provide sufficient funding to aid rural communities in treating radionuclide in the Hickory and Marble Falls aquifers and disposing of radioactive wastes generated by the process.

ES.10 ECOLOGICALLY UNIQUE STREAM SEGMENTS AND RESERVOIR SITES

No sites are recommended for designation but some sites have been identified as needing further study or meriting comment.

ES.10.1 Ecologically Unique Stream Segments

While the LCRWPG did not recommend any site for designation as an ecologically unique stream segment, the ten stream segments shown in *Table ES.15* were identified as meriting further study and future consideration for such designation.

Table ES.15 Stream Segments Identified for Further Study

Stream Segment	Location	Criteria Used
Barton Springs segment of the Edwards Aquifer	Recharge stretches of Barton, Bear, Little Bear, Onion, Slaughter, and Williamson Creeks in Travis and Hays Counties	*Riparian*: lower end is in a city park *Quality*: designated an "ecoregion" stream *Species:* only known population of the endangered *Eurycea sosrum*, salamander
Bull Creek	From the confluence with Lake Austin upstream to its headwaters in Travis County	*Biologic:* nearly pristine *Hydrologic:* reduces flooding *Riparian:* in Bull Creek Preserve *Quality*: high aesthetic value *Species:* endangered salamander (*Eurycea sp.*)
Colorado River	Within TNRCC classified segments 1409 and 1410 including Gorman Creek in Burnet, Lampasas, and Mills Counties	*Biologic:* white bass spawning area *Riparian:* in Colorado Bend State Park *Quality:* high aesthetic value *Species:* endangered Concho water snake, rare mollusks
Colorado River	TNRCC classified segments 1428 and 1434 in Travis, Bastrop, and Fayette Counties	*Biologic:* riverine habitat on Central Flyway *Hydrologic:* reduces flooding, filters water, connected to aquifers *Riparian:* in McKinney Roughs Environmental Learning Center *Quality:* aquatic life use *Species:* endangered blue sucker and Houston toad
Colorado River	TNRCC classified segment 1402 including Shaws Bend in Fayette, Colorado, Wharton, and Matagorda Counties	*Biologic:* riverine habitat on Central Flyway *Species:* endangered blue sucker
Cummins Creek	From the confluence with the Colorado River upstream to FM 159 in Fayette County	*Quality:* designated an "ecoregion" stream
Llano River	TNRCC classified segment 1415 from the confluence with Johnson Creek to CR 2768 near Castell in Llano County	*Quality:* exceptional aesthetic value
Pedernales River	TNRCC classified segment 1414 in Kimball, Gillespie, Blanco, and Travis Counties	*Biologic:* significant nature area *Riparian:* in 2 state parks, 1 national park, 1 city park *Quality:* exceptional aesthetic value
Rocky Creek	From the confluence with the Lampasas River upstream to the union of North Rocky Creek and South Rocky Creek in Burnet County	*Quality:* designated an "ecoregion" stream
Hamilton Creek	From the outflow of Hamilton Springs to the confluence with the Colorado River	

ES.10.2 Unique Reservoir Sites

Six specific reservoir sites, one reservoir enhancement project, and a non-specific reservoir site, were considered as possible candidates for this designation. *Table ES.16* summarizes the sites considered and the corresponding recommendations.

Table ES.16 Potential Reservoir Sites Identified for LCRWPG Evaluation

Potential Site Location	LCRWPG Recommendation
Mills County: Off-channel reservoir alternatives for Pompey and Bennett Creeks, plus an in-channel alternative on the Colorado River	Support residents' efforts to construct reservoirs and pipelines for water supply.
Fayette and Colorado Counties: Shaws Bend site	Oppose potential designation: would inundate 12,400 acres and directly impact an additional 12,913 acres; exacerbate flooding; adversely impact cultural and historic resources, bottomland forests, riverine habitat, and archaeological sites.
Colorado County: Cummins Creek site	Oppose potential designation: local community voiced strong opposition; would adversely affect 7,200 acres of bottomland forest, stream segments designated as "ecologically significant;" 15 dams already exist on the creek.
Llano County: Small in-channel check dams	Support further study and potential development of small in-channel check dams within existing floodplains, no specific sites yet identified, public support not determined, need has not been verified.
Llano County: Llano River diversion to Lake Buchanan	Support further study of this reservoir enhancement project; past studies and new technology indicate that this may be a desirable project; potential benefits would be an increase in Highland Lakes lake levels and improved Llano County flood control; cost-effectiveness and public support remain in question.
Fayette County: Clear Creek site	Oppose potential designation: local community voiced strong opposition, no potential projects officially under consideration for Clear Creek.
Unspecified Locations: Study of LCRA off-channel flood storage facilities	Support further study and potential development for priority use within the Lower Colorado River Basin; specific locations not yet identified; potential impacts on recommended upstream reservoir projects undefined.

ES.11 ECONOMIC IMPACT OF UNMET NEEDS AND INFRASTRUCTURE FUNDING

This section was not complete at the time of submittal, but will be included in the Final 2006 Regional Water Plan for the LCRWPA.

ES.12 PUBLIC PARTICIPATION

Regional Planning Group members put forth a major effort to reach out to interest groups, civic leaders, small water utilities, and the public-at-large. The LCRWPG will have held more than 42 open regular monthly meetings in locations throughout the LCRWPA by December 2005. Two public meetings in Burnet and Columbus and one public hearing in Austin will be held to receive public comments.

Members of the LCRWPG made presentations to over 20 civic and special-interest groups throughout the area at various times through the planning process. The LCRWPG also maintained a web page and provided fact sheets about the process and proposed solutions. An interview on a local radio station and the issuing of news releases to media outlets in the region also allowed for public outreach in a variety of formats. In this way, the LCRWPG succeeded in providing important information to thousands of regional stakeholders.

The LCRWPG also formed several committees to develop portions of and to help guide and oversee the development of the regional water plan. These committees include the following:

- Environmental Flows Committee
- Groundwater Management Plan Review Committee
- Public Involvement Committee
- Unique Stream Segment Committee
- Water Modeling Committee

All of these efforts made information and updates on the regional water planning process available to thousands of people throughout the entire region. Additional information concerning public involvement can be found in Chapter 10.

ES.13 REMAINING ISSUES AND CONCERNS

Due to the time frame and technique employed, the water availability numbers that have been developed using the "No Call" WAM are approximations that may still have some amount of error in them. One clear example of this is that junior water rights in Region K that are not subject to the "No Call" assumption appear to experience an increase in reliability, which should not occur. Further, the Planning group had remaining questions about the assumptions used by Region F's consultants for allocation of water among various users within Region F itself and the use of safe yield, which could have affected availability of water in Region K to some degree.

A number of technical issues regarding the WAM have been identified as requiring further consideration and analysis. Due to the lack of time and funding, it was not possible to fully explore these issues in time for them to be addressed in the current plan. The Region K group recommends, however, that these issues be further examined during future rounds of planning. These issues generally include enhancements to the WAM routines, updates to the datasets, and a review of fundamental assumptions. Some specific examples of issues that have been identified to date for further review include, without limitation:

a. The WAM's approach to modeling environmental flow restrictions on water rights

b. The naturalized flows used in the WAM

c. The WAM's incorporation (or lack thereof) of channel gains and losses

d. The WAM's treatment (or lack thereof) of "futile call" issues

e. The WAM's incorporation of existing subordination or similar agreements and ability to model these types of agreements

f. The WAM's backup of Austin's steam electric water rights with LCRA stored water

g. The WAM's representation of a zero firm yield for several major reservoirs in the basin

It is recognized that a few of the above listed issues have been under investigation for betterment of the model. For example, during May 2005, TCEQ revised some of the naturalized flow estimates for the Lower Basin; however, it was not feasible to incorporate the revision in the datasets in this round of planning.

Region K group members understand that a TWDB stakeholder process regarding the regional water planning process is likely to be initiated in the summer of 2006. A topic of discussion will be the possible changes to modeling assumptions used in regional water planning.

The volumes of water for planning purposes available under various strategies for meeting identified shortages are largely dependent upon information developed from the November 2004 WAM (Run 3), as modified by the "No Call" assumption. The Regional Planning Group recognized that these are subject to potentially significant changes pending further possible technical refinements to the WAM. Further, the availability of, and the necessity for, some of the identified strategies will be affected by the outcome of pending court litigation and pending or future applications at TCEQ, some of which are already or anticipated to be the subject of contested-case hearing and/or litigation. Three areas where the outcome of these proceedings have the most significant potential for impacting strategies involve: (1) strategies to meet Austin's demands through indirect reuse of treated effluent, (2) strategies to meet some of the water demands for STPNOC through alternative ROR water rights, and (3) strategies LCRA has identified to meet various demands through the amendment of existing water rights, the Water Management Plan, or obtaining new permits. These are generally described below.

Resolution of disputes regarding ownership and control of treated effluent once discharged to the river (as more fully described in Chapter 8 Section 8.2.7) could affect how available return flows are incorporated in future regional plans. One way to address this uncertainty would be to evaluate alternative strategies that assume different potential outcomes of that litigation, but this approach was deemed too complicated given the time and resource constraints. Instead, for this planning period, COA's indirect reuse water supply strategy of using its return flows, transported via the bed and banks of the river, to meet Austin's steam electric shortages at Fayette Power Project is incorporated into the plan. Alternative strategies such as purchase of raw water are simply listed. It is recognized that outcomes may vary considerably depending on which alternative may ultimately be used, and that further refinement may be necessary; however, the intent of including these strategies was to capture a range of possible strategies that could be used to meet Austin's long-term demands.

Similarly, while strategies to meet water needs at STP involve the renewal of the water sale contract between LCRA and STPNOC beyond 2030 and assume that the water rights permit associated with the facility is without term and continues beyond the contract term, those issues are both the subject of ongoing litigation between LCRA and STPNOC that involve, among other things, interpretation of existing agreements between LCRA and STPNOC related to the ownership of water rights that currently serve the South Texas Project. Resolution of that dispute will affect whether STPNOC is served under an existing ROR water right with stored water backup from the LCRA's system, or a ROR water right under STPNOC's pending water rights application, if granted. It is recognized in this instance as well, that outcomes may vary considerably depending on which alternative strategy may ultimately be used; however, it is the intent that the strategies for meeting STPNOC's long-term demands capture the range of these possibilities.

Finally, the potential impacts of various water rights amendments, pending applications for new permits, and proposed and possible future revisions to the LCRA Water Management Plan have raised concerns among other water right holders regarding the impacts to water quality and existing water rights, and among environmental interests with special focus on the bay impacts. Whether those applications are ultimately granted by TCEQ, and the character and magnitude of any special conditions that might be included to protect existing water right holders or meet environmental requirements, could greatly affect the availability of water. The members of the LCRWPG recognize that the assumptions regarding special conditions may differ markedly from those ultimately included. Inclusion of such assumptions is not intended to be dispositive on what conditions are believed to be appropriate.

By including alternative strategies in this plan, it was expressly recognized and agreed that participants in this planning process have not waived their right to raise legal arguments for or against those strategies or any applications either currently pending or that may be filed in the future. It was also expressly recognized and agreed that the disposition of strategies and alternatives that are affected by the uncertainties involved in pending litigation and contested-case hearings including as related to the applications listed in Chapter 2 of this plan, is not a basis for considering those alternatives to be inconsistent with this plan and the state water plan.

ES.14 FOR MORE INFORMATION

For information regarding opportunities to obtain additional information about the Region K planning process and how you can participate, please refer to the Region K website or the LCRA web page at: www.regionk.org; www.lcra.org or navigate directly to http://www.lcra.org/water/lcrwpg.html

Full text of the 16 RWPG Adopted Plans will be available on the TWDB web page at: www.twdb.state.tx.us/.

Copies of this Executive Summary and other information materials may also be obtained by calling John Burke, Chairman, Lower Colorado Regional Water Planning Group, 512-303-3943.

Please refer to the body of the Plan for detailed information regarding methodology, projections, and issue discussions.

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CHAPTER 1.0: INTRODUCTION AND DESCRIPTION OF THE LOWER COLORADO REGIONAL WATER PLANNING AREA

1.1 INTRODUCTION TO THE PLANNING PROCESS

Sections 16.051 and 16.055 of the Texas Water Code direct the Executive Administrator of the Texas Water Development Board (TWDB) to prepare and maintain a comprehensive State Water Plan as a flexible guide for the development and management of all water resources in Texas in order to ensure that sufficient supplies of water will be available at a reasonable cost to further the State's economic growth. Section 16.056 requires the TWDB to amend the Plan as needed in response to increased knowledge and changing conditions.

In February 1998, the TWDB adopted rules establishing 16 regional water planning areas and designated the initial members of the regional water planning groups representing 11 interests (*Figure 1.1*). Each Regional Water Planning Group (RWPG) has the option to add interest group categories and members. With technical and financial assistance from the TWDB, and in accordance with planning guidelines it set forth, the RWPGs prepared a consensus-based Regional Water Plan by 5 January 2001. The TWDB assembled the Regional Water Plans into a new State Water Plan by 5 January 2002. It is anticipated that the Regional Water Plans and the State Water Plan will be updated every five years. The second round of regional water planning started in spring 2002. The second round "initially prepared" Regional Water Plan was to be submitted to the TWDB 1 June 2005 and is to be finalized and adopted by 5 January 2006. Subsequently, by 5 January 2007, the TWDB will prepare a new State Water Plan which will incorporate the adopted Regional Water Plans.

The Lower Colorado Regional Water Planning Area, initially designated by the TWDB as "Region K," encompasses all or part of 14 counties mostly within the Lower Colorado River Basin from the Hill Country to the Gulf of Mexico (*Figure 1.2*). The Lower Colorado Regional Water Planning Group (LCRWPG), representing the 11 TWDB-required interest groups and two additional regional interest groups, is responsible for the development of the Lower Colorado Regional Water Plan (*Table 1.1*). The TWDB's guidelines require the LCRWPG's Regional Water Plan to complete the following tasks:

- Description of the region (Chapter 1)
- Population and water demand projections (Chapter 2)
- Estimates of currently available water supplies (Chapter 3)
- Identification, evaluation, and selection of water management strategies (Chapter 4)
- Impacts of selected water management strategies on key parameters of water quality and impacts of moving water from rural and agricultural areas (Chapter 5)
- Water conservation and drought management strategy development (Chapter 6)
- Regional plan consistency with State's long term protection goals (Chapter 7)
- Unique stream segments/reservoir sites and Legislative recommendations (Chapter 8)
- Report to Legislature on water infrastructure funding (Chapter 9)
- Public participation and education/input (Chapter 10)

Figure 1.1 : TWDB Designated Regional Water Planning Areas

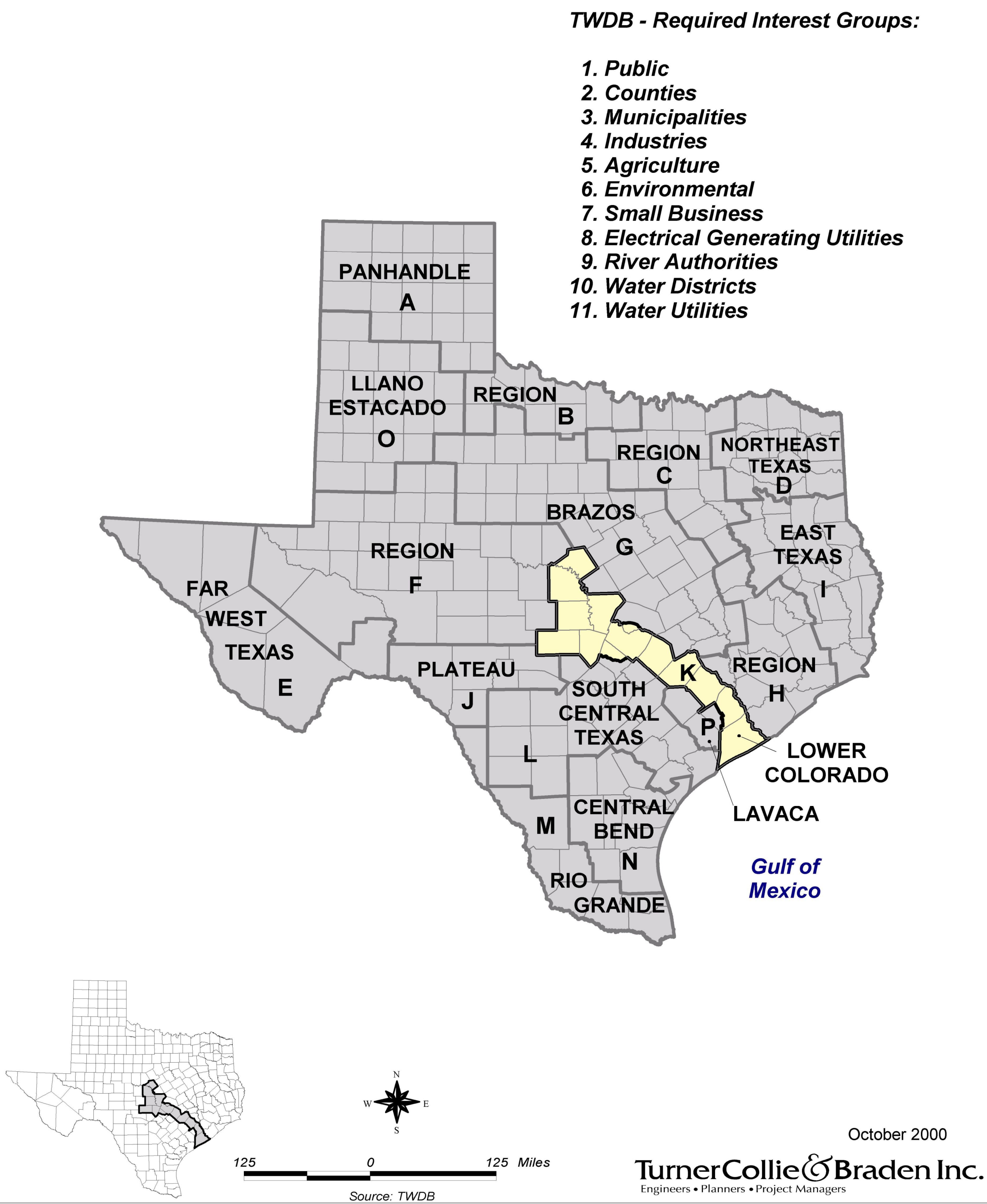


Figure 1.2 : Lower Colorado Regional Water Planning Area (Region K)

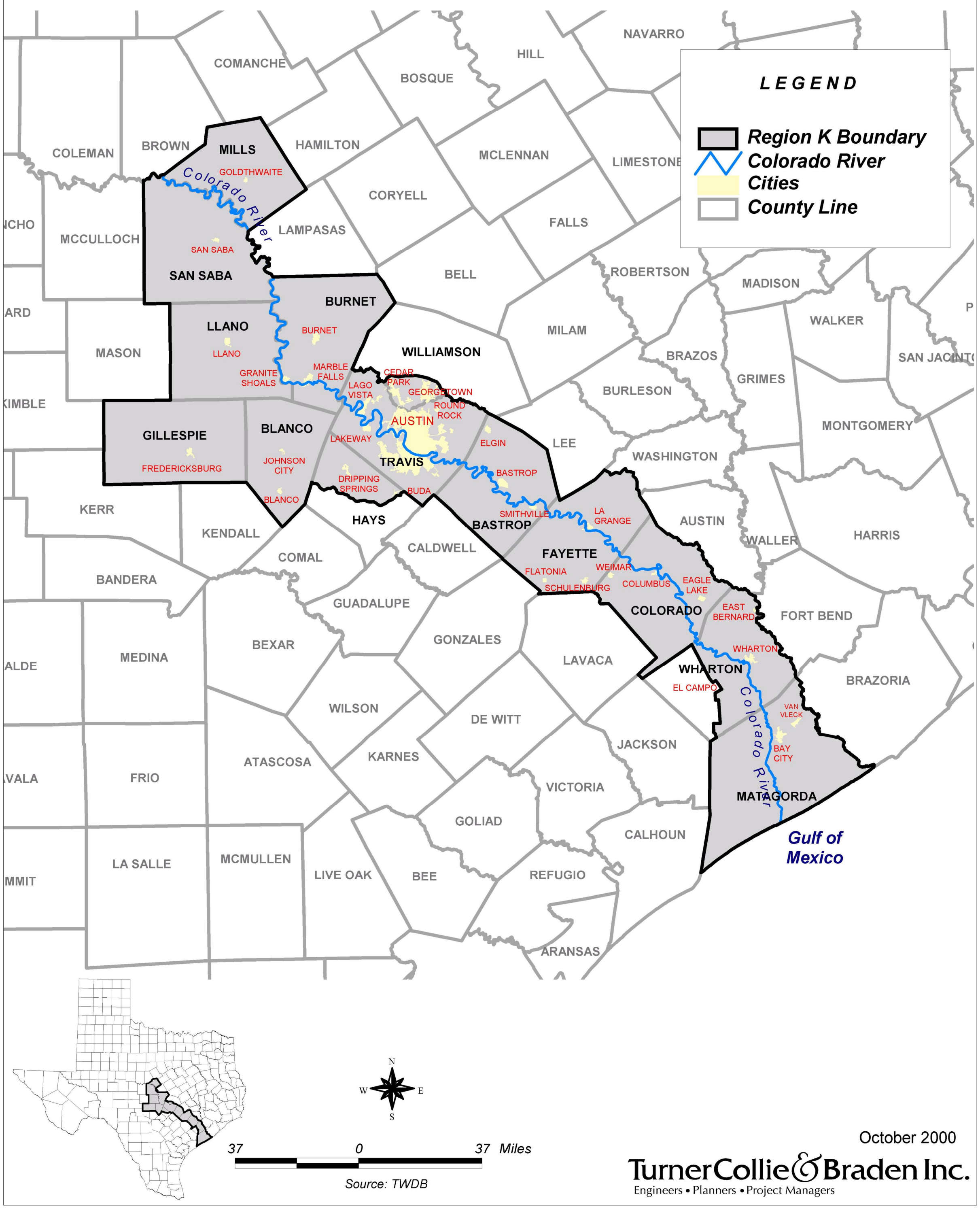


Table 1.1a The Lower Colorado Regional Water Planning Group Voting Board Members

Interest	Name	Entity	County (Location of Interest)
Public	Julia Marsden	League of Women Voters	Travis
Counties	Chris King	Wharton County Commissioners Court	Wharton
	Bill Neve	Burnet County Commissioners Court	Burnet
	Billy Roeder	Gillespie County Commissioners Court	Gillespie
	James Sultemeier	Blanco County Commissioners Court	Blanco
Municipalities	Dennis Jones	City of Lago Vista	Travis
	Teresa Lutes	City of Austin	Williamson
Industries	Barbara Johnson	Austin Area Research Organization, Inc.	Travis
Agricultural	Bill Miller	Rancher	Llano
	Haskell Simon	Rice Industry Rep. and Farmer	Matagorda
Environmental	Jim Barho	Protect Lakes Inks, Buchanan	Burnet
	Ron Fieseler	Blanco-Pedernales GCD	Hays
	Jennifer Walker	Sierra Club, Lone Star Chapter	Travis
Small Businesses	Ronald Gertson		Wharton
	Harold Streicher	Assistant Fayette County Attorney	Fayette
Electric Generating Utilities	Rick Gangluff	STP Nuclear Operating Company	Matagorda
River Authorities	Mark Jordan	LCRA	Travis
Water Districts	Paul Tybor	Hill Country UWCD	Gillespie
Water Utilities	John Burke	Aqua WSC	Bastrop
Other(s)	Roy Varley		Mills
	Bob Pickens		Colorado
Recreation	Del Waters	The Ski Dock	Travis

Table 1.1b The Lower Colorado Regional Water Planning Group Nonvoting Members

David Bradsby	Texas Parks & Wildlife Department
Jock Davis	Texas Department of Agriculture
Joe McCarley	Texas Department of Agriculture
David Meesey	Texas Water Development Board
Dexter J. Svetlik	United States Department of Agriculture
Recording Secretary:	
Dan Strub	City of Austin Water Conservation

Table 1.1c The Lower Colorado Regional Water Planning Group Alternate Members

Cynthia Braendle	Sandy Dannhardt	Neil Hudgins
Terry Fischer	Laura B. Marbury	Billy Mann
Ron Anderson	Harold Sohner	Steve Balas
Calvin Ransleben	Cole Rowland	Terry Bray
Ronny Hibler	Bill Stewart	Hugh Farmer
Sheril Smith	Floyd Cooley	Chris Lippe, P.E.
Rodney Willis		

Texas is an extremely diverse state both in climate and economics, and these differences were considered in the creation of the 16 RWPGs. This diversity requires the use of a variety of water management strategies, the combination of which will be unique for each region. The types of strategies that may be considered include:

- expected/advanced water conservation
- water reuse
- expanded use of existing supplies
- reallocation of reservoir storage
- water marketing and inter-basin transfers
- subordination of water rights
- yield enhancement measures
- chloride control measures
- new supply development

Water availability, economics, environmental concerns, and public acceptance were considered during the process of developing water management strategies within each region. The final Regional Water Plan must comply with all existing state and federal regulations regarding existing water rights, instream flows, bay/estuary freshwater inflows, water quality, threatened/endangered species, critical habitats, and sites of historical importance.

The overall goal of the State Water Plan is to address water supply needs at the local level with the consideration of balancing affordable water supply availability and conserving the State's natural resources.

1.2 DESCRIPTION OF THE LOWER COLORADO REGIONAL WATER PLANNING AREA

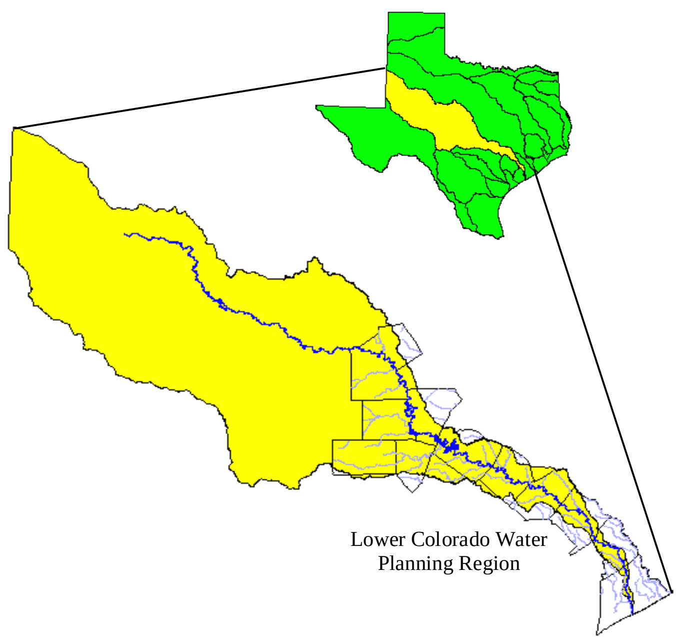
The Lower Colorado Regional Water Planning Area (Region K) encompasses all or part of the following counties:

Bastrop	Llano
Blanco	Matagorda
Burnet	Mills
Colorado	San Saba
Fayette	Travis
Gillespie	Wharton (partial)
Hays (partial)	Williamson (partial)

Most of the Lower Colorado Region (Region K) lies within the Colorado River Basin and crosses the Great Plains and the Coastal Plains physiographic provinces. The following sections provide a general description of the area's physical and socioeconomic characteristics, as well as water quality and natural resource issues of importance to the region.

1.2.1 Physical Characteristics of the Lower Colorado Regional Water Planning Area[1]

Figure 1.3: The Colorado River Basin



The Colorado River Basin extends well beyond the boundaries of Region K northwest into eastern New Mexico (*Figure 1.3*). From these headwaters, the river travels 900 miles to the Gulf of Mexico. The Colorado River Basin is bordered by the Brazos River Basin to the north and east, and by the Guadalupe River, and Lavaca River Basins to the south and west. The total drainage area of the Colorado River is 42,318 sq mi, 11,403 sq mi of which is considered non-contributory to the river's water supply. There are six major tributaries with drainage areas greater than 1,000 sq mi that contribute to the Colorado River: Beall's Creek and the Concho River, above the LCRWPG boundary; and the San Saba, Llano, and Pedernales Rivers as well as Pecan Bayou, which occur in San Saba, Llano, Travis, and Mills Counties, respectively. All of these major tributaries and approximately 90 percent of the entire contributing drainage for the river occur upstream of Mansfield Dam near Austin. This dam is the primary regulator of water flow, from its location south to the Gulf of Mexico. Downstream of Austin, there are only two tributaries with drainage areas greater than 300 sq mi, Onion Creek in Travis County and Cummins Creek in Colorado County.

[1] Lower Colorado River Authority (LCRA), June 1992. *Instream Flows for the Lower Colorado River*, Final Report.

1.2.1.1 Geology of the Lower Colorado River Basin[2, 3]

The northernmost boundary of Region K lies in the Central Texas section of the Great Plains physiographic province (*Figure 1.4*). It is here that the Colorado River intersects the broad, low structural zone exposing early Paleozoic and Precambrian igneous and metamorphic formations, called the Llano Uplift. In the northwestern portion of the region, the major southern tributaries and the Colorado River drain the Edwards Plateau section of the Great Plains province, which is characterized by Cretaceous-aged limestone formations overlain by Tertiary-aged sediments. The Colorado River meanders through these limestone deposits in relatively steep narrow canyons in this area; however, there are also flat-topped remnants of the once more extensive Edwards Plateau. At the eastern edge of the Edwards Plateau, the Edwards aquifer outcrops at several locations along the Balcones Fault Zone, creating aquifer recharge zones and associated natural discharge points or springs, such as Barton Springs in Travis County. Typical soils (*Figure 1.5*) of the Llano Uplift are reddish-brown to brown, neutral to slightly acidic, calcareous, sandy loams. Soils mapped on the Edwards Plateau section typically consist of dark, deep to shallow, stony, calcareous clays.

The Western Gulf Coast section of the Coastal Plains province contains the remaining 300 miles of the Colorado River south of the Balcones Fault Zone in Travis County to the Gulf of Mexico. The Western Gulf Coast section is characterized as an elevated sea bottom with low topographic relief ranging from low hills in the west to coastal flats. Surface geologic units mapped along the next portion of the Colorado River include a relatively narrow band of Upper Cretaceous formations just southeast of the Balcones Fault Zone, followed by a belt of Tertiary deposits that outcrop from Bastrop County southeast to Colorado County. The remaining geologic units, from Colorado County to the Gulf of Mexico, are mapped as Quaternary-aged deposits. Sediments in the Western Gulf Coast section are composed primarily of marine deposits such as limestones, marls, and shales; however, the river valley also contains significant fluvial (river) terrace deposits of granitic assemblage, quartz and quartzite, chert, limestone, sandstone, siltstone, hornblende schist, silicified wood, and rip-up clasts. Colorado Basin soils in the Western Gulf Coast section are typically dark, neutral to slightly acidic, clay loams, and clays. Near the coast, soils become light, acidic sands, and darker, loamy to clayey soils.

1.2.1.2 Climate[4, 5, 6]

The climate across the State of Texas varies considerably; however, there are no natural boundaries, and changes occur gradually from east to west. In general, average temperatures, rainfall, and the length of the growing season decrease from the east to the north and west. The upper atmospheric winds, or jetstreams, affect the large-scale weather patterns in the state. The polar jetstream affects the movement of cold artic air masses from December through February. The moist warm air masses are brought to

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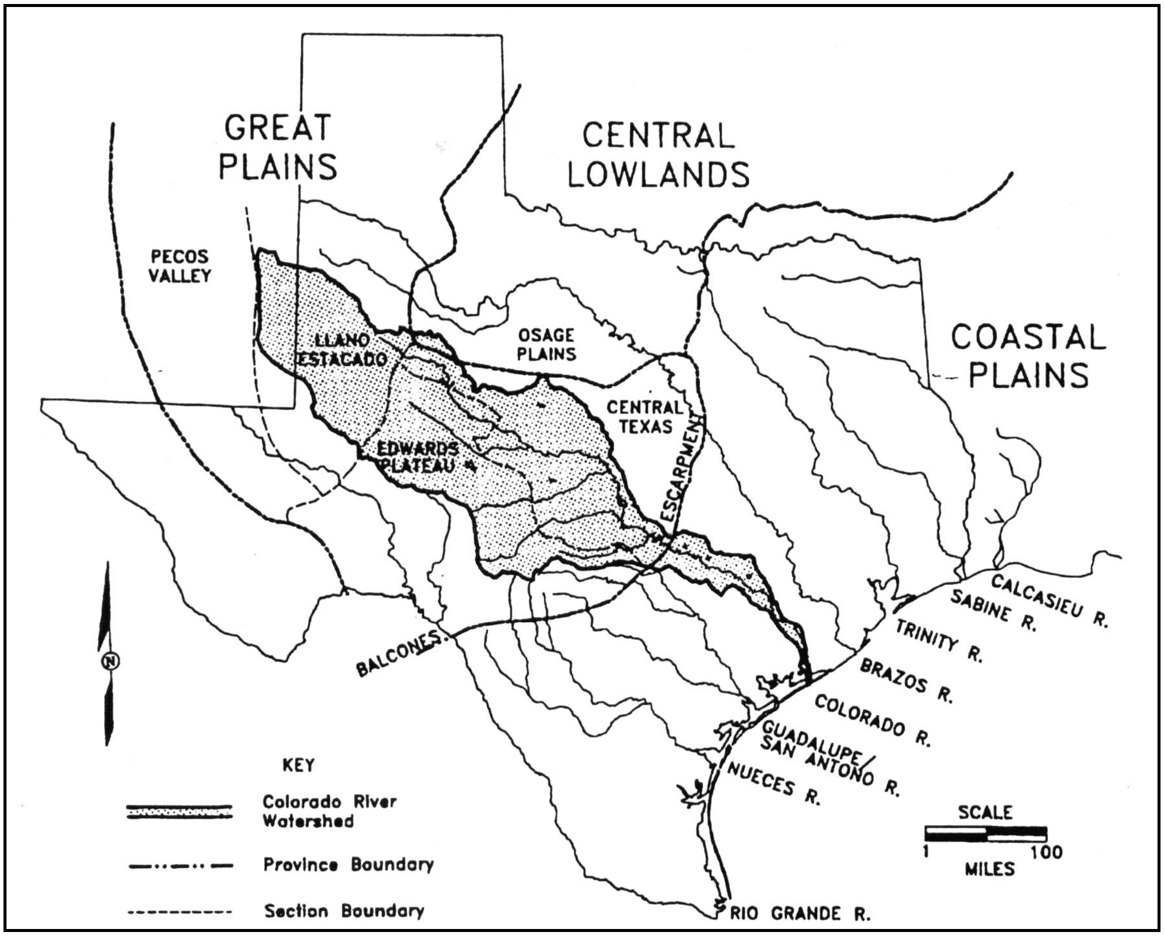
[2] LCRA, Op. Cit., June 1992.
[3] Texas Water Development Board (TWDB), May 1977. *Continuing Water Resource Planning and Development for Texas, Volume II*.
[4] TWDB, Op. Cit., May 1977.
[5] Hatch, S. L., et al. July 1990. *Checklist of the Vascular Plants of Texas.* Texas Agricultural Experiment Station, College Station, Texas.
[6] Jones, B. D., 1990. *Texas Floods and Droughts. In National Water Summary 1988–1989*. U.S. Geological Survey, pp. 513–520.

Figure 1.4: Physiographic Provinces and Major Drainage Basins of the Western Gulf Slope
(Modified from Conner and Suttkus, 1977)

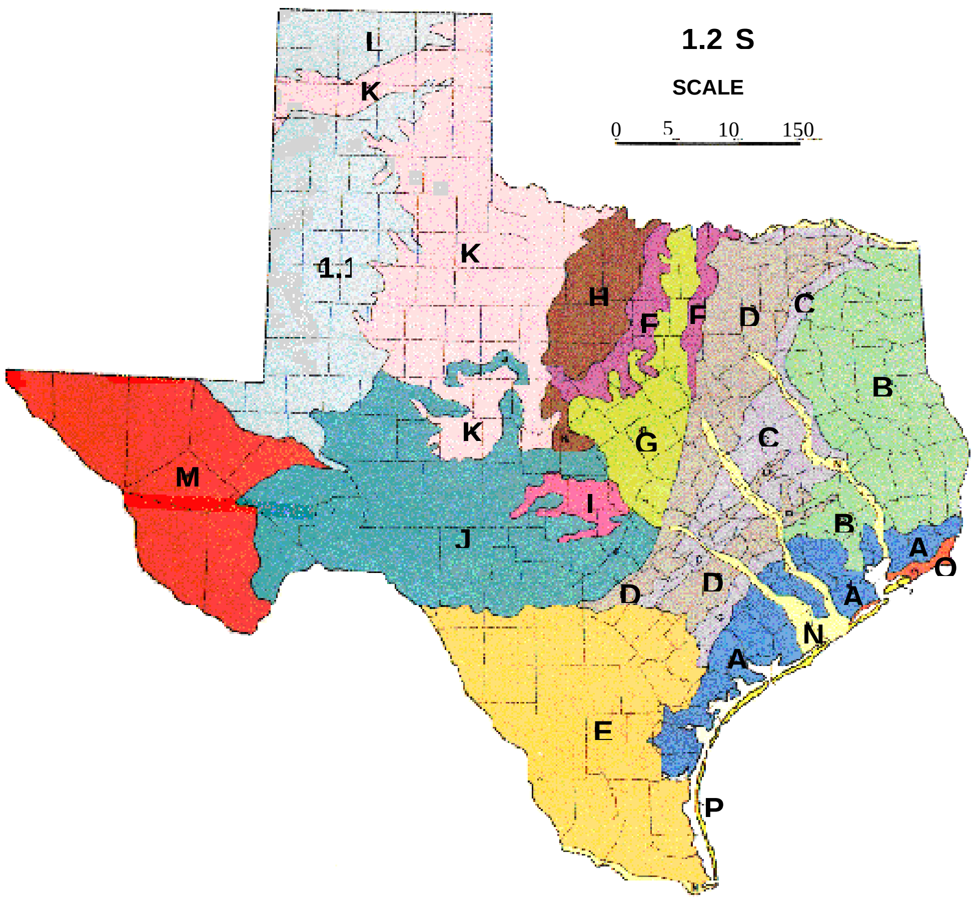


Texas from the Pacific Ocean by the subtropical jetstream, whose influence is most prevalent during the spring and fall.

Region K lies entirely within the warm-temperate/subtropical zone. The constant flow of warm tropical maritime air from the Gulf of Mexico produces a humid subtropical climate with hot summers across the lower third of the region. This maritime air combines with cooler and drier continental air further inland, which results in a subtropical climate with dry winters and humid summers in the remainder of the region. Winters in Region K typically are mild with frequent, short duration surges of colder continental air masses and strong northerly winds. Average annual net evaporation in Region K varies from 20 to 24 inches at the coast to approximately 44 inches in the uppermost portion of the region (*Figure 1.6*).

Figure 1.5: Soils of Texas

(Source: Bureau of Economic Geology, 1977)



A Dark-colored, neutral to slightly acid clay loams & clays; some lighter colored sandy loams; acid soils mostly east of Trinity River.

B Light-colored, acid sandy loams, clay loams, & sands; some red soils & clays.

C Light-brown to dark-gray, acid sandy loams, clay loams, & clays.

D Dark-colored calcareous clays; some grayish-brown, acid sandy loams & clay loams along eastern edge of the major prairie & interspersed in minor prairies.

E Dark calcareous to neutral clays & clay loams; reddish-brown, neutral to slightly acid sandy loams; grayish-brown, neutral sandy loams & clay loams; some saline soils near coast.

F Light-colored, acid loamy sands & sandy loams.

G Dark-colored, deep to shallow clay loams, clays, & stony calcareous clays over limestone.

H Reddish-brown to grayish-brown, neutral to slightly acid sandy loams & clay loams; some stony soils.

I Reddish-brown to brown, neutral to slightly acid, gravelly & stony sandy loams.

J Dark, calcareous stony clays & clay loams.

K Dark-brown to reddish-brown, neutral to slightly calcareous sandy loams, clay loams, & clays.

L Dark-brown to reddish-brown neutral sands, sandy loams, & clay loams; some very shallow calcareous clay loams.

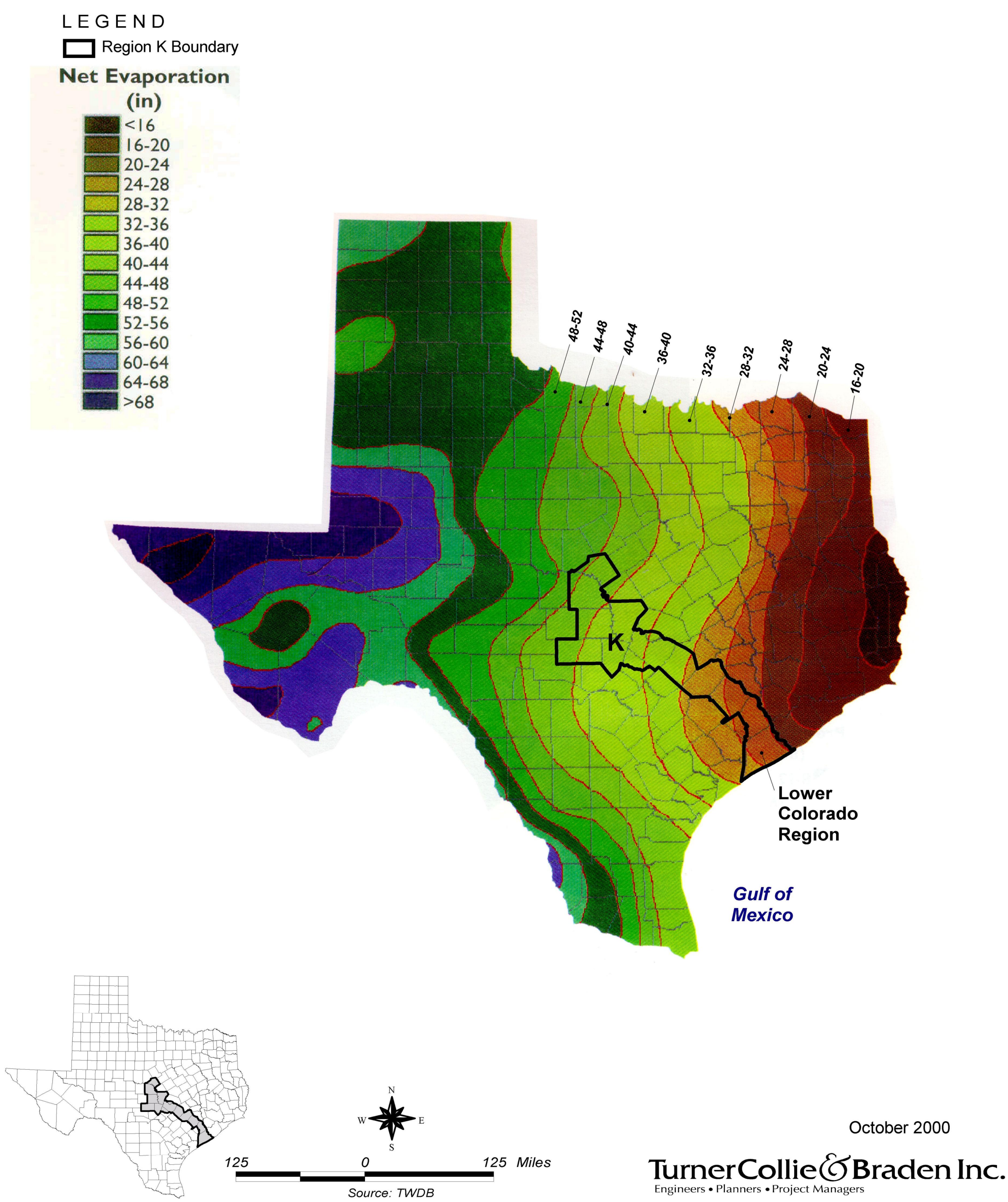
M Light reddish-brown to brown sands; clay loams & clays (mostly calcareous, some saline) & rough stony lands.

N Light-brown to reddish-brown, acid sandy loams; acid & calcareous clay loams & clays.

O Light- & dark-colored, acid sands, sandy loams, & clays.

P Tan, loose sand & shell material.

Figure 1.6 : Lower Colorado Regional Water Planning Area (Region K) Average Annual Net Evaporation

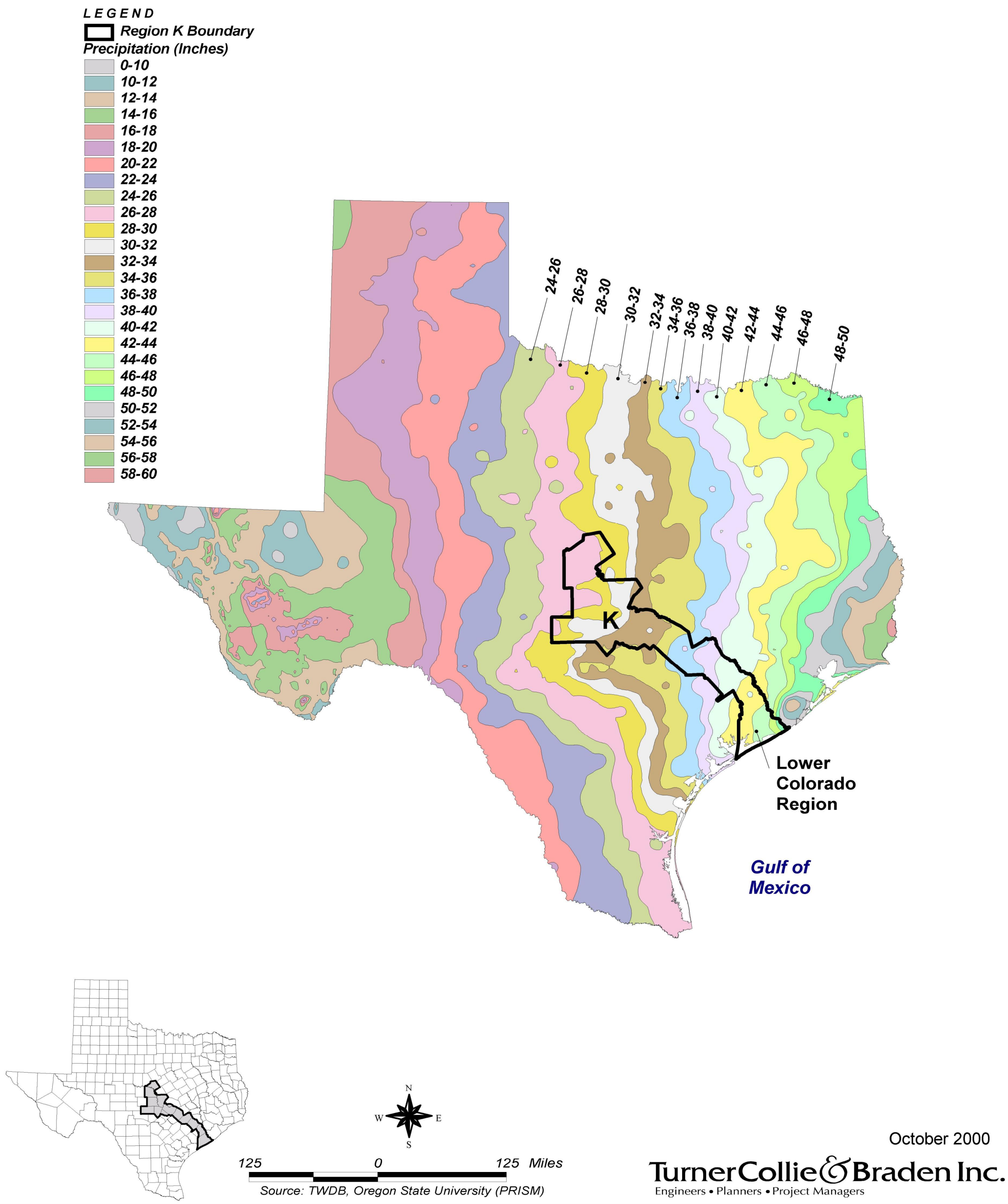


The amount of rainfall varies across the Lower Colorado Planning Region from an average of 44 inches at the coast to 24 inches in the northwestern portion of the region (*Figure 1.7*). The rainfall distribution pattern in this region has two peaks: spring is typically the wettest season with a peak in May, and a second peak usually occurs in September, coinciding with the tropical cyclone season in the late summer/early fall. The spring rains are typified by convective thunderstorms that produce high intensity, short duration precipitation events with rapid runoff. These thunderstorms are generally caused by successive frontal systems that move through the state. These weak cold air masses are overrun by warm Gulf moisture, and the line of instability that develops where the two air masses come in contact produces thunderstorms. The fall seasonal rains are primarily governed by tropical storms and hurricanes that originate in the Caribbean Sea or the Gulf of Mexico and make landfall on the coast from Louisiana to Mexico. As the storm moves inland, the coverage area for a single tropical cyclone event can be quite large and the storm severe, with wind and flood damage common.

The hydrologic characteristics of the Colorado River are closely linked to the precipitation patterns that occur in the river basin, especially the cycles of floods and droughts, which are common in Texas. Major flood and drought events are those with statistical recurrence intervals greater than 25 years and 10 years, respectively. Streamflow gaging data collection began in the early 1900s, and the data show that there ha been a major drought in almost every decade of this century. Droughts in Texas are primarily the result of the presence of a strong subtropical high-pressure cell, called a Bermuda High, which becomes stationary over the state and prevents low-pressure fronts from passing through the state. Major droughts can cause stock ponds and small reservoirs to go dry and large reservoirs, such as Lake Travis, can drop their storage levels to less than one-third their capacity. The average annual runoff during the period from 1941 to 1970 ranged from 350 ac-ft/sq mi near the mouth of the Colorado River to less than 50 ac-ft/sq mi in the westernmost portion of the basin's contributing zone, which translates to an overall basin average of 81 ac-ft/sq mi. During this 30-year time period there were three major statewide droughts: 1947 to 1948, 1950 to 1957, and 1960 to 1967. These periods of drought saw average annual runoff values decrease 72 to 80 percent, to 16 to 23 ac-ft/sq mi, which resulted in record low flows in the Colorado River. The most severe of these droughts occurred from 1950 to 1957, in which 94 percent of the counties in the state were declared disaster areas. The drought of record for Region K is the period 1947 to 1957, and these drought-of-record conditions were used in this regional water planning effort.

The end of a drought cycle is often marked by one or more flooding events, allowing aquifers and man-made water storage facilities to recharge. The floodplains of the upper Colorado River and its tributaries are typically steep, narrow channels with rocky soils and sparse vegetative cover. During intense rain events this allows for rapid runoff, resulting in sharp-crested floods with high peak discharges and velocities. Downstream, the floodplains become wider with denser vegetation, which decreases these streamflow velocities; however, the massive volumes of water moving down the river basin can still cause a great deal of flood damage. Areas expected to be most prone to flood damage in the Lower Colorado Planning Region are along Lake Travis and Lake Austin, and the Cities of Austin, La Grange, Columbus, Wharton, and Matagorda. Historically, the coastal portion of the river basin is affected by hurricanes two of every five years. The Hill Country in Central Texas has experienced more severe flood events than any other region of the country. In fact, the continental United States record for the most intense 18-hour rainfall occurred in Williamson County in the Brazos River Basin in 1921, with 36 inches of rain. From 1843 to 1938, there have been 22 major floods along the Colorado River. The most intense localized flash flood in the Lower Colorado Planning Region in recent history occurred 24 May 1981 in Austin. This storm produced a flood with a recurrence level greater than 100 years, caused $40 million in damages, and was responsible for 13 deaths.

Figure 1.7 : Lower Colorado Regional Water Planning Area (Region K) Average Annual Precipitation

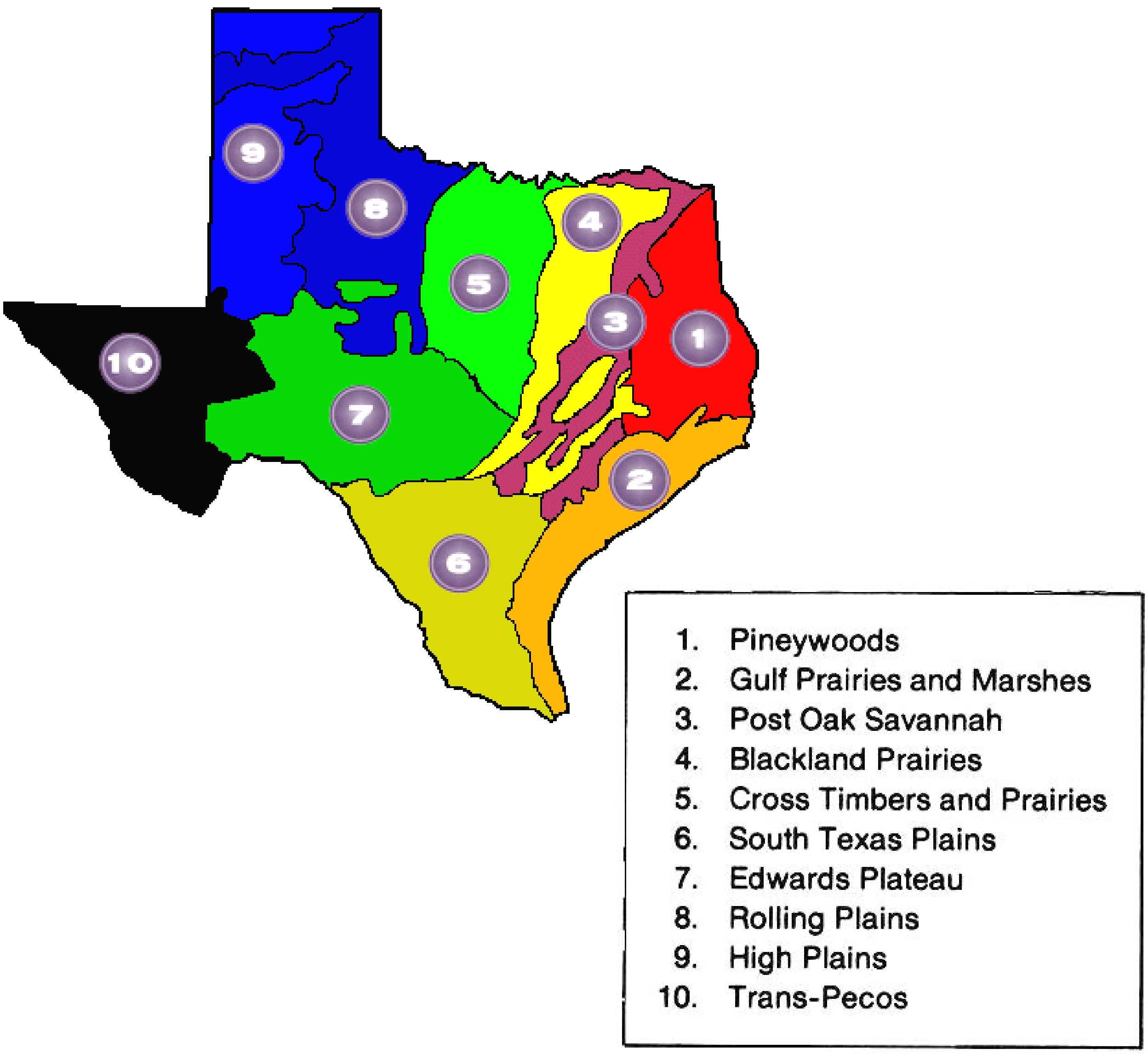


1.2.1.3 Vegetational Areas[7]

Natural regions, or vegetation areas, are based on the interaction of geology, soils, physiography, and climate. There are ten vegetational areas that cross the State of Texas and five of these intersect Region K (*Figure 1.8*). These are the Cross Timbers and Prairies, the Edwards Plateau, the Blackland Prairies, the Post Oak Savannah, and the Gulf Prairies and Marshes. Each of these vegetation areas is described below. *Figure 1.9* shows the dominant plant species that occur in Region K.

Figure 1.8: Vegetational Areas of Texas

(Source: Dr. Stephen L. Hatch, Texas Agricultural Experiment Station)



[7] Hatch, et al., Op. Cit., July 1990.

The **Cross Timbers and Prairies** vegetational area includes all of Mills County, most of Burnet County, the north portions of San Saba and Travis Counties, and the section of Williamson County within the Lower Colorado Planning Region. This region falls within the southern extension of the Central Lowlands and the western edge of the Coastal Plains physiographic provinces. There are sharp contrasts in topography, soils, and vegetation in this region due to the wide variety of geologic formations in the area. Elevations range from 500 feet to 1,500 feet above mean sea level. Cross Timber soils are typically of the orders Mollisol and Alfisol. In the East and West Cross Timbers subregions, soils range from light, slightly acid loamy sands and sandy loams with yellowish-brown to red clayey subsoils in the upland areas to dark, neutral to calcareous clayey bottomland soils, and loamy alluvial soils along minor streambeds. The North Central Prairies subregion is interspersed with sandstone and shaley ridges and hills. Uplands are brown sandy loam to silt loam, slightly acid soils that overlay red to gray, neutral to alkaline clayey subsoils. The bottomlands have brown to dark gray, loamy, and clayey, neutral to calcareous, and alluvial soils.

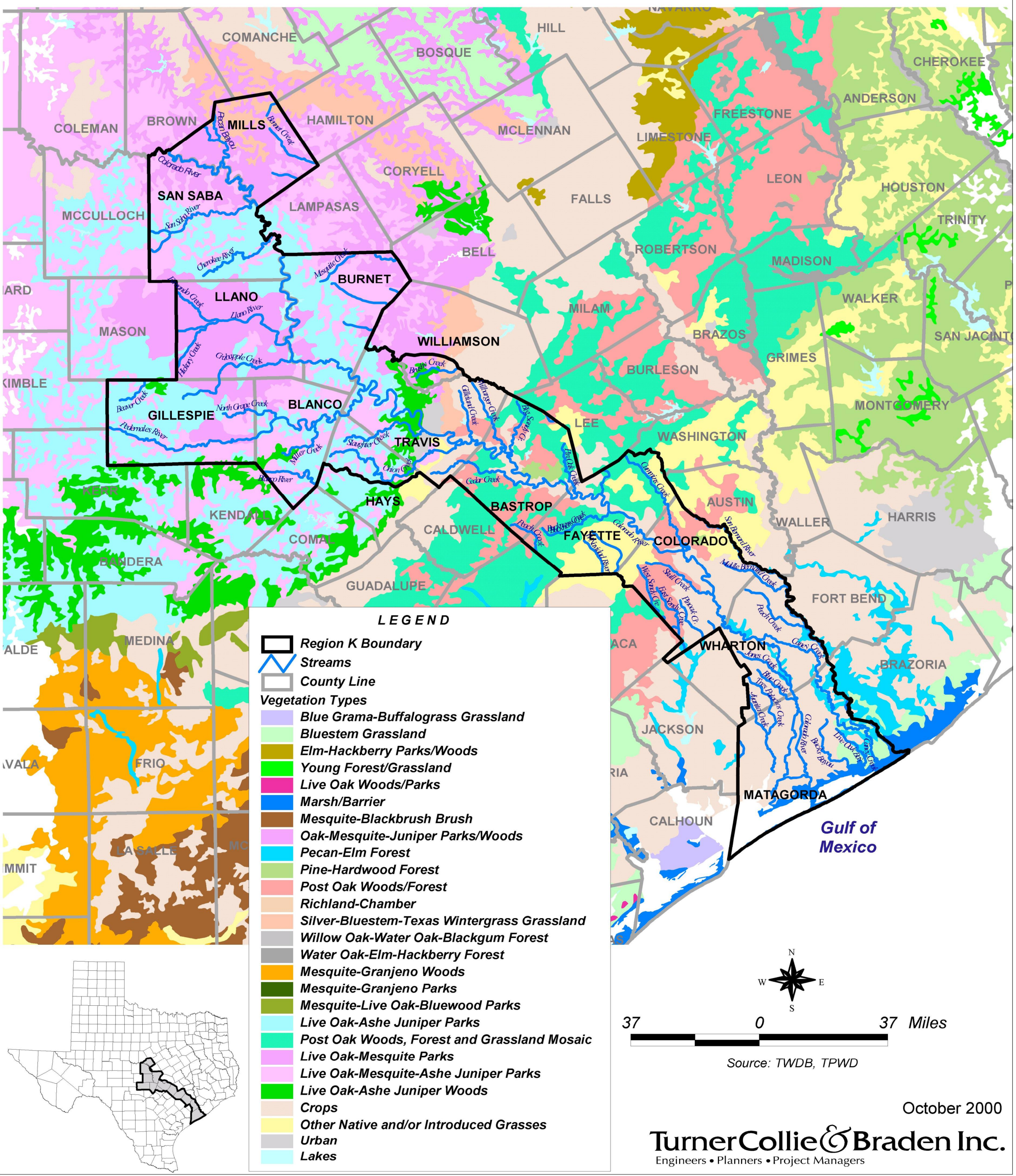
The Cross Timbers and Prairies support tallgrasses such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and Canada wildrye (*Elymus canadensis*), with minor populations of midgrasses and shortgrasses such as sideoats grama (*Bouteloua curtipendula*), blue grama (*B. gracilis*), hairy grama (*B. hirsuta*), Texas wintergrass (*Stipa leucotricha*), and buffalograss (*Buchloe dactyloides*). Overgrazing has allowed the midgrasses and shortgrasses to increase their range and has allowed the invasion of scrub oak (*Quercus turbinella*), honey mesquite (*Prosopis glandulosa*), and Ashe juniper (*Juniperus ashei*) in upland areas, as well as hairy tridens (*Erioneuron pilosum*), Texas grama (*Bouteloua rigidiseta*), red lovegrass (*Eragrostis secundiflora*), wild barleys (*Hordeum*), threeawns (*Aristida*), fringed-leaf paspalum (*Paspalum setaceum*), and tumble windmillgrass (*Chloris verticillata*). Bottomland trees include pecan (*Carya illinoensis*), oak (*Quercus*), and elm (*Ulmus*), with invasion of mesquite. Typical shrubs and vines include skunkbush (*Rhus aromatica*), saw greenbriar (*Smilax bona-nox*), bumelia (*Bumelia lanuginosa*), and poison ivy (*Rhus toxicodendron*).

Today, approximately 75 percent of the Cross Timbers and Prairies natural region is rangeland and pastureland. White-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), squirrel (*Sciurus spp*.), bob white quail (*Colinus virginianus*), and mourning dove (*Zenaida macroura*) are plentiful.

The **Edwards Plateau** vegetational area consists of an area of West Central Texas commonly known as the “Hill Country” and includes the entire portion of Hays County within the Lower Colorado Planning Region; all of Llano, Gillespie, and Blanco Counties; most of San Saba County; southern Burnet County; and western Travis County. The geologic formation known as the Balcones Escarpment forms the eastern and southern boundary of this region. Elevations range from 1,200 feet to over 3,000 feet above mean sea level, and the landscape is deeply dissected, hilly, rough, and well drained. Edwards Plateau soils are typically shallow Entisols, Mollisols, or Alfisols that have a variety of surface textures and are underlain by limestone.

Historically, the natural vegetation of the Edwards Plateau was grassland or open savannah-type plains with trees or brush along rocky slopes and streambeds. Tallgrasses such as cane bluestem (*Bothriochloa barbinodis*), big bluestem, little bluestem, Indiangrass, and switchgrass, are still common today along rocky outcrops and protected areas with good soil moisture. In areas with more shallow soils, tallgrasses have been replaced by midgrasses and shortgrasses such as sideoats grama, Texas grama, and buffalograss. Typical wildflowers are Engelmann daisy (*Engelmannia pinnatifida*), orange zexmania

Figure 1.9 : Lower Colorado Regional Water Planning Area (Region K) Vegetation Distribution



(*Wedelia hispida*), western ragweed (*Ambrosia psilostachya*), and sneezeweed (*Helenium quadridentatum*). Areas disturbed by over-grazing have been invaded by pricklypear (*Opuntia*), bitterweed (*Hymenoxys odorata*), broadleaf milkweed (*Asclepias latifolia*), smallhead sneezeweed (*H. microcephalum*), broomweeds (*Amphiachyris* and *Gutierrezia*), prairie coneflower (*Ratibida columnifera*), mealycup sage (*Salvia farinacea*), and tasajillo (*Opuntia leptocaulis*). Common woody species are live oak (*Quercus virginiana*), sand shin oak (*Quercus havardii*), post oak (*Quercus stellata*), mesquite, and juniper.

Land suitable for cultivation occurs only along narrow streams and divides within the Edwards Plateau region and in these areas tree orchards are common. The majority of the region is utilized as rangeland for the production of livestock and wildlife. This area was once one of the major wool and mohair producers in the country, providing up to 98 percent of the nation's mohair; however, the loss of federal mohair subsidies has caused a decline in this industry over the past decade. The Edwards Plateau also supports the largest deer population in North America, and exotic big game ranches are increasing across the region.

Within Region K, the **Blackland Prairies** vegetational area occurs in eastern Travis County, several small sections of Bastrop County, western and eastern portions of Fayette County, and a minor portion of Colorado County. The characteristic topography is gently rolling hills to nearly level with well-defined contours for rapid surface drainage. Elevation varies from 250 to 700 feet above mean sea level. Major soil orders include Vertisols and Alfisols, which are naturally very productive and fertile. Upland soils are dark, calcareous, and clayey. Bottomland soils are typically reddish-brown to dark gray, slightly acid to calcareous, loamy to clayey to alluvial.

The Blackland Prairie once supported a tallgrass prairie dominated by big bluestem, little bluestem, Indiangrass, tall dropseed (*Sporobolus asper*), and Silveus dropseed (*S. silveanus*). Minor species including sideoats grama, hairy grama, Mead's sedge (*Carex meadii*), Texas wintergrass, and buffalograss have increased due to grazing pressure. Erosion and agricultural activities have decreased the productivity of these soils. Common wildflowers include asters (*Aster*), prairie bluet (*Hedyotis nigricans*), prairie-clover (*Petalostemon*), and late coneflower (*Rudbeckia serotina*). Typical legumes are snoutbeans (*Rhynchosia*), and vetch (*Vicia*). Areas disturbed by grazing and agriculture have been invaded by mesquite, huisache (*Acacia smallii*), oak, and elm trees. Oak, elm, cottonwood (*Populus deltoides*), and native pecan can be found in moist drainage areas. Isolated areas of Blackland Prairies are intermingled within the Post Oak Savannah vegetation area.

In the latter 19th and early 20th centuries, approximately 98 percent of the Blackland Prairies vegetational area had been converted to cropland. Pastureland and livestock forage cropland began to increase in the 1950s, and today only 50 percent of the area is used for cropland. Cultivated pastures make up 25 percent of the land area, and the rest is used as rangeland. Significant game species include dove, bobwhite quail, and squirrel.

The **Post Oak Savannah** vegetational area within Region K occurs in most of Bastrop and Colorado Counties and central Fayette County. The region is characterized by gently rolling, moderately dissected wooded plains with elevations between 300 feet and 800 feet above mean sea level. There are several areas of Blackland Prairie intermingled in the southern portion of the Post Oak Savannah. Typically shallow upland soils are gray, slightly acid sandy loams that overlay gray, mottled, or red, firm clayey subsoils. Infiltration-resistant claypan layers occur at varying soil depths, which impedes the percolation of moisture. Bottomland soils are reddish-brown to dark gray, slightly acid to calcareous, loamy to clayey alluvial.

Typically, short oak trees, such as post oak and blackjack oak (*Q. marilandica*), are interspersed among the tallgrass species of little bluestem, silver bluestem (*Bothriochloa saccharoides*), Indiangrass, switchgrass, and midgrass and shortgrass species of, Texas wintergrass (*Stipa leucotricha*), purpletop (*Tridens flavus*), narrowleaf woodoats (*Chasmanthium sessiliflorum*), and beaked panicum (*Panicum anceps*). Elms, junipers, hickories (*Carya*), and hackberries (*Celtis*) are also common trees here. Shrubs and vines such as yaupon (*Ilex vomitoria*), American beautyberry (*Callicarpa americana*), coralberry (*Symphoricarpos orbiculatus*), greenbriar (*Smilax*), and grapes (*Vitis*) are typical. Historically, periodic wildfires have suppressed the overgrowth of brush and trees, and in their absence thickets tend to form. Wildflowers characteristic of the true prairie species include wild indigo (*Babtisia*), indigobush (*Amorpha fruticosa*), senna (*Cassia*), tickleclover (*Desmodium*), lespedezas (*Lespedeza*), prairie-clovers, western ragweed, crotons (*Croton*), and sneezeweeds.

The post oak savannah was extensively cultivated through the 1940s; however, today many acres have been returned to native habitat or tame pastureland, which have been seeded with nonnative species such as bermudagrass, bahiagrass, weeping lovegrass, and clover. The region supports game species such as deer, squirrel, and quail.

The **Gulf Prairies and Marshes** vegetational area encompasses all of Matagorda County, the entire portion of Wharton County within Region K, and the eastern tip of Colorado County. This is a 30- to 80-mile-wide strip of lowlands adjacent to the Texas coast from the Louisiana border to the Mexico border. The landscape consists of low, wet coastal marshes, and nearly flat, undissected plains with elevations from sea level to 250 feet. Marsh soils are typically dark, poorly drained, saline and sodic, sandy loams, and clays, and light neutral sands. Prairie soils are characterized by dark, neutral to slightly acid clay loams, and clays, with a narrow belt of light acid sands and darker loamy to clayey soils along the coast. Bottomland and delta soils are typically reddish-brown to dark gray, slightly acid to calcareous, loamy to clayey alluvial.

Original Gulf Prairie vegetation consisted of tallgrasses and post oak savannah. Today, however, trees and shrubs such as honey mesquite, oaks, acacia, and bushy sea-ox-eye (*Borrichia frutescens*) have formed thickets in many areas. Characteristic tallgrasses include gulf cordgrass (*Spartina spartinae*), big bluestem, little bluestem, Indiangrass, eastern gamagrass (*Tripsacum dactyloides*), gulf muhly (*Muhlenbergia capillaris*), tanglehead (*Heteropogon contortus*), as well as *Panicum* and *Paspalum* species. Typical wildflowers include asters, Indian paintbrush (*Castilleja indivisa*), poppy mallows (*Callirhoe*), phloxs (*Phlox*), bluebonnets (*Lupinus*), and evening primroses (*Oenothera*). Common invaders such as yankeeweed (*Eupatorium compositifolium*), broomsedge bluestem (*Andropogon virginicus*), smutgrass (*Sporobolus indicus*), western ragweed, tumblegrass (*Schedonnardus paniculatus*), threeawns (*Aristida*), pricklypear, and many annual wildflowers and grasses have increased their ranges. Saline Gulf Marsh areas support species of sedges (*Carex* and *Cyperus*), rushes (*Juncus*), bulrushes (*Scirpus*), cordgrasses (*Spartina*), seashore saltgrass (*Distichlis spicata*), common reed (*Phragmites australis*), marshmillet (*Zizaniopsis miliacea*), longtom (*Paspalum lividum*), seashore dropseed (*Sporobolus virginicus*), and knotroot bristlegrass (*Setaria geniculata*). Marshmillet and maidencane (*Panicum hemitomon*) are two important freshwater grass species found in the upper coast. Typical aquatic forbs include pepperweeds (*Lepidium*), smartweeds (*Polygonum*), docks (*Rumex*), bushy seedbox (*Ludwigia alternifolia*), green parrotfeather (*Myriophyllum pinnatum*), pennyworts (*Hydrocotyle*), water lilies (*Nymphaea*), narrowleaf cattail

(*Typha domingensis*), spiderworts (*Tradescantia*), and duckweeds (*Lemna*). Common halophytic herbs and shrubs found on the salty sands of the coast include spikesedges (*Eleocharis*), fimbries (*Fimbrystalis*), glassworts (*Salicornia*), sea-rockets (*Cakile*), maritime saltwort (*Batis maritima*), morning glories (*Ipomoea*), and bushy sea-ox-eye.

The low coastal marshes of the Gulf Prairies and Marshes vegetational area provide excellent habitat for upland game and waterfowl. Higher elevations of the marshes are used for livestock and wildlife production. These coastal marshes and barrier islands contain most of the State's National Seashore parks. Urban, industrial, and recreational developments have been increasing in this region and cultivation has never been of much importance due to the saline soils and recurrent flooding of the area. However, approximately one-third of the inland prairies region is cultivated. This is also the major area of irrigated crop production, consisting primarily of rice cultivation, for the entire Lower Colorado Region. Bermudagrass and several bluestem species are common in tamed pasturelands. The Gulf Prairies and Marshes region has seen more industrialization than anywhere in Texas since World War II.

1.2.1.4 Water Resources[8, 9]

Two percent, or 3,432,320 acres, of the total area in Texas is covered with water. The primary surface water feature of Region K is the Colorado River. *Figure 1.10* displays the surface water hydrology characteristics of the region. The major sources of dependable surface water supplies in the region are the Highland Lakes reservoir system and the run-of-the-river (ROR) water from the Colorado River. ROR water rights allow permit holders to divert water directly from a watercourse up to their permitted amounts if the water is present in the river and after downstream senior priority rights are satisfied. Tributary ROR water rights and off-channel storage are also utilized by several water user groups (WUGs). And a small portion of the planning region's surface water supply comes from local supplies within adjacent river basins. There are 11 water supply reservoirs within the LCRWPG boundaries: Goldthwaite, Blanco, Llano, and Cedar Creek reservoirs, Lake Walter E. Long, and the Highland Lakes System (Lakes Buchanan, Inks, Lyndon B. Johnson, Marble Falls, Travis, and Austin). Lake Georgetown is located outside the boundaries of Region K in Williamson County; however, a small portion of this water supply is utilized within the region. The major Colorado River ROR water rights holders (based on firm yield) in Region K are the Lower Colorado River Authority (LCRA), City of Austin (COA), and STP Nuclear Operating Company. The City of Corpus Christi, located in Region N, and the Colorado River Municipal Water District, located in Region F immediately upstream of Region K, are also major water right holders on the Colorado River.

Large quantities of fresh to slightly saline groundwater underlie more than 81 percent of the land in Texas. There are nine "major" aquifers that can produce large quantities of water over a large area, and 20 "minor" aquifers that yield smaller amounts of water over smaller geographic areas. At present, 56 percent of the State's annual water consumption is derived from the State's major and minor aquifers, 75 percent of which is used for agriculture. Of these 29 aquifers, five major and five minor aquifers occur within Region K.

The five major aquifers are the Carrizo-Wilcox, Edwards aquifer (Balcones Fault Zone [BFZ]), Edwards-Trinity (Plateau), Gulf Coast, and Trinity (*Figure 1.11*). These aquifers tend to run in curved belts northeast to southwest across the state.

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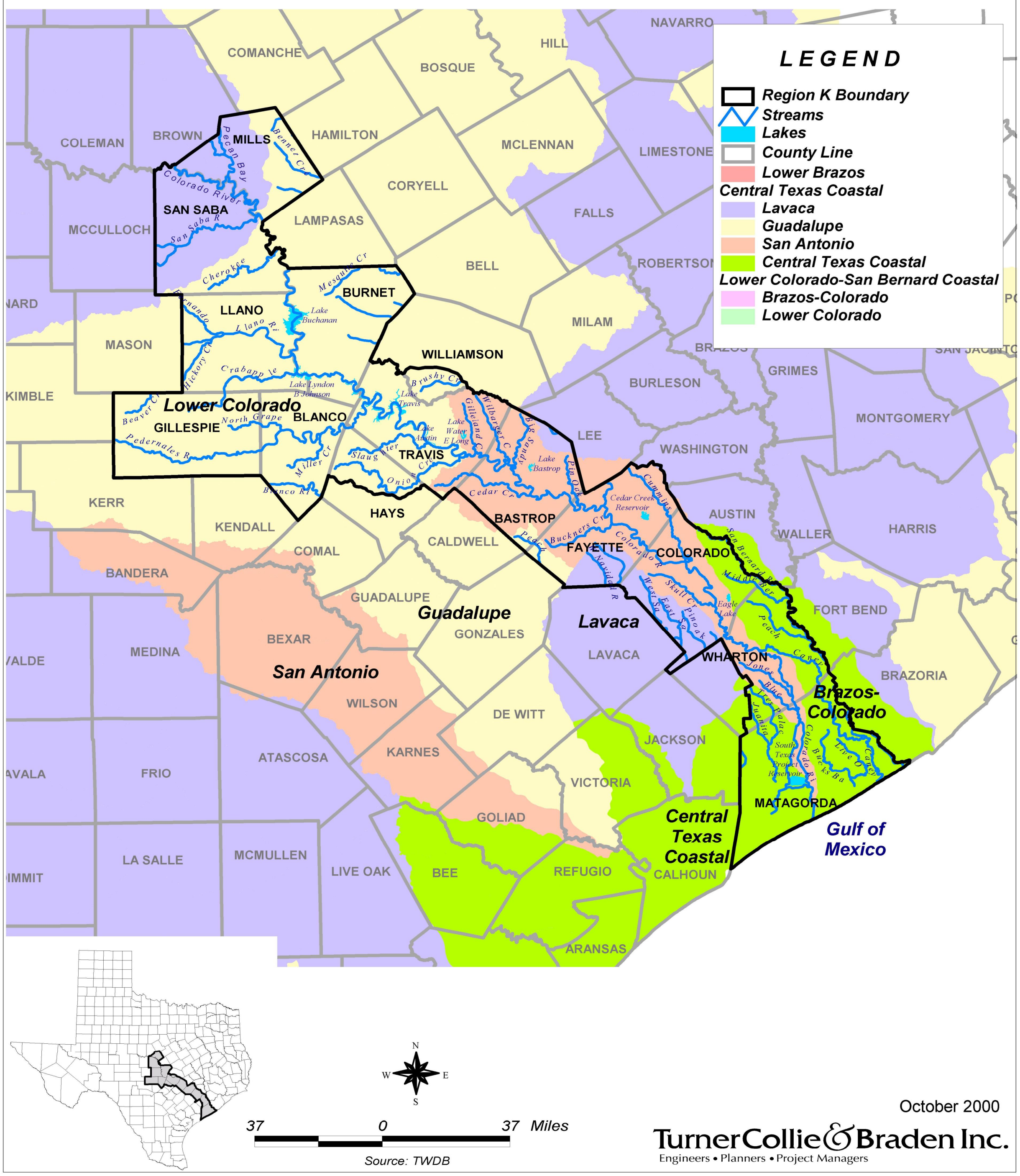
[8] Dallas Morning News, 1999. *Texas Almanac 2000-2001, 60th Edition*, Texas A&M Press.
[9] Texas Water Development Board (TWDB), November 1995. *Aquifers of Texas, Report 345.*

Figure 1.10 : Lower Colorado Regional Water Planning Area (Region K) Surface Water Hydrology



The northern most major aquifer in Region K is the Trinity, which has both unconfined water-table and pressurized artesian zones, and covers portions of Mills, Burnet, Gillespie, Blanco, Travis, Hays, and Bastrop Counties. Within the region, the Trinity aquifer contains two major early Cretaceous age formations: the Antlers formation, which consists of a maximum of 900 feet of sand and gravel, with clay beds in the middle section; and the Travis Peak formation, which contains calcareous sands and silts, conglomerates, and limestones. West of the Trinity aquifer in Gillespie County is a small eastern water-table portion of the Edwards-Trinity (Plateau) aquifer. Within the planning region, the Edwards-Trinity (Plateau) aquifer contains saturated sediments of lower Cretaceous age formations and overlying limestones and dolomites. Maximum saturated thickness of the aquifer is 800 feet; however, the eastern portion of the aquifer in Gillespie County is thinner. Overlying a portion of the Trinity artesian zone is the Edwards (BFZ) aquifer, which covers portions of Hays, Travis, and Williamson Counties within Region K. In this area, the aquifer contains both unconfined and artesian zones and feeds the well-known recreational Barton Springs, which contributes an estimated average of 50 cubic feet per second (cfs) of flow to the Colorado River. The Edwards BFZ is primarily composed of early Cretaceous age limestone deposits that have a thickness ranging between 200 feet and 600 feet. This aquifer has a high permeability and transmissivity, making it heavily dependent on consistent recharge and extremely sensitive to environmental stresses. Southeast of the Trinity is the Carrizo-Wilcox aquifer in portions of Bastrop and Fayette Counties. This aquifer contains both water-table and artesian zones and consists of two hydrologically connected formations, the Wilcox Group and the overlying Carrizo formation, which are predominantly composed of Tertiary age sand that is imbedded with gravel, silt, clay, and lignite. The thickness of the artesian zone ranges from 200 feet to 3,000 feet. The southernmost and largest major aquifer within Region K is the Gulf Coast aquifer, which stretches continuously from southeastern Fayette County through Matagorda County. This portion of the aquifer is described as a leaky artesian system, which is composed of Cenozoic age complex interbedded clays, silts, sands, and gravel. In some areas near the Gulf Coast, heavy pumping has caused the intrusion of saltwater into aquifer layers that previously had good water quality. The physical characteristics of this aquifer make it susceptible to dewatering, or a permanent compaction of the clay layer and loss of water storage capacity, as a result of overuse of the aquifer. This compaction can also cause subsidence of surface land overlying the aquifer, which can contribute to flood and structural damage in the area.

The minor aquifers occurring within Region K are the Ellenburger-San Saba, Hickory, Marble Falls, Queen City, and Sparta (*Figure 1.12*). All five of these aquifers contain unconfined zones and pressurized artesian zones. The Ellenburger-San Saba, Hickory, and Marble Falls aquifers occur in the northwestern portion of the planning region, have discontinuous circular coverage areas, and overlap one another. The Hickory aquifer is composed of the Hickory Sandstone Member of the Cambrian Riley formation, which contains some of the oldest sedimentary rocks found in Texas. This aquifer has a maximum thickness of 480 feet. The Ellenburger-San Saba aquifer has the same general shape as the Hickory and is composed of late Cambrian age limestone and dolomite. San Saba Springs is thought to be supplied primarily by the Ellenburger-San Saba and Marble Falls aquifers, which may be hydrologically connected in some areas. The Marble Falls aquifer occurs in several disconnected outcrops of Pennsylvanian age limestone that form fractures, solution cavities, and channels. The maximum thickness of this aquifer is 600 feet. Numerous large springs are fed by the Marble Falls aquifer, which provide a substantial portion of baseflow to the San Saba and Colorado Rivers in San Saba County. The Queen City and Sparta aquifers overlap one another across southeastern Bastrop and northwestern Fayette Counties. The Queen City aquifer is composed of Tertiary age sand, loosely cemented sandstone, and interbedded clay. The maximum thickness of this aquifer is less than 500 feet. The Sparta aquifer overlies the downdip portion of the Queen City aquifer and consists of Tertiary age sand and interbedded clay.

Figure 1.11 : Lower Colorado Regional Water Planning Area (Region K) Major Aquifers

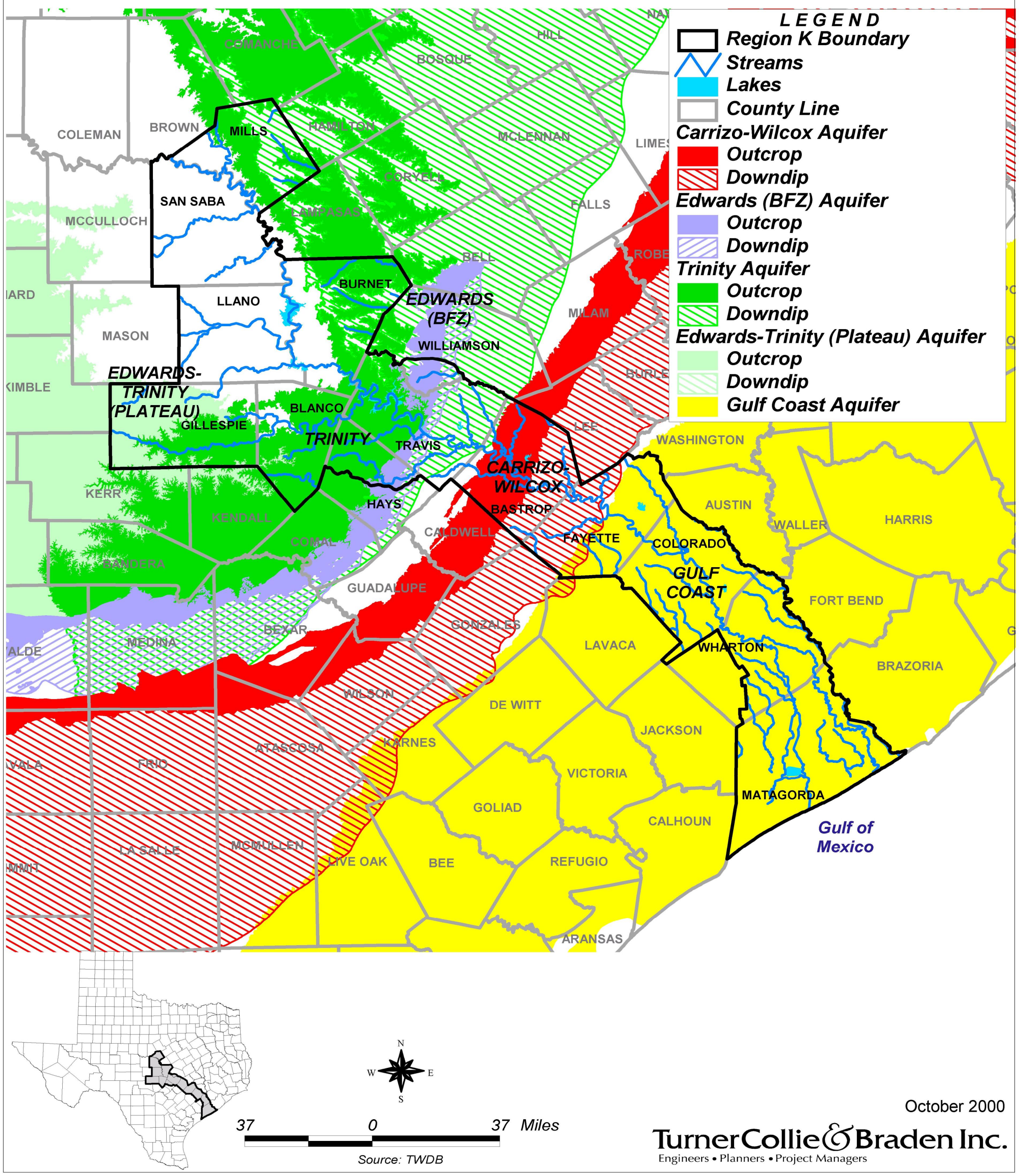
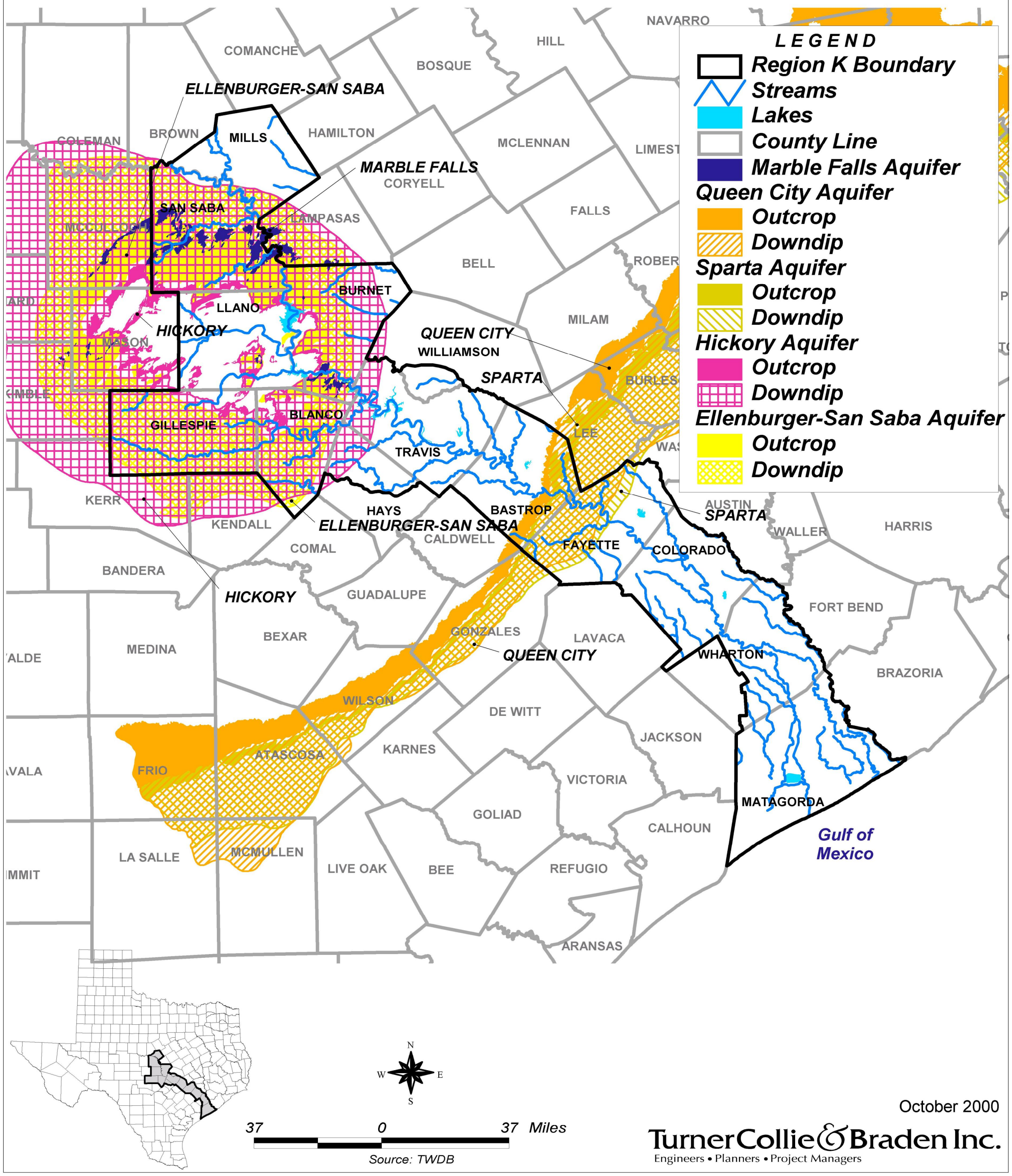


Figure 1.12 : Lower Colorado Regional Water Planning Area (Region K) Minor Aquifers



Surface water and groundwater supply availabilities for Region K are discussed in *Chapter 3* of this report.

1.2.1.5 Land Resources[10]

The majority of Region K's land area falls within the Colorado River Basin and 92 percent of the region's population resides in this portion of the basin. Land use (*Figure 1.13*) in Region K consists primarily of agricultural land in Matagorda, Wharton, Colorado, Fayette, and eastern Travis Counties. Forestland runs through the middle of Colorado and Fayette Counties; western Travis and Burnet Counties; southeastern Llano County; and a significant portion of Gillespie and Hays Counties. Rangeland predominates in Mills, San Saba, northwestern Llano, and eastern Burnet Counties. Blanco County is primarily a mixture of forestland and rangeland. Bastrop County is a mixture of forestland, agricultural land, and rangeland. A significant concentration of urban land only occurs in the Austin metropolitan area.

The State of Texas has 123 state parks and 14 of these, with a total of 28,223 acres, occur within the counties of Region K (*Table 1.2*). The Texas State Park System offers a variety of recreational and educational opportunities, including camping, hiking, fishing, boating, water skiing, swimming, wildlife viewing, picnicking, and tours of nature exhibits and historical sites.

1.2.1.6 Wildlife Resources[11]

There are 17 national wildlife refuges in Texas, comprising over 463,000 acres, and four of these occur within Region K (83,338 acres). Refuges function to preserve and protect critical wildlife habitat for unique, rare, threatened, and/or endangered species. Many refuges allow bird and wildlife viewing, hunting, and fishing during specific times of the year. In addition, the Texas Parks & Wildlife Department (TPWD) currently manages 50 Wildlife Management Areas (WMAs) in the state with a total of 750,000 acres. Two WMAs lie within Region K and encompass approximately 7,500 acres. These areas preserve and manage quality wildlife habitat and can allow compatible activities such as research, hunting, fishing, hiking, camping, bicycling, and horseback riding. *Table 1.3* lists the wildlife refuges and management areas within Region K.

Each county within the Lower Colorado Planning Region provides habitat for several threatened or endangered animal and plant species. Endangered species are those at risk of extinction. Threatened species are those likely to become endangered in the future. These designations are made at the state and federal level by the TPWD and the U.S. Fish and Wildlife Service (USFWS). State and federal threatened and endangered species listings for each county in Region K are presented in *Appendix 1A*. Rare species that are not listed as threatened or endangered are also included.

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[10] Dallas Morning News (Texas Almanac 2000–2001), Op. Cit., 1999.
[11] Dallas Morning News (Texas Almanac 2000–2001), Op. Cit., 1999.

Table 1.2 State Parks Located Within the Lower Colorado Region

Name	County	Acreage	Description
Admiral Nimitz Museum and Historical Center	Gillespie	7	Established in 1969 and contains special exhibits from World War II.
Bastrop State Park	Bastrop	3,504	Established between 1933 and 1935 and contains the “Lost Pines” isolated region of loblolly pine and hardwoods.
Blanco State Park	Blanco	105	Established in 1933 along the Blanco River and has fishing for winter rainbow trout, perch, catfish, and bass.
Buescher State Park	Bastrop	1,017	Established between 1933 and 1936 and was part of Stephen F. Austin's colonial grant; an estimated 250 species of birds can be found in the park.
Colorado Bend State Park	San Saba	5,328	Established in 1984 and part is in Lampasas Co.; contains scenic Gorman Falls and is home to rare and endangered species including the bald eagle, golden-cheeked warbler, and black-capped vireo.
Enchanted Rock State Park	Gillespie and Llano	1,644	Established in 1978 along Big Sandy Creek and contains a large granite outcrop that is the second largest batholith in the U.S. Enchanted Rock is also a national natural landmark and a national historic site.
Inks Lake State Park	Burnet	1,202	Established in 1940 along Inks Lake.
Lake Bastrop S. Shore Park	Bastrop	773	Established in 1989.
Longhorn Cavern State Park	Burnet	639	Established between 1932 and 1937 and was dedicated as a natural landmark in 1971. The cave has been used as a shelter since prehistoric times.
LBJ State Historical Park	Gillespie	718	Established in 1965 along the banks of the Pedernales River; contains LBJ’s home and a portion of the official Texas Longhorn herd, as well as bison, deer, and wild turkey; living-history demonstrations at the restored Sauer-Beckmann house.
Matagorda Island State Park	Matagorda	7,325	A natural accreting barrier island located offshore between Port O’Conner and Fulton and is home to a variety of migratory and resident wildlife, including 18 state or federally listed endangered species.
McKinney Falls State Park	Travis	744	Established in 1970.
Monument Hill State Historical Park/Kreische Brewery State Historical Park	Fayette	5	Established in 1907/1977. Memorial to the Salado Creek Battle in 1842 and the “black bean lottery” of the Mier Expedition; and one of the first breweries in the state.
Pedernales State Park	Blanco	5,212	Established in 1970 and has typical Edwards Plateau terrain with live oaks, deer, turkey, and stone hills.

Figure 1.13 : Lower Colorado Regional Water Planning Area (Region K) Landuse Distribution

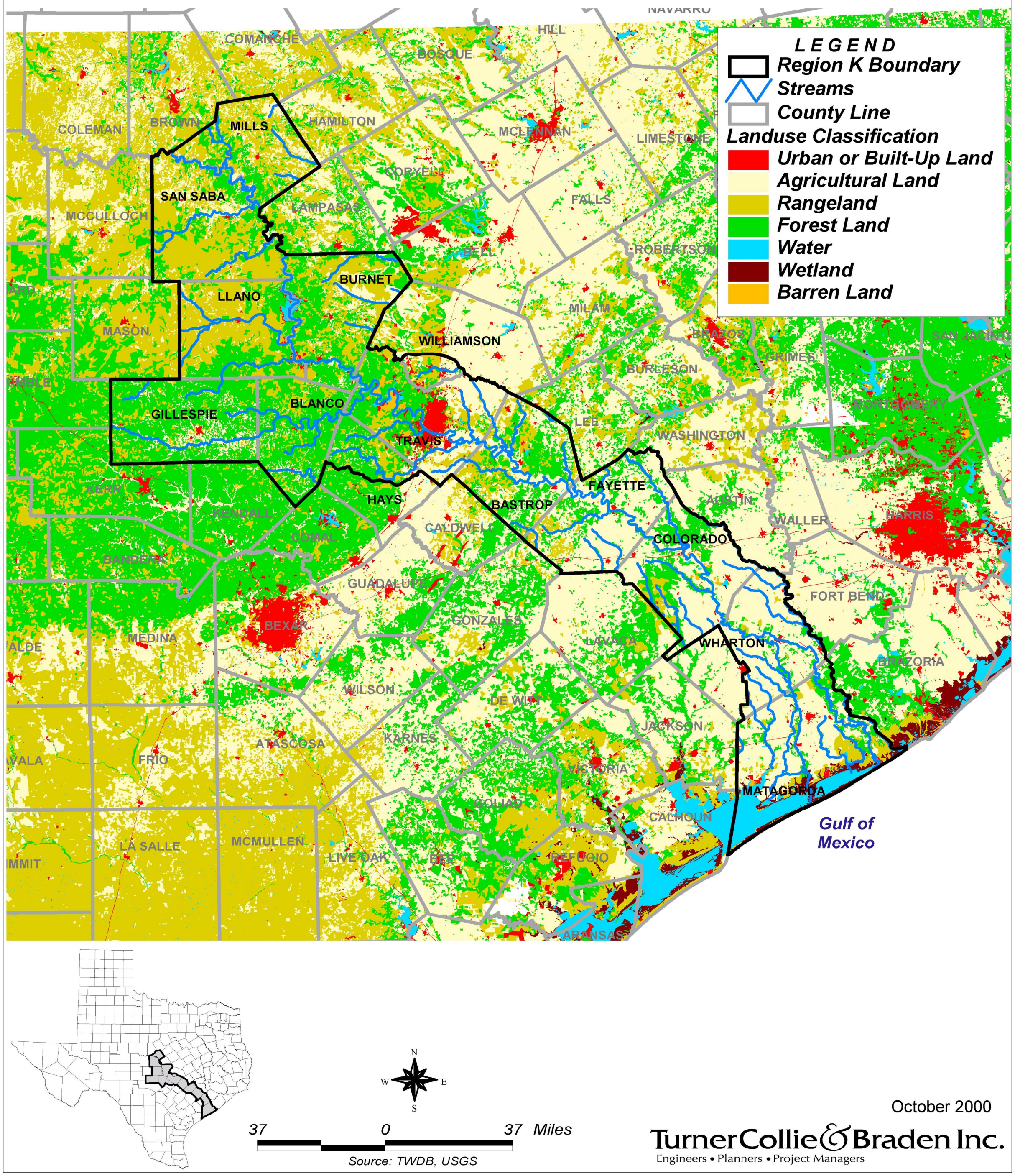


Table 1.3 Wildlife Refuges/Management Areas Located Within the Lower Colorado Region

Name	County	Acreage	Description
National Wildlife Refuges			
Attwater Prairie Chicken	Colorado	8,000	Established in 1972 to preserve habitat for the endangered Attwater Prairie Chicken, which includes native tallgrass prairie, potholes, sandy knolls, marshes, and some wooded areas.
Balcones Canyonlands	Travis	14,144	Established in 1992 northwest of Austin to protect the nesting habitat of two endangered bird species: golden-cheeked warbler and the black-capped vireo. The refuge will eventually encompass 46,000 acres of oak-juniper woodlands and other habitats.
Big Boggy	Matagorda	4,526	Coastal prairie and salt marsh along East Matagorda Bay for the benefit of wintering waterfowl.
Matagorda Island	Matagorda	56,668	A natural accreting barrier island located offshore between Port O'Conner and Fulton and is home to a variety of migratory and resident wildlife, including 18 state or federally listed endangered species.
Wildlife Management Areas			
Mad Island	Matagorda	7,281	This area allows hunting and wildlife viewing.
D. R. Wintermann	Wharton	246	This area has restricted access.

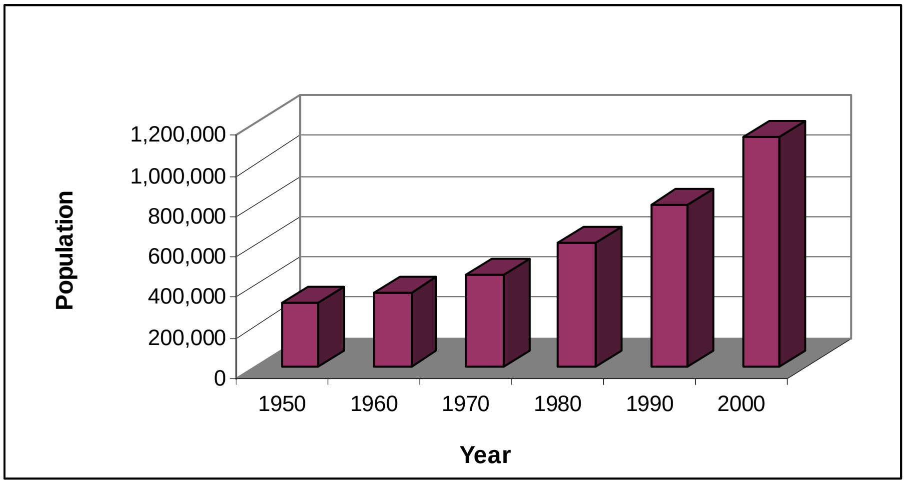
1.2.2 Socioeconomic Characteristics of the Lower Colorado Regional Water Planning Area

1.2.2.1 Historic and Current Population Trends[12]

Region K has had a steady increase in population from 1950 to the present. As *Figure 1.14* shows, in 1950 there were approximately 316,573 people, which has increased to an estimated 1,132,228 people in 2000. This corresponds to an overall 257 percent increase in the number of people living in the region during that time period. The average compound annual growth rate for the 1950 to 2000 period was an estimated 2.4 percent. The period from 1990 to 2000 had the largest percent increase of almost 41 percent, or an addition of 331,199 people. The time period of smallest population growth occurred between 1950 and 1960, with an increase of 45,830 persons (14.5 percent). As discussed in Chapter 2, this growth trend is expected to continue for the entire State of Texas, as well as Region K. For the period 1990 to 2060, a compound annual growth rate of 1.8 percent is projected, resulting in a total regional population of 2,713,905 in 2060.

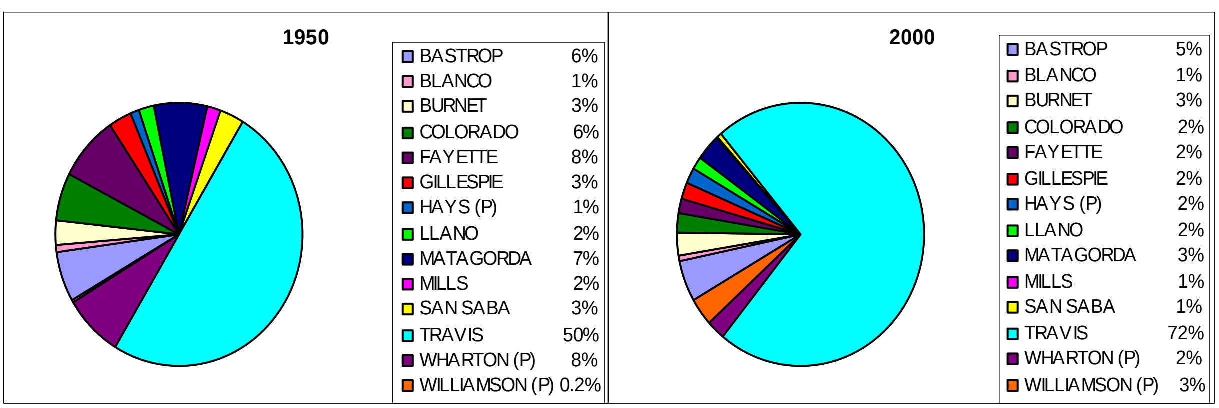
[12] Bureau of the Census, Decadal Censuses of 1950, 1960, 1970, 1980, 1990 and 2000; and Region K historic population data supplied by the Texas Water Development Board for 1980–2000. The Region K 2000 Population projections were developed utilizing year 2000 census data as a starting point with adjustments made by the LCRWPG as necessary. Populations for the Partial Region K counties of Hays, Williamson, and Wharton were estimated by determining the percent decreases observed in projections from the U.S. Census and the TWDB for 1980 and 1990; these percent decreases were then averaged and applied to the 1950, 1960, and 1970 U.S. Census partial-county populations.

Figure 1.14: Historic Lower Colorado Regional Water Planning Area Population



Comparison of the region's county population distribution between 1950 and 2000 (*Figure 1.15*) shows that Travis County still contains the majority of the region's population. However, this proportion has increased from 50 percent in 1950 to 72 percent in 2000 due to the rapid growth of the Austin area. Travis County's population has more than quadrupled between 1950 and 2000, with the addition of over half a million people. Hays County has also seen a large population increase with almost eight times as many people living in the county in 2000 as in 1950. Other counties in the region have experienced much smaller growth rates.

Figure 1.15: Lower Colorado Region County Population Distribution



1.2.2.2 Primary Economic Activities[13, 14]

Economic activities in Region K include agriculture, government/services, manufacturing, mining, and trades. *Table 1.4* lists the primary economic base of each county as well as the breakdown of mining and agricultural activities. *Appendix 1B* has a list of the Region K industry economic value estimates.

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[13] Dallas Morning News (Texas Almanac 2000–2001), Op. Cit., 1999.
[14] Texas Comptroller of Public Accounts, Texas Economy, www.window.state.tx.us/ecodata/regional/.

Table 1.4 Lower Colorado Region Primary Economic Activities by County

County	Primary Economic Base	Mineral Deposits	Agriculture
Bastrop	government/services, tourism, agribusiness, computer equipment	clay, oil, gas	hay, beef cattle, turfgrasses, horses, goats, pecans, pine
Blanco	tourism, agribusiness, ranch supplies and equipment manufacturing, hunting	insignificant	cattle, sheep, goats, hay, vegetables, wheat, peaches, pecans, greenhouse nurseries
Burnet	stone processing, manufacturing, agribusiness, tourism, hunting	granite, limestone	cattle, goats, sheep, hay, hunting, pecans
Colorado	agribusiness, oilfield services/ equipment, manufacturing, mineral processing	gas, oil	rice, cattle, nursery, corn, poultry, hay, sorghum, cedar, pine
Fayette	agribusiness, tourism, electrical power generation, mineral production, small manufacturing	oil, gas, sand, gravel	poultry, beef cattle, dairies, corn, sorghum, peanuts, hay, pecans
Gillespie	agribusiness, tourism, government/ services, food processing, hunting, small manufacturing, granite processing	sand, gravel, gypsum, limestone	beef cattle, turkeys, sheep, goats, peaches, hay, sorghum, oats, wheat, grapes
Hays (p)	tourism, retirement, some manufacturing, hunting	sand, gravel, cement	beef cattle, goats, exotic wildlife, greenhouse nurseries, hay, corn, sorghum, wheat, cotton
Llano	tourism, retirement, ranch commerce center, vineyards, granite mining, hunting	granite, vermiculite, llanite	beef cattle, turkeys, hogs, sheep, goats, hay, peanuts, oats
Matagorda	petroleum operations, petrochemicals, agribusiness, varied manufacturing, significant tourism, electrical power generation	gas, oil, salt	major rice-growing area, cotton, turfgrass, grains, soybeans, cattle
Mills	agribusiness, hunting	insignificant	beef cattle, sheep, goats, sorghum, hay, dairies, pecans
San Saba	agribusiness, stone processing, tourism, hunting, government/ services	stone	cattle, poultry, sheep, goats, pecans, wheat, hay, peanuts
Travis	education, state government, tourism, research, industries, conventions	limestone, sand, gravel, oil, gas	cattle, nursery crops, hogs, sorghum, corn, cotton, small grains, pecans
Wharton (p)	oil, sulphur, and other minerals, agribusiness, hunting, varied manufacturing	oil, gas	leading rice producing county, cotton, milo, corn, sorghum, soybeans, turfgrass, eggs, beef cattle
Williamson (p)	agribusiness, varied manufacturing, government/services	stone, sand, gravel	beef cattle, sorghum, cotton, corn, wheat

(p) - a portion of the county lies within the LCRWPG boundaries

Agriculture plays a major role in most of the counties in Region K. Livestock accounts for more than 60 percent of the planning region's agricultural cash receipts and important crops include rice, hay, wheat, and cotton. The counties located in the northwestern portion of the planning region depend heavily on livestock production. Rice is the major crop produced in the southernmost counties of Colorado, Wharton, and Matagorda.

The manufacturing sector consists primarily of the technology and semiconductor industries, in the mid-region counties of Bastrop, Travis, and Williamson. The largest single manufacturing industry in the coastal counties is petroleum refining and petrochemicals, and the price fluctuations in oil prices resulted in a slight decline in the economic growth rate during this period. Electrical generation is a notable industry in Matagorda County. The South Texas Electric Generating Station provides generation capacity to serve more than 1 million homes as well as being the largest employer and source of revenue for the county. At the same time, there has been significant economic growth in food processing, lumber, wood products, and construction supplies for the coastal counties. Textile and apparel industries are found throughout Region K; however, the economic growth rate has been on the decline over the past decade. The construction sector economic trend was productive throughout the planning region due to increases in residential markets, prison facilities, and shopping malls.

In the decade between 1984 and 1994, almost every sector of the regional economy experienced growth, except construction and mining. During this time, average annual employment growth rates for Region K were 2.7 percent for the far northern portion of the region, 3.5 percent for the middle portion, and 1.3 percent for the lower portion of the region.

Table 1.5 Lower Colorado Region County Population and Economic Estimates

County Name	July 2002 Resident Population [1]	CY 2002 Personal Income [1]		CY 1999	CY 1999 Poverty [2]		CY 2003 Average Labor Force Employment and Unemployment [3]			
		Per Capita ($)	Total (millions $)	Median Household Income ($)[2]	Individuals in Poverty	Poverty Rate (%)	Labor Force	Persons Employed	Persons Un-employed	Unemploy-ment Rate (%)
Bastrop	64,257	$22,057	$1,417	$43,578	6,456	11.6	31,851	29,785	2,066	6.5
Blanco	8,787	$26,817	$236	$39,369	922	11.2	4,131	3,976	155	3.8
Burnet	37,571	$25,765	$968	$37,921	3,614	10.9	17,615	16,738	877	5.0
Colorado	20,406	$24,577	$502	$32,425	3,171	16.2	8,446	8,037	409	4.8
Fayette	22,266	$27,662	$616	$34,526	2,426	11.4	11,172	10,812	360	3.2
Gillespie	21,662	$27,410	$594	$38,109	2,067	10.2	10,855	10,594	261	2.4
Hays	109,718	$23,910	$2,623	$45,006	13,039	14.3	57,473	54,237	3,236	5.6
Llano	17,864	$23,608	$422	$34,830	1,733	10.3	5,911	5,615	296	5.0
Matagorda	37,999	$21,277	$808	$32,174	6,913	18.5	15,073	12,901	2,172	14.4
Mills	5,115	$22,644	$116	$30,579	900	18.4	2,601	2,550	51	2.0
San Saba	6,046	$20,666	$125	$30,104	936	16.6	2,744	2,671	73	2.7
Travis	847,815	$35,492	$30,100	$46,761	99,388	12.5	501,220	471,869	29,351	5.9
Wharton	41,121	$24,304	$999	$32,208	6,703	16.5	19,695	18,342	1,353	6.9
Williamson	290,353	$26,979	$7,833	$60,642	11,735	4.8	164,676	156,399	8,277	5.0
LCRWPG [4]	1,530,980	$30,934	$47,359	-	160,003	-	853,463	804,526	48,937	5.7
Texas	21,736,925	$29,039	$631,208	$39,927	3,117,609	15.4	10,910,344	10,172,828	737,516	6.8

[1] U.S. Bureau of Economic Analysis (URL: http://www.bea.doc.gov/bea/regional/bearfacts/countybf.cfm)
[2] U.S. Bureau of the Census (URL: http://factfinder.census.gov) (Fact Sheet for community profiles.)
[3] Texas Workforce Commission (URL: http://www.twc.state.tx.us/lmi/) (http://www.tracer2.com/)
[4] Includes all of Hays, Wharton, and Williamson Counties.

1.2.2.3 Historical Water Uses[15, 16, 17]

Total annual water use in the Lower Colorado Regional Planning Area has increased approximately 5 percent from 1980 to 2000 (*Figure 1.16*). A peak water use of 1.17 million ac-ft occurred in 1988. By 1992 the region's water use had decreased almost 20 percent to 0.94 million ac-ft. The period from 1980 to 2000 has seen a relatively moderate fluctuation of +/-17 percent as compared to the 20-year annual water demand average of approximately one million ac-ft. When compared to the region's consistently increasing population and industry, the effect of improvements in water use efficiencies is evident. Relative water use distribution, by water use category, has remained relatively similar between 1980 and 2000 (*Figure 1.17*). Irrigation is the largest water use in Region K, which accounted for almost 80 percent of water use in 1980 and 62 percent in 2000. Municipal has consistently been the second largest water use since 1980, followed by steam-electric power, mining, manufacturing, and livestock water uses.

Figure 1.16: Lower Colorado Regional Water Planning Area Historical Water Demand

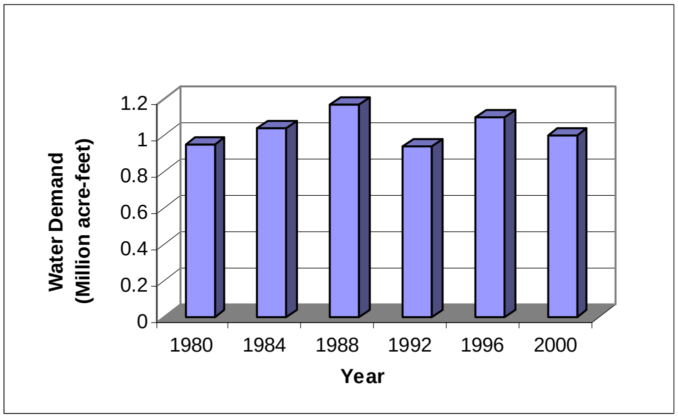
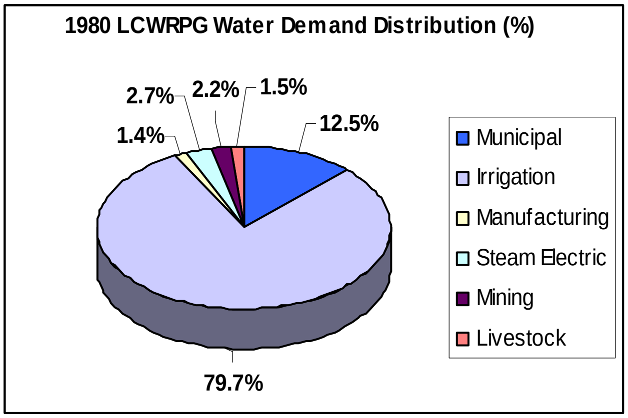
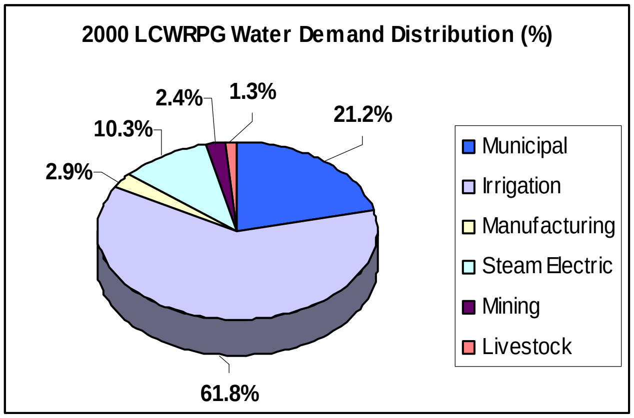


Figure 1.17: Lower Colorado Region User Group Water Demand Distribution





Irrigation water demand has decreased over this 20-year period, with an actual decrease of approximately 18 percent. Municipal experienced an 80 percent increase in actual water demand between 1980–2000, while livestock saw a 6 percent decrease, mining saw a 15 percent increase, manufacturing saw a 117 percent increase, and steam-electric power generation saw the largest actual water demand increase of 305 percent.

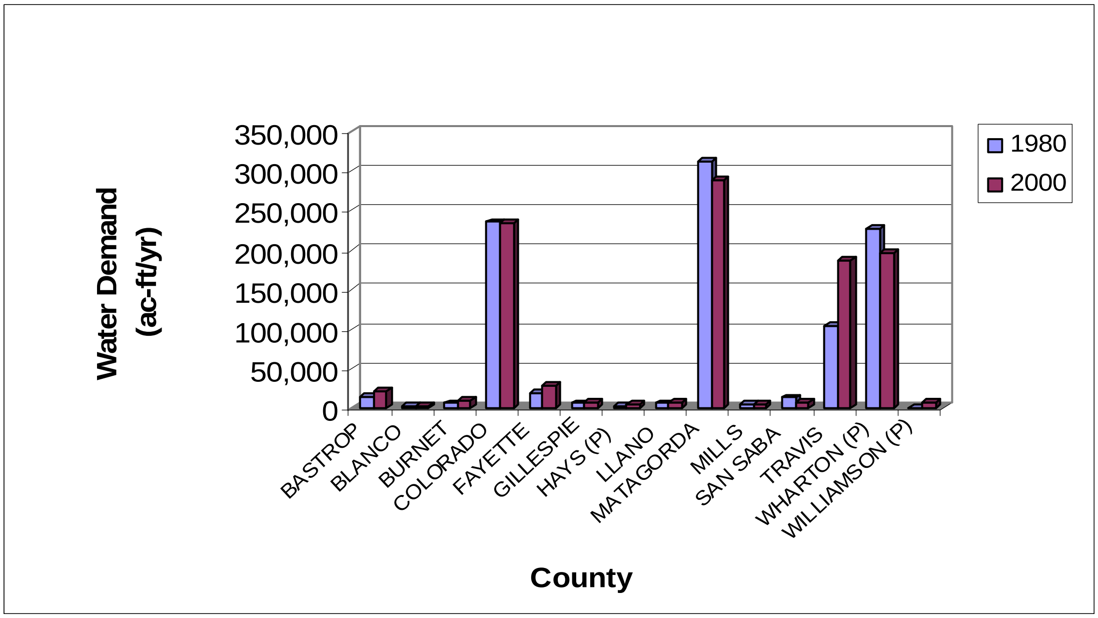
[15] The Region K 2000 population projections were developed utilizing year 2000 Census data as a starting point with adjustments made by the LCRWPG as necessary.

[16] LCRA, March 1999, *Water Management Plan*.

[17] Lower Colorado River Authority (LCRA), December 1997. *Freshwater Inflow Needs of the Matagorda Bay System.*

The water demand distribution between the 14 counties in Region K shows that demand has consistently been greatest during the period from 1980 to 2000 in Matagorda County, which accounted for approximately 33 percent of the region's total water demand in 1980 and 29 percent in 2000 (*Figure 1.18*). The major water use in Matagorda County is rice irrigation. Colorado and Wharton Counties are among the largest water users in the region, which is also attributed to the extensive rice irrigation in these counties. Travis County contains the region's only major demand center, and its water use ranked fourth overall in 1980 and in 2000. Overall, these four counties account for approximately 93 and 90 percent of the region's total water demand, respectively, for 1980 and 2000. Details of Region K's water demand are presented in Chapter 2.

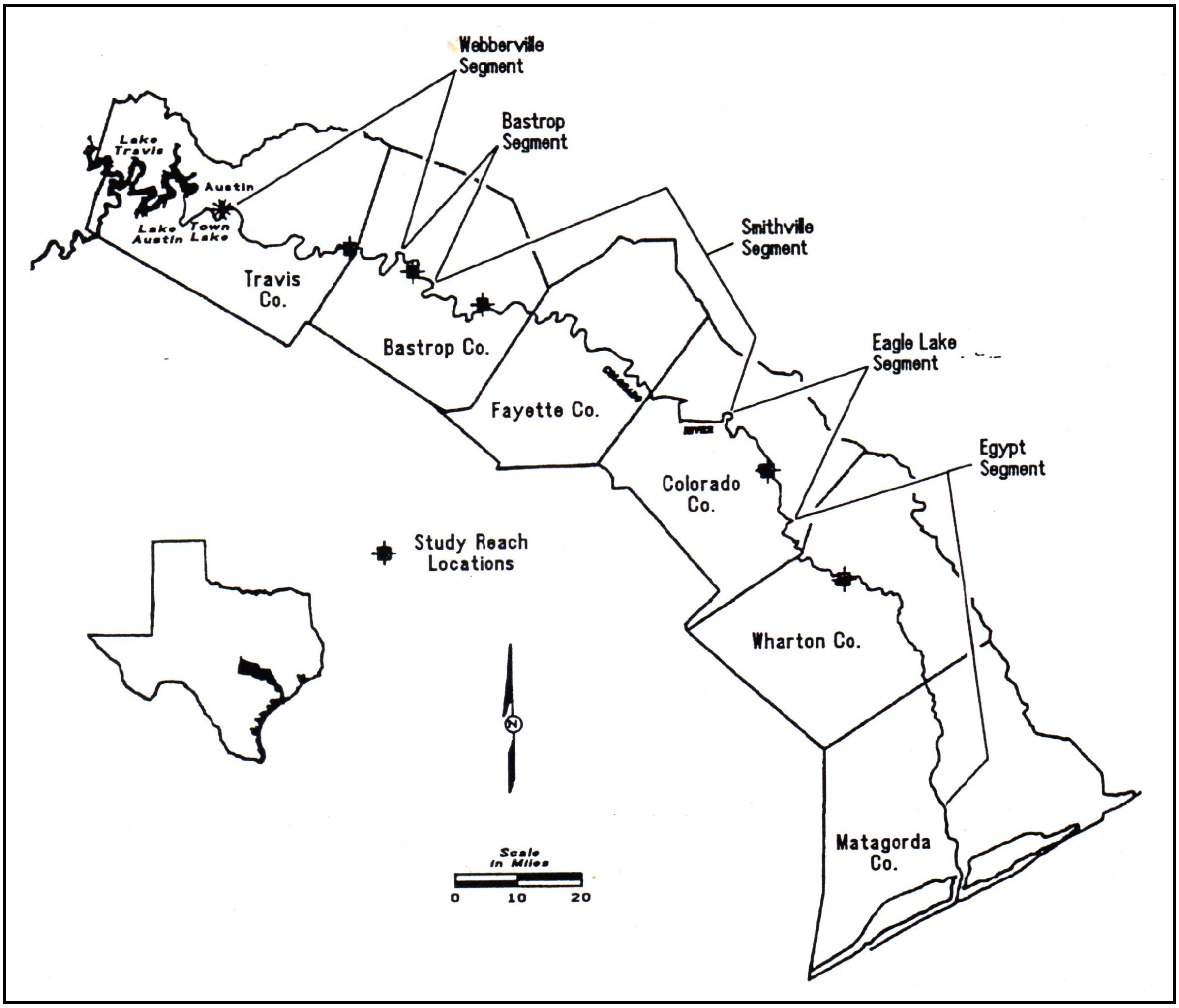
Figure 1.18: Lower Colorado Regional Water Planning Area County Water Demand Distribution



Flows for the maintenance of important environmental resources are also a significant water use within the free-flowing reaches of streams in Region K. Free-flowing reaches above the Highland Lakes System in San Saba and Mills Counties are dependent on water releases from Stacy Dam at O.H. Ivie Reservoir, which is outside Region K and is under the control of the Colorado River Municipal Water District. A management plan has been implemented in this area, between O. H. Ivie Reservoir and Lake Buchanan, to protect the federally endangered Concho Water Snake. The minimum continuous instream flow releases from Stacy Dam are 11 cfs from April through September and 2.5 cfs from October through March. These flow regimes are designed to preserve and protect the aquatic foodbase of the Concho Water Snake. These instream flows were required by the USFWS as a mitigation component to obtain a Section 404 permit from the U.S. Army Corps of Engineers (USACE) in order to build Stacy Dam. The water management plan also specifies that once every 2 years Stacy Dam will release a 2-day 2,500 cfs instream flow to provide channel maintenance for the water snake habitat.

The free-flowing reaches below the Highland Lakes System downstream to the mouth of the Colorado River are under the control of the LCRA. A 1992 instream flow study was performed by the LCRA for five consecutive study reaches, which start downstream of Austin at river mile 290 (from the mouth of the Colorado River) to river mile 34 near Bay City (*Figure 1.19*). The results of the 1992 study were subsequently incorporated into the TCEQ approved LCRA Water Management Plan (WMP). The LCRA Water Management Plan is updated approximately every five years on an as needed basis to reflect changing conditions in the basin.

Figure 1.19: Lower Colorado River Instream Study Reaches (LCRA)



Subsistence or critical instream flows are classified as a non-interruptible demand on water resources, and instream flows have been maintained by LCRA at or above the minimum critical flow in accordance with the current WMP. *Table 1.6* gives the minimal critical flow requirements recommended by the LCRA for two gage stations along the Lower Colorado River.

Target instream flows are designed to provide an optimal range of habitat complexity to support a well-balanced, native aquatic community within a stream reach. *Table 1.6* provides a schedule of flows recommended by the LCRA for the Colorado River study stream reaches to meet the physical habitat requirements of the native fish communities and other critical aquatic habitats. Target flows were adjusted monthly to incorporate the normal seasonal variations in flows for which native fish species are adapted. LCRA has maintained these flow regimes whenever water resources are adequate, but target flows are classified as interruptible demands that have been reduced during drought conditions. For further details, please refer to LCRA's WMP.

Table 1.6 Schedule of Recommended Flows for the Colorado River Downstream of Austin

Month	Critical Flows (cfs)		Target Flows (cfs)		
	Austin Gage [c]	Bastrop Gage	Bastrop Gage	Eagle Lake	Egypt
January	46	120	370	300	240
February	46	120	430	340	280
March	46	500 [b]	560	500 [a]	360
April	46	500 [b]	600	500 [a]	390
May	46	500 [b]	1,030	820	670
June	46	120	830	660	540
July	46	120	370	300	240
August	46	120	240	200	160
September	46	120	400	320	260
October	46	120	470	380	310
November	46	120	370	290	240
December	46	120	340	270	220

Source: LCRA, March 1999, *Water Management Plan*.

[a] Since target flow at Eagle Lake (based on overall community habitat availability) were insufficient to meet Blue Sucker (*Cycleptus elongatus*) spawning requirements during March and April, target flows were superseded by critical flow recommendations for this reach.

[b] This flow should be maintained for a continuous period of not less than six weeks during these months. A flow of 120 cfs will be maintained on all days not within the six week period.

[c] LCRA will maintain a mean daily flow of 100 cfs at the Austin gage at all times, to the extent of inflows each day to the Highland Lakes as measured by upstream gages, until the combined storage of Lakes Buchanan and Travis reaches 1.1 million acre-feet of water. A mean daily flow of 75 cfs, to the extent of inflows each day to the Highland Lakes as measured by upstream gages, will then be maintained until the combined storage of Lakes Buchanan and Travis reaches 1.0 million acre-feet of water, then a subsistence/critical flow of 46 cfs will be maintained at all times, regardless of inflows.

In addition, if the subsistence/critical flow of 46 cfs should occur for an extended period of time, then operational releases will be made by LCRA to temporarily alleviate the subsistence/critical flow conditions. Specifically, should the flow at the Austin gage be below a 65 cfs daily average for a period of 21 consecutive days, LCRA will make operational releases from storage sufficient to maintain daily average flow at the Austin gage of at least 200 cfs for two consecutive days. If this operational release conditions persists for three consecutive cycles (69 days), then a minimum average daily flow of at least 75 cfs will be maintained for the next 30 days.

Maintenance flows are classified as short periods of higher than normal flows that are needed to remove the buildup of silt and overgrowth of macrophytic vegetation. These flows should occur naturally during rainfall events, but may benefit from periodic dam releases to accomplish this task.

Freshwater inflow is also essential for healthy coastal estuarine ecosystems along the Texas Coast. Ninety-seven percent of the fishery species (shellfish and finfish) in the Gulf of Mexico spend all or a portion of their life cycle in estuaries. The life cycles of estuarine-dependent species vary seasonally and have different migratory patterns between the estuary and the Gulf. The Matagorda Bay system is the second largest estuary in the state, and this system receives freshwater inflow from the Colorado River, the Lavaca River, and surface runoff from the contributing drainage basin areas. On average, Matagorda Bay annually receives approximately 560 billion gallons (more than 1.7 million ac-ft) of freshwater from the Colorado River and basin. This corresponds to about 69 percent of the river's available water supply from surface runoff inflow. The LCRA performed a freshwater inflow study on the bay system in 1997 and determined the critical inflow that would keep salinity near the mouth of the river less than 25 parts per million (ppm) for protection of fishery sanctuary habitat during droughts. Target inflows were also determined that would result in producing 98 percent of the maximum total normalized biomass for key estuarine fishery species, while maintaining a certain salinity, population density, and nutrient inflow conditions. Modeling efforts determined that the optimal total critical flows and target flows for the Matagorda Bay system are 287,400 ac-ft/yr and 2,000,000 ac-ft/yr, respectively. *Table 1.7* provides the monthly flows required exclusively from the Colorado River's contribution to the bay system. The Colorado River provides about 52 percent of the bay system's target freshwater inflows and about 60 percent of the critical inflows. It should be noted here that there is a current effort underway to revise the Freshwater Inflow Needs Study that is nearly complete. Draft data show a potential need to provide increased target and critical inflows. These study results, when finalized, will be used in the next round of planning.

Table 1.7 Critical and Target Flows Schedule For Matagorda Bay System From the Colorado River

Month	Freshwater Inflows (1,000 ac-ft)[1]	
	Critical	Target
January	14.26	44.1
February	14.26	45.3
March	14.26	129.1
April	14.26	150.7
May	14.26	162.2
June	14.26	159.3
July	14.26	107
August	14.26	59.4
September	14.26	38.8
October	14.26	47.4
November	14.26	44.4
December	14.26	45.2
Annual Totals	171.1	1,033.1

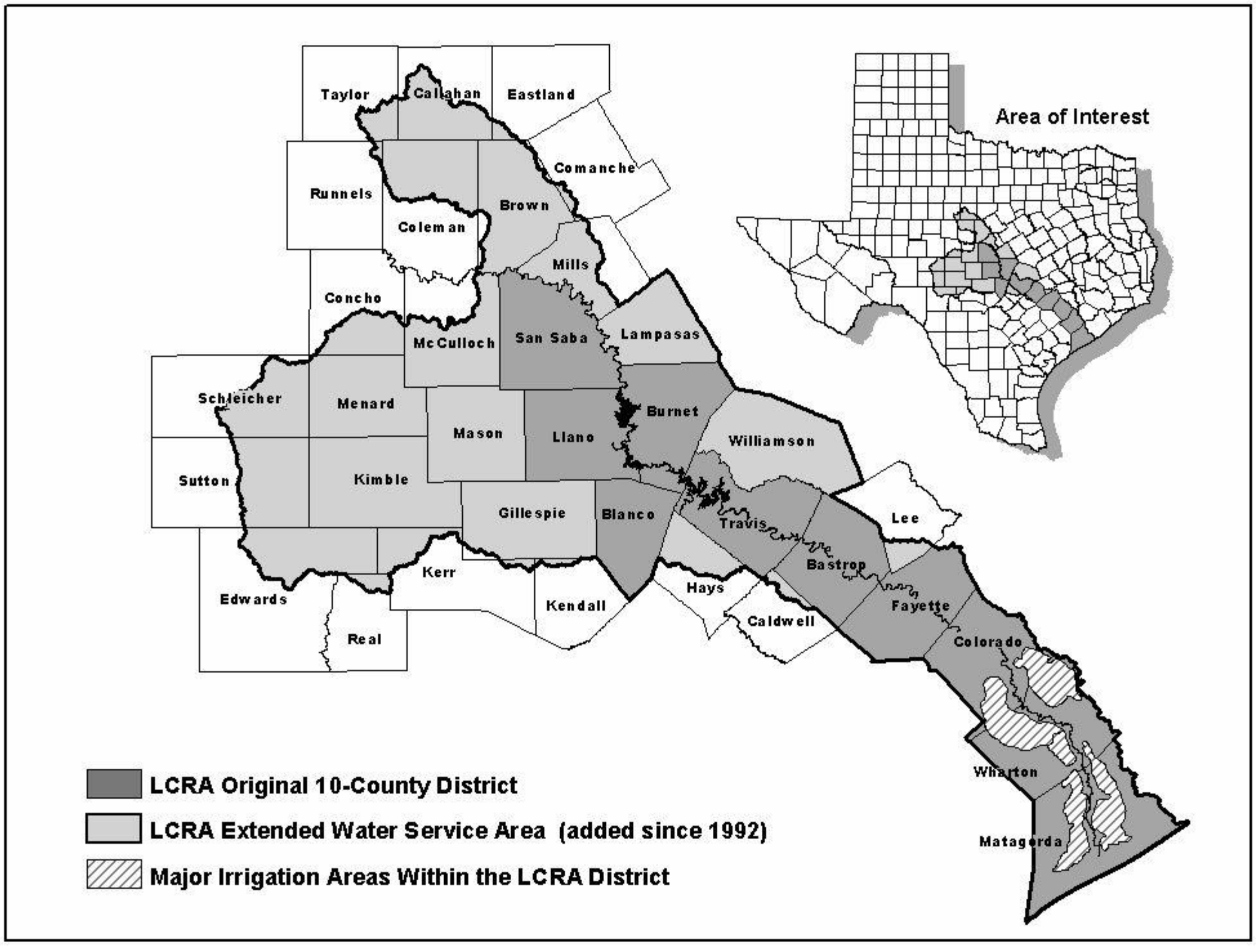
[1] Schedule of flows is designed to optimize biodiversity/productivity under normal rainfall. Under drought conditions, target flows should be curtailed in accordance to the severity of the drought and flows should be maintained at or above critical levels based on water quality considerations.

1.2.2.4 Wholesale Water Providers

The TWDB guidelines allow each RWPG to identify and designate "wholesale water provider(s)" for each region. These guidelines define a wholesale water provider as an entity ". . . which delivers and sells a significant amount of raw or treated water for municipal and/or manufacturing use on a wholesale basis." The intent of these TWDB guidelines is to ensure that there is an adequate future supply of water for each entity that receives all or a significant portion of its current water supply from another entity.

As discussed in Chapter 2, the LCRWPG has officially designated the LCRA and the City of Austin as wholesale water providers. The LCRA provides water for municipal, irrigation, manufacturing, steam-electric, and mining uses within a 33-county service area. The LCRA currently provides water to entities in each of the 14 counties within the Lower Colorado Regional Planning Area (*Figure 1.20*). The COA supplies water for municipal, manufacturing, and steam-electric uses. The City's water planning area encompasses portions of Travis, Williamson, and Hays Counties (*Figure 1.21*).

Figure 1.20: Lower Colorado River Authority Water Supply Service Area



Source: The Lower Colorado River Authority (March 2000)

Figure 1.21: City of Austin Water Supply Service Area

1.2.3 Water Quality in the Colorado River Basin[18, 19, 20]

The chemical characteristics of and the State Water Quality Criteria assigned to the Colorado River vary along its length (900 river miles) from the upper basin that is mainly within the West Texas Regional Water Planning Area (Region F) to the mouth of the river at Matagorda Bay in the Lower Colorado Regional Planning Area (Region K) (*Table 1.8*). The water quality differences of the various stream segments of the Colorado River are due to variations in both natural and man-made influences affecting each segment's drainage area. In addition, water flowing from upstream segments of the Colorado River and its tributaries also contribute to each downstream segment's water quality characteristics.

The Colorado River is divided into 18 mainstream classified stream segments, which are defined by the Texas Commission on Environmental Quality (TCEQ), which was formerly the Texas Natural Resource Conservation Commission (TNRCC), as:

> Surface waters of an approved planning area exhibiting common biological, chemical, hydrological, natural, and physical characteristics and processes. Segments will normally exhibit common reactions to external stresses (e.g., discharge or pollutants). Segmented waters include most rivers and their major tributaries, major reservoirs and lakes, and marine waters, which have designated physical boundaries, specific uses, and specific numerical physicochemical criteria. Segments are classified in the water identification system utilized by the TNRCC Office of Water Resources Management (OWRM) and are the management unit to which water quality standards and regulations are applicable under the Clean Water Act.

Approximately 70 percent of these mainstream segments are within Region K. There are also 16 classified stream segments that are tributaries of the Colorado River, and almost 40 percent of these are within Region K.

The TNRCC initiated the Texas Clean Rivers Program (CRP) in 1991 to address the Texas Clean Rivers Act. The State Legislature passed this act in response to concerns within the state that water quality issues were being addressed in an uncoordinated fashion. The CRP established a watershed management approach to identify and evaluate water quality issues, as well as to set priorities for the improvement of water quality throughout the state. The CRP set up a partnership in each river basin that consisted of the TNRCC, other state agencies, river authorities, local governments, and private citizens. Each river basin is to provide the TNRCC with updated regional water quality data, and the TNRCC is required to summarize these basin-wide assessments into a statewide report every 2 years.

In 1996, the TNRCC published two reports that updated water quality information for each river basin and stream segment in the state: *The State of Texas Water Quality Inventory* and *Texas Water Quality: A Summary of River Basin Assessments*. The CRP's Colorado River Basin regional assessment technical report defines the "Upper Basin" of the Colorado River as the classified mainstream segments 1411–1413 and 1426 and classified tributary segments 1421–1425. These segments fall within the SB 1 Regions F and G. The "Middle Basin" contains mainstream segments 1403–1410, 1429, and 1433 and tributary segments 1414–1417, 1427, 1431, and 1432. These segments fall within SB 1 Region F and the Lower

[18] TWDB, Op. Cit., May 1977.
[19] TNRCC, December 1996. *Texas Water Quality: A Summary of River Basin Assessments*, Texas Clean Rivers Program Report SFR-46.
[20] TNRCC, October 1996. *Regional Assessment of Water Quality: Colorado River Basin & Colorado/Lavaca Coastal Basin*, Texas Clean Rivers Program Technical Report.

Table 1.8 Classified Stream Segment Uses and Water Quality Criteria in the Colorado River Basin 2002

COLORADO RIVER BASIN			USES [1]			STATE STREAM STANDARDS CRITERIA [2]						
Stream Segment #	**Stream Segment Name**	**SB 1 Planning Region**	**Recreation**	**Aquatic Life**	**Water Supply**	**Chloride Annual Avg. (mg/L)**	**Sulfate Annual Avg (mg/L)**	**TDS Annual Avg (mg/L)**	**D.O. (mg/L)**	**pH Range**	**Fecal Coliform (30-day geometric mean, CFU/100ml)**	**Temp (*F)**
1401	Colorado River - Tidal	K	CR	H					4.0	6.5–9.0	200	95
1402	Colorado River below Smithville	K	CR	H	PS	100	100	500	5.0	6.5–9.0	200	95
1403	Lake Austin	K	CR	H	PS	100	75	400	5.0	6.5–9.0	200	90
1404	Lake Travis	K	CR	E	PS	100	75	400	6.0	6.5–9.0	200	90
1405	Marble Falls Lake	K	CR	H	PS	125	75	500	5.0	6.5–9.0	200	94
1406	Lake LBJ	K	CR	H	PS	125	75	500	5.0	6.5–9.0	200	94
1407	Inks Lake	K	CR	H	PS	150	100	600	5.0	6.5–9.0	200	90
1408	Lake Buchanan	K	CR	H	PS	150	100	600	5.0	6.5–9.0	200	90
1409	Colorado River above Lake Buchanan	K	CR	H	PS	200	200	900	5.0	6.5–9.0	200	91
1410	Colorado River below Ivie Reservoir	K	CR	H	PS	500	455	1,475	5.0	6.5–9.0	200	91
1411	E. V. Spence Reservoir	F	CR	H	PS	950	450	1,500	5.0	6.5–9.0	200	93
1412	Colorado River below Lake J. B. Thomas	F	CR	H		11,000	2,500	20,000	5.0	6.5–9.0	200	93
1413	Lake J. B. Thomas	F	CR	H	PS	80	110	500	5.0	6.5–9.0	200	90
1414	Pedernales River	K	CR	H	PS	125	75	525	5.0	6.5–9.0	200	91
1415	Llano River	K	CR	H	PS	50	50	350	5.0	6.5–9.0	200	91
1416	San Saba River	K/G	CR	H	PS	50	50	425	5.0	6.5–9.0	200	90
1417	Lower Pecan Bayou	K	CR	H		310	120	1,025	5.0	6.5–9.0	200	90
1418	Lake Brownwood	F	CR	H	PS	150	100	500	5.0	6.5–9.0	200	90
1419	Lake Coleman	F	CR	H	PS	150	100	500	5.0	6.5–9.0	200	93
1420	Pecan Bayou above Lake Brownwood	F	CR	H	PS	500	500	1,500	5.0	6.5–9.0	200	90
1421	Concho River	F	CR	H	PS	775	425	1,600	5.0	6.5–9.0	200	90
1422	Lake Nasworthy	F	CR	H	PS	450	400	1,500	5.0	6.5–9.0	200	93
1423	Twin Buttes Reservoir	F	CR	H	PS	200	100	700	5.0	6.5–9.0	200	90
1424	Middle Concho/S. Concho River	F	CR	H	PS	150	150	700	5.0	6.5–9.0	200	90
1425	O. C. Fisher Lake	F	CR	H	PS	150	150	700	5.0	6.5–9.0	200	90
1426	Colorado River blw E. V. Spence Reservoir	F	CR	H	PS	610	980	2,000	5.0	6.5–9.0	200	91
1427	Onion Creek	K	CR	H	PS/AP	50/100	50/100	400/500	5.0	6.5–9.0	200	90
1428	Colorado River below Town Lake [3]	K	CR	E	PS	100	100	500	6.0	6.5–9.0	200	95
1429	Town Lake [4]	K	CR	H	PS	75	75	400	5.0	6.5–9.0	200	90
1430	Barton Creek	K	CR	H	AP2	50	50	500	5.0	6.5–9.0	200	90
1431	Middle Pecan Bayou	F	CR			410	120	1,100	2.0	6.5–9.0	200	90
1432	Upper Pecan Bayou	F	CR	H	PS	200	150	800	5.0	6.5–9.0	200	90
1433	O. H. Ivie Reservoir [5]	F	CR	H	PS	*n/a*	*n/a*	*n/a*	5.0	6.5–9.0	200	93
1434	Colorado River above La Grange	K	CR	E	PS	100	100	500	6.0	6.5–9.0	200	95

Source: TNRCC, 2002. **Texas Surface Water Quality Viewer 2002** (Developed from water quality data collected between March 1, 1996 and February 28, 2001)
URL: http://www.tnrcc.state.tx.us/water/quality/data/ …ENTER THE 2002 VIEWER). *The Interactive Viewer displays information developed for the State's assessment of surface water quality in 2000 and 2002. Provides the ability to look up uses, standards, and water quality assessment information for bodies of surface water in Texas. Additionally, provides an option to search using a Texas map, by the name of a body of water, or by its segment identification number.*

[1] Uses: CR = Contact Recreation; H = High Aquatic Life; E = Exceptional Aquatic Life; PS = Public Water Supply; AP = Aquifer Protection

[2] Criteria: Standards set by the TCEQ (formerly TNRCC) do not guarantee the water to be usable for municipal, domestic, irrigation, livestock, &/or industrial uses, such as segment #1412 & others; this causes the above screening process to be misleading for certain segments, especially for salinity.

[3] Dissolved Oxygen (D.O.) criteria of 6.0 mg/L only applies at stream flows ≥ 150 cfs as measured at USGS gage #8158000 located in Travis County upstream from U.S. 183.

[4] While segment #1429 may exhibit quality characteristics which would make it suitable for contact recreation, the use is prohibited by local regulation for reasons unrelated to water quality.

[5] Numerical criteria for Total Dissolved Solids (TDS), chlorides, and sulfates have not yet been established for this new reservoir.

Colorado Regional Water Planning Area (Region K). The Colorado River's "Lower Basin" lies wholly within Region K and includes the mainstream segments 1401, 1402, 1428, and 1434 as well as several unclassified tributary segments.

Upstream of Region K, high salinity concentrations are the primary concern in the CRP's "Upper Basin" stream segments. This is caused both by the natural characteristics of the geologic formations in the watershed as well as pollution from oil and gas activities. As *Table 1.8* shows, some of these stream segments have very high water quality criteria for salinity, or total dissolved solids (TDS), which is an aggregate measurement of various mineral concentrations including chlorides, carbonates, and sulfates. The designated uses of a stream segment, such as recreation, aquatic life, and water supply, are based on the Texas Surface Water Quality Standards, which are criteria with the force of law. Potential uses for water in segments with very high salinity criteria, such as segment 1412 below Lake J. B. Thomas, are limited by the high TDS concentrations that exist, despite the fact that the criteria are rarely exceeded. For example, the secondary drinking water standard for TDS is 1,000 milligrams per liter (mg/l).

The water quality of the "Middle Basin" and "Lower Basin" improves significantly due largely to the dilution of the upstream base flow by inflow of higher quality tributary waters. Major tributaries from the headwaters of O. H. Ivie Reservoir down through the Highland Lakes System, namely the Llano River and the San Saba River, have TDS concentrations that are generally less than 500 mg/l at their confluence with the Colorado River. Water quality of the "Lower Basin" is subject to poor quality at low flow conditions due to salt water intrusion (i.e., tidal influence).

1.2.4 Agricultural and Natural Resources Issues Within the Lower Colorado Region[21, 22, 23, 24, 25]

The primary agricultural issue in Region K is the availability of sufficient quantities of irrigation water for rice farming under drought of record conditions. Natural resources, on the other hand, have impacts from both water quantity and water quality issues. Classified stream segments in the Colorado River Basin are shown in *Figure 1.22* and those with water quality concerns are listed. The stream segments that have water quality concerns within Region K are discussed below.

1.2.4.1 Threats Within the Lower Colorado Region Due to Water Quality Issues

The primary water quality issue for all of the surface water stream segments and the major groundwater aquifers in Region K is the increasing potential for water contamination due to nonpoint source pollution. Nonpoint source pollution is precipitation runoff that, as it flows over the land, picks up various pollutants that adhere to plants, soils, and man-made objects and which eventually infiltrates into the groundwater table or flows into a surface water stream. As more and more land in the Colorado River watershed and aquifer recharge zones is developed, the runoff from precipitation events will pick up increasing amounts of pollution. Another nonpoint source of pollution is the accidental spill of toxic chemicals near streams or over recharge zones that will send a concentrated pulse of contaminated water

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[21] TNRCC, Op. Cit., December 1996.
[22] TNRCC, Op. Cit., October 1996.
[23] LCRA, March 1999, *Water Management Plan*.
[24] Texas Water Development Board (TWDB), February 2000. *A Numerical Groundwater Flow Model of the Upper and Middle Trinity aquifer, Hill Country Area*, Open-file report 00–02.
[25] TWDB, et al., April 1999. *Assessment of Groundwater Availability in the Carrizo-Wilcox aquifer in Central Texas – Results of Numerical Simulations of Six Groundwater-Withdrawal Projections (2000–2050),* Draft Final Contract Report.

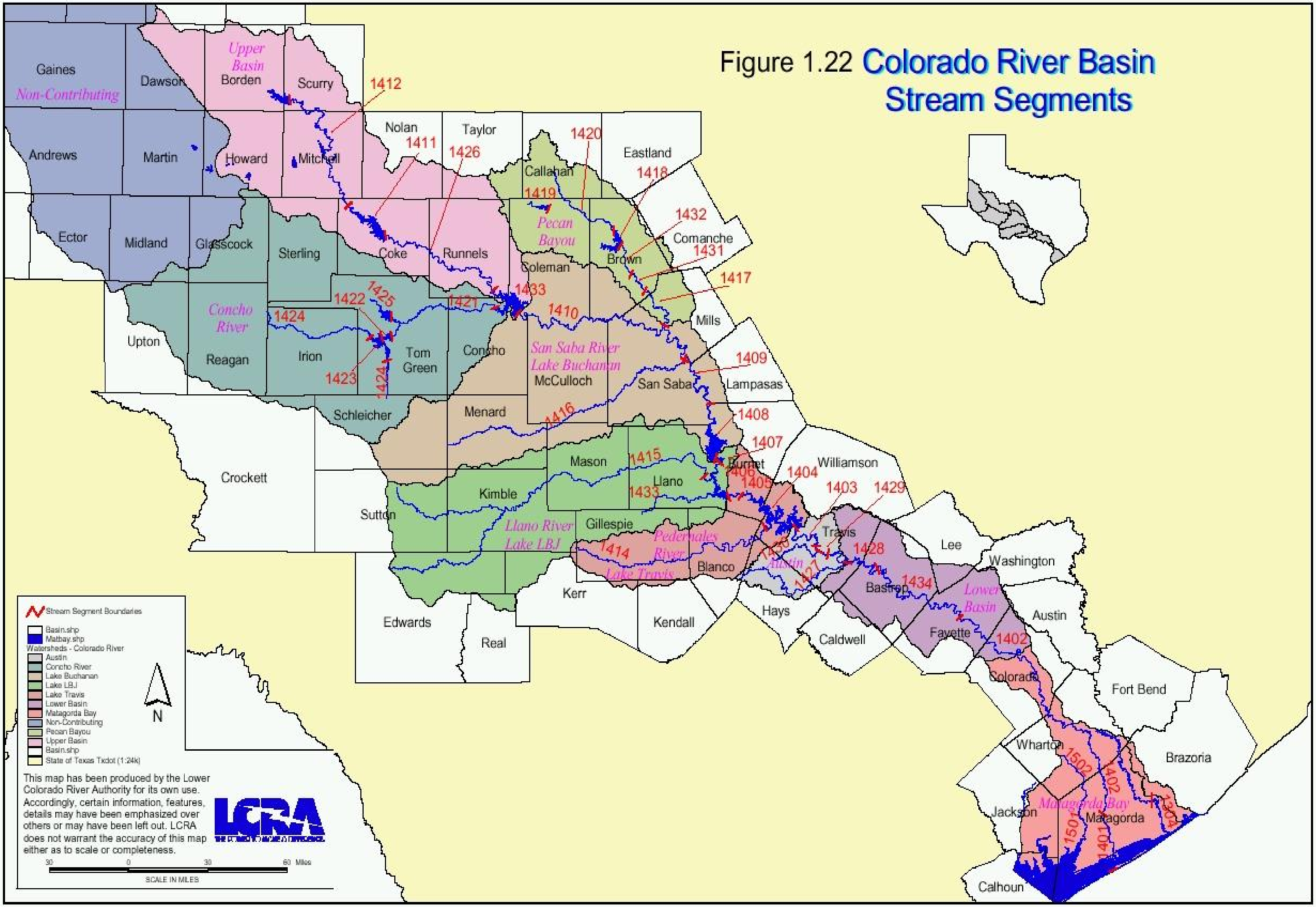
Figure 1.22 Colorado River Basin Stream Segments
Gaines
Non-Contributing
Dawson
Upper Basin
Borden
Scurry
1412
Nolan
Taylor
1411
1426
1420
Eastland
Andrews
Martin
Howard
Mitchell
Callahan
1418
1419
Pecan Bayou
1432
Comanche
1431
Ector
Midland
Glasscock
Sterling
Coke
Runnels
Coleman
Brown
1417
1433
1425
1422
1421
1410
Mills
Concho River
1424
Upton
Reagan
Irion
Tom Green
Concho
San Saba River Lake Buchanan
McCulloch
1409
San Saba
Lampasas
1423
1424
Schleicher
Menard
1416
1408
1407
Crockett
Mason
1415
Burnet
Williamson
1406
1405
1404
1403
1429
Llano
1433
Kimble
Sutton
Llano River Lake LBJ
Gillespie
Pedernales River
Travis
1428
Lee
Washington
1414
Lake Travis
Blanco
Austin
1427
Bastrop
1434
Lower Basin
Kerr
Edwards
Real
Kendall
Hays
Caldwell
Fayette
Austin
1402
Colorado
Fort Bend
Wharton
1502
1402
Brazoria
Matagorda Bay
Jackson
Matagorda
1501
1401
1304
Calhoun
Stream Segment Boundaries
Basin.shp
Matbay.shp
Watersheds - Colorado River
Austin
Concho River
Lake Buchanan
Lake LBJ
Lake Travis
Lower Basin
Matagorda Bay
Non-Contributing
Pecan Bayou
Upper Basin
Basin.shp
State of Texas Txdot (1:24k)
N
This map has been produced by the Lower Colorado River Authority for its own use. Accordingly, certain information, features, details may have been emphasized over others or may have been left out. LCRA does not warrant the accuracy of this map either as to scale or completeness.
30
0
30
60 Miles
SCALE IN MILES

through stream segments and/or aquifers. Public water supply groundwater wells that currently only use chlorination water treatment, and domestic groundwater wells that may not treat the water before consumption, are especially vulnerable to nonpoint source pollution, as are the habitats of threatened and endangered species that live in and near springs and certain stream segments. Nonpoint sources of pollution are difficult to control and there has been increased awareness and research of this issue as well as interest in the initiation of abatement programs.

There are concerns throughout the entire Colorado River Basin regarding surface water quality. These concerns include aquatic life use, nutrient enrichment, algal growth, sediment contaminants, public water supply, and narrative criteria. However, under normal hydrologic conditions, there are 11 classified stream segments with a concern for all or part of the stream segment, based on data reported for 2002, for exceeding the State Water Quality Criteria in Region K (*Table 1.8* and *Table 1.9*).

Table 1.9 Stream Segment Water Quality Concerns in the Lower Colorado Region [1]

Stream Segment #	Stream Segment Name	Aquatic Life Use	Nutrient Enrichment Concern	Algal Growth Concern	Sediment Contaminants Concern	Public Water Supply Concern	Narrative Criteria Concern
1401	Colorado River - Tidal						
1402	Colorado River below Smithville						
1403	Lake Austin	portion					
1404	Lake Travis	portion					
1405	Marble Falls Lake	portion					
1406	Lake LBJ	portion					
1407	Inks Lake	portion					
1408	Lake Buchanan			portion			
1409	Colorado River above Lake Buchanan						
1410	Colorado River below Ivie Reservoir					entire	
1414	Pedernales River						
1415	Llano River						
1416	San Saba River						
1417	Lower Pecan Bayou		portion	entire			
1427	Onion Creek						
1428	Colorado River below Town Lake		portion				portion
1429	Town Lake						
1430	Barton Creek				portion		
1434	Colorado River above La Grange		portion				

Source: TNRCC, 2002. www.tnrcc.state.tx.us/water/quality/data

[1] The "portion" parameter is assigned to a classified stream segment when the readings taken for a particular water quality indicator exceed the State Water Quality Criteria for a portion of the stream segment. The "entire" parameter is assigned when the readings exceed the criteria for the entire stream segment.

Another surface water quality indicator is dissolved oxygen (DO) and the associated biochemical oxygen demand (BOD). DO is a measure of the amount of oxygen that is available in the water for metabolism by microbes, fish, and other aquatic organisms. BOD is a measure of the amount of organic material, containing carbon and/or nitrogen, in a body of water that is available as a food source to microbial and other aquatic organisms, which require the consumption of dissolved oxygen from the water to metabolize the organic material. The basin-wide concentrations of DO that have existed in the past were indicative of relatively unpolluted waters; however, these have been changing and have become a concern in some segments of the Colorado River and its tributaries, as populations and urban development continue to increase. The primary manmade sources of BOD in bodies of water are the discharge of municipal and industrial waste, as well as nonpoint source pollution from urban and agricultural runoff. Thus, the presence of excess amounts of BOD allows increased rates of microbial and algal metabolism, which in turn depletes the dissolved oxygen concentrations in the water. Without sufficient levels of DO in the water, other aquatic organisms such as fish cannot survive. Data from 2002 indicates that there are five classified stream segments with a concern for DO, based on the State Water Quality Criteria in the Lower Colorado Regional Water Planning Area (*Table 1.8* and *Table 1.9*).

Another set of surface water quality indicators that can deplete DO levels in surface water bodies are termed "nutrients" and includes nitrogen (Kjeldahl nitrogen, nitrite+nitrate, and ammonia nitrogen), phosphorus (phosphates, orthophosphates, and total phosphorus), sulfur, potassium, calcium, magnesium, iron, and sodium. Nutrients are monitored by the TCEQ as a part of the Texas Clean Rivers Program; however, there is no state or federal standards for screening nutrients. Currently, naturally occurring background levels reported by the U.S. Geological Survey (USGS) or historical data collected by the TCEQ are used to determine the level of concern for nutrients. Nutrients have the same primary man-made sources as the BOD sources described above. Based on 2002 data, there are three classified stream segments with a concern in the Lower Colorado Regional Water Planning Area (*Table 1.8* and *Table 1.9*).

Fecal coliform is harmless bacteria that is present in human and/or animal waste. However, the presence of this organism is an indicator for the presence of disease-causing bacteria and viruses that are also found in human/animal wastes. Municipal waste is treated to remove most of the bacterial and viral contaminants so that safe levels will exist in the surface water body upon discharge from the point source. Therefore, when fecal coliform is detected, the most likely source of contamination is nonpoint source pollution, which can include agricultural runoff as well as runoff from failed septic systems. A wastewater treatment plant point source could also be the source of contamination if the system is not functioning properly. Data, reported for 2002, indicate that there are no classified stream segments with a concern for fecal coliform, based on the State Water Quality Criteria in Region K (*Table 1.8* and *Table 1.9).*

The presence of toxic dissolved metals, such as aluminum, barium, arsenic, chromium, cadmium, copper, lead, nickel, mercury, selenium, silver, and zinc, in surface water are a concern in one classified stream segment in the Lower Colorado Regional Water Planning Area (*Table 1.8* and *Table 1.9*).

1.2.4.2 Threats Due to Water Quantity Issues

As mentioned previously, the primary threat to agriculture in Region K is water shortages for irrigation that are anticipated to occur in Matagorda, Wharton, and Colorado Counties during a repeat of the drought of record. The water supply available for irrigation is from three sources: ROR supplies, stored water from the Highland Lakes System, and groundwater. Whenever the Colorado River's natural flows are insufficient to meet irrigation demands, the LCRA releases water from upstream storage reservoirs to supplement the ROR supplies from streamflows. The water supplied from the Highland Lakes storage is considered an interruptible supply and is subject to curtailment in accordance with policies and procedures specified in LCRA's Water Management Plan. Consequently, under drought of record conditions, there are substantial shortages of water for irrigation in Matagorda, Wharton, and Colorado Counties. Potential strategies for meeting these irrigation needs are presented in Chapter 4.

Water quantity is also a concern during drought conditions in terms of instream flows and freshwater inflows to Matagorda Bay. As discussed in Section 1.2.2.3, the free-flowing reaches below the Highland Lakes System downstream to the mouth of the Colorado River have been studied by the LCRA, and critical instream flows have been determined as the non interruptible demand on water resources. Instream flows have been maintained by LCRA at or above the minimum critical flow in accordance with the current WMP. Target instream flows, also determined by the LCRA study, provide flows to support an optimal range of habitat complexity for a well-balanced, native aquatic community within a stream reach. LCRA has maintained these flow regimes whenever water resources are adequate, but target flows are classified as interruptible demands that have been reduced during drought conditions. For further details, please refer to LCRA's WMP.

The Highland Lakes provide the primary surface water storage and flood control capabilities for Region K. The issue of providing maintenance of these reservoirs to retain the maximum water storage capacity will become increasingly important as natural sedimentation processes decrease the volume of water each reservoir can hold. Currently, there are no programs in place to address this issue.

With regard to flood control, Lake Travis is the only reservoir in the Highland Lake System specifically designated for this purpose. Currently, the LCRA must regulate the release of flood flows from Mansfield Dam so as to minimize and balance the impacts of floodwaters upstream and downstream of the dam without compromising the safety of the dam. Because development continues to encroach upon and alter the floodplain of the Lower Colorado River, the LCRA in cooperation with the USACE is currently studying alternative flood control measures, such as modifying current flood control operations and the possible addition of new off-channel flood control structures.

One of the major groundwater quantity concerns involves the Barton Springs segments of the Edwards aquifer (BFZ), which is a karst formation that responds quickly to changes in the environment due its highly permeable and transmissive characteristics. South of the artesian zone of the Edwards aquifer there exists an interface, or "bad water line," that separates the good quality groundwater from a layer of water that is not usable for human consumption due to the high TDS content. This line, which is also referred to as the saline-water line or freshwater/saline-water interface, marks the interface where the groundwater reaches a TDS concentration of 1,000 mg/l. Little is actually known about this interface and research is currently being conducted to delineate the "bad water line" and to determine the effects that pumping large quantities of aquifer water will have on its location. At present, there is a great deal of concern and uncertainty regarding the intrusion of poor quality water into the freshwater zone. The current lack of factual information makes the formulation of management strategies extremely difficult.

The second major issue in the Barton Springs segments of the Edwards aquifer (BFZ) is the minimum required environmental flows discharged from the artesian zone through Barton Springs. Increased groundwater pumping from the aquifer during drought conditions decreases all spring discharges, which can potentially impact the state and federally listed threatened and endangered species that depend on the springs for habitat, such as the Barton Springs salamander, and can potentially affect water supply availability downstream.

The primary water quantity issue in the Gulf Coast aquifer is subsidence, which is the dewatering of the interlayers of clay within the aquifer as a result of over-pumping. This compaction of the clay causes a loss of water storage capacity in the aquifer, which in turn causes the land surface to sink, or subside. Once the ability of the clay to store water is gone, it can never be restored. The implementation of water conservation practices and conversion to surface water sources are currently the only remedies for this situation. Saltwater intrusion from the Gulf of Mexico into the Gulf Coast aquifer is also a potential concern due to groundwater pumping rates that are greater than the recharge rates of the aquifer.

The Trinity aquifer's primary water quantity concern is the anticipated water-level declines during drought conditions due to increased demand that will be placed on the aquifer's resources. Recently, a computer model has been developed to simulate the flow of groundwater within the Trinity aquifer and results, for the portion of the aquifer that lies within Region K, suggest that water levels in the Dripping Springs area of Hays County, could decline more than 100 feet by the year 2040. Other portions of Hays County as well as Blanco and Travis Counties, may experience moderate water-level declines between 50 to 100 feet by the year 2010. Most of the rivers gain water from the Trinity aquifer as they pass over the aquifer. Increased pumping during drought conditions will decrease the base flow of the rivers that cross the Trinity aquifer; however, the groundwater flow model suggests that these rivers will continue to flow seasonally.

The Carrizo-Wilcox aquifer's primary water quantity concern is the water-level declines anticipated through the year 2060 due to increased pumping. Groundwater withdrawals increased an estimated 270 percent between 1988 and 1996, from 10,100 to 37,200 acre-feet per year (ac-ft/yr), from the mostly porous and permeable sandstone aquifer. The area in and around the Carrizo-Wilcox aquifer is expected to see continued population growth and increases in water demand. The TWDB co-sponsored a study of the Central Texas portion of the Carrizo-Wilcox aquifer using a computer model to assess the availability of groundwater in the area. Six water demand scenarios were simulated in the model, which ranged from considering only the current 1999 demand, to analyzing all projected future water demands through the year 2050. On the basis of the calibrated model, all withdrawal scenario water demands appear to be met by groundwater from the Carrizo-Wilcox aquifer through the year 2050. The simulations indicate that the aquifer units remain fully saturated over most of the study area. The simulated water-level declines in the Carrizo-Wilcox aquifer mainly reflect a pressure reduction within the aquifer's artesian zone. Some dewatering takes place in the center of certain pumping areas. In addition, simulations indicate that drawdown within the confined portion of the aquifer will significantly increase the movement of groundwater out of the shallow, unconfined portions to the deeper artesian portions of the aquifer. The relationships that currently exist between surface and groundwater may also change. Simulations indicate that the Colorado River, which currently gains water from the Carrizo-Wilcox aquifer, may begin to lose water to the aquifer by the year 2050.

The LCRWPG passed a resolution regarding the "mining of groundwater" on February 9, 2000, which strongly opposes the over-utilization of groundwater, including the mining of groundwater, within its region at rates that could lead to eventual harm to the groundwater resources, except during limited periods of extreme drought. They define groundwater mining as "the withdrawal of groundwater from an aquifer at an annualized rate, which exceeds the average annualized recharge rate to an aquifer where the recharge rate can be scientifically derived with reasonable accuracy." This resolution addresses the concerns listed above for the Barton Springs segments of the Edwards (BFZ), Gulf Coast, Trinity, and Carrizo-Wilcox aquifers that are located within Region K. Based on the projected future groundwater demand in Region K, the LCRWPG's position on groundwater mining restricts the water supply strategies that can be considered for the Lower Colorado Regional Water Plan, which are discussed in more detail in Chapter 4.

1.2.5 Existing Water Planning in the Lower Colorado Regional Water Planning Area

In response to Senate Bill 1, enacted in 1997, Lower Colorado Regional Water Planning Group prepared, adopted, and submitted *2000 Region "K" Water Supply Plan* to the Texas Water Development Board (TWDB); describing how local entities may address future water supply needs for the next 50 years. The newest State Water Plan, Water for Texas-2002, delivered by the TWDB to the Texas Legislature in January 2002, incorporated the approved Regional Water Plan and contained legislative recommendations for future water policies. The following sections describe some of the history and requirements of Senate Bill 1.

In 1997, the 75th Texas Legislature enacted Senate Bill 1 (also referred to as SB 1 or the Brown-Lewis Water Plan), which provided a major overhaul of many long-standing state water laws and policies. Among its many provisions, SB 1 legislation amended Chapter 36 of the Texas Water Code to require certain water supply entities to develop water management plans (WMPs), water conservation plans (WCPs), and/or drought contingency plans (DCPs). WCPs and DCPs must be submitted to TNRCC (now TCEQ) for review and certification. TNRCC received the plans, reviewed them for minimum criteria according to TNRCC's Chapter 288 Rules that reflect SB 1 rules. Finally, TNRCC sent the water supply entity a letter of certification that its plan contains the necessary minimum criteria components. It should be noted that TNRCC (now TCEQ) has not subjectively critiqued the quality of the water management, water conservation, or drought contingency plans; it only determined whether or not minimum criteria have been met. Each water supply entity is required to update their respective plan every five years so that the plan will improve as the water supply entity gains experience in managing its water resources. TWDB also receives copies of each certified WCP and DCP for review with respect to TWDB's water planning efforts. However, there are no rules requiring action by TWDB.

One category of the SB 1 required plan is the WMP, which is to be developed by Groundwater Conservation Districts (GCDs) in the state. The intent of a WMP is to conserve, preserve, prevent waste, protect, and recharge water supplies within a water conservation district. These WMPs are required to be submitted to TWDB for review and administrative certification. Plans for existing districts were required to be submitted by 1 September 1998. Plans for districts established and confirmed after that date are generally required to be submitted within two years of the date that the district is confirmed by election. Surface water conservation districts, primarily river authorities, are also required to submit WMPs as a provision of the final adjudication of the river authority's water rights and receive administrative certification from TCEQ. In Region K, there were initially four designated GCDs and one surface water conservation district (LCRA), and all have received certification from TWDB or TCEQ for their WMPs. Additional districts have been established and confirmed since that time and *Table 1.10* shows each district along with the status of their WMPs. WMPs are also submitted to RWPGs for inclusion in the Regional Water Plan and to allow the regional planning groups to focus on strategies for current and future shortages that do not conflict with the management plans. *Figure 1.23* shows the groundwater conservation districts located in Region K.

The SB 1 State Water Plan also requires each entity that possesses major surface water and/or groundwater rights to develop a WCP (*Table 1.11*). These plans include irrigation water rights of at least 10,000 ac-ft/yr and non-irrigation (municipal, industrial, mining, recreational) water rights of at least 1,000 ac-ft/yr. The intent of the WCP is to develop and implement programs that will reduce water use within each of the major WUGs listed below, primarily through utilizing advances in technology, reducing distribution system water losses, and educating customers and encouraging voluntary participation in water use efficiency efforts. Approximately 90 percent of Region K's water use occurs in the agricultural irrigation and municipal sectors, and the majority of the WCPs have targeted these two water use groups. There are currently 15 entities in the Lower Colorado Regional Water Planning Area required to develop WCPs, and these WCPs have been submitted and received certification from TCEQ. The remainder of entities holding water rights are not required to develop or submit a WCP unless they petition TCEQ for an amendment to their water right or apply for a capital improvement loan with TWDB. In addition, Chapter 288 of the TCEQ Rules requires wholesale water supply customers to submit water conservation plans to the wholesale supplier.

Table 1.10 Groundwater Conservation Districts in Lower Colorado Region and Their Water Management Plan Status

Groundwater Conservation District [1]	Lower Colorado Region County	Aquifers Managed [2]	Water Management Plan
Barton Springs/Edwards Aquifer Conservation District (BSEACD)	Hays, Travis	Edwards (BFZ) & Trinity Aquifers, & Alluvial Deposits	Certified [3]
Blanco-Pedernales GCD	Blanco	Trinity, Edwards-Trinity, Ellenberger, Hickory and Marble Falls Aquifers	Certified [3]
Coastal Bend GCD	Wharton	Gulf Coast Aquifer	Certified [3]
Coastal Plains GCD	Matagorda	Gulf Coast Aquifer	Certified [3]
Fayette County GCD	Fayette	Gulf Coast, Carrizo-Wilcox, Queen City, Sparta Aquifer and Colorado River Alluvium	Certified [3]
Fox Crossing UWCD	Mills	Trinity Aquifer	Certified [3]
Hays-Trinity GCD	Hays	Trinity Aquifer	In Development
Hickory UWCD #1	San Saba	Hickory Aquifer, Ellenberger-San Saba, & Marble Falls Aquifers	Certified [3]
Hill Country UWCD	Gillespie	Edwards-Trinity, Ellenberger-San Saba, & Hickory Aquifers	Certified [3]
Lost Pines GCD	Bastrop	Carrizo-Wilcox Aquifer	Submitted to TWDB

Source: TWDB
[1] UWCD = Underground Water Conservation District; GCD = Groundwater Conservation District.
[2] Water systems managed: Only portions of the indicated aquifer systems are located within a GCD's jurisdiction.
[3] TWDB certification of administrative completeness.

Figure 1.23 : Groundwater Conservation Districts

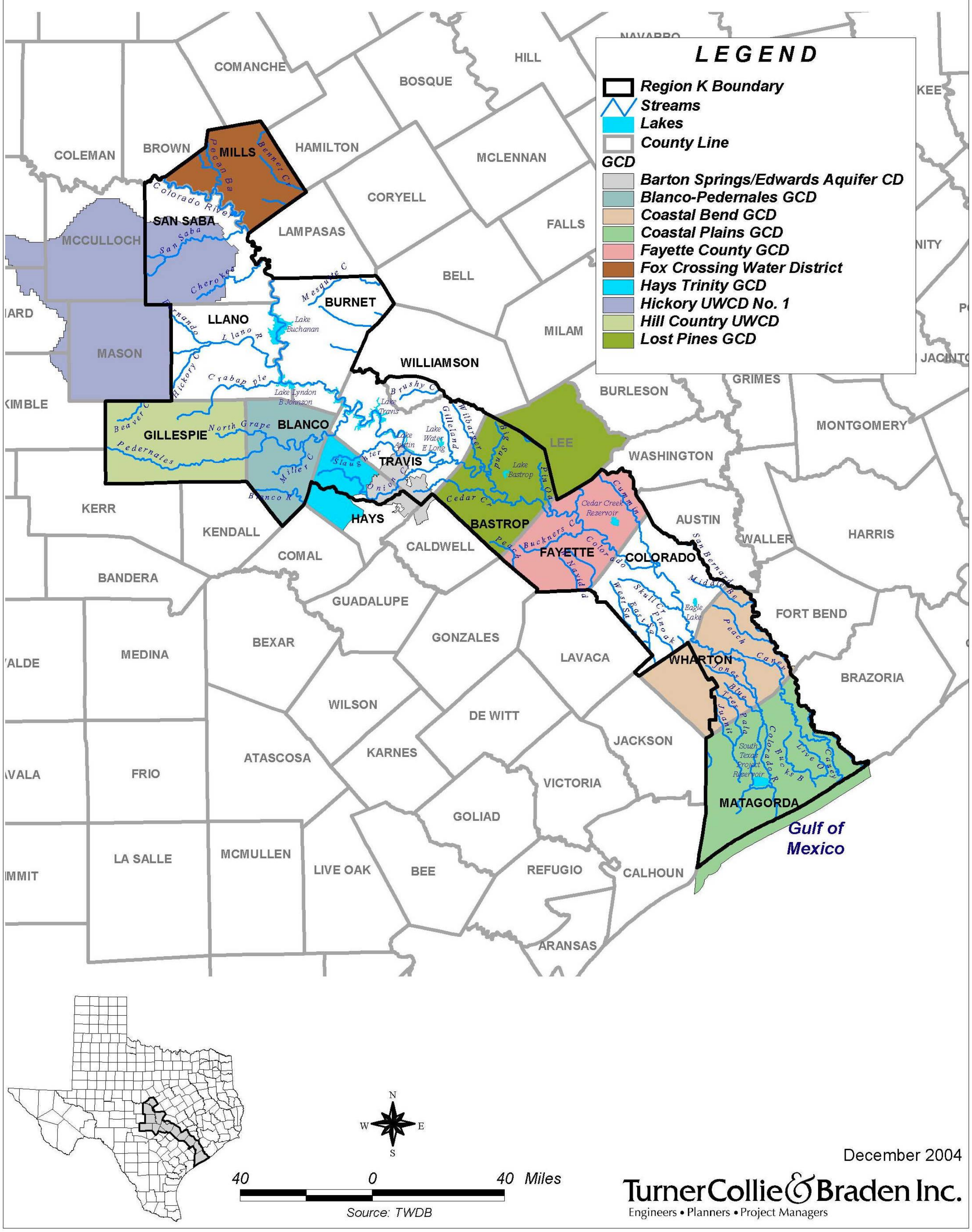

Table 1.11 Lower Colorado Region SB 1-Required Water Conservation Plans

Entity	County	Water Uses [1]	Water Conservation Plan
City of Llano	Llano	MUN, IRR	Complete 4/04/02
Lake LBJ Municipal Utility District	Llano	MUN	Complete 2/05/02
Don A. Culwell/Leslie L. Appelt	Matagorda	IND, REC	na
Farmers Canal Company	Matagorda	IRR	Complete 3/20/02
Houston Lighting & Power (aka Richmond Irrigation Company)	Matagorda	IND	Complete 11/06/00
Texas Brine Co. LLC	Matagorda	IND	Complete 9/20/01
City of Goldthwaite	Mills	MUN, IND, IRR	Complete 8/07/02
Lower Colorado River Authority (LCRA)	Region K	MUN, IND, MIN, IRR, HYD	Complete 3/27/00
Capitol Aggregates, Ltd.	Travis	MIN, IRR	Complete 3/27/00
City of Austin	Travis	MUN, IND, IRR, REC, HYD	Complete 6/18/02
City of Cedar Park	Travis/Williamson	MUN, IND	Complete 3/09/00
H & L New Gulf, Inc.	Wharton	MUN, MIN, IND	Complete 1/05/00
Lacy Withers Armour Trust et al.	Wharton	MUN, IND, IRR, REC	Complete 9/07/00
Leonard Wittig	Wharton	MUN, MIN, IND, IRR	Complete 6/03/99

Source: TCEQ (formerly TNRCC) List of SB1-required WCPs, dated 3/27/00. Confirmation of completion from TCEQ personnel's verification of the TCEQ database 11/05/04.
[1] Water uses: IRR = irrigation; MUN = municipal; IND = industrial; MIN = mining; REC = recreation; HYD = hydroelectric.

The third category of water resource planning effort required by SB 1 is the DCP. The intent of the DCP is to specify how a water supply entity will contract and supply dependable stored water supplies to its customers during a repeat of the drought of record, which is the period 1948–1957 for Region K. Triggering conditions for water shortages during a drought must be defined, and the actions that will be taken by the water supplier to mitigate the adverse effects of these water shortages must be specified. The DCP's major goals are extending the supplies of dependable water, preserving essential water uses, protecting public health and safety, and establishing equitable distributions of water among the water supplier's customers.

All wholesale water suppliers (*Table 1.12a*) and those retail water suppliers with at least 3,300 water supply connections (*Table 1.12b*) were to submit DCPs to TNRCC by 1 September 1999. Retail entities with fewer than 3,300 connections were required to submit DCPs to the RWPGs by 1 September 2000. However, the RWPGs do not review or certify drought contingency plans. All wholesale water suppliers (*Table 1.12a*) and those retail water suppliers with at least 3,300 water supply connections (*Table 1.12b*) are required to submit DCPs to the TCEQ (formerly TNRCC) again in May 2005.

Table 1.12a Lower Colorado Region SB 1-Required Drought Contingency Plans (Entities With Contract Water Sales to Others)

Water Wholesaler [1]	County	Water Source [2]	Drought Contingency Plan
Austin City of–Water & Wastewater*	Travis	S	Complete
Austin's Colony	Travis	G	Received
Brushy Creek Municipal Utility Dist	Williamson	G	Received
Cedar Park City of*	Williamson	S	Received
Chisholm Trail S U D	Williamson	G	Received
Eagle Lake City of	Colorado	G	Received
El Campo City of*	Wharton	G	Received
Kyle City of	Hays	G	Received
LCRA-Buchanan Dam	Llano	S	Complete
Manville Water Supply Corporation*	Travis	G	Received
Noack Water Supply Corporation	Williamson	P	Received
Round Rock City of*	Williamson	S	Received
San Marcos City of*	Hays	Y	Received
Taylor City of*	Williamson	S	Received
Travis Co MUD 4	Travis	S	Received
Travis Co WCID No 17*	Travis	S	Received
West Travis County Regional W S	Travis	S	Received

Sources: TCEQ (formerly TNRCC) List of SB1-Required Drought Contingency Plans, updated 3-23-00; and the Public Drinking Water Public Water Supply System database, updated 3-23-00.

[1] MUD = Municipal Utility District; WCID = Water Control & Improvement District; WS = Water System or Water Supply.

[2] Water source: G = groundwater; S = surface water; P = surface water purchased; W = groundwater purchased; Y = gw (under the influence of surface water); Z = gw (under the influence of surface water purchased)

*Wholesaler also supplies retail water service with more than 3,300 connections.

Table 1.12b Lower Colorado Region SB 1-Required Drought Contingency Plans (Retail Water Suppliers With > 3,300 Connections)

Retail Public Water Supplier (> 3,300 connections)[1]	County	Water Source [2]	Drought Contingency Plan
Anderson Mill MUD	Williamson	P	Complete
Aqua Water Supply Corporation	Bastrop	W	Received
Austin City Of–Water & Wastewater*	Travis	S	Complete
Bay City City of	Matagorda	G	Received
Cedar Park City of*	Williamson	S	Received
El Campo City of*	Wharton	G	Received
Fredericksburg City of	Gillespie	G	Received
Georgetown City of	Williamson	G	Received
Manville Water Supply Corporation*	Travis	G	Received
Pflugerville City of	Travis	G	Received
Round Rock City of*	Williamson	S	Received
San Marcos City of*	Hays	Y	Received
Taylor City of*	Williamson	S	Received
Travis Co WCID No. 17*	Travis	S	Received
Wharton City of	Wharton	G	Received

Sources: TCEQ (formerly TNRCC) List of SB1-Required Drought Contingency Plans, updated 3-23-00; and the Public Drinking Water Public Water Supply System database, updated 3-23-00.

[1] MUD = Municipal Utility District; WCID = Water Control & Improvement District; WS = Water System or Water Supply.

[2] Water source: G = groundwater; S = surface water; P = surface water purchased; W = groundwater purchased; Y = gw (under the influence of surface water); Z = gw (under the influence of surface water purchased)

*Retailer also supplies wholesale water service.

All of the remaining municipal WUGs serve less than 3,300 connections. These WUGs are required to have drought contingency plans, but they are not required to be submitted to the TCEQ for review and comment. The definition of a WUG for municipal purposes has been expanded to include entities that provide retail water service in excess of 280 ac-ft/yr, or approximately 250,000 gallons per day (gpd). Systems which serve 3,300 connections, assuming 3.2 persons per connection and 130 gallons per person per day, would be serving approximately 1.4 million gallons per day (mgd). As a result, the WUGs covered in the category of less than 3,300 connections will have water usage ranging from 250,000 gpd to 1.3 mgd, or 280 to 1,540 ac-ft/yr. Entities with less than 280 ac-ft/yr of usage are included in the County-Other Municipal WUG. In the interest of brevity, the remaining WUGs are not listed individually.

APPENDIX 1A

THREATENED AND ENDANGERED SPECIES IN THE LOWER COLORADO REGIONAL WATER PLANNING AREA (Texas Parks & Wildlife Department Special Species Lists and Annotated County Lists of Rare Species)

KEY: COUNTY THREATENED OR ENDANGERED SPECIES

LE,LT	Federally Listed Endangered/Threatened
PE,PT	Federally Proposed Endangered/Threatened
E/SA,T/SA	Federally Endangered/Threatened by Similarity of Appearance
C1	Federal Candidate for Listing, Category 1; information supports proposing to list as Endangered/Threatened
DL,PDL	Federally Delisted/Proposed for Delisting
NL	Not Federally Listed
E,T	State Listed Endangered/Threatened
"blank"	Rare, but with no regulatory listing status

Species appearing on these lists do not all share the same probability of occurrence. Some species are migrants or wintering residents only, or may be historic or considered extirpated.

Source: Texas Parks and Wildlife Department Special Species Lists and Annotated County Lists of Rare Species (current as of November 2004)

TABLE 1A-1: THREATENED OR ENDANGERED SPECIES OF BASTROP COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******AMPHIBIANS******				
Houston Toad	*Bufo houstonensis*	endemic; species sandy substrate, water in pools, ephemeral pools, stock tanks; breeds in spring especially after rains; burrows in soil when inactive; breeds February-June; associated with soils of the Sparta, Carrizo, Goliad, Queen City, Recklaw, Weches, and Willis geologic formations	LE	E
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Whooping Crane	*Grus americana*	potential migrant	LE	E
Wood Stork	*Mycteria americana*	forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
******FISHES******				
American Eel	*Anguilla rostrata*	most aquatic habitats with access to ocean; spawns January-February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries		
Blue Sucker	*Cycleptus elongatus*	usually inhabits channels and flowing pools with a moderate current; bottom type usually consists of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles		T
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
******MAMMALS******				
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in man-made structures or in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; usually roosts in clusters that may number in the thousands; hibernates in caves during winter; opportunistic insectivore		
Elliot's Short-tailed Shrew	*Blarina hylophaga hylophaga*	sandy areas in live oak mottes, grassy areas with a Loblolly pine (Pinus taeda) overstory, and grassy areas near Post oak (Quercus stellata) stands; burrows extensively under leaf litter, logs, and into soil, but ground cover is not required; needs soft damp soils for ease of burrowing		
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
******REPTILES******				
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas and adjacent Mexico; oak-juniper woodlands & mesquite-prickly pear associations; eggs laid underground; eats small invertebrates		
Texas Garter Snake	*Thamnophis sirtalis*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface		

Common Name	Scientific Name	Description	Federal Status	State Status
	annectens	cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T
******PLANTS******				
Sandhill woolywhite	*Hymenopappus carrizoanus*	endemic; open areas in deep sands derived from Carrizo and similar Eocene formations, including disturbed areas; flowering late spring-fall		

TABLE 1A-2: THREATENED OR ENDANGERED SPECIES OF BLANCO COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******AMPHIBIANS******				
Blanco River Springs Salamander	*Eurycea pterophila*	subaquatic; springs and caves in the Blanco River drainage in Blanco, Hays, and Kendall counties		
Edwards Plateau Spring Salamanders	*Eurycea sp. 7*	endemic; springs and waters of some caves of this region		
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Mountain Plover	*Charadrius montanus*	breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous		
Whooping Crane	*Grus americana*	potential migrant	LE	E
Zone-tailed Hawk	*Buteo albonotatus*	arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions		T
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; known from headwater, perennial streams of the Edward's Plateau region		
Guadalupe Darter	*Percina sciera apristis*	spawns January to June; typically over gravel or gravel and sand raceways of medium streams and rivers, and pools; feeds mainly on larval insects in riffles		
******MAMMALS******				
Black Bear	*Ursus americanus*	within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in man-made structures or in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters that may number in thousands; hibernates in caves during winter; opportunistic insectivore		
Llano Pocket Gopher	*Geomys texensis texensis*	found in deep, brown loamy sands or gravelly sandy loams and is isolated from other species of pocket gophers by intervening shallow stony to gravelly clayey soils		
Plains Spotted Skunk	*Spilogale putorius*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		

Common Name	Scientific Name	Description	Federal Status	State Status
	interrupta			
******REPTILES******				
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas; eats small invertebrates; eggs laid underground		
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
******VASCULAR PLANTS******				
Canyon mock-orange	*Philadelphus ernestii*	endemic; solution-pitted outcrops of Cretaceous limestone in mesic canyons, usually in shade of mostly deciduous slope forest; flowering April-May		
Granite spiderwort	*Tradescantia pedicellata*	endemic; rocky soils in the Edwards Plateau; flowering March-June (July?)		
Hill country wild-mercury	*Argythamnia aphoroides*	shallow to moderately deep clays and clay loams over limestone, in grasslands associated with plateau live oak woodlands, mostly on rolling uplands; flowering April-May; fruit persisting until midsummer		

TABLE 1A-3: THREATENED OR ENDANGERED SPECIES OF BURNET COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******ARACHNIDS******				
Bone Cave Harvestman	*Texella reyesi*	endemic, small, blind, cave-adapted harvestman	LE	
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Bald Eagle	*Haltaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter, hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Interior Least Tern	*Sterna antillarum athalassos*	this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Mountain Plover	*Charadrius montanus*	breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous		
Whooping Crane	*Grus americana*	potential migrant	LE	E
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
******MAMMALS******				
Black Bear	*Ursus americanus*	within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		
Gray Wolf	*Canis lupus*	formerly known throughout the western two-thirds of the state in forests, brushlands, or grasslands	LE	E
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Red Wolf	*Canis rufus*	formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
******REPTILES******				
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		

Common Name	Scientific Name	Description	Federal Status	State Status
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
******VASCULAR PLANTS******				
Basin bellflower	*Campanula reverchonii*	endemic; dry gravels and very shallow sandy soils derived from Precambrian igneous and metamorphic rocks, on open slopes and rock outcrops; flowering May-July, September-October		
Enquist's sandmint	*Brazoria enquistii*	primarily on sand banks in and along beds of streams that drain granitic /gneissic landscapes; flowering/fruiting late April-early June		
Rock Quillwort	*Isoetes lithophila*	very shallow seasonally wet sand or gravel in vernal pools on granite or gneiss outcrops; sporulating in late spring and opportunistically at other seasons		
Granite spiderwort	*Tradescantia pedicellata*	endemic; rocky soils in the Edwards Plateau; flowering March-June (July?)		
Edwards Plateau Cornsalad	*Valerianella texana*	very shallow, well-drained but seasonally moist gravelly soils derived from igneous or metamorphic rocks, often along the downslope margin of rock outcrop, in full sun or in partial shade of oak-juniper woodlands; flowering March–April		

TABLE 1A-4: THREATENED OR ENDANGERED SPECIES OF COLORADO COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******AMPHIBIANS******				
Houston Toad	*Bufo houstonensis*	endemic; species sandy substrate, water in pools, ephemeral pools, stock tanks; breeds in spring especially after rains; burrows in soil when inactive; breeds February-June; associated with soils of the Sparta, Carrizo, Goliad, Queen City, Recklaw, Weches, and Willis geologic formations	LE	E
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Attwater's Greater Prairie-chicken	*Tympanuchus cupido attwateri*	this county within historic range; endemic; open prairies of mostly thick grass one to three feet tall; from near sea level to 200 feet along coastal plain on upper two-thirds of Texas coast; males form communal display flocks during late winter-early spring; booming grounds important; breeding February-July	LE	E
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
White-faced Ibis	*Plegadis chihi*	prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
White-tailed Hawk	*Buteo albicaudatus*	near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May		T
Whooping Crane	*Grus americana*	potential migrant	LE	E
Wood Stork	*Mycteria americana*	forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
American Eel	*Anguilla rostrata*	most aquatic habitats with access to ocean; spawns January-February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries		
******INSECTS******				
Texas Asaphomyian Tabanid Fly	*Asaphomyia texanus*	globally historic; adults of tabanid spp. found near slow-moving water; eggs laid in masses on leaves or other objects near or over water; larvae are aquatic and predaceous; females of tabanid spp. bite, while males chiefly feed on pollen and nectar; using sight, carbon dioxide, and odor for selection, tabanid spp. lie in wait in shady areas under bushes and trees for a host to happen by		
******MAMMALS******				
Black Bear	*Ursus americanus*	within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T

Common Name	Scientific Name	Description	Federal Status	State Status
Louisiana Black Bear	*Ursus americanus luteolus*	possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
******REPTILES******				
Smooth Green Snake	*Liochlorophis vernalis*	Gulf Coastal Plain; mesic coastal shortgrass prairie vegetation; prefers dense vegetation		T
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T
******VASCULAR PLANTS******				
Coastal gay-feather	*Liatris bracteata*	endemic; black clay soils of prairie remnants; flowering in fall		

TABLE 1A-5: THREATENED OR ENDANGERED SPECIES OF FAYETTE COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Interior Least Tern	*Sterna antillarum athalassos*	this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Whooping Crane	*Grus americana*	potential migrant	LE	E
Wood Stork	*Mycteria americana*	forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
American Eel	*Anguilla rostrata*	most aquatic habitats with access to ocean; spawns January-February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries		
******MAMMALS******				
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Red Wolf	*Canis rufus*	formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
******REPTILES******				
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T
******VASCULAR PLANTS******				
Texas Meadow-rue	*Thalictrum texanim*	endemic; mesic woodlands or forests, including wet ditches on partially shaded roadsides; flowering March-May		
Navasota Ladies' Tresses	*Spiranthes parksii*	endemic; margins of and openings within post oak woodlands in sandy loams along intermittent tributaries of rivers; flowering late October-early November	LE	E

TABLE 1A-6: THREATENED OR ENDANGERED SPECIES OF GILLESPIE COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******AMPHIBIANS******				
Edwards Plateau Spring Salamanders	*Eurycea sp. 7*	endemic; springs and waters of some caves of this region		
Pedernales River Springs Salamander	*Eurycea sp. 6*	endemic; known only from springs		
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Interior Least Tern	*Sterna antillarum athalassos*	nests along sand and gravel bars within braided streams and rivers; also known to nest on man-made structures	LE	E
Whooping Crane	*Grus americana*	potential migrant	LE	E
Zone-tailed Hawk	*Buteo albonotatus*	arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions		T
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
******MAMMALS******				
Black Bear	*Ursus americanus*	within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		

Common Name	Scientific Name	Description	Federal Status	State Status
Big Free-tailed Bat	*Nyctinomops macrotis*	habitat data sparse but records indicate that species prefers to roost in crevices and cracks in high canyon walls, but will use buildings, as well; reproduction data sparse, but gives birth to single offspring late June-early July; females gather in nursery colonies; winter habits undetermined, but may hibernate in the Trans-Pecos; opportunistic insectivore		
Gray Wolf	*Canis lupus*	formerly known throughout the western two-thirds of the state in forests, brushlands, or grasslands	LE	E
Llano Pocket Gopher	*Geomys texensis texensis*	found in deep, brown loamy sands or gravelly sandy loams and is isolated from other species of pocket gophers by intervening shallow stony to gravelly clayey soils		
******REPTILES******				
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas and adjacent Mexico; oak-juniper woodlands & mesquite-prickly pear associations; eggs laid underground; eats small invertebrates		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet/moist microhabitats conducive to occurrence, but not restricted to them; hibernates underground or in or under surface cover; breeds March-August		
******VASCULAR PLANTS******				
Big Red Sage	*Salvia penstemonoides*	endemic; moist to seasonally wet clay or silt soils in creekbeds and seepage slopes of limestone canyons; flowering June-October		
Edwards Plateau Cornsalad	*Valerianella texana*	very shallow, well-drained but seasonally moist gravelly soils derived from igneous or metamorphic rocks, often along the downslope margin of rock outcrops, in full sun or in partial shade of oak-juniper woodlands; flowering and fruiting March-April		
Hill country wild-mercury	*Argythamnia aphoroides*	shallow to moderately deep clays and clay loams over limestone, in grasslands associated with plateau live oak woodlands, mostly on rolling uplands; flowering April-May; fruit persisting until midsummer		
Warnock's coral root	*Hexalectris warnockii*	leaf litter and humus in oak-juniper woodlands in mountain canyons in the Trans Pecos but at lower elevations to the east, often on narrow terraces along creekbeds		
Basin bellflower	*Campanula reverchonii*	endemic; dry gravels and very shallow sandy soils derived from Precambrian igneous and metamorphic rocks, on open slopes and rock outcrops; flowering May-July, September-October		
Carr's rattlesnake-root	*Prenanthes carrii*	rich humus soil in upper limestone woodland canyon drainages; sometimes just above, but primarily below transitions to creek side seepage shelves ; flowering/fruiting late August-November		
Rock quillwort	*Isoetes lithophila*	very shallow seasonally wet sand or gravel in vernal pools on granite or gneiss outcrops; sporulating in late spring and opportunistically at other seasons		
Small-headed pipewort	*Eriocaulon körnickianum*	wet acid sands of upland seeps and bogs, often on sphagnum mats with little other vegetative cover; flowering/fruiting late May-late June		

TABLE 1A-7: THREATENED OR ENDANGERED SPECIES OF HAYS COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******AMPHIBIANS******				
Blanco Blind Salamander	*Eurycea robusta*	troglobitic; water-filled subterranean caverns; may inhabit deep levels of the Balcones aquifer to the north and east of the Blanco River		T
Blanco River Springs Salamander	*Eurycea pterophila*	subaquatic; springs and caves in the Blanco River drainage in Blanco, Hays, and Kendall counties		
Edwards Plateau Spring Salamanders	*Eurycea sp. 7*	endemic; springs and waters of some caves of this region		
San Marcos Salamander	*Eurycea nana*	headwaters of the San Marcos River downstream to ca. ½ mile past IH-35; water over gravelly substrate characterized by dense mats of algae (*Lyng bya*) and aquatic moss (*Leptodictym riparium*), and water temperatures of 21-22 ^{O} C; diet includes amphipods, midge larve, and aquatic snails	LT	T
Texas Blind Salamander	*Eurycea rathbuni*	troglobitic; water-filled subterranean caverns along a six mile stretch of the San Marcos Spring Fault, in the vicinity of San Marcos; eats small invertebrates, including snails, copepods, amphipods, and shrimp	LE	E
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Whooping Crane	*Grus americana*	potential migrant	LE	E
Zone-tailed Hawk	*Buteo albonotatus*	arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions		T
******CRUSTACEANS******				
Texas Cave Shrimp	*Palaemonetes antrorum*	subterranean sluggish streams and pools		
Ezell's Cave Amphipod	*Stygobromus flagellatus*	known only from artesian wells		
******FISHES******				
Blue Sucker	*Cycleptus elongatus*	usually inhabits channels and flowing pools with a moderate current; bottom type usually consists of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles		T

Common Name	Scientific Name	Description	Federal Status	State Status
Fountain Darter	*Etheostoma fonticola*	known only from the San Marcos and Comal rivers; springs and spring-fed streams in dense beds of aquatic plants growing close to bottom, which is normally mucky; feeding mostly diurnal; spawns year-round with August and late winter to early spring peaks	LE	E
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
Guadalupe Darter	*Percina sciera apristis*	spawns January to June; typically over gravel or gravel and sand raceways of medium streams and rivers, and pools; feeds mainly on larval insects in riffles		
San Marcos Gambusia	*Gambusia georgei*	(extirpated) – endemic; formerly known from upper San Marcos River; restricted to shallow, quiet, mud-bottomed shoreline areas without dense vegetation in thermally constant main channel	LE	E
*******INSECTS******				
Comal Springs Dryopid Beetle	*Stygoparnus comalensis*	dryopids usually cling to objects in a stream; dryopids are sometimes found crawling on stream bottoms or along shores; adults may leave the stream and fly about, especially at night; most dryopid larvae are vermiform and line in soil or decaying wood	LE	
Comal Springs Riffle Beetle	*Heterelmis comalensis*	Comal and San Marcos Springs	LE	
Edwards Aquifer Diving Beetle	*Haideoporus texanus*	habitat poorly known; known from an artesian well in Hays County		
Flint's Net-spinning Caddisfly	*Cheumatopsyche flinti*	very poorly known species with habitat description limited to "a spring"		
San Marcos Saddle-case Caddisfly	*Protoptila arca*	known from an artesian well in Hays County; locally very abundant; swift, well-oxygenated warm water about 1-2 m deep; larvae and pupal cases abundant on rocks		
Balcones Cave Amphipod	*Stygobromus balconis*	A small subterranean amphipod. Found in cave pools		
Comal Springs Diving Beetle	*Comaldessus stygius*	known only from the outflows at Comal Springs; aquatic; diving beetles generally inhabit the water column		
*******MAMMALS******				
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
*******REPTILES******				
Cagle's Map Turtle	*Graptemys caglei*	endemic; Guadalupe River System; short stretches of shallow water with swift to moderate flow and gravel or cobble bottom, connected by deeper pools with a slower flow rate and a silt or mud bottom; gravel bar riffles and transition areas between riffles and pools especially important in providing insect prey items; nest on gently sloping sand banks within ca. 30 feet of water's edge	C1	T
Keeled Earless Lizard	*Holbrookia propinqua*	coastal dunes, barrier islands, and other sandy areas; eats insects and likely other small invertebrates; eggs laid underground March-September (most May-August)		
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas and adjacent Mexico; oak-juniper woodlands & mesquite-prickly pear associations; eggs laid underground; eats small invertebrates		
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

Common Name	Scientific Name	Description	Federal Status	State Status
******VASCULAR PLANTS******				
Canyon mock-orange	*Philadelphus ernestii*	endemic; solution-pitted outcrops of Cretaceous limestone in mesic canyons, usually in shade of mostly deciduous slope forest; flowering April-May		
Hill country wild-mercury	*Argythamnia aphoroides*	shallow to moderately deep clays and clay loams over limestone, in grasslands associated with plateau live oak woodlands, mostly on rolling uplands; flowering April-May; fruit persisting until midsummer		
Texas wild-rice	*Zizania texana*	perennial, emergent, aquatic grass known only from the upper 2.5 km of the San Marcos River in Hays County	LE	E
Warnock's coral root	*Hexalectris warnockii*	leaf litter and humus in oak-juniper woodlands in mountain canyons in the Trans Pecos but at lower elevations to the east, often on narrow terraces along creekbeds		

TABLE 1A-8: THREATENED OR ENDANGERED SPECIES OF LLANO COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Zone-tailed Hawk	*Buteo albonotatus*	arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions		T
Interior Least Tern	*Sterna antillarum athalassos*	this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Whooping Crane	*Grus americana*	potential migrant	LE	E
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
******MAMMALS******				
Black Bear	*Ursus americanus*	within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		
Gray Wolf	*Canis lupus*		LE	E
Llano Pocket Gopher	*Geomys texensis texensis*	found in deep, brown loamy sands or gravelly sandy loams and is isolated from other species of pocket gophers by intervening shallow stony to gravelly clayey soils		

Common Name	Scientific Name	Description	Federal Status	State Status
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Red Wolf	*Canis Rufus*	formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
******MOLLUSKS******				
Texas Hornshell	*Popenaias popeii*	Rio Grande drainage from the Pecos River to the Falcon Breaks	C1	
******REPTILES******				
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas & adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas; eats small invertebrates; eggs laid underground		
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
******VASCULAR PLANTS******				
Basin bellflower	*Campanula reverchonii*	endemic; dry gravels and very shallow sandy soils derived from Precambrian igneous and metamorphic rocks, on open slopes and rock outcrops; flowering May-July, September-October		
Edward Plateau Cornsalad	*Valerianellla texana*	very shallow, well-drained but seasonally moist gravelly soils derived from igneous or metamorphic rocks, often along the downslope margin of rock outcrops, in full sun or in partial shade of oak-juniper woodlands; flowering and fruiting March-April		
Elmendorf's Onion	*Allium elmendorfii*	endemic; deep sands derived from Queen City and similar Eocene formations; flowering April-May		
Enquist's sandmint	*Brazoria enquistii*	primarily on sand banks in and along beds of streams that drain granitic /gneissic landscapes; flowering/fruiting late April-early June		
Granite spiderwort	*Tradescantia pedicellata*	endemic; rocky soils in the Edwards Plateau; flowering March-June (July?)		
Rock quillwort	*Isoetes lithophila*	very shallow seasonally wet sand or gravel in vernal pools on granite or gneiss outcrops; sporulating in late spring and opportunistically at other seasons		

TABLE 1A-9: THREATENED OR ENDANGERED SPECIES OF MATAGORDA COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Attwater's Greater Prairie-chicken	*Tympanuchus cupido attwateri*	this county within historic range; endemic; open prairies of mostly thick grass one to three feet tall; from near sea level to 200 feet along coastal plain on upper two-thirds of Texas coast; males form communal display flocks during late winter-early spring; booming grounds important; breeding February-July	LE	E
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Brown Pelican	*Pelecanus occidentalis*	largely coastal and near shore areas, where it roosts on islands and spoil banks	LE	E
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Interior Least Tern	*Sterna antillarum athalassos*	this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Piping Plover	*Charadrius melodus*	wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats	LT	T
Reddish Egret	*Egretta rufescens*	resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear		T
Snowy Plover	*Charadrius alexandrinus*	wintering migrant along the Texas Gulf Coast beaches and bayside mud or salt flats		
Sooty Tern	*Sterna fuscata*	predominately "on the wing"; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July		T
White-faced Ibis	*Plegadis chihi*	prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
White-tailed Hawk	*Buteo albicaudatus*	near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May		T
Whooping Crane	*Grus americana*	potential migrant	LE	E
Wood Stork	*Mycteria americana*	forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); birds move into Gulf States in search of mud flats and wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
******FISHES******				
American Eel	*Anguilla rostrata*	most aquatic habitats with access to ocean; larva move to coastal waters, metamorphose, then females move into freshwater; muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries		
******MAMMALS******				
Black Bear	*Ursus americanus*	within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands;	T/SA NL	T

Common Name	Scientific Name	Description	Federal Status	State Status
		dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles		
Louisiana Black Bear	*Ursus americanus luteolus*	within historical range in eastern Texas; inhabits bottomland hardwoods and large tracts of undeveloped forested areas; dens in tree hollows, rock piles, or under brush piles	LT	T
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Ocelot	*Felis pardalis*	dense chaparral thickets; mesquite-thorn scrub and live oak mottes; avoids open areas; breeds and raises young June-November	LE	E
Red Wolf	*Canis rufus*	formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
West Indian Manatee	*Trichechus manatus*	Gulf and bay system; opportunistic, aquatic herbivore	LE	E
******REPTILES******				
Atlantic Hawksbill Sea Turtle	*Eretmochelys imbricata*	Gulf and bay system	LE	E
Green Sea Turtle	*Chelonia mydas*	Gulf and bay system	LT	T
Gulf Saltmarsh Snake	*Nerodia clarkii*	saline flats, coastal bays, & brackish river mouths		
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Gulf and bay system	LE	E
Leatherback Sea Turtle	*Dermochelys coriacea*	Gulf and bay system	LE	E
Loggerhead Sea Turtle	*Caretta caretta*	Gulf and bay system	LT	T
Scarlet Snake	*Cemophora coccinea*	mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September		T
Smooth Green Snake	*Liochlorophis vernalis*	Gulf Coastal Plain; mesic coastal shortgrass prairie vegetation; prefers dense vegetation		T
Texas Diamond-back Terrapin	*Malaclemys terrapin littoralis*	coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide		
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Texas Tortoise	*Gopherus berlandieri*	open brush with a grass understory is preferred; open grass and bare ground are avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; longevity greater than 50 years; active March-November; breeds April-November		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T
******VASCULAR PLANTS******				
Coastal Gay-Feather	*Liatris bracteata*	endemic; black clay soils of prairie remnants; flowering in fall		
Threeflower broomweed	*Thurovia triflora*	endemic; black clay soils of remnant grasslands, also tidal flats; flowering July-November		

TABLE 1A-10: THREATENED OR ENDANGERED SPECIES OF MILLS COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Interior Least Tern	*Sterna antillarumathalassos*	this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Whooping Crane	*Grus americana*	potential migrant	LE	E
Wood Stork	*Mycteria americana*	forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
******MAMMALS******				
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		
Gray Wolf	*Canis lupus*	formerly known throughout the western two-thirds of the state in forests, brushlands, or grasslands	LE	E
Red Wolf	*Canis rufus*	formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E
******REPTILES******				
Concho Water Snake	*Nerodia Paucimaculata*	endemic; Concho and Colorado river systems; shallow fast-flowing water with a rocky or gravelly substrate preferred; adults can be found in deep water with mud bottoms; breeding March-October	LT	
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
******VASCULAR PLANTS******				
Hill Country Wild-Mercury	*Argythamnia Aphoroides*	shallow to moderately deep clays and clay loams over limestone, in grasslands associated with plateau live oak woodlands, mostly on rolling uplands; flowering April-May; fruit persisting until midsummer		

TABLE 1A-11: THREATENED OR ENDANGERED SPECIES OF SAN SABA COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	due to similar field characteristics, treat all Peregrine Falcons as federal listed Endangered; potential migrant	DL	T
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Interior Least Tern	*Sterna Antillarum Athalassos*	this subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish & crustaceans, when breeding forages within a few hundred feet of colony	LE	E
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Whooping Crane	*Grus americana*	potential migrant	LE	E
Zone-tailed Hawk	*Buteo albonotatus*	arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions		T
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
******REPTILES******				
Concho Water Snake	*Nerodia paucimaculata*	endemic; Concho and Colorado river systems; shallow fast-flowing water with a rocky or gravelly substrate preferred; adults can be found in deep water with mud bottoms; breeding March-October	LT	
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas and adjacent Mexico; oak-juniper woodlands & mesquite-prickly pear associations; eggs laid underground; eats small invertebrates		
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
******MAMMALS******				
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		

Common Name	**Scientific Name**	**Description**	**Federal Status**	**State Status**
Llano Pocket Gopher	*Geomys texensis texensis*	found in deep, brown loamy sands or gravelly sandy loams and is isolated from other species of pocket gophers by intervening shallow stony to gravelly clayey soils		
Gray Wolf	*Canis lupus*	formerly known throughout the western two-thirds of the state in forests, brushlands, or grasslands	LE	E
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
Red Wolf	*Canis rufus*	formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	LE	E

TABLE 1A-12: THREATENED OR ENDANGERED SPECIES OF TRAVIS COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******AMPHIBIANS******				
Austin Blind Salamander	*Eurycea waterlooensis*	mostly restricted to subterranean cavities of the Edwards Aquifer; dependent upon water flow/quality from the Barton Springs segment of the Edwards Aquifer; only known from the outlets of Barton Springs [Sunken Gardens (Old Mill) Spring, Eliza Spring, and Parthenia (Main) Spring which forms Barton Springs Pool]; feeds on amphipods, ostracods, copepods, plant material, and (in captivity) a wide variety of small aquatic invertebrates	C1	
Barton Springs Salamander	*Eurycea sosorum*	dependent upon water flow from the Barton Springs segment of the Edwards Aquifer; only known from the outlets of Barton Springs; spring dweller, but ranges into subterranean water-filled caverns; found under rocks, in gravel, or among aquatic vascular plants & algae, as available; feeds primarily on amphipods	LE	E
Edwards Plateau Spring Salamanders	*Eurycea sp. 7*	endemic; springs and waters of some caves of this region		
Jollyville Plateau Salamander	*Eurycea sp. 1*	known from springs and waters of some caves of Travis and Williamson counties north of the Colorado River		
Pedernales River Springs Salamander	*Eurycea sp. 6*	endemic; known only from springs		
******ARACHNIDS******				
A Cave Spider	*Cicurina cueva*	very small, cave-adapted spider		
Bandit Cave Spider	*Cicurina bandida*	very small, cave-adapted spider		
Bee Creek Cave Harvestman	*Texella reddelli*	small, blind, cave-adapted harvestman endemic to a few caves in Travis and Williamson counties	LE	
Bone Cave Harvestman	*Texella reyesi*	small, blind, cave-adapted harvestman endemic to a few caves in Travis and Williamson counties; weakly differentiated from *Texella reddelli*	LE	
Tooth Cave Pseudoscorpion	*Tartarocreagris texana*	small, cave-adapted pseudoscorpion known from small limestone caves of the Edwards Plateau	LE	
Tooth Cave Spider	*Neoleptoneta myopica*	very small, cave-adapted, sedentary spider	LE	
Warton's Cave Spider	*Cicurina wartoni*	very small, cave-adapted spider	C1	
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		

Common Name	Scientific Name	Description	Federal Status	State Status
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Whooping Crane	*Grus americana*	potential migrant	LE	E
******CRUSTACEANS******				
An Amphipod	*Stygobromus russelli*	subterranean waters, usually in caves & limestone aquifers; resident of numerous caves in ca. 10 counties of the Edwards Plateau		
Bifurcated Cave Amphipod	*Stygobromus bifurcatus*	found in cave pools		
******FISHES******				
American Eel	*Anguilla rostrata*	most aquatic habitats with access to ocean; spawns January-February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries		
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
Smalleye shiner	*Notropis buccula*	endemic to upper Brazos River system and its tributaries; apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates	C1	
******INSECTS******				
Balcones Cave Amphipod	*Stygobromus balconis*	A small subterranean amphipod. Found in cave pools		
Kretschmarr Cave Mold Beetle	*Texamaurops reddelli*	small, cave-adapted beetle found under rocks buried in silt; small, Edwards Limestone caves in of the Jollyville Plateau, a division of the Edwards Plateau	LE	
Tooth Cave Blind Rove Beetle	*Cylindropsis sp. 1*	one specimen collected from Tooth Cave; only known North American collection of this genus		
Tooth Cave Ground Beetle	*Rhadine persephone*	resident, small, cave-adapted beetle found in small Edwards Limestone caves in Travis and Williamson counties	LE	
******MAMMALS******				
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
******REPTILES******				
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas and adjacent Mexico; oak-juniper woodlands & mesquite-prickly pear associations; eggs laid underground; eats small invertebrates		
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T
******VASCULAR PLANTS******				
Basin bellflower	*Campanula reverchonii*	endemic; dry gravels and very shallow sandy soils derived from Precambrian igneous and metamorphic rocks, on open slopes and rock outcrops; flowering May-July, September-October		
Bracted twistflower	*Streptanthus bracteatus*	endemic; shallow clay soils over limestone, mostly on rocky slopes, in openings in juniper-oak woodlands; flowering April-May		

Common Name	Scientific Name	Description	Federal Status	State Status
Canyon mock-orange	*Philadelphus ernestii*	endemic; solution-pitted outcrops of Cretaceous limestone in mesic canyons, usually in shade of mostly deciduous slope forest; flowering April-May		
Correll's false dragon-head	*Physostegia correllii*	wet soils including roadside ditches and irrigation channels; flowering June-July		
Texabama croton	*Croton alabamensis var. texensis*	mostly deciduous or evergreen deciduous woodlands in duff-covered loamy clay soils on rocky slopes in comparatively mesic limestone ravines, often locally abundant on deeper soils on small terraces in canyon bottoms; flowering late February-March; fruit maturing and dehiscing by early June		

TABLE 1A-13: THREATENED OR ENDANGERED SPECIES OF WHARTON COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Attwater's Greater Prairie-chicken	*Tympanuchus cupido attwateri*	this county within historic range; endemic; open prairies of mostly thick grass one to three feet tall; from near sea level to 200 feet along coastal plain on upper two-thirds of Texas coast; males form communal display flocks during late winter-early spring; booming grounds important; breeding February-July	LE	E
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Eskimo Curlew	*Numenius borealis*	nonbreeding: grasslands, pastures, plowed fields, and less frequently, marshes and mudflats	LE	E
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
White-faced Ibis	*Plegadis chihi*	prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
White-tailed Hawk	*Buteo albicaudatus*	near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May		T
Whooping Crane	*Grus americana*	potential migrant	LE	E
Wood Stork	*Mycteria americana*	forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T
******FISHES******				
American Eel	*Anguilla rostrata*	most aquatic habitats with access to ocean; spawns January-February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries		
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
Sharpnose Shiner	*Notropis oxyrhynchus*	endemic to Brazos River drainage; also, apparently introduced into adjacent Colorado River drainage; large turbid river, with bottom a combination of sand, gravel, and clay-mud	C1	
******MAMMALS******				
Black Bear	*Ursus americanus*	within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA NL	T
Louisiana Black Bear	*Ursus americanus luteolus*	within historical range in eastern Texas; inhabits bottomland hardwoods and large tracts of undeveloped forested areas; dens in tree hollows, rock piles, or under brush piles	LT	T
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
******REPTILES******				
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		

Common Name	Scientific Name	Description	Federal Status	State Status
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

TABLE 1A-14: THREATENED OR ENDANGERED SPECIES OF WILLIAMSON COUNTY

Common Name	Scientific Name	Description	Federal Status	State Status
******AMPHIBIANS******				
Georgetown Salamander	*Eurycea naufragia*	endemic; known from springs and waters in/around town of Georgetown in Williamson County	C1	
Jollyville Plateau Salamander	*Eurycea tonkawae*	known from springs and waters of some caves of Travis and Williamson counties north of the Colorado River		
******ARACHNIDS******				
Bone Cave Harvestman	*Texella reyesi*	small, blind, cave-adapted harvestman endemic to a few caves in Travis and Williamson counties; weakly differentiated from *Texella reddelli*	LE	
******BIRDS******				
American Peregrine Falcon	*Falco peregrinus anatum*	potential migrant; nests in west Texas	DL	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	potential migrant	DL	T
Bald Eagle	*Haliaeetus leucocephalus*	found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Black-capped Vireo	*Vireo atricapillus*	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous & broad-leaved shrubs & trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	LE	E
Golden-cheeked Warbler	*Dendroica chrysoparia*	juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer	LE	E
Henslow's Sparrow	*Ammodramus henslowii*	wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Mountain Plover	*Charadrius montanus*	shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Whooping Crane	*Grus americana*	potential migrant	LE	E
******FISHES******				
Guadalupe Bass	*Micropterus treculi*	endemic; headwater, perennial streams of the Edward's Plateau region		
Sharpnose Shiner	*Notropis oxyrhynchus*	endemic to Brazos River drainage; also, apparently introduced into adjacent Colorado River drainage; large turbid river, with bottom a combination of sand, gravel, and clay-mud	C1	
Smalleye Shiner	*Notropis buccula*	endemic to upper Brazos River system and its tributaries; apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates	C1	
******INSECTS******				
Tooth Cave Ground Beetle	*Rhadine persephone*	resident, small, cave-adapted beetle found in small Edwards Limestone caves in Travis and Williamson counties	LE	
Coffin Cave Mold Beetle	*Batrisodes texanus*	resident, small, cave-adapted beetle found in small Edwards limestone caves in Travis and Williamson counties	LE	

Common Name	Scientific Name	Description	Federal Status	State Status
******MAMMALS******				
Cave Myotis Bat	*Myotis velifer*	colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore		
Plains Spotted Skunk	*Spilogale putorius interrupta*	catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
******REPTILES******				
Spot-tailed Earless Lizard	*Holbrookia lacerata*	central & southern Texas and adjacent Mexico; oak-juniper woodlands & mesquite-prickly pear associations; eggs laid underground; eats small invertebrates		
Texas Garter Snake	*Thamnophis sirtalis annectens*	wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August		
Texas Horned Lizard	*Phrynosoma cornutum*	open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake	*Crotalus horridus*	swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T
******VASCULAR PLANTS******				
Texabama croton	*Croton alabamensis var. texensis*	mostly deciduous or evergreen deciduous woodlands in duff-covered loamy clay soils on rocky slopes in comparatively mesic limestone ravines, often locally abundant on deeper soils on small terraces in canyon bottoms; flowering late February-March; fruit maturing and dehiscing by early June		

APPENDIX 1B

LOWER COLORADO REGION INDUSTRY ECONOMIC VALUE ESTIMATES
(LCRA Community and Economic Development, IMPLAN 2004 - base year 2001)

Appendix 1B: Lower Colorado Region Industry Economic Value Estimates*

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
1	Oilseed farming	809	24.605	1.256	1.691	12.787	0.943	16.678
2	Grain farming	5,651	134.524	5.115	32.465	59.578	5.098	102.256
3	Vegetable and melon farming	113	4.501	0.322	0.044	0.911	0.024	1.301
4	Tree nut farming	170	7.397	0.829	0.205	1.231	0.121	2.386
5	Fruit farming	317	12.732	1.684	0.039	2.095	0.209	4.027
6	Greenhouse and nursery production	1,378	94.944	31.658	1.208	34.689	0.947	68.502
8	Cotton farming	137	15.928	0.957	0.474	2.126	0.108	3.665
10	All other crop farming	1,297	39.581	1.166	0.931	10.221	0.678	12.996
11	Cattle ranching and farming	9,744	128.936	6.483	40.432	-70.772	4.213	-19.645
12	Poultry and egg production	493	61.811	2.589	0.158	3.351	0.06	6.159
13	Animal production, except cattle and poultry	697	17.54	0.726	1.724	-0.429	0.223	2.243
14	Logging	28	4.096	0.531	0.468	1.017	0.089	2.105
15	Forest nurseries, forest products, and timber	18	6.18	0.267	0.274	1.863	0.444	2.848
16	Fishing	336	16.445	2.509	2.921	3.82	0.446	9.695
17	Hunting and trapping	739	54.368	2.618	3.118	14.869	5.753	26.358
18	Agriculture and forestry support activities	1,924	53.85	26.491	8.478	-4.271	1.12	31.817
19	Oil and gas extraction	2,740	790.508	72.436	65.876	93.938	52.513	284.763
24	Stone mining and quarrying	346	40.11	10.483	2.747	6.317	1.045	20.593
25	Sand, gravel, clay, and refractory mining	308	25.576	8.306	2.299	4.42	0.737	15.763
26	Other nonmetallic mineral mining	66	8.496	1.439	0.543	1.133	0.187	3.302
27	Drilling oil and gas wells	222	26.49	3.96	0.107	1.599	0.755	6.421
28	Support activities for oil and gas operation	2,111	470.785	78.958	2.193	15.879	21.384	118.414
30	Power generation and supply	3,058	1,081.38	105.685	151.652	319.214	121.877	698.427
31	Natural gas distribution	324	137.003	9.34	8.979	9.504	13.47	41.293
32	Water, sewage and other systems	276	15.02	2.508	3.297	3.905	0.559	10.27
33	New residential 1-unit structures, nonfarm	10,654	1,326.65	325.528	103.458	28.047	10.7	467.734
34	New multifamily housing structures, nonfarm	1,956	170.485	59.605	19.527	-8.142	0.739	71.729
35	New residential additions and alterations, nonfarm	3,717	430.314	110.862	35.094	-6.69	3.626	142.893
36	New farm housing units and additions and alterations	266	33.063	8.08	2.562	-0.044	0.279	10.878

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
37	Manufacturing and industrial buildings	1,566	116.53	48.247	14.868	-10.522	1.028	53.621
38	Commercial and institutional buildings	15,276	1,254.28	464.009	146.659	-82.988	12.181	539.861
39	Highway, street, bridge, and tunnel construction	2,707	250.382	83.788	26.202	-8.524	2.498	103.964
40	Water, sewer, and pipeline construction	1,011	99.377	31.069	9.769	-5.958	1.009	35.89
41	Other new construction	16,746	1,040.17	524.402	162.316	-93.68	6.869	599.907
42	Maintenance and repair of farm and nonfarm residential buildings	1,750	200.758	52.762	16.719	-6.055	1.433	64.859
43	Maintenance and repair of nonresidential buildings	4,214	358.882	127.425	40.618	-18.747	3.926	153.222
44	Maintenance and repair of highways, streets, and bridges	584	63.48	17.874	5.579	-3.657	0.694	20.49
45	Other maintenance and repair construction	4,953	355.547	156.943	48.481	-18.865	3.181	189.739
47	Other animal food manufacturing	28	13.329	0.851	0.049	0.296	0.071	1.266
49	Rice milling	3	1.221	0.094	0.005	0.065	0.007	0.171
51	Wet corn milling	6	4.518	0.212	0.015	0.34	0.021	0.588
53	Other oilseed processing	7	3.307	0.125	0.004	0.022	0.012	0.163
58	Confectionery manufacturing from purchased chocolate	34	7.675	1.374	0.065	2.142	0.059	3.64
59	Nonchocolate confectionery manufacturing	57	7.596	0.766	0.038	1.159	0.03	1.993
60	Frozen food manufacturing	583	120.067	17.227	0.91	20.946	0.845	39.928
61	Fruit and vegetable canning and drying	51	15.168	1.924	0.089	2.56	0.112	4.684
62	Fluid milk manufacturing	157	68.377	8.193	0.377	1.706	0.598	10.873
64	Cheese manufacturing	16	9.168	0.504	0.027	0.164	0.055	0.75
65	Dry, condensed, and evaporated dairy product	6	2.45	0.114	0.008	0.337	0.01	0.469
66	Ice cream and frozen dessert manufacturing	6	1.682	0.188	0.01	0.208	0.011	0.418
67	Animal, except poultry, slaughtering	179	68.025	4.629	0.245	0.543	0.431	5.848
68	Meat processed from carcasses	467	111.614	11.776	0.621	2.216	0.605	15.218
69	Rendering and meat byproduct processing	82	18.579	2.868	0.145	3.457	0.128	6.599
71	Seafood product preparation and packaging	29	5.368	0.767	0.049	-0.034	0.02	0.802
73	Bread and bakery product, except frozen,	340	44.426	10.741	0.515	10.038	0.321	21.616

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
	manufacturing							
75	Mixes and dough made from purchased flour	1	0.214	0.019	0.001	0.029	0.001	0.049
77	Tortilla manufacturing	80	8.386	2.652	0.096	1.383	0.071	4.201
78	Roasted nuts and peanut butter manufacturing	18	5.398	0.202	0.009	0.364	0.016	0.591
79	Other snack food manufacturing	53	21.413	3.292	0.176	6.447	0.185	10.1
80	Coffee and tea manufacturing	2	0.598	0.027	0.001	0.012	0.002	0.043
82	Mayonnaise, dressing, and sauce manufacturing	9	3.595	0.309	0.017	0.717	0.012	1.055
83	Spice and extract manufacturing	42	15.658	2.954	0.153	5.057	0.128	8.292
84	All other food manufacturing	53	11.15	1.362	0.068	0.688	0.057	2.175
85	Soft drink and ice manufacturing	229	73.319	12.249	0.162	8.856	0.605	21.871
86	Breweries	20	15.198	1.875	0.034	4.099	2.478	8.487
87	Wineries	40	9.314	0.751	0.002	0.345	0.495	1.593
89	Tobacco stemming and redrying	0	0.092	0.002	0	0	0	0.002
92	Fiber, yarn, and thread mills	1	0.073	0.012	0	0.001	0	0.014
93	Broadwoven fabric mills	3	0.372	0.076	0	0.008	0.002	0.087
100	Curtain and linen mills	58	7.627	1.497	-0.012	1.054	0.026	2.566
101	Textile bag and canvas mills	23	1.525	0.434	-0.003	0.028	0.004	0.462
103	Other miscellaneous textile product mills	82	11.83	2.53	-0.014	0.502	0.055	3.073
107	Cut and sew apparel manufacturing	176	21.556	4.427	0.038	2.565	0.08	7.11
108	Accessories and other apparel manufacturing	83	9.931	1.676	0.014	0.664	0.03	2.383
109	Leather and hide tanning and finishing	2	0.486	0.033	0.002	0.013	0.001	0.05
110	Footwear manufacturing	19	2.469	0.641	0.038	0.046	0.015	0.74
111	Other leather product manufacturing	18	1.305	0.304	0.017	0.244	0.006	0.57
112	Sawmills	6	0.979	0.17	0.011	0.047	0.013	0.24
116	Engineered wood member and truss manufacturing	181	20.645	5.245	0.317	1.903	0.294	7.758
117	Wood windows and door manufacturing	6	0.729	0.111	0.011	0.039	0.007	0.169
119	Other millwork, including flooring	96	6.817	2.912	0.178	0.023	0.094	3.207
120	Wood container and pallet manufacturing	228	16.567	6.785	0.422	0.945	0.254	8.406
121	Manufactured home, mobile home,	816	109.502	31.112	2.197	11.753	1.7	46.762

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
	manufacturing							
122	Prefabricated wood building manufacturing	8	0.89	0.141	0.007	0.013	0.008	0.169
123	Miscellaneous wood product manufacturing	33	3.752	0.795	0.051	0.241	0.052	1.138
125	Paper and paperboard mills	12	5.703	1.092	0.022	1.053	0.055	2.222
126	Paperboard container manufacturing	23	4.936	0.99	0.015	0.193	0.048	1.246
128	Surface-coated paperboard manufacturing	3	0.79	0.062	0.001	0.003	0.005	0.07
131	Die-cut paper office supplies manufacturing	9	1.874	0.392	0.008	0.117	0.02	0.537
132	Envelope manufacturing	5	0.691	0.138	0.002	0.004	0.005	0.149
135	All other converted paper product manufacturing	4	0.761	0.109	0.002	0.094	0.006	0.212
136	Manifold business forms printing	66	12.014	2.978	0.082	2.789	0.124	5.974
137	Books printing	171	28.869	8.878	0.274	3.438	0.318	12.909
139	Commercial printing	2,585	305.308	94.364	2.081	24.709	2.66	123.814
140	Tradebinding and related work	116	9.506	4.301	0.094	1.054	0.098	5.547
141	Prepress services	187	14.536	7.636	0.153	1.393	0.129	9.311
142	Petroleum refineries	31	79.69	1.564	3.477	1.091	0.76	6.892
143	Asphalt paving mixture and block manufacturing	198	99.272	12.82	25.902	-11.995	1.552	28.278
144	Asphalt shingle and coating materials manufacturing	13	5.151	0.447	1.495	0.182	0.065	2.189
147	Petrochemical manufacturing	311	180.057	42.806	5.676	21.661	4.538	74.68
148	Industrial gas manufacturing	33	10.571	4.183	0.696	3.546	0.193	8.618
150	Other basic inorganic chemical manufacturing	8	4.181	0.859	0.175	1.043	0.054	2.132
151	Other basic organic chemical manufacturing	344	423.615	24.138	3.676	29.536	7.946	65.295
152	Plastics material and resin manufacturing	2	1.257	0.115	0.023	0.132	0.02	0.29
153	Synthetic rubber manufacturing	2	0.857	0.141	0.03	0.153	0.016	0.34
158	Fertilizer, mixing only, manufacturing	12	3.429	0.159	0.04	0.213	0.03	0.442
160	Pharmaceutical and medicine manufacturing	1,303	551.013	85.375	21.594	121.265	10.582	238.816
161	Paint and coating manufacturing	3	1.165	0.118	0.023	0.136	0.017	0.294
163	Soap and other detergent manufacturing	31	10.854	0.857	0.196	1.899	0.144	3.095
164	Polish and other	38	10.342	1.773	0.438	3.133	0.203	5.547

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
	sanitation good manufacturing							
165	Surface active agent manufacturing	6	3.137	0.091	0.026	0.046	0.028	0.191
166	Toilet preparation manufacturing	47	22.51	1.953	0.52	8.003	0.195	10.672
169	Custom compounding of purchased resins	29	10.063	1.854	0.461	1.234	0.079	3.628
170	Photographic film and chemical manufacturing	6	2.023	0.347	0.092	0.51	0.015	0.964
171	Other miscellaneous chemical product manufacturing	209	75.583	13.841	2.421	9.87	1.509	27.642
172	Plastics packaging materials, film and sheet	503	128.538	18.102	0.695	15.202	0.882	34.88
173	Plastics pipe, fittings, and profile shapes	126	17.316	4.503	0.127	1.558	0.095	6.283
175	Plastics bottle manufacturing	103	18.882	2.389	0.059	2.079	0.077	4.605
177	Plastics plumbing fixtures and all other plastics	659	115.571	21.895	0.748	13.587	0.658	36.887
178	Foam product manufacturing	438	99.501	18.528	0.598	14.606	0.64	34.372
179	Tire manufacturing	4	0.624	0.148	0.011	0.021	0.013	0.192
180	Rubber and plastics hose and belting manufacturing	30	4.486	1.474	0.052	0.704	0.029	2.259
181	Other rubber product manufacturing	11	1.818	0.408	0.014	0.191	0.011	0.624
183	Vitreous china and earthenware articles manufacturing	64	4.414	1.783	0.074	0.49	0.053	2.4
185	Brick and structural clay tile manufacturing	261	32.867	9.363	0.376	5.113	0.38	15.232
188	Clay refractory and other structural clay products	134	15.552	6.663	0.163	1.678	0.19	8.693
190	Glass and glass products, except glass containers	219	45.274	13.875	0.444	10.481	0.594	25.395
191	Cement manufacturing	171	78.462	10.815	0.318	26.129	0.947	38.209
192	Ready-mix concrete manufacturing	1,110	191.453	45.99	1.744	23.055	2.079	72.867
193	Concrete block and brick manufacturing	89	14.458	2.996	0.115	1.683	0.173	4.967
194	Concrete pipe manufacturing	91	16.86	3.405	0.118	2.296	0.194	6.012
195	Other concrete product manufacturing	197	21.551	5.664	0.219	2.512	0.224	8.618
196	Lime manufacturing	86	22.834	4.508	0.123	3.389	0.282	8.302
197	Gypsum product manufacturing	3	0.482	0.054	0.003	0.053	0.003	0.113
199	Cut stone and stone	365	29.62	12.293	0.513	2.267	0.342	15.416

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
	product manufacturing							
200	Ground or treated minerals and earths manufacturing	35	8.093	0.787	0.024	2.862	0.084	3.757
201	Mineral wool manufacturing	3	0.313	0.044	0.001	0.044	0.002	0.092
202	Miscellaneous nonmetallic mineral products	62	7.024	1.629	0.059	1.513	0.074	3.276
203	Iron and steel mills	9	3.234	0.372	0.008	0.066	0.019	0.464
209	Primary aluminum production	10	2.738	0.437	0.013	0.042	0.017	0.509
212	Aluminum extruded product manufacturing	151	24.91	6.567	0.143	0.421	0.2	7.33
217	Copper wire, except mechanical, drawing	123	13.741	10.706	0.233	-0.292	0.048	10.695
218	Secondary processing of copper	4	1.008	0.115	0.002	0.004	0.005	0.127
221	Ferrous metal foundries	234	33.019	10.687	0.235	1.434	0.281	12.637
223	Nonferrous foundries, except aluminum	45	5.224	1.47	0.023	0.198	0.039	1.73
227	All other forging and stamping	97	17.115	4.249	0.069	1.951	0.114	6.383
228	Cutlery and flatware, except precious, manufacturing	7	1.438	0.387	0.028	0.49	0.009	0.914
229	Hand and edge tool manufacturing	43	5.85	1.798	0.034	0.953	0.042	2.827
231	Kitchen utensil, pot, and pan manufacturing	0	0.012	0.002	0	0.001	0	0.004
232	Prefabricated metal buildings and components	123	17.633	4.481	0.096	0.562	0.114	5.253
233	Fabricated structural metal manufacturing	169	28.576	6.476	0.132	4.739	0.187	11.534
234	Plate work manufacturing	212	10.436	8.043	0.138	1.406	0.068	9.656
235	Metal window and door manufacturing	28	4.138	1.179	0.02	0.726	0.03	1.955
236	Sheet metal work manufacturing	367	61.071	15.236	0.293	9.626	0.406	25.562
237	Ornamental and architectural metal work manufacturing	133	17.212	5.707	0.135	2.452	0.121	8.416
238	Power boiler and heat exchanger manufacturing	19	4.131	1.318	0.031	0.834	0.031	2.215
239	Metal tank, heavy gauge, manufacturing	28	5.097	1.379	0.02	0.744	0.035	2.179
240	Metal can, box, and other container manufacturing	14	3.058	0.398	0.009	0.123	0.013	0.543
241	Hardware manufacturing	15	2.869	0.378	0.006	0.391	0.014	0.789
242	Spring and wire product	67	6.953	2.402	0.038	1.049	0.048	3.537

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
	manufacturing							
243	Machine shops	784	89.324	31.737	0.566	4.948	0.737	37.988
244	Turned product and screw, nut, and bolt manufacturing	12	1.809	0.514	0.006	0.284	0.012	0.816
246	Metal coating and nonprecious engraving	76	11.221	2.468	0.031	2.043	0.068	4.611
247	Electroplating, anodizing, and coloring metal	69	3.864	2.207	0.032	0.409	0.024	2.671
248	Metal valve manufacturing	346	56.546	13.996	0.221	12.85	0.358	27.424
252	Fabricated pipe and pipe fitting manufacturing	19	2.742	0.848	0.01	0.504	0.019	1.381
253	Industrial pattern manufacturing	3	0.168	0.084	0.001	0.014	0.001	0.099
255	Miscellaneous fabricated metal product manufacturing	18	2.821	0.769	0.012	0.388	0.02	1.189
256	Ammunition manufacturing	85	11.872	6.234	0.152	0.337	0.22	6.943
257	Farm machinery and equipment manufacturing	53	9.272	1.133	0.066	0.97	0.024	2.193
258	Lawn and garden equipment manufacturing	7	2.154	0.188	0.014	0.225	0.015	0.442
259	Construction machinery manufacturing	34	8.557	1.092	0.072	0.437	0.052	1.653
260	Mining machinery and equipment manufacturing	20	1.829	0.301	0.011	0.138	0.008	0.459
261	Oil and gas field machinery and equipment	448	54.381	22.753	0.735	3.099	0.425	27.012
263	Plastics and rubber industry machinery	3,418	827.295	270.103	11.42	191.746	7.896	481.166
266	Printing machinery and equipment manufacturing	1	0.2	0.052	0.004	0.006	0.001	0.062
267	Food product machinery manufacturing	2	0.179	0.071	0.004	0.019	0.001	0.096
268	Semiconductor machinery manufacturing	99	46.933	6.869	0.694	5.352	0.329	13.244
269	All other industrial machinery manufacturing	11	2.765	0.399	0.023	0.165	0.008	0.596
270	Office machinery manufacturing	18	2.234	0.291	0.02	0.101	0.008	0.42
271	Optical instrument and lens manufacturing	59	3.62	2.504	0.22	0.401	0.026	3.151
272	Photographic and photocopying equipment manufacturing	19	2.77	1.038	0.14	0.34	0.02	1.539
273	Other commercial and service industry machine manufacturing	63	10.851	2.984	0.136	0.048	0.054	3.222

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
275	Air purification equipment manufacturing	99	9.746	3.786	0.178	1.42	0.082	5.466
278	AC, refrigeration, and forced air heating	4	0.818	0.147	0.008	0.037	0.006	0.198
279	Industrial mold manufacturing	77	6.34	2.846	0.128	0.242	0.046	3.262
280	Metal cutting machine tool manufacturing	51	4.342	1.741	0.088	0.384	0.033	2.246
282	Special tool, die, jig, and fixture manufacturing	36	2.05	1.106	0.047	0.038	0.015	1.206
283	Cutting tool and machine tool accessory manufacturing	16	1.582	0.337	0.016	0.085	0.009	0.446
285	Turbine and turbine generator set units manufacturing	3	1.662	0.201	0.017	0.39	0.014	0.621
286	Other engine equipment manufacturing	4	1.138	0.074	0.004	0.068	0.002	0.147
287	Speed changers and mechanical power transmission manufacturing	94	13.681	3.628	0.205	1.813	0.076	5.723
288	Pump and pumping equipment manufacturing	62	16.768	4.48	0.268	2.323	0.169	7.24
289	Air and gas compressor manufacturing	75	14.504	2.771	0.144	2.224	0.108	5.248
293	Overhead cranes, hoists, and monorail system	9	1.77	0.176	0.009	0.101	0.007	0.293
294	Industrial truck, trailer, and stacker manufacturing	24	3.864	0.471	0.024	-0.052	0.018	0.461
298	Industrial process furnace and oven manufacturing	12	0.978	0.207	0.009	0.097	0.005	0.319
301	Scales, balances, and miscellaneous general	97	19.678	6.055	0.305	2.722	0.196	9.279
302	Electronic computer manufacturing	11,731	4,388.82	1,452.72	53.387	86.82	42.306	1,635.23
303	Computer storage device manufacturing	17	6.104	1.246	0.211	0.7	0.044	2.201
304	Computer terminal manufacturing	247	30.43	22.433	0.487	-0.18	0.084	22.824
305	Other computer peripheral equipment manufacturing	2,010	509.185	112.902	2.537	-1.245	3.627	117.821
306	Telephone apparatus manufacturing	1,930	1,104.72	190.368	5.005	267.807	9.361	472.541
307	Broadcast and wireless communications equipment manufacturing	359	152.598	24.603	0.402	18.201	1.137	44.343
308	Other communications equipment manufacturing	471	79.273	31.808	0.515	8.799	0.633	41.755
309	Audio and video equipment manufacturing	48	7.708	1.301	0.022	-0.013	0.035	1.345

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
311	Semiconductors and related device manufacturing	17,626	3,533.68	1,473.23	54.458	1,468.66	27.325	3,023.67
312	All other electronic component manufacturing	5,448	901.335	228.844	5.205	45.081	6.507	285.637
313	Electromedical apparatus manufacturing	513	114.494	24.817	0.734	6.827	0.672	33.05
314	Search, detection, and navigation instrument	169	35.272	10.392	0.227	3.001	0.227	13.848
316	Industrial process variable instruments	852	107.81	61.824	1.517	10.048	0.845	74.233
317	Totalizing fluid meters and counting devices	12	2.277	0.19	0.005	0.091	0.007	0.292
318	Electricity and signal testing instruments	548	84.198	31.606	1.328	16.365	0.576	49.876
321	Watch, clock, and other measuring and controlling	186	32.429	8.688	0.144	2.148	0.213	11.193
322	Software reproducing	261	27.534	22.866	0.654	0.518	0.015	24.053
323	Audio and video media reproduction	26	3.476	0.803	0.01	0.973	0.015	1.801
324	Magnetic and optical recording media manufacturing	5	1.639	0.163	0.004	0.018	0.008	0.193
325	Electric lamp bulb and part manufacturing	40	9.194	4.156	0.274	1.846	0.08	6.355
326	Lighting fixture manufacturing	447	74.766	16.676	1.908	7.884	0.604	27.072
330	Household refrigerator and home freezer manufacturing	4	0.801	0.115	0.009	0.004	0.005	0.132
333	Electric power and specialty transformer manufacturing	10	1.218	0.331	0.047	0.113	0.009	0.5
334	Motor and generator manufacturing	77	11.492	3.277	0.359	1.224	0.091	4.951
335	Switchgear and switchboard apparatus manufacturing	32	5.793	1.244	0.129	1.05	0.042	2.464
336	Relay and industrial control manufacturing	100	22.701	7.19	0.707	0.651	0.231	8.78
337	Storage battery manufacturing	1	0.222	0.059	0.009	0.019	0.002	0.089
340	Other communication and energy wire manufacturing	1	0.944	0.055	0.005	0.151	0.01	0.222
341	Wiring device manufacturing	298	46.212	12.22	1.347	8.725	0.35	22.643
343	Miscellaneous electrical equipment manufacturing	110	30.113	4.796	0.457	0.27	0.203	5.725
346	Motor vehicle body manufacturing	12	1.331	0.217	0.006	0.008	0.004	0.234

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
349	Travel trailer and camper manufacturing	23	4.289	1.042	0.047	0.352	0.027	1.469
350	Motor vehicle parts manufacturing	61	14.783	3.179	0.012	0.644	0.084	3.918
351	Aircraft manufacturing	84	23.909	6.424	0.011	-0.234	0.153	6.353
352	Aircraft engine and engine parts manufacturing	191	45.535	9.616	0.001	6.305	0.192	16.115
353	Other aircraft parts and equipment	343	78.957	18.111	0.009	5.078	0.395	23.593
357	Ship building and repairing	1	0.12	0.04	0	0.003	0.001	0.044
358	Boat building	15	2.059	0.62	0	0.32	0.011	0.952
361	All other transportation equipment manufacturing	2	0.997	0.056	0	0.101	0.003	0.16
362	Wood kitchen cabinet and countertop manufacturing	995	75.01	30.788	0.264	7.648	0.913	39.613
363	Upholstered household furniture manufacturing	161	13.515	3.624	0.027	0.022	0.055	3.728
364	Nonupholstered wood household furniture manufacturing	58	5.08	1.355	0.012	0.481	0.024	1.871
365	Metal household furniture manufacturing	59	12.351	1.832	0.018	2.285	0.067	4.203
366	Institutional furniture manufacturing	119	18.638	5.207	0.04	3.755	0.105	9.107
367	Other household and institutional furniture	2	0.105	0.026	0	0.005	0	0.031
369	Custom architectural woodwork and millwork	14	2.175	0.422	0.004	0.266	0.009	0.7
371	Showcases, partitions, shelving, and lockers	164	13.224	4.476	0.033	1.798	0.068	6.375
372	Mattress manufacturing	86	11.82	2.756	0.013	1.46	0.056	4.285
373	Blind and shade manufacturing	223	21.537	5.729	0.063	2.871	0.104	8.767
374	Laboratory apparatus and furniture manufacturing	14	1.637	0.222	0.02	0.018	0.006	0.266
375	Surgical and medical instrument manufacturing	155	30.706	8.032	0.958	6.637	0.231	15.857
376	Surgical appliance and supplies manufacturing	1,449	358.673	87.722	7.032	90.089	3.081	187.925
378	Ophthalmic goods manufacturing	51	4.591	1.448	0.17	0.95	0.033	2.6
379	Dental laboratories	86	4.669	2.352	0.235	0.234	0.033	2.853
380	Jewelry and silverware manufacturing	1,969	283.614	52.606	8.427	15.101	2.143	78.277
381	Sporting and athletic goods manufacturing	88	14.306	2.859	0.381	0.809	0.277	4.326
382	Doll, toy, and game	77	6.261	2.162	0.27	0.977	0.069	3.478

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
	manufacturing							
383	Office supplies, except paper, manufacturing	9	0.649	0.191	0.017	0.154	0.007	0.369
384	Sign manufacturing	319	34.573	8.216	0.756	1.024	0.289	10.284
385	Gasket, packing, and sealing device manufacturing	248	25.926	5.943	0.429	2.701	0.122	9.195
386	Musical instrument manufacturing	50	4.174	1.17	0.12	0.29	0.041	1.621
389	Buttons, pins, and all other miscellaneous manufacturing	166	16.379	3.444	0.384	1.751	0.135	5.714
390	Wholesale trade	29,741	5,433.95	1,955.68	138.583	518.513	1,057.03	3,669.81
391	Air transportation	698	138.136	47.058	0.735	1.929	7.781	57.503
393	Water transportation	10	5.791	0.494	0.064	0.344	0.148	1.05
394	Truck transportation	3,744	444.358	121.265	10.012	73.653	4.219	209.149
395	Transit and ground passenger transportation	4,189	157.974	54.323	30.098	3.099	7.918	95.438
396	Pipeline transportation	99	62.303	14.164	11.179	-2.005	3.356	26.694
397	Scenic and sightseeing transportation and support	795	80.46	31.982	4.81	4.714	2.359	43.865
398	Postal service	2,553	190.265	156.712	0	-5.093	0	151.618
399	Couriers and messengers	3,125	213.471	70.884	6.781	38.251	0.754	116.67
400	Warehousing and storage	313	21.752	11.745	1.097	3.031	0.727	16.6
401	Motor vehicle and parts dealers	10,217	929.565	415.922	73.885	30.602	92.222	612.631
402	Furniture and home furnishings stores	4,011	267.68	113.695	6.096	19.357	30.736	169.884
403	Electronics and appliance stores	3,086	184.826	116.497	25.204	-10.136	13.106	144.671
404	Building material and garden supply stores	6,584	427.778	191.267	8.838	38.126	53.712	291.945
405	Food and beverage stores	15,355	796.195	311.84	39.682	37.126	80.841	469.489
406	Health and personal care stores	3,204	154.446	81.215	4.231	11.515	17.471	114.433
407	Gasoline stations	4,739	283.068	97.844	25.114	3.669	33.18	159.808
408	Clothing and clothing accessories stores	7,141	300.752	123.653	10.057	23.805	37.848	195.362
409	Sporting goods, hobby, book and music stores	3,730	167.86	57.555	7.845	8.38	16.019	89.8
410	General merchandise stores	8,905	394.801	192.765	1.778	33.241	44.041	271.824
411	Miscellaneous store retailers	7,728	356.231	107.128	20.731	4.634	23.997	156.49
412	Nonstore retailers	8,780	290.181	61.149	33.301	5.384	33.348	133.181
413	Newspaper publishers	1,869	203.308	72.267	16.397	38.775	1.9	129.338
414	Periodical publishers	535	91.294	26.338	5.314	20.664	0.822	53.138
415	Book publishers	847	232.097	45.867	9.697	51.321	2.202	109.087

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
416	Database, directory, and other publishers	170	37.866	6.236	1.311	14.645	0.367	22.559
417	Software publishers	5,987	1,501.98	513.248	155.685	374.342	16.892	1,060.17
418	Motion picture and video industries	1,009	117.455	31.194	6.986	7.336	2.971	48.487
419	Sound recording industries	608	156.399	27.202	5.387	63.747	1.35	97.685
420	Radio and television broadcasting	1,815	282.383	80.426	18.224	-5.088	1.753	95.315
421	Cable networks and program distribution	1,102	589.926	37.759	7.588	109.145	14.4	168.893
422	Telecommunications	7,816	1,932.19	455.795	100.419	430.051	202.727	1,188.99
423	Information services	1,299	188.783	82.329	22.033	23.518	3.28	131.16
424	Data processing services	2,660	361.414	157.444	34.919	55.497	4.015	251.874
425	Nondepository credit intermediation and related activities	4,854	654.309	252.379	15.309	212.989	37.056	517.734
426	Securities, commodity contracts, investments	12,528	973.68	304.792	268.272	-34.635	22.445	560.873
427	Insurance carriers	7,350	1,287.35	355.201	33.674	21.868	65.991	476.734
428	Insurance agencies, brokerages, and related	7,143	661.255	294.597	26.237	248.441	3.984	573.26
429	Funds, trusts, and other financial vehicles	995	257.79	16.272	2.881	-0.326	3.116	21.943
430	Monetary authorities and depository credit intermediary	6,790	1,276.05	250.988	15.098	583.997	19.894	869.977
431	Real estate	31,266	4,659.99	333.472	212.543	2,099.52	603.103	3,248.64
432	Automotive equipment rental and leasing	1,233	134.048	27.612	3.901	58.094	6.791	96.398
433	Video tape and disc rental	833	38.963	10.353	1.474	11.578	3.003	26.409
434	Machinery and equipment rental and leasing	710	162.119	21.627	3.042	77.148	5.342	107.158
435	General and consumer goods rental except video rentals	1,682	102.858	51.229	7.362	29.676	2.531	90.798
436	Lessors of nonfinancial intangible assets	145	594.271	7.174	0.348	484.563	53.691	545.776
437	Legal services	10,132	1,127.62	513.647	118.64	216.812	6.499	855.599
438	Accounting and bookkeeping services	4,127	253.443	145.679	33.634	32.049	1.602	212.964
439	Architectural and engineering services	15,050	1,303.78	625.592	150.007	188.355	8.461	972.416
440	Specialized design services	818	90.225	27.336	6.284	22.606	1.577	57.803
441	Custom computer programming services	24,243	2,004.29	1,536.74	367.4	-122.965	11.335	1,792.51
442	Computer systems design services	4,463	530.019	286.339	71.588	-54.372	12.491	316.046

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
443	Other computer related services, including computer facilities management	1,312	143.979	75.172	18.111	29.834	1.41	124.526
444	Management consulting services	5,081	477.538	246.894	59.209	92.302	2.88	401.285
445	Environmental and other technical consulting	1,678	186.571	63.89	14.509	59.663	0.892	138.954
446	Scientific research and development services	5,830	370.536	275.003	65.917	-37.966	2.438	305.392
447	Advertising and related services	4,415	451.718	192.398	44.657	81.388	5.043	323.487
448	Photographic services	536	28.524	7.218	1.611	8.563	1.214	18.606
449	Veterinary services	1,653	84.42	30.264	6.924	0.071	2.654	39.914
450	All other miscellaneous professional and technical	1,840	215.637	41.341	9.471	126.126	2.48	179.418
451	Management of companies and enterprises	2,279	179.248	89.625	21.706	7.039	3.294	121.664
452	Office administrative services	3,187	506.53	150.142	20.079	98.878	4.615	273.715
453	Facilities support services	1,407	124.458	53.012	7.754	29.796	0.395	90.957
454	Employment services	17,631	470.084	347.444	47.089	10.479	2.199	407.211
455	Business support services	9,939	626.651	274.046	37.258	164.932	13.383	489.619
456	Travel arrangement and reservation services	1,546	106.168	36.903	4.813	9.147	1.622	52.485
457	Investigation and security services	3,936	137.784	84.57	11.043	18.566	2.23	116.409
458	Services to buildings and dwellings	9,721	327.576	173.776	22.712	27.633	4.396	228.517
459	Other support services	1,108	150.003	38.178	4.809	51.333	1.831	96.151
460	Waste management and remediation services	955	152.073	47.113	9.87	22.976	7.222	87.181
461	Elementary and secondary schools	1,459	48.82	29.719	1.203	-0.985	0	29.937
462	Colleges, universities, and junior colleges	2,166	68.814	35.161	1.666	-2.279	0	34.547
463	Other educational services	5,924	273.872	115.473	4.25	61.686	3.108	184.517
464	Home health care services	7,013	227.113	91.963	16.098	-1.066	0.683	107.678
465	Offices of physicians, dentists, and other healthcare	16,782	1,557.62	822.568	145.47	201.126	8.804	1,177.97
466	Other ambulatory health care services	3,024	465.983	116.536	20.346	30.38	3.294	170.555
467	Hospitals	11,682	1,384.94	522.654	89.919	4.35	5.469	622.392
468	Nursing and residential care facilities	9,288	369.082	214.692	13.155	7.157	2.823	237.826

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
469	Child day care services	5,660	186.158	60.214	5.917	27.988	1.719	95.838
470	Social assistance, except child day care service	7,164	177.284	112.74	11.164	-7.487	0.895	117.312
471	Performing arts companies	5,275	77.945	33.83	10.888	-5.11	2.708	42.314
472	Spectator sports	752	5.52	4.07	1.563	-1.609	0.595	4.618
473	Independent artists, writers, and performers	1,055	83.635	17.862	6.202	4.541	0.708	29.313
474	Promoters of performing arts and sports and agents	950	30.064	9.462	3.087	4.262	1.233	18.044
475	Museums, historical sites, zoos, and parks	479	27.685	6.501	0.048	-0.144	0.234	6.64
476	Fitness and recreational sports centers	3,053	39.956	30.129	10.445	-6.423	1.737	35.889
477	Bowling centers	370	6.344	3.288	1.137	0.399	0.399	5.223
478	Other amusement, gambling, and recreation industry	5,266	221.303	59.387	21.386	42.887	11.729	135.389
479	Hotels and motels, including casino hotels	5,239	301.033	101.482	29.829	55.19	26.687	213.188
480	Other accommodations	1,233	168.849	18.224	4.488	26.387	5.276	54.375
481	Food services and drinking places	56,194	2,298.21	761.895	263.359	-9.237	140.636	1,156.65
482	Car washes	1,048	41.336	11.415	3.718	12.887	1.278	29.298
483	Automotive repair and maintenance, except car wash	11,164	1,671.39	268.165	90.187	391.921	72.086	822.359
484	Electronic equipment repair and maintenance	1,622	196.685	58.831	20.241	28.9	3.729	111.701
485	Commercial machinery repair and maintenance	1,778	168.122	48.224	16.215	36.34	3.042	103.821
486	Household goods repair and maintenance	720	81.457	11.256	3.952	23.252	1.474	39.934
487	Personal care services	3,077	147.3	50.911	10.829	31.067	2.893	95.7
488	Death care services	704	42.985	13.999	2.888	7.295	1.652	25.834
489	Dry-cleaning and laundry services	3,067	139.467	53.953	10.891	23.433	4.63	92.906
490	Other personal services	1,686	176.584	29.953	6.147	60.875	4.039	101.014
491	Religious organizations	382	44.81	28.399	0	0	0	28.399
492	Grant making and giving and social advocacy organizations	5,071	124.338	39.043	0	0	0.113	39.156
493	Civic, social, professional and similar organizations	11,790	361.835	163.887	0	0	0.714	164.601
494	Private households	8,486	85.716	66.688	0	19.028	0	85.716
495	Federal electric utilities	0	0	0	0	0	0	0
496	Other Federal Government enterprises	103	8.664	7.986	0	-0.283	0	7.703
497	State and local	752	67.425	33.026	0	-27.335	0	5.692

IMPLAN modeling code	Industry	Employment	Millions of dollars					
			Industry Output	Employee Compensation	Proprietor Income	Other Property Income	Indirect Business Tax	Total Value Added
	government passenger transit							
498	State and local government electric utilities	2,484	1,110.86	161.637	0	463.838	45.144	670.618
499	Other State and local government enterprises	2,129	295.214	94.138	0	60.698	0.598	155.434
503	State & Local Education	34,407	1,625.30	1,419.64	0	205.66	0	1,625.30
504	State & Local Non-Education	85,200	3,921.24	3,342.56	0	578.684	0	3,921.24
505	Federal Military	3,212	80.291	68.455	0	11.836	0	80.291
506	Federal Non-Military	11,225	721.553	615.155	0	106.398	0	721.553
508	Inventory valuation adjustment	0	11.749	0	0	11.934	0	11.934
509	Owner-occupied dwellings	0	2,892.04	0	0	1,802.80	443.957	2,246.76
	Totals	875,818	86,477.33	30,454.95	4,633.24	14,304.03	3,994.27	53,386.49

*Source: LCRA Community and Economic Development, IMPLAN 2004 - base year 2001, data is for the 14 Region K counties (includes all of Hays, Williamson, and Wharton Counties).

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CHAPTER 2.0: POPULATION PROJECTIONS AND WATER DEMAND PROJECTIONS

A key task in the preparation of the regional water plan for the Lower Colorado Regional Water Planning Area (Region K) is to estimate current and future water demands within the region. In subsequent chapters of this plan, these projections are compared with estimates of currently available water supplies to identify the location, extent, and timing of future water shortages.

Table 2.1 below is a summary of regional population and water demand projections for Region K.

Table 2.1 Population and Water Demand Projections for the Lower Colorado Region

Regional Projections	2000	2010	2020	2030	2040	2050	2060
POPULATION	**1,132,228**	**1,359,677**	**1,657,025**	**1,936,324**	**2,181,851**	**2,447,058**	**2,713,905**
Municipal Water Demand (ac-ft/yr)	213,303	252,637	304,735	352,737	394,101	439,049	484,170
Manufacturing Water Demand (ac-ft/yr)	28,887	38,162	44,916	56,233	69,264	77,374	85,698
Irrigation Water Demand (ac-ft/yr)	620,930	589,705	567,272	545,634	524,809	504,695	468,763
Steam-Electric Water Demand (ac-ft/yr)	103,875	153,522	156,894	194,396	208,982	214,783	222,058
Mining Water Demand (ac-ft/yr)	23,945	30,620	31,252	31,613	26,964	27,304	27,598
Livestock Water Demand (ac-ft/yr)	13,395	13,395	13,395	13,395	13,395	13,395	13,395
TOTAL WATER DEMAND	**1,004,335**	**1,078,041**	**1,118,464**	**1,194,008**	**1,237,515**	**1,276,600**	**1,301,682**

As indicated, the population in Region K is projected to more than double over the next 60 years. This projected increase in population is the principal "driver" underlying the projected increase in total water demand from approximately 1,004,000 acre-feet (ac-ft) in the year 2000 to 1,302,000 ac-ft in the year 2060.

The following sections of this chapter describe the methodology used to develop regional population and water demand projections. This chapter also presents projections of population and water demand for cities, wholesale water providers of municipal and manufacturing water, and for categories of water use including municipal, manufacturing, irrigation, steam-electric power generation, mining, and livestock watering. Projected demands are also provided for each of the four river basins and two coastal basins that are partially located within Region K.

2.1 TWDB GUIDELINES FOR REVISIONS TO POPULATION AND WATER DEMAND PROJECTIONS

Texas Water Development Board (TWDB) performed the primary data analysis in 2002 to develop draft population projections for each identified water user group (WUG) in the Lower Colorado Regional Water Planning Area. These projections were reviewed with Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife Department (TPWD), and the Texas Department of Agriculture (TDA) prior to being released as draft consensus projections. The Lower Colorado Regional Water Planning Group (LCRWPG) used these draft population numbers and prepared draft population and water demand projections for all WUGs within Region K.

The new population projections were developed using a standard cohort-component procedure in conjunction with data from the 2000 Census and other sources. The cohort-component procedure, which uses separate cohorts such as age, sex, race, ethnic groups, and components of change such as fertility rates, survival rates, and migration rates, was used to calculate future county populations. The municipal water use estimates were initially developed based on data collected from the TWDB Water Use Survey through year 2000.

In essence, TWDB rules require that the State's projections be used as the "default" for regional water planning unless there are substantiated reasons to revise those projections. The TWDB established guidelines to be used in developing proposed revisions. Based on these guidelines, a number of revisions to the State's "default" projections were proposed by the LCRWPG and adopted by the TWDB.

TWDB rules require that the analysis of current and future water demands be performed for each WUG within Region K. To be considered a WUG within the municipal category, one of the following must apply.

- Each city with a population of 500 or more
- Individual utilities providing more than 280 acre feet per year (ac-ft/yr) of water for municipal use (for counties having four or less of these utilities)
- Collective Reporting Units (CRUs) consisting of grouped utilities having a common association

All smaller communities and rural areas, aggregated at the county level, are considered a WUG and are referred to as "County-Other" for each county. Additionally, for each county, the categories of manufacturing, irrigation, steam-electric power generation, mining, and livestock water use are each considered a WUG. Furthermore, TWDB rules require the determination of demands associated with each of the wholesale water providers designated by the Regional Water Planning Group (RWPG). There are two wholesale water providers in Region K: Lower Colorado River Authority (LCRA) and the City of Austin (COA).

2.2 POPULATION PROJECTIONS

The population and water demand projections presented in this chapter were developed by revising the State's "default" projections to reflect more current information, in accordance with TWDB guidelines. This section describes the methodology applied by the planning group to develop the TWDB-approved population projections for Region K (TWDB approved on February 17, 2004).

2.2.1 Methodology

Municipal water demand projections are calculated as the product of three variables: current and projected population, per capita water use rates, and assumptions regarding the effects of certain water conservation measures.

The following describes the procedures followed in the development of the population projections presented in this chapter:

Identify the initial baseline projection: The baseline population projection for regional water planning is the State's "most likely" scenario for each county and WUG. These projections represent "default" values that are used, except where revisions were justified per TWDB guidelines.

Evaluate recent population growth trends: As indicated above, TWDB guidelines allow for adjustments of population projections if new or better information warrants such a revision. Using the 2000 census, the planning group calculated the growth rate for this period. This adjusted year 2000 population estimate was then used as the starting point for the development of a revised population projection through 2060 using the growth rates in the State's projections for each decade.

Select proposed population projection: Proposed population projections were determined after the TWDB default projections and other available projections were compared. The TWDB projection was selected as the proposed projection, except in cases where better information was available. The majority of adjustments that were made to the population projections were based on variations in the land area for the various systems. Areas that were limited in geographic extent and near build-out requested that population be capped if they did not anticipate annexing new territory. Those areas that did anticipate annexing additional territory as growth occurred requested higher corresponding population projections. These population projections are summarized in the following section.

2.2.2 Regional Population Projection

Projections of population growth for Region K indicate a doubling of the region's population from approximately 1.1 million in 2000 to 2.7 million in the year 2060 (*Figure 2.1*). *Table 2.2* presents these projections by county for each decade of the 60-year planning period. Each of the 14 counties in the region are projected to grow significantly over the planning period, with Travis County continuing to account for nearly 75 percent of the total population for the region, as shown in *Table 2.2*.

Figure 2.1: Lower Colorado Region Population Projections

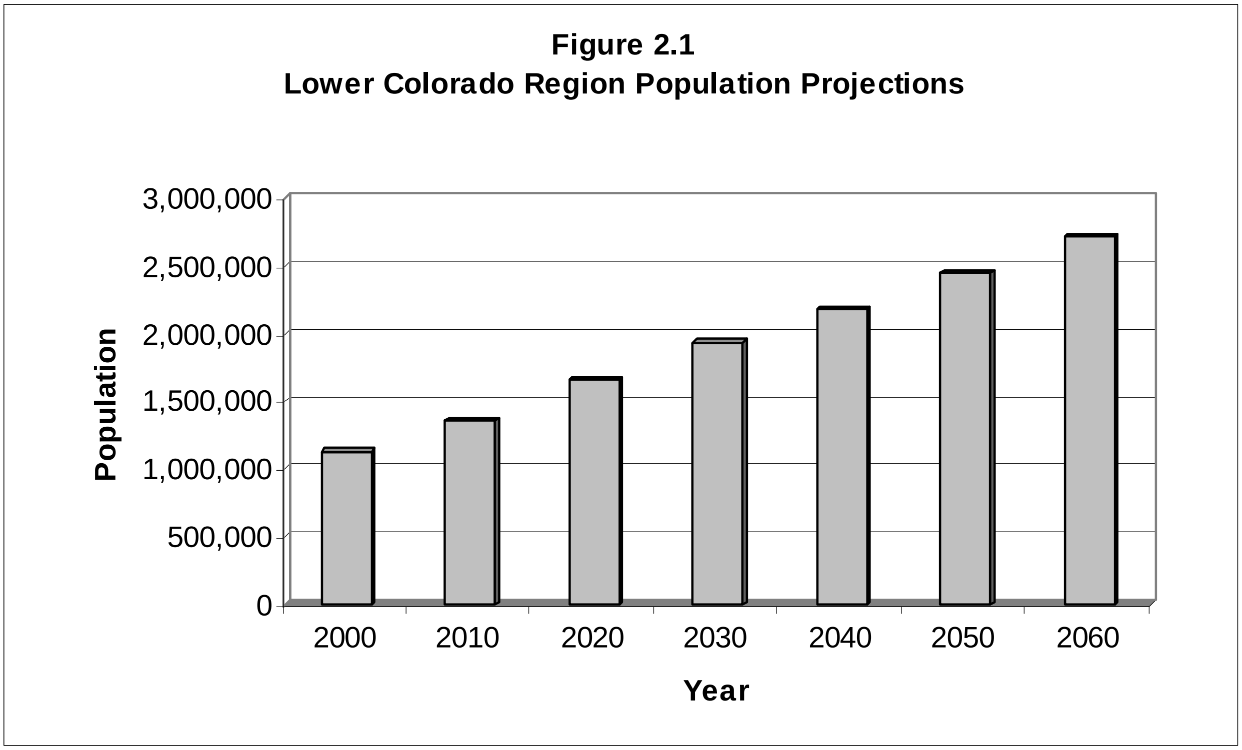


Table 2.2 Population Projection by County

County	1996	2000	2010	2020	2030	2040	2050	2060
Bastrop	46,738	57,733	75,386	97,601	123,734	153,392	190,949	237,958
Blanco	7,352	8,418	9,946	11,756	13,487	15,002	16,641	18,544
Burnet	29,426	34,147	41,924	51,044	60,382	69,271	78,981	90,263
Colorado	19,574	20,390	21,101	22,032	22,550	22,760	22,801	22,561
Fayette	21,757	21,804	24,826	28,808	32,363	35,259	38,933	44,120
Gillespie	19,700	20,814	24,089	27,510	28,845	28,845	28,845	28,845
Hays (p)	17,662	25,090	46,143	69,377	88,887	108,495	132,051	150,574
Llano	12,852	17,044	17,360	17,360	17,360	17,360	17,360	17,360
Matagorda	38,183	37,957	40,506	43,295	44,991	45,925	45,793	45,377
Mills	4,964	5,151	5,137	5,414	5,476	5,537	5,497	5,397
San Saba	5,565	6,186	6,387	6,746	7,059	7,332	7,365	7,409
Travis	680,540	812,280	969,955	1,185,499	1,385,236	1,550,538	1,722,737	1,888,543
Wharton (p)	27,799	26,721	28,260	29,872	30,911	31,508	31,523	31,188
Williamson (p)	19,771	38,493	48,657	60,711	75,043	90,627	107,582	125,766
TOTAL	**951,883**	**1,132,228**	**1,359,677**	**1,657,025**	**1,936,324**	**2,181,851**	**2,447,058**	**2,713,905**

(p) Denotes that only the portion of the county in Region K is considered.
* Population projections by city, county, and portion of a river basin within a county for each of the 14 counties in the Lower Colorado Region are provided in *Appendix 2A*.

As discussed in Chapter 1, Region K covers a portion of four major river basins and two coastal basins. Of these, the Colorado River Basin is projected to contain approximately 91 percent of the region's population in the year 2060. *Table 2.3* presents the population projections by river basin for Region K.

Table 2.3 Population Projection by River Basin

River Basin	1996	2000	2010	2020	2030	2040	2050	2060
Brazos	21,116	46,602	58,637	73,002	89,703	107,633	127,220	148,515
Brazos-Colorado	48,976	45,827	48,670	51,748	53,654	54,711	54,634	54,101
Colorado	855,143	1,011,523	1,222,072	1,499,228	1,757,573	1,982,222	2,226,069	2,469,945
Colorado-Lavaca	11,144	12,525	13,345	14,236	14,782	15,085	15,052	14,911
Guadalupe	6,618	5,610	6,649	7,971	9,272	10,455	11,809	13,426
Lavaca	8,886	10,141	10,304	10,840	11,340	11,745	12,274	13,007
TOTAL	**951,883**	**1,132,228**	**1,359,677**	**1,657,025**	**1,936,324**	**2,181,851**	**2,447,058**	**2,713,905**

The complete population projections for Region K by water user group are provided in *Appendix 2A*. *Appendix 2B* provides a comparison of the 2001 Region K Water Plan Population projections versus the 2006 projections (the projections presented in this report). *Appendix 2C* provides the gallons per capita day for each WUG.

2.3 WATER DEMAND PROJECTIONS

Total water demand for Region K is projected to increase by approximately 297,000 ac-ft over the 60-year planning period. This increase (approximately 30 percent) is largely due to the counter effect of projected increases in municipal, manufacturing, and steam-electric water demand and the projected decrease in irrigation water demand. The following figures (*Figures 2.2* and *2.3*) show the relative portion of projected water demand by type of use for the year 2000 through the year 2060.

Figure 2.2: Lower Colorado Region Total Water Demand Projections

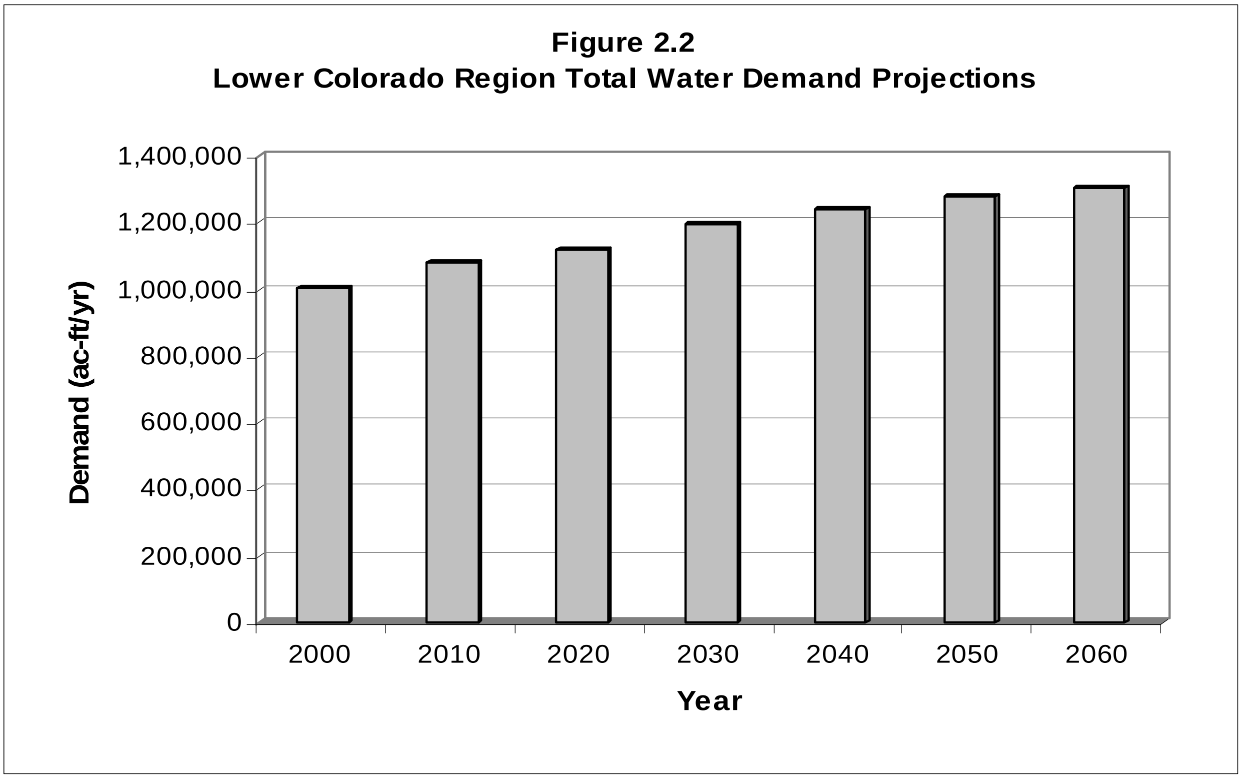
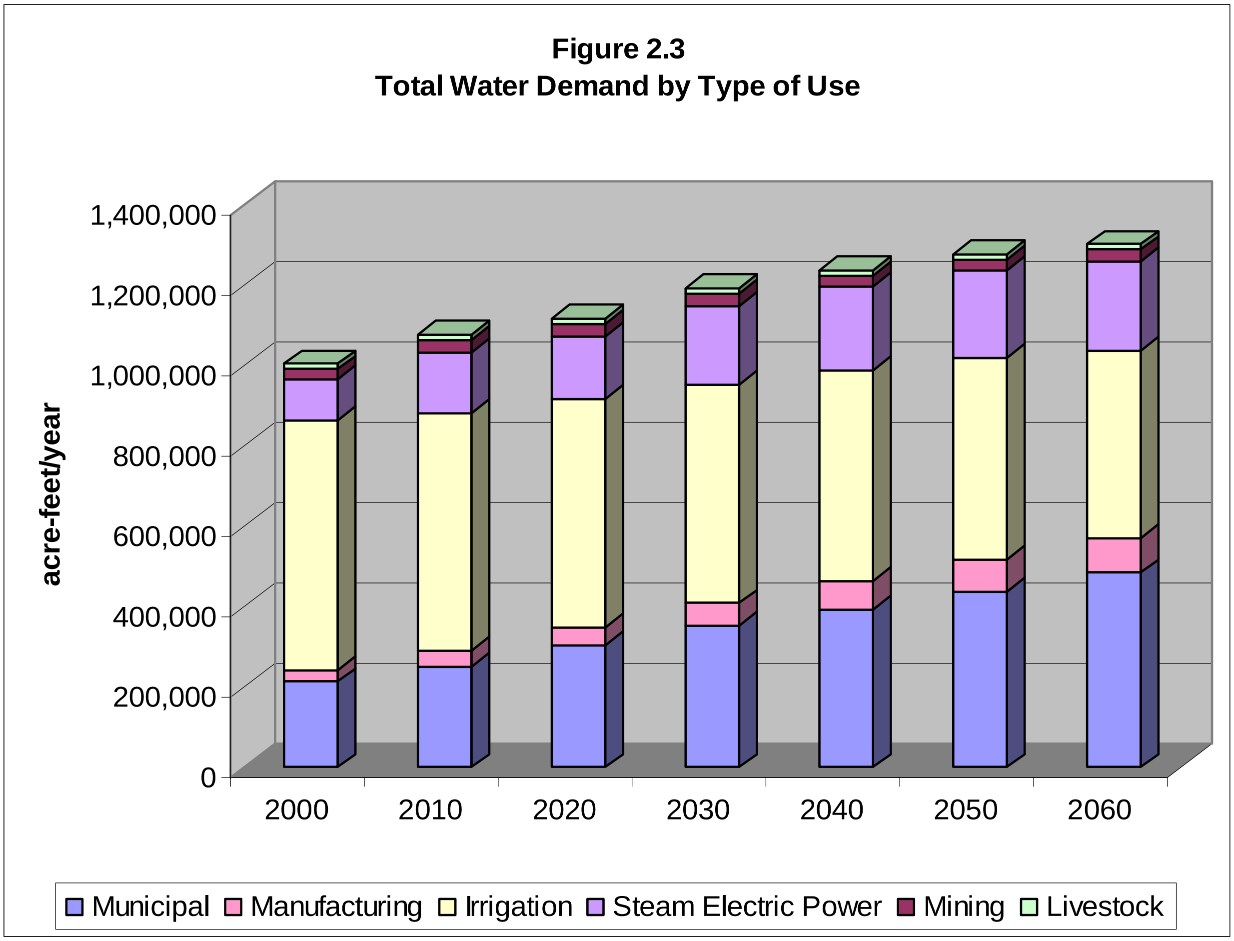


Figure 2.3: Total Water Demand by Type of Use



2.3.1 Municipal Water Demand Projections

2.3.1.1 Methodology

As with the population projections, the planning group generated the proposed municipal water demand projections by starting with the state default projections and making updates on the basis of better, more current information. The following procedure describes the methodology used for generating these projections:

1. ***Identify TWDB Projected Per Capita Use Rate:*** After population, the second key variable in the TWDB's municipal water demand projections is per capita use, expressed as gallons of water used per person per day. TWDB estimates of per capita water use are derived from data provided by water suppliers annually, and are simply the total annual reported municipal water use divided by total estimated population, and then divided by 365 (days in a year). The starting point in TWDB's default projections is a per capita use estimate for a year with below-normal rainfall when water use is typically high. Region K per capita use values were developed from year 2000 data. The year 2000 was chosen for the following reasons:

- Due to the year 2000 Census, the population figures will be more accurate than any single-year population estimates between 1990 and 2000.
- According to the Palmer Drought Severity Index for the past decade, the year 2000 was the driest year in the last decade for the majority of the regions and for the state as a whole.
- Year 2000 water use data also takes into account not only a dry-year water usage, but the water use savings that have resulted to date from the 1991 State Water-Efficient Plumbing Act or conservation programs supported by the city or utility.

TWDB guidelines for revisions to municipal water demand projections provide that adjustments in per capita use rates can be proposed if more recent data indicate that per capita use has changed. The guidelines for revision also provide for the modification of TWDB conservation assumptions, if changes to the assumptions are justified. In this analysis, the City of Austin used year 1998 as their base year instead of year 2000, since the COA had mandatory water conservation measures in place during year 2000.

2. ***Municipal Water Demand:*** The municipal water demand projections are the product of the proposed population projections and the proposed per capita usage projections described above. These projections were adopted by the TWDB and are presented for each municipal WUG by county, river basin, and decade in *Appendix 2A*.

2.3.1.2 Regional Municipal Water Demand Projections

Municipal water demand for Region K is projected to increase by approximately 271,000 ac-ft/yr over the 60-year planning period. While this is a significant increase in municipal water use over the planning period, this increase (approximately 127 percent) is less than the increase in population over the same period (approximately 140 percent). This is due to projected reductions in per capita water use associated with the adoption of various water conservation measures. *Figure 2.4* presents the total municipal water demand projections, and *Table 2.4* presents the projected municipal water demand by county for each of the 14 counties in Region K.

Figure 2.4: Lower Colorado Region Municipal Water Demand Projections

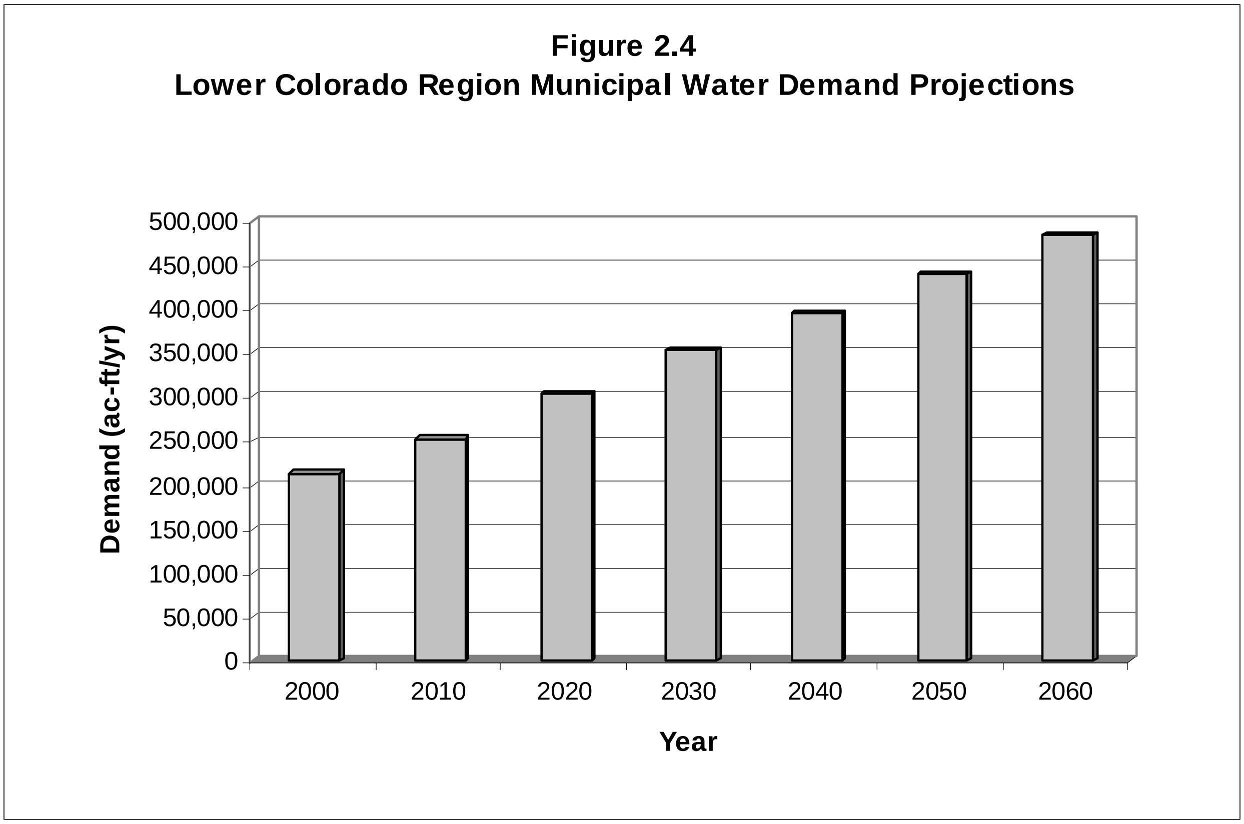


Table 2.4 Municipal Water Demand Projections by County (ac-ft/yr)

County	1996	2000	2010	2020	2030	2040	2050	2060
Bastrop	7,884	9,315	11,679	14,762	18,327	22,505	27,818	34,610
Blanco	1,078	1,205	1,369	1,580	1,783	1,951	2,151	2,396
Burnet	5,301	5,752	6,810	8,097	9,380	10,633	12,003	13,684
Colorado	3,082	3,100	3,132	3,189	3,189	3,141	3,122	3,089
Fayette	3,506	3,522	3,890	4,417	4,879	5,244	5,751	6,495
Gillespie	3,520	3,921	4,432	4,968	5,113	5,048	5,015	5,015
Hays (p)	2,991	3,955	7,192	10,656	13,446	16,266	19,742	22,498
Llano	2,852	4,042	4,054	4,018	3,976	3,929	3,905	3,905
Matagorda	5,460	5,423	5,590	5,830	5,906	5,883	5,815	5,762
Mills	936	992	971	999	991	982	966	951
San Saba	1,032	1,296	1,299	1,316	1,328	1,339	1,331	1,336
Travis	136,472	160,151	189,602	229,928	266,748	296,675	327,840	357,541
Wharton (p)	4,070	3,680	3,776	3,880	3,910	3,880	3,847	3,806
Williamson (p)	3,383	6,949	8,841	11,095	13,761	16,625	19,743	23,082
TOTAL	**181,567**	**213,303**	**252,637**	**304,735**	**352,737**	**394,101**	**439,049**	**484,170**

(p) Denotes that only the portion of the county in Region K is considered.
* Municipal water demand projections by city, county, and portion of a river basin within a county for each of the 14 counties in Region K are provided in *Appendix 2A.*

As with population, the large majority of current and projected municipal water demand occurs in the Colorado River Basin (approximately 92 percent in the year 2060). *Table 2.5* presents these municipal water demand projections by river basin.

Table 2.5 Municipal Water Demand Projections by River Basin (ac-ft/yr)

River Basin	1996	2000	2010	2020	2030	2040	2050	2060
Brazos	3,324	8,080	10,204	12,753	15,715	18,881	22,336	26,097
Brazos-Colorado	7,026	6,684	6,870	7,125	7,208	7,167	7,095	7,027
Colorado	166,973	194,550	231,390	280,387	325,098	363,157	404,476	445,562
Colorado-Lavaca	1,747	1,550	1,598	1,657	1,671	1,661	1,641	1,626
Guadalupe	1,109	829	951	1,115	1,280	1,425	1,604	1,825
Lavaca	1,388	1,610	1,624	1,698	1,765	1,810	1,897	2,033
TOTAL	**181,567**	**213,303**	**252,637**	**304,735**	**352,737**	**394,101**	**439,049**	**484,170**

2.3.2 Manufacturing Water Demand Projections

2.3.2.1 Methodology

For regional water planning purposes, manufacturing water use is considered to be the cumulative water demand by county and river basin for all industries within specified industrial classifications (SIC) determined by the TWDB. Manufacturing water use projections that were developed by the TWDB were used as the default projections except where new information warranted a revision. Current TWDB rules protect manufacturing users from disclosure of their usage information on an individual basis, so there was little information available to verify this projection.

2.3.2.2 Regional Manufacturing Water Demand Projections

Annual manufacturing water demand for Region K is projected to increase from 28,887 ac-ft in the year 2000 to 85,698 ac-ft/yr in the year 2060. These demands are predominately from existing and future industries in Travis and Matagorda Counties. The expected usage of water for manufacturing purposes in Matagorda County that has already been contracted is responsible for the large increase in manufacturing demand from the year 2000 to the year 2010. *Figure 2.5* and *Table 2.6* present the projected manufacturing water demand for each of the counties in Region K.

Figure 2.5: Lower Colorado Region Manufacturing Water Demand Projections

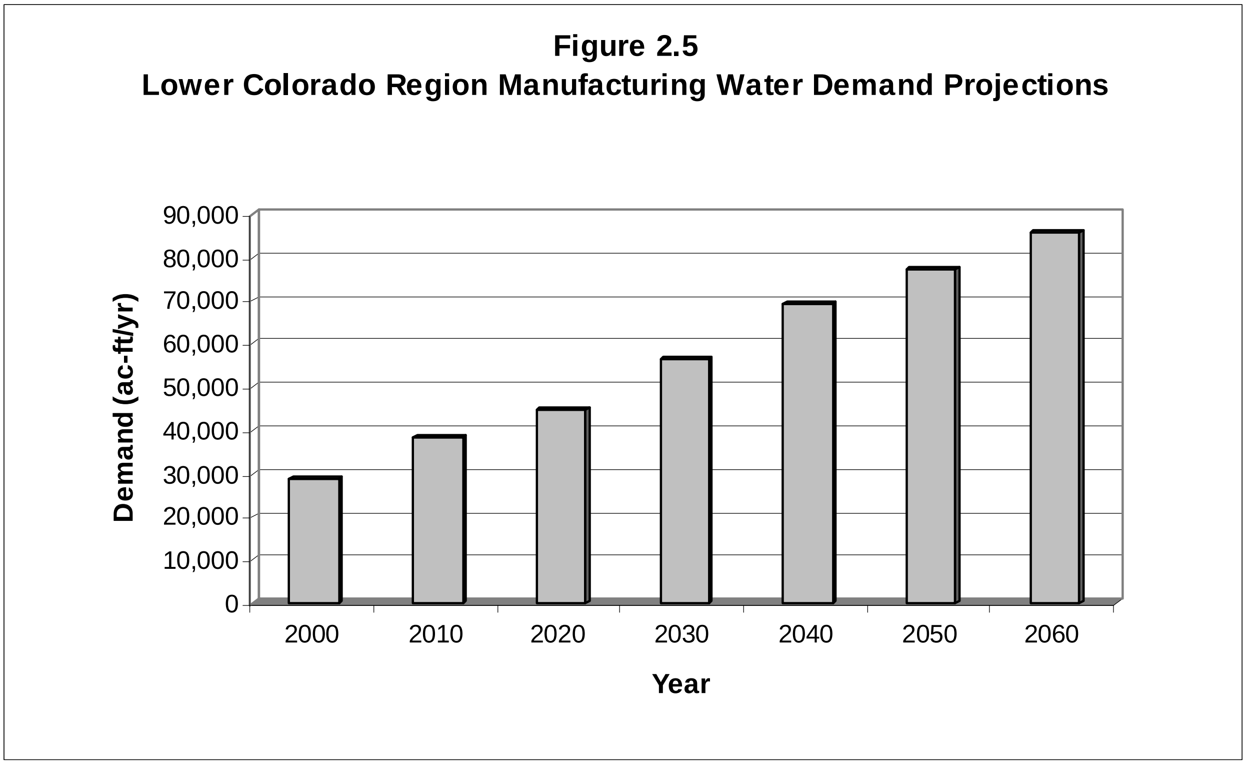


Table 2.6 Manufacturing Water Demand Projections by County (ac-ft/yr)

County	1996	2000	2010	2020	2030	2040	2050	2060
Bastrop	81	70	92	111	130	150	169	183
Blanco	0	2	2	2	2	2	2	2
Burnet	542	743	963	1,109	1,248	1,384	1,502	1,636
Colorado	176	144	176	192	205	217	227	245
Fayette	124	162	205	230	254	277	297	322
Gillespie	305	440	506	539	566	591	612	655
Hays (p)	395	509	691	809	928	1,048	1,156	1,255
Llano	2	2	3	3	3	3	3	3
Matagorda	10,536	10,355	12,180	13,253	13,991	14,686	15,259	16,267
Mills	1	1	1	1	1	1	1	1
San Saba	11	24	28	30	31	32	33	35
Travis	13,245	16,179	23,002	28,294	38,508	50,483	57,703	64,652
Wharton (p)	233	256	313	343	366	390	410	442
Williamson (p	5	0	0	0	0	0	0	0
TOTAL	**25,656**	**28,887**	**38,162**	**44,916**	**56,233**	**69,264**	**77,374**	**85,698**

(p) Denotes that only the portion of the county in Region K was considered.

* Manufacturing water demand projections by city, county, and portion of a river basin within a county for each of the 14 counties in Region K are provided in *Appendix 2A.*

Manufacturing water demand in Region K is predominately in the Colorado and Brazos-Colorado River Basins. *Table 2.7* presents these demands by river basin for Region K.

Table 2.7 Manufacturing Water Demand Projections by River Basin (ac-ft/yr)

River Basin	1996	2000	2010	2020	2030	2040	2050	2060
Brazos	315	0	0	0	0	0	0	0
Brazos-Colorado	4,908	5,466	6,431	6,998	7,389	7,758	8,061	8,595
Colorado	20,189	23,152	31,395	37,543	48,435	61,063	68,841	76,591
Colorado-Lavaca	116	100	122	134	143	152	160	173
Guadalupe	4	7	9	11	12	14	15	17
Lavaca	124	162	205	230	254	277	297	322
TOTAL	**25,656**	**28,887**	**38,162**	**44,916**	**56,233**	**69,264**	**77,374**	**85,698**

2.3.3 Irrigation Water Demand Projections

2.3.3.1 Methodology

The irrigation water use projections that were developed by TWDB were used as the default projections except in cases where more effective and current information was submitted. The TWDB projections were determined with assistance from the Texas Agricultural Extension Service, and they assume expected case water conservation practices with no reduction in Federal farm program subsidies. In recognition of the variation of irrigation usage with commodity prices, TWDB also allowed the RWPG to use any year of the last 5 years, if they determined that year was more representative of the irrigation demand than the year 2000 demand. The TWDB guidance allowed the use of a single year (1995-2000), a composite of all of the years, and either the largest acreage or the largest water demand based on their data for use in determining the irrigation demands. The largest year acreage planted was used for Colorado and Wharton Counties, and the largest water demand year was used for Matagorda County.

2.3.3.2 Regional Irrigation Water Demand Projections

Irrigation water demand for Region K is projected to decrease from 620,930 ac-ft/yr in 2000 to 468,763 ac-ft/yr in the year 2060. Irrigation water demand in Region K is concentrated in Colorado, Matagorda, and Wharton Counties and is largely used to meet irrigation needs for rice farming. Over the next 60 years, a decrease in irrigation water demand is projected due to improvements in irrigation efficiency and reductions in irrigated acres due to forecasted unfavorable farming economics. *Figure 2.6* and *Table 2.8* present the projected irrigation water demands by county for Region K.

Figure 2.6: Lower Colorado Region Irrigation Water Demand Projections

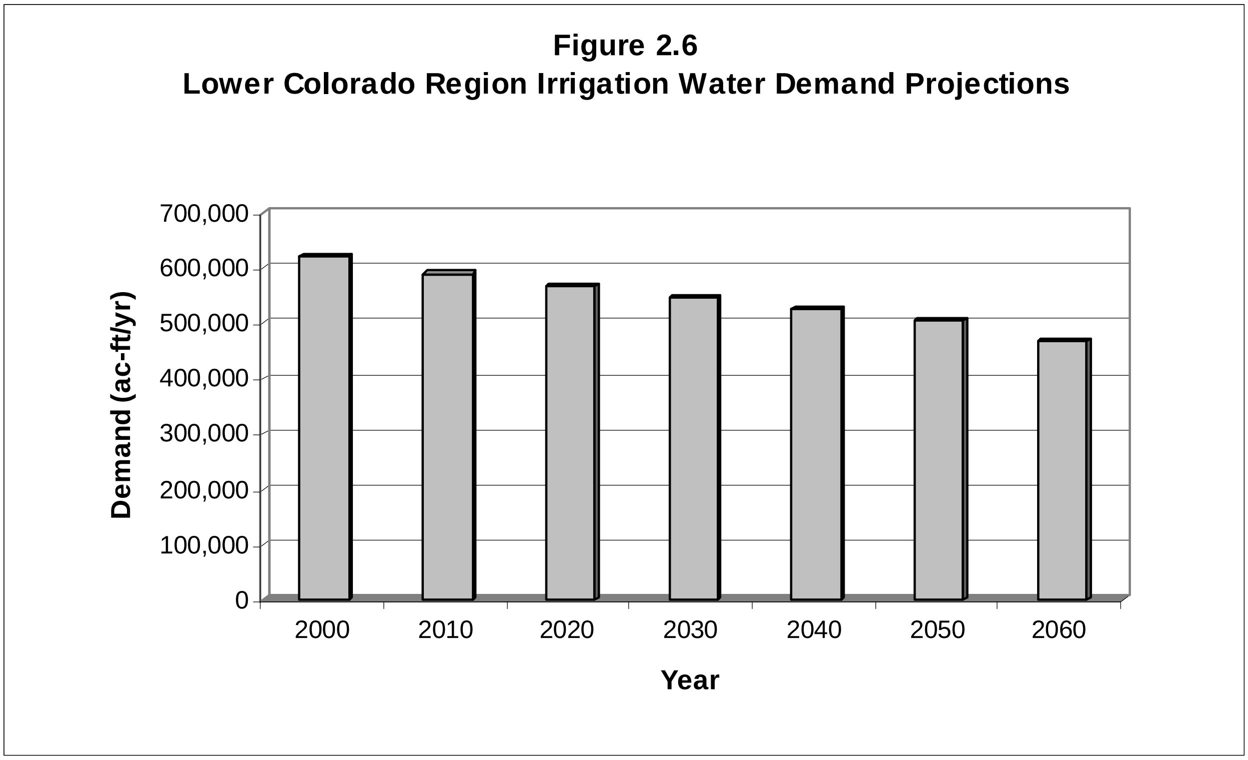


Table 2.8 Irrigation Water Demand Projections by County (ac-ft/yr)

County	1996	2000	2010	2020	2030	2040	2050	2060
Bastrop	738	1,846	1,610	1,407	1,226	1,072	934	814
Blanco	504	73	69	66	62	58	56	55
Burnet	213	103	101	100	98	96	95	93
Colorado	218,833	210,242	200,822	192,465	184,380	176,555	168,946	161,663
Fayette	608	789	739	692	648	606	568	533
Gillespie	3,720	2,065	2,039	2,013	1,987	1,960	1,936	1,912
Hays (p)	81	12	11	11	11	11	11	11
Llano	1,442	995	979	963	946	930	915	900
Matagorda	275,314	205,990	193,048	186,072	179,353	172,916	166,722	160,750
Mills	3,613	3,001	2,936	2,872	2,810	2,749	2,689	2,631
San Saba	3,245	3,349	3,240	3,136	3,035	2,937	2,841	2,749
Travis	1,165	1,224	1,126	1,034	951	875	805	741
Wharton (p)	250,417	191,241	182,985	176,441	170,127	164,044	158,177	135,911
Williamson (p)	0	0	0	0	0	0	0	0
TOTAL	**759,893**	**620,930**	**589,705**	**567,272**	**545,634**	**524,809**	**504,695**	**468,763**

(p) Denotes that only the portion of the county in Region K was considered.
* Irrigation water demand projections by city, county, and portion of a river basin within a county for each of the 14 counties in Region K are provided in *Appendix 2A.*

Because irrigation water demand is concentrated in Region K's lower three counties, projected demand is greatest in the Brazos-Colorado and Colorado-Lavaca Coastal Basins. The Colorado and Lavaca River Basins also constitute a significant portion of irrigation water demand. *Table 2.9* presents these projected irrigation water demands for Region K.

Table 2.9 Irrigation Water Demand Projections by River Basin (ac-ft/yr)

River Basin	1996	2000	2010	2020	2030	2040	2050	2060
Brazos	396	432	412	394	377	361	348	334
Brazos-Colorado	353,917	259,052	245,871	236,718	227,888	219,390	211,181	194,231
Colorado	124,965	107,473	102,527	98,613	94,848	91,239	87,767	79,746
Colorado-Lavaca	157,896	129,739	122,234	117,830	113,585	109,511	105,591	98,950
Guadalupe	381	151	139	128	119	110	101	94
Lavaca	122,338	124,083	118,522	113,589	108,817	107,198	99,707	95,408
TOTAL	**759,893**	**620,930**	**589,705**	**567,272**	**545,634**	**524,809**	**504,695**	**468,763**

2.3.4 Steam-Electric Water Demand Projections

2.3.4.1 Methodology

The steam-electric water use projections developed by TWDB were used as the default projections except where more effective and current information indicated the need for revision.

2.3.4.2 Regional Steam-Electric Water Demand Projections

Steam-electric water demand is projected to increase from 103,875 ac-ft/yr in the year 2000 to 222,058 ac-ft/yr in the year 2060. Of the 14 counties in Region K, only Bastrop, Fayette, Llano, Matagorda, Travis, and Wharton Counties have or are projected to have any steam-electric water demand. *Figure 2.7* and *Table 2.10* present the projected steam-electric water demand by county for each county in Region K.

Figure 2.7: Lower Colorado Region Steam Electric Water Demand Projections

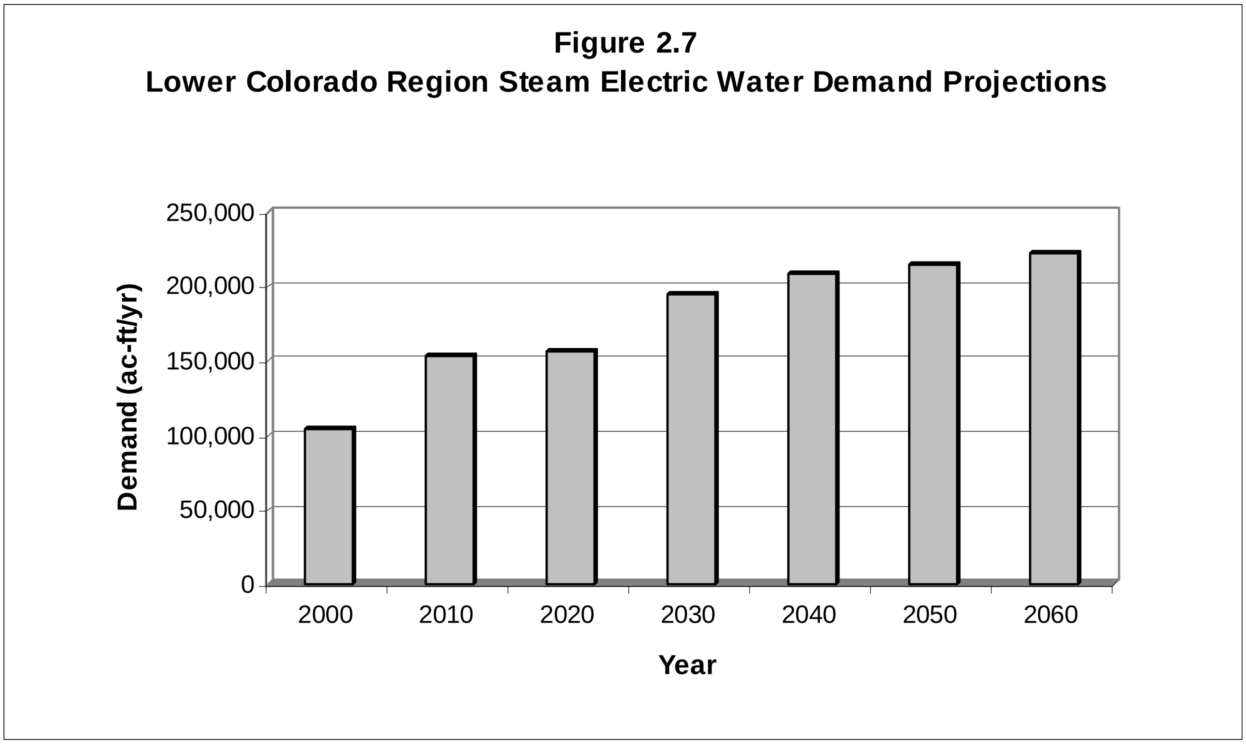


Table 2.10 Steam-Electric Water Demand Projections by County (ac-ft/yr)

County	1996	2000	2010	2020	2030	2040	2050	2060
Bastrop	5,715	7,846	12,000	14,000	16,000	18,000	19,500	19,500
Blanco	0	0	0	0	0	0	0	0
Burnet	0	0	0	0	0	0	0	0
Colorado	0	0	0	0	0	0	0	0
Fayette	24,334	21,306	42,720	43,200	52,500	63,840	63,840	69,750
Gillespie	0	0	0	0	0	0	0	0
Hays (p)	0	0	0	0	0	0	0	0
Llano	1,976	1,271	1,057	843	985	1,159	1,371	1,629
Matagorda	40,362	65,948	80,000	80,000	102,000	102,000	102,000	102,000
Mills	0	0	0	0	0	0	0	0
San Saba	0	0	0	0	0	0	0	0
Travis	9,028	7,494	17,500	18,500	22,500	23,500	27,500	28,500
Wharton (p)	0	10	245	351	411	483	572	679
Williamson (p)	0	0	0	0	0	0	0	0
TOTAL	**81,415**	**103,875**	**153,522**	**156,894**	**194,396**	**208,982**	**214,783**	**222,058**

(p) Denotes that only the portion of the county in Region K was considered.
* Steam-electric water demand projections by city, county, and portion of a river basin within a county for each of the 14 counties in Region K are provided in *Appendix 2A.*

Since each of Region K's steam-electric power generation facilities is located along the Colorado River, all of the projected steam-electric water demand is located within the Colorado River Basin. *Table 2.11* shows the projected steam-electric water demand by basin.

Table 2.11 Steam-Electric Water Demand Projections by River Basin (ac-ft/yr)

River Basin	1996	2000	2010	2020	2030	2040	2050	2060
Brazos	0	0	0	0	0	0	0	0
Brazos-Colorado	0	0	0	0	0	0	0	0
Colorado	81,415	103,875	153,522	156,894	194,396	208,982	214,783	222,058
Colorado-Lavaca	0	0	0	0	0	0	0	0
Guadalupe	0	0	0	0	0	0	0	0
Lavaca	0	0	0	0	0	0	0	0
TOTAL	**81,415**	**103,875**	**153,522**	**156,894**	**194,396**	**208,982**	**214,783**	**222,058**

2.3.5 Mining Water Demand Projections

2.3.5.1 Methodology

TWDB mining water usage projections were developed based on projected future production levels by mineral category and expected water use rates. These production projections were derived from state and national historic rates and were constrained by accessible mineral reserves in each region. TWDB's mining water demand projections were used except where more effective and current information was available.

2.3.5.2 Regional Mining Water Demand Projections

Mining water demand for Region K is projected to experience a 5,000 ac-ft increase in Bastrop County for the Alcoa Three Oaks Mine in 2010, which is expected to close before 2040. Without the Three Oaks Mine, the overall mining water demand increases slightly from 2000 through 2060. *Table 2.12* presents the projected mining water demand by county for each county in Region K.

Mining water demand in Region K is predominately in the Colorado River Basin. *Table 2.13* presents these demands by river basin for Region K.

Figure 2.8: Lower Colorado Region Mining Water Demand Projections

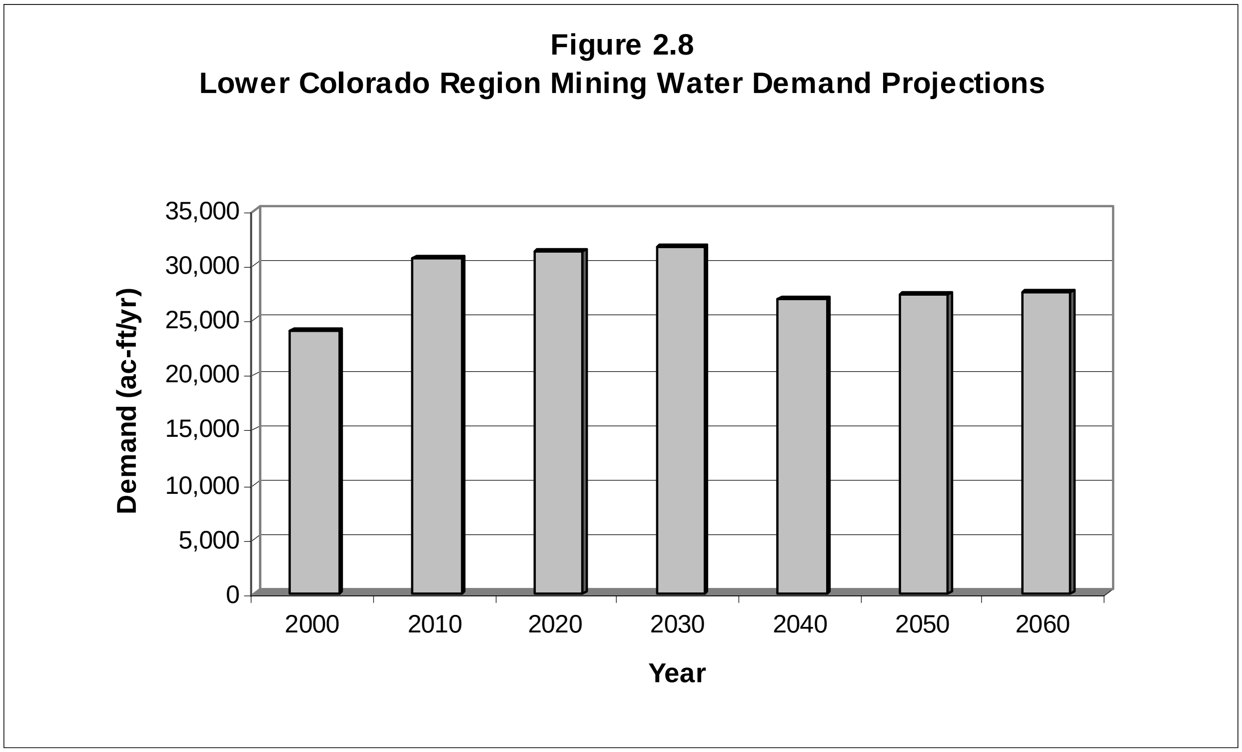


Table 2.12 Mining Water Demand Projections by County

County	1996	2000	2010	2020	2030	2040	2050	2060
Bastrop	28	28	5,033	5,035	5,036	37	38	39
Blanco	6	6	5	5	5	5	5	5
Burnet	1,359	1,725	1,956	2,049	2,098	2,145	2,190	2,235
Colorado	31,244	19,674	20,804	21,197	21,416	21,623	21,821	21,996
Fayette	46	43	42	42	42	42	42	42
Gillespie	9	9	8	8	8	8	8	8
Hays (p)	6	18	12	6	2	0	0	0
Llano	152	152	149	148	148	148	148	148
Matagorda	277	196	177	172	169	167	165	163
Mills	0	0	0	0	0	0	0	0
San Saba	163	163	163	163	163	163	163	163
Travis	3,312	1,285	1,531	1,649	1,727	1,804	1,880	1,935
Wharton (p)	809	633	731	773	798	822	844	864
Williamson (p)	6	13	9	5	1	0	0	0
TOTAL	**37,417**	**23,945**	**30,620**	**31,252**	**31,613**	**26,964**	**27,304**	**27,598**

(p) Denotes that only the portion of the county in the Region K was considered.

* Mining water demand projections by city, county, and portion of a river basin within a county for each of the 14 counties in Region K are provided in *Appendix 2A.*

Table 2.13 Mining Water Demand Projections by River Basin (ac-ft/yr)

River Basin	1996	2000	2010	2020	2030	2040	2050	2060
Brazos	71	105	109	107	106	107	109	110
Brazos-Colorado	979	746	848	893	919	944	966	987
Colorado	34,315	21,251	27,742	28,303	28,623	23,933	24,234	24,493
Colorado-Lavaca	281	195	178	173	170	168	167	165
Guadalupe	14	13	14	15	15	15	15	15
Lavaca	1,757	1,635	1,729	1,761	1,780	1,797	1,813	1,828
TOTAL	**37,417**	**23,945**	**30,620**	**31,252**	**31,613**	**26,964**	**27,304**	**27,598**

2.3.6 Livestock Water Demand Projections

2.3.6.1 Methodology

For all 14 counties in Region K, the livestock water use projections developed by TWDB were used as the default projections. These projections were developed using Texas Agricultural Statistics Service projections of number of livestock by type and county and Texas Agricultural Extension Service estimates of water use rates by type of livestock.

2.3.6.2 Regional Livestock Water Demand Projections

Livestock water demand for Region K represents approximately 1.0 percent of the total regional water demand. Livestock water demand is projected to remain constant over the 50-year planning period. This constant projected demand of 13,395 ac-ft is approximately 20 percent less than the value reported by TWDB for 1996. *Table 2.14* presents the projected livestock water demand by county for each of the 14 counties in Region K.

Figure 2.9: Lower Colorado Region Livestock Water Demand Projections

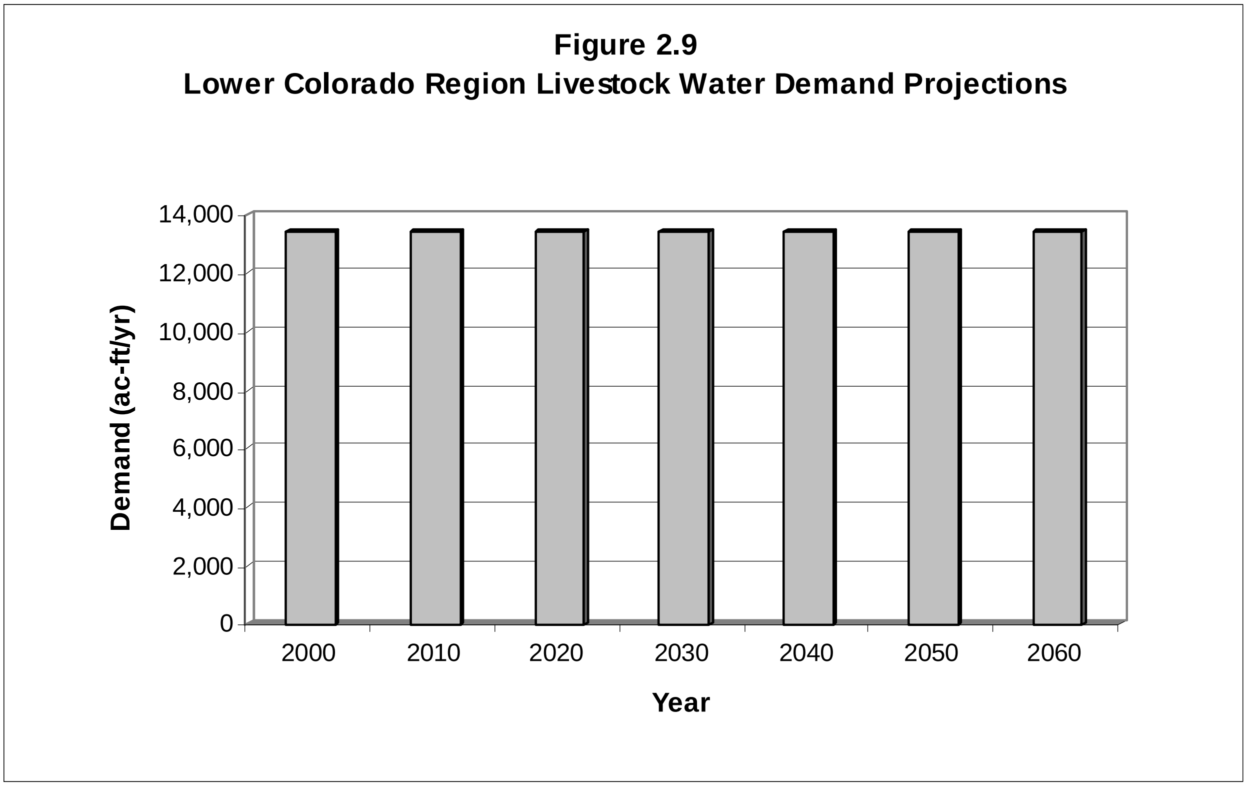


Table 2.14 Livestock Water Demand Projections by County (ac-ft/yr)

County	1996	2000	2010	2020	2030	2040	2050	2060
Bastrop	1,760	1,522	1,522	1,522	1,522	1,522	1,522	1,522
Blanco	477	443	443	443	443	443	443	443
Burnet	652	835	835	835	835	835	835	835
Colorado	1,762	1,473	1,473	1,473	1,473	1,473	1,473	1,473
Fayette	1,895	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Gillespie	1,836	1,062	1,062	1,062	1,062	1,062	1,062	1,062
Hays (p)	222	220	220	220	220	220	220	220
Llano	713	751	751	751	751	751	751	751
Matagorda	1,746	1,151	1,151	1,151	1,151	1,151	1,151	1,151
Mills	1,936	918	918	918	918	918	918	918
San Saba	1,743	1,191	1,191	1,191	1,191	1,191	1,191	1,191
Travis	1,778	704	704	704	704	704	704	704
Wharton (p)	680	728	728	728	728	728	728	728
Williamson (p)	2	0	0	0	0	0	0	0
TOTAL	**17,202**	**13,395**	**13,395**	**13,395**	**13,395**	**13,395**	**13,395**	**13,395**

(p) Denotes that only the portion of the county in Region K was considered.

* Livestock water demand projections by city, county, and portion of a river basin within a county for each of the 14 counties in Region K are provided in *Appendix 2A.*

Livestock water demand in Region K is located predominately in the Brazos and Brazos-Colorado River Basins. *Table 2.15* presents these demands by river basin for Region K.

Table 2.15 Livestock Water Demand Projections by River Basin (ac-ft/yr)

River Basin	1996	2000	2010	2020	2030	2040	2050	2060
Brazos	1,390	1,059	1,059	1,059	1,059	1,059	1,059	1,059
Brazos-Colorado	1,226	953	953	953	953	953	953	953
Colorado	12,349	9,455	9,455	9,455	9,455	9,455	9,455	9,455
Colorado-Lavaca	883	646	646	646	646	646	646	646
Guadalupe	426	356	356	356	356	356	356	356
Lavaca	928	926	926	926	926	926	926	926
TOTAL	**17,202**	**13,395**	**13,395**	**13,395**	**13,395**	**13,395**	**13,395**	**13,395**

2.4 ENVIRONMENTAL WATER DEMANDS

A use category that is recognized by the LCRWPG is environmental water demands. These demands are considered necessary to preserve the aquatic ecosystem within the region. In particular, planning for and meeting environmental water demands have been determined necessary to protect the habitat associated with the Colorado and Colorado-Lavaca estuary.

2.4.1 The Story/History of Matagorda Bay [1, 2, 3, 4, 5]

Matagorda Bay has an interesting and varied history. The earliest map that contained the Texas Gulf Coast was by Alonzo Alvarez de Pineda in 1513. The next explorer was probably Cabeza de Vaca in 1528 followed by Don Luis de Moscoso de Alverado in 1542. The ill fated LaSalle expedition in 1685 resulted in an active renewal of interest by the Spanish government. In a subsequent expedition by Alonzo de Leon in 1689, the first recorded description of the "Raft" in the Colorado River was described, refer to *Figure 2.10* for a map of Matagorda Bay in 1705.

The raft was a vast accumulation of drift logs, snags, whole trees, and brush in sections miles in length and 40 to 50 feet thick growing at a rate of about 500 feet per year. In the years after the establishment of Matagorda by Stephen F. Austin's initial colony (Austin 300) the raft continued to grow, refer to *Figure 2.11* for a map of Austin's Colony and Matagorda Bay. The U.S. Army Corps of Engineers (USACE) was enrolled to clear the raft to enable river navigation from Matagorda, the number two port in Texas, inland to central Texas. In 1853 the decision was made to bypass the raft by digging a canal parallel to the river. This allowed riverboat traffic for about six years, but by 1860 the growing raft again prevented navigation. The intervention of the civil war prevented any additional work on the raft. While the periodic floods had always been a problem, the restoration of the raft, which grew to an estimated 40 miles in length and extended into Wharton County, greatly exacerbated flooding damage.

In 1923 Governor Pat Neff approved legislation that resulted in the retaining of General George W. Goethus, who built the Panama Canal. His plan was to clear a path along the East Bank, removing key

[1] *Bay City and Matagorda County – A History*, Pages 4, 8, 16, 165, 166
[2] *Corralling the Colorado*, Page 7
[3] *Historic Matagorda County*, Pages 135, 139
[4] Originally authored by Haskell Simon, Vice Chairman Region K, modified for this report
[5] Additional information from *Flood to Faucet* and interviews with Earl Eidelbach, LCRA from *The Daily Tribune*

logs and allowing the force of the river to clear the raft. Not much was accomplished until a major flood came in 1929. In one massive flushing action the huge mass was washed into Matagorda Bay.

The delta formed by this enormous conglomeration of sediment and debris that had been washed into Matagorda Bay continued to grow outward into the Bay until it connected the mainland to Matagorda Peninsula, forming a five mile long land bridge, land locking the Seaport of Matagorda and dividing Matagorda Bay into East Matagorda Bay and West Matagorda Bay.

In 1935 the Drainage District cut a channel through the peninsula connecting the Colorado River to the Gulf of Mexico. This caused most of the natural flow of the river to go directly into the Gulf of Mexico, refer to *Figure 2.12* for a map of the development of the Colorado River Delta.

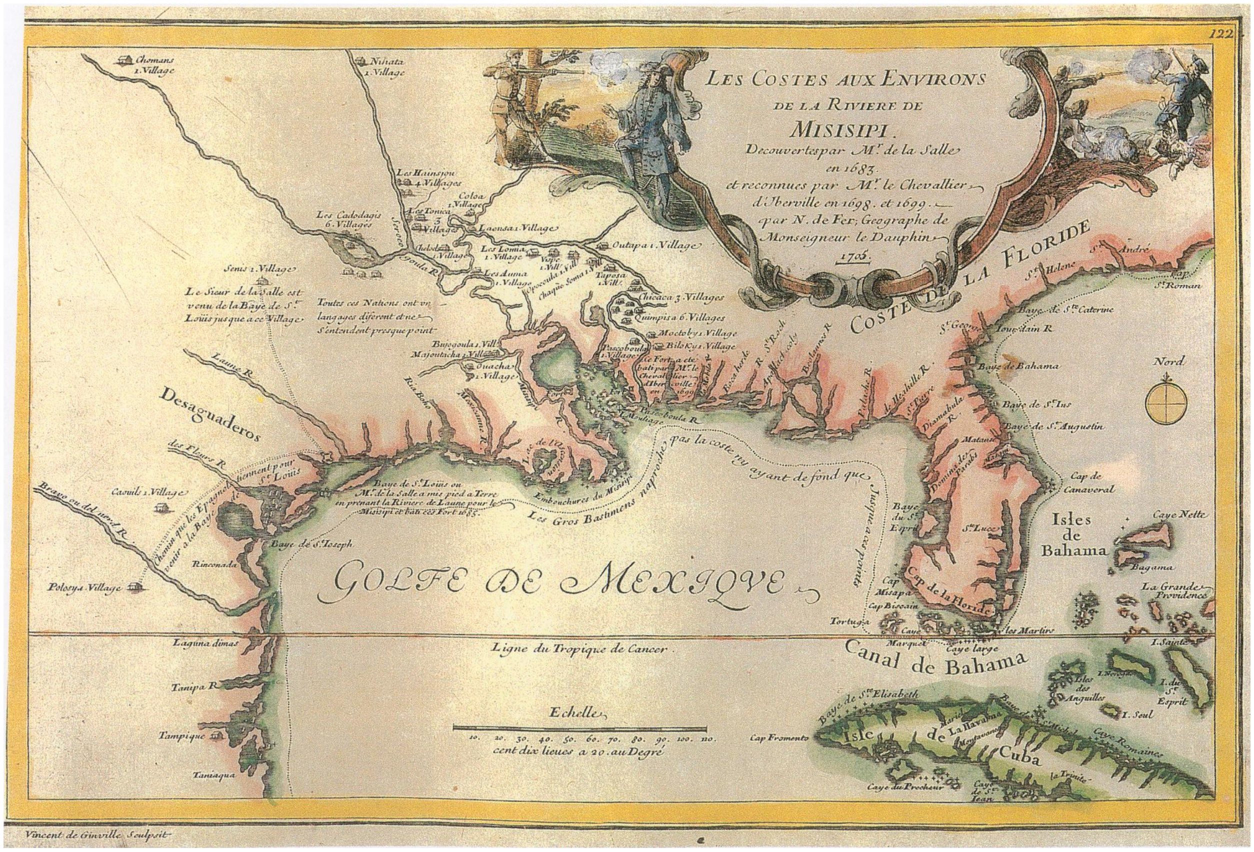
In 1990 the USACE agreed to the next major alteration affecting Matagorda Bay. In order to construct a jetty system at the mouth of the Colorado River in the Gulf of Mexico, a diversion channel was added to the overall design as recommended by the resource agencies. This would divert essentially 100 percent of the river flow into the east end of West Matagorda Bay. This project was completed in 1991. The USACE also closed Parker's Cut (Tiger Island Cut), the channel connecting the Colorado River to West Matagorda Bay, refer to *Figures 2.13* and *2.14*.

Recently, efforts were made to reopen Parker's Cut to accommodate recreational fishing by shortening travel time to the fishing areas. The resource agencies oppose the reopening believing it would be detrimental to fisheries production. Finally a compromise was reached that would open a channel into the Bay just North of the diversion dam. This would allow access to the Bay without going through the locks, but with minimal diversion of freshwater.

In less than 75 years major alterations have been made that dramatically and dynamically changed the characteristics of the Bay. The river flow into Matagorda Bay was reduced significantly, and then it was back to almost 100 percent discharge into West Matagorda Bay by the early 1990s. There are other sources that contribute to the freshwater inflows of Matagorda Bay in addition to the contributions by the Colorado River, but these flows have not been measured and are occasionally overlooked.

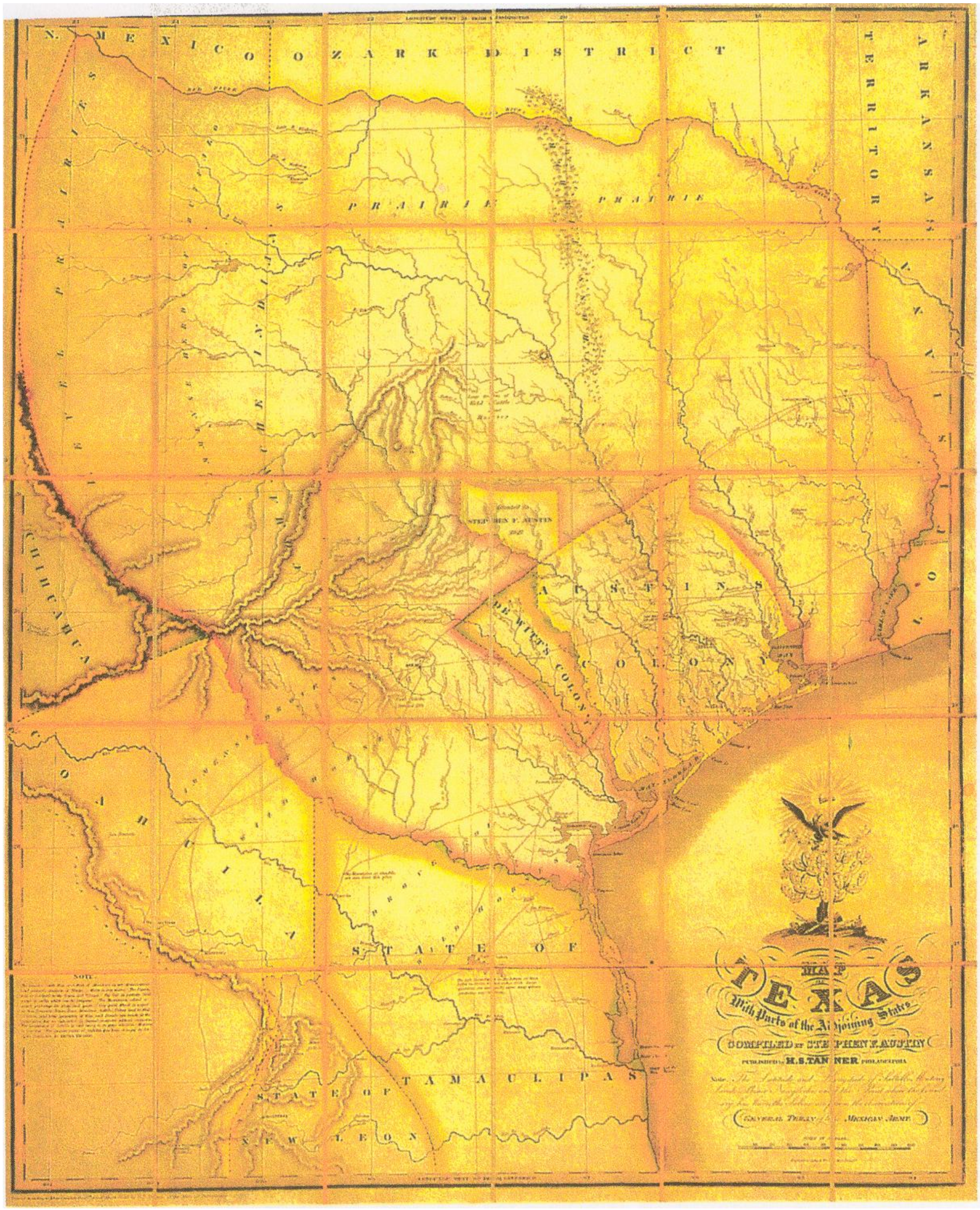
It is difficult to determine the affect of these changes on the Bay's performance. Most entities seem to agree that short-term analysis or comparisons will not yield significant "cause and effects." Certainly with the major changes in the geography and hydrology of the Bay, it is questionable how useful older data may be. One thing is certain; Matagorda Bay, unlike other Texas Bays, has seen major changes in the last 75 years.

Figure 2.10: Matagorda Bay in 1705



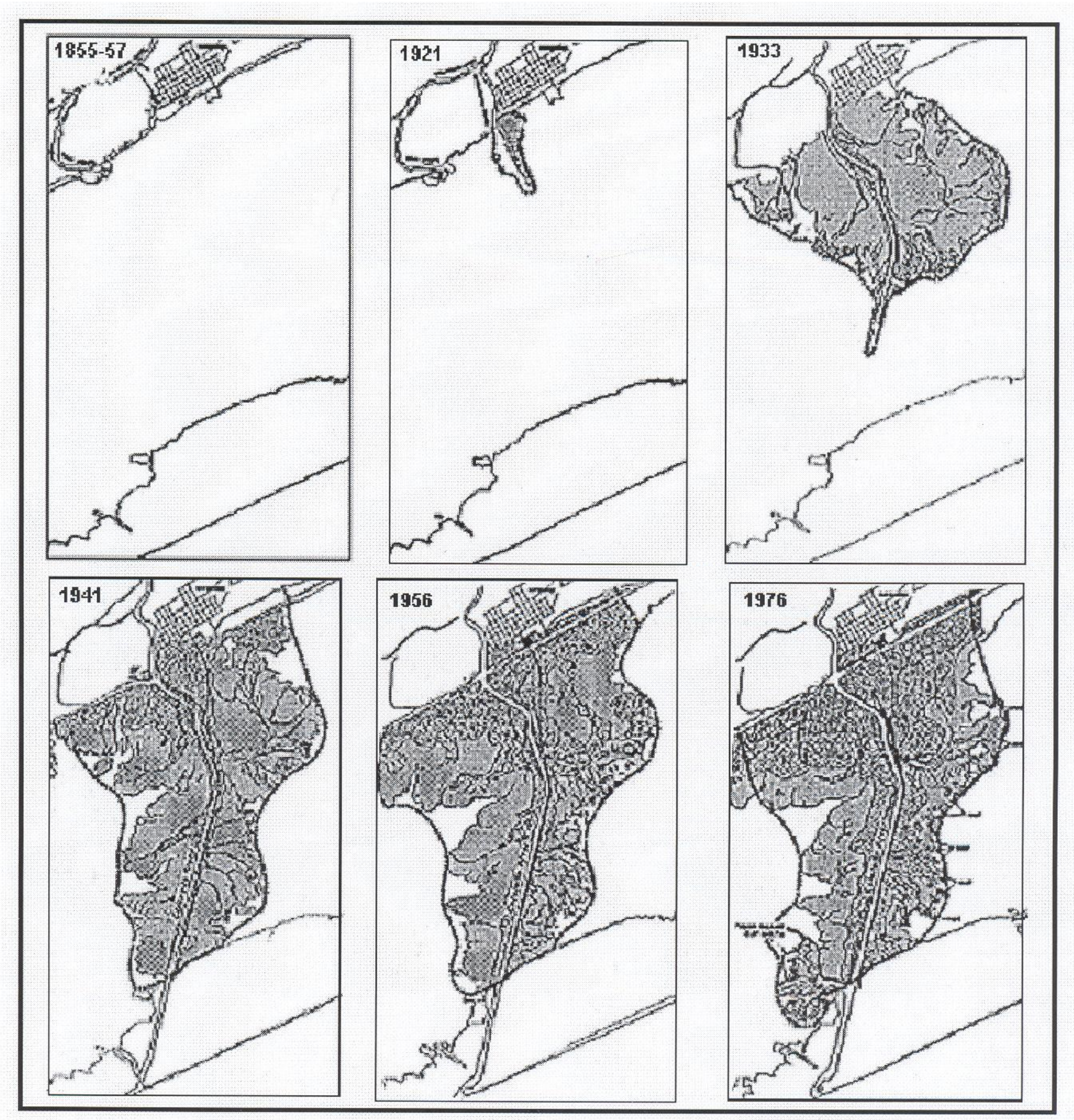
Nicolas de Fer 1705 – Collection of F. Carrington Weems Houston, Texas as shown in *Maps of Texas and the Southwest 1513-1900* by James C. Martin and Robert Sidney Martin, Page 49.

Figure 2.11: Austin's Colony and Matagorda Bay



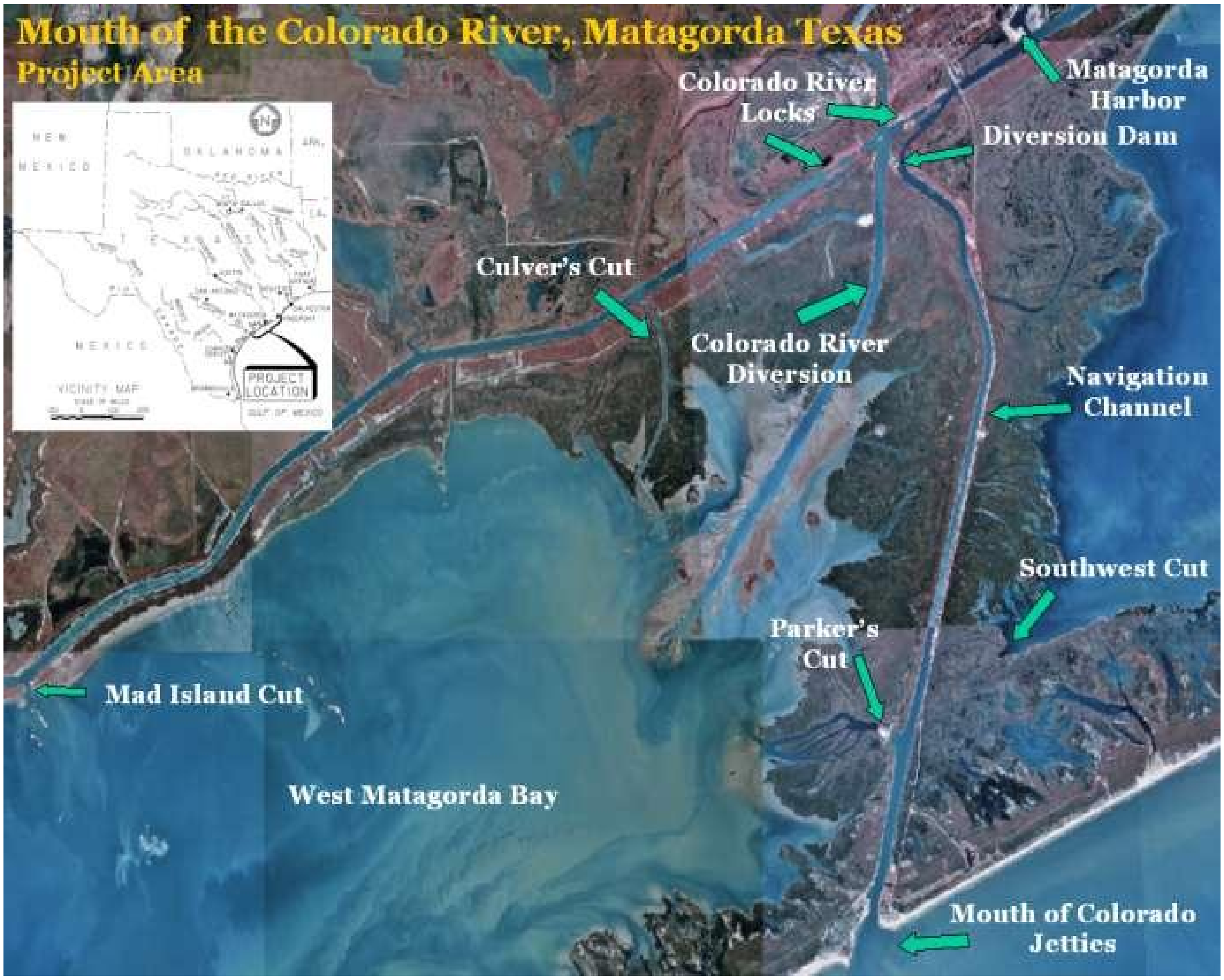
Stephen F. Austin, 1830 – The San Jacinto Museum of History as shown in *Maps of Texas and the Southwest 1513-1900* by James C. Martin and Robert Sidney Martin, Page 52.

Figure 2.12: Development of Colorado River Delta



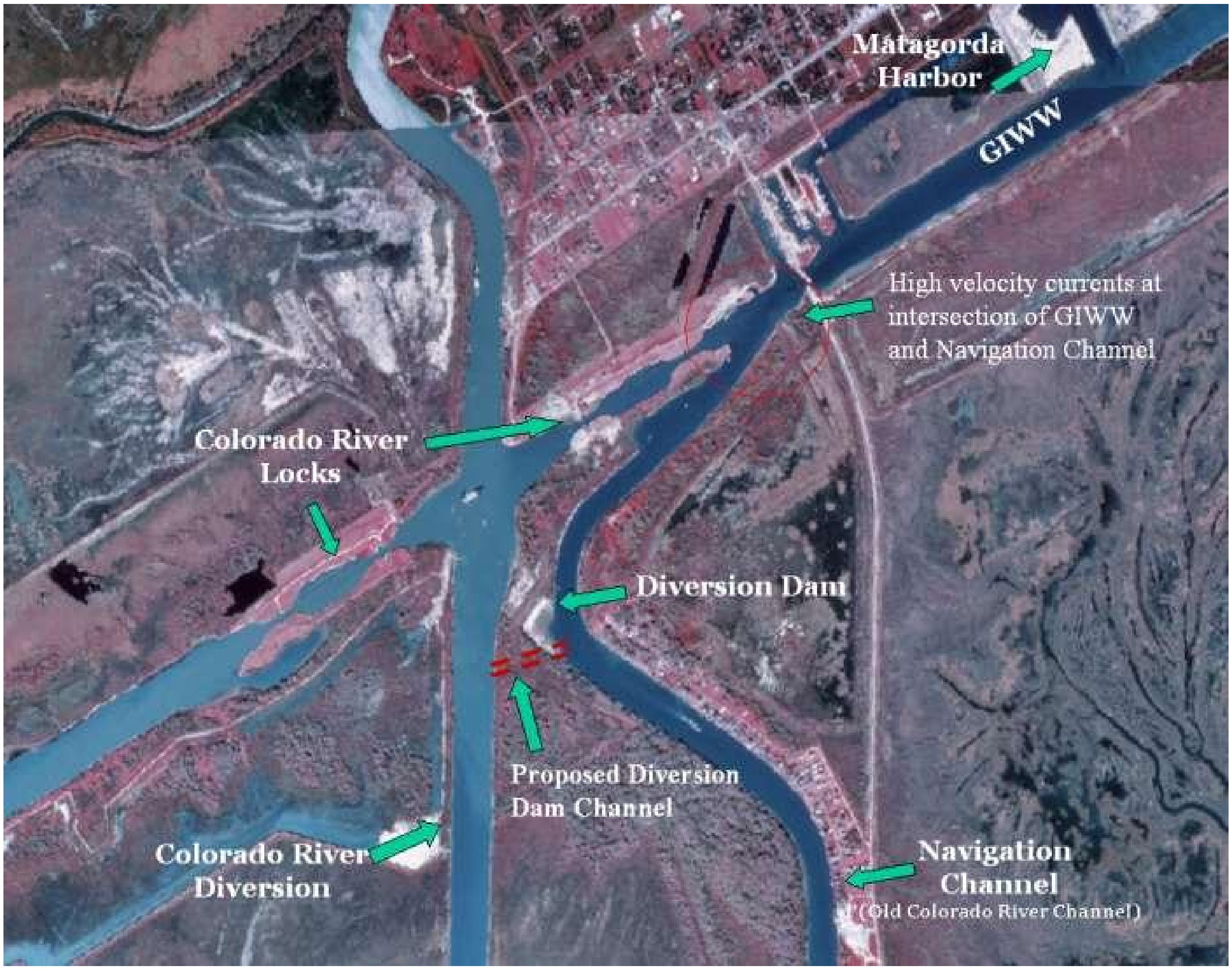
Delta Development – Mouth of Colorado River Project Assessment Report Coastal Technology Corporation (Adapted from USGS, Tobin & Kargl)

Figure 2.13: Mouth of the Colorado River, Matagorda Texas



USACE Galveston District webpage:
http://www.swg.usace.army.mil/items/ColoradoRiver/MOC.asp

Figure 2.14: Colorado River Diversion Channel and Navigation Channel



USACE Galveston District webpage:
http://www.swg.usace.army.mil/items/ColoradoRiver/MOC.asp

2.4.2 Current Instream Flow Requirements for the Colorado River[6]

The LCRWPG does not have the resources to perform the studies to determine appropriate instream flow requirements for the Colorado River. Therefore, we present data that has been developed by the LCRA.

LCRA operates under a WMP that defines its water management programs and policies. The plan is developed by LCRA and evolves over the years in response to changing conditions and new information.

LCRA completed an analysis of instream flow needs for the Colorado River in June 1992. Based on those studies, LCRA generated instream flow recommendations for critical and target flows.

Critical flow requirements are those necessary to maintain species population during severe drought conditions. From the LCRA analysis, it is recommended that a flow of at least 46 cfs be maintained at the Austin gage at all times. If this flow should occur for an extended period of time, then operational releases will be made by LCRA to temporarily alleviate these low flow conditions. Specifically, if flow at the Austin gage is less than 65 cfs daily average for 21 consecutive days, the LCRA will make operational releases from storage sufficient to maintain daily average flow at the Austin gage of at least 200 cfs for two consecutive days. If this operational release condition persists for three consecutive cycles (69 days), then a minimum average daily flow of at least 75 cfs will be maintained for the next 30 days. A mean daily flow of 100 cfs is also maintained at the Austin gage to the extent of inflows to Lakes Buchanan and Travis, except during times of drought, when a minimum mean daily flow of 75 cfs is maintained to the extent inflows are available. In addition to the flow requirements at the Austin gage, a mean daily discharge of 120 cfs will be maintained at the Bastrop gage. This minimum flow will be maintained in order to provide adequate water quality conditions in the Colorado River. During a six-week period within the months of March, April, and May, a minimum flow of 500 cfs will be maintained at the Bastrop gage.

Target flow requirements are those necessary to provide an optimal range of habitat complexity for the support of a well-balanced native aquatic community. These flow regimes (described in *Table 2.16*) are considered optimal ranges and should be maintained whenever water resources are adequate. However, these flows should be classified as interruptible demand subject to curtailment during drought conditions. Since native fish species are adapted to normal seasonal variations in flow regimes, target flows were adjusted monthly to emulate the annual cycle.

In addition to critical and target flow requirements, periodic high flow conditions (or scouring flood flows) are needed to prevent siltation and dense macrophytic growth from occurring in the Colorado River.

Total commitments of the Combined Firm Yield from the Highland Lakes for instream flow maintenance will be an average of 12,800 ac-ft/yr, with a maximum of 36,720 ac-ft in any one year; 58,700 ac-ft in any two consecutive years; 76,800 ac-ft in any three or four consecutive years; 106,100 ac-ft in any 5 consecutive years, and 128,600 ac-ft in any 6 to 10 consecutive years.

[6]Taken from information provided by the LCRA.

Table 2.16 Instream Flow Requirements for the Colorado River

Month	Critical Flows (cfs)		Target Flows (cfs)		
	Austin Gage [c]	Bastrop Gage	Bastrop Gage	Eagle Lake	Egypt
January	46	120	370	300	240
February	46	120	430	340	280
March	46	500 [b]	560	500 [a]	360
April	46	500 [b]	600	500 [a]	390
May	46	500 [b]	1,030	820	670
June	46	120	830	660	540
July	46	120	370	300	240
August	46	120	240	200	160
September	46	120	400	320	260
October	46	120	470	380	310
November	46	120	370	290	240
December	46	120	340	270	220

Source: LCRA, March 1999, *Water Management Plan*.

[a] Since target flow at Eagle Lake (based on overall community habitat availability) were insufficient to meet Blue Sucker (Cycleptus elongatus) spawning requirements during March and April, target flows were superseded by critical flow recommendations for this reach.

[b] This flow should be maintained for a continuous period of not less than six weeks during these months. A flow of 120 cfs will be maintained on all days not within the six week period.

[c] LCRA will maintain a mean daily flow of 100 cfs at the Austin gage at all times, to the extent of inflows each day to the Highland Lakes as measured by upstream gages, until the combined storage of Lakes Buchanan and Travis reaches 1.1 million acre-feet of water. A mean daily flow of 75 cfs, to the extent of inflows each day to the Highland Lakes as measured by upstream gages, will then be maintained until the combined storage of Lakes Buchanan and Travis reaches 1.0 million acre-feet of water, then a subsistence/critical flow of 46 cfs will be maintained at all times, regardless of inflows.

In addition, if the subsistence/critical flow of 46 cfs should occur for an extended period of time, then operational releases will be made by LCRA to temporarily alleviate the subsistence/critical flow conditions. Specifically, should the flow at the Austin gage be below a 65 cfs daily average for a period of 21 consecutive days, LCRA will make operational releases from storage sufficient to maintain daily average flow at the Austin gage of at least 200 cfs for two consecutive days. If this operational release conditions persists for three consecutive cycles (69 days), then a minimum average daily flow of at least 75 cfs will be maintained for the next 30 days.

2.4.3 Current Bay and Estuary Requirements

The LCRWPG does not have the resources to perform the studies to determine appropriate freshwater inflow needs requirements for the Colorado-Lavaca estuary. Therefore, we present data that has been developed by LCRA.

The Colorado-Lavaca estuary is the second largest estuary on the Texas Gulf Coast. This estuary, also known as the Matagorda Bay system, covers 352 sq mi. While Matagorda Bay is the largest body of water, other major bays in the estuary system are Lavaca, East Matagorda, Keller, Carancahua, and Tres Palacios Bay.

In 1985 the Texas Legislature directed TPWD and TWDB to continue studies of the estuaries to determine freshwater inflow requirements to be considered in the allocation of the State's water resources. These studies were to have been completed by December 31, 1989. However, due to a lack of funding, changes in priorities, and other factors, they have been delayed. To expedite the completion of this study, LCRA entered into a cooperative agreement with TPWD, TWDB, and TNRCC (now TCEQ) in 1993. The LCRA agreed to modify existing methods used by TPWD and TWDB and to apply those methods to compute alternative freshwater needs for the estuary. This study is currently being updated again and should be completed mid-2005 (see Section 2.4.4 for more information).

The freshwater inflow needs were estimated by a methodology developed in conjunction with the TPWD and TWDB, and is similar to methodologies used for other Texas estuaries. The first major element in this process is the development of statistical relationships for the interactions between freshwater inflows and important indicators of estuarine ecosystem conditions. The parameters that were considered in this analysis are: salinity, species productivity, and nutrient inflows. The next major step in this process involves using the statistical functions to compute optimal monthly and seasonal freshwater inflow needs. This is accomplished using TWDB's Texas Estuarine Mathematical Programming (TxEMP) Model. The TxEMP model estimates the freshwater inflow needs of an estuary by representing mathematically the varied and complex interactions between freshwater inflows and salinity, species productivity, and nutrient inflows. The third major element in the process of developing inflow needs is the simulation of the salinity conditions throughout the estuary using the TxBLEND model developed by TWDB and modified by the LCRA. The application of the TWDB methodology and the resulting estimates of freshwater inflow needs are documented in "Freshwater Inflow Needs of the Matagorda Bay System" (LCRA 1997).

The freshwater inflow needs for the estuarine ecosystem associated with the Matagorda Bay system were estimated for two levels: target and critical. Target inflow needs were determined as the monthly and seasonal inflows that produced 98 percent of the maximum normalized population biomass for nine key estuarine finfish and shellfish species while maintaining specified salinity, population density, and nutrient inflow conditions. The critical inflow needs were determined by finding the minimum total annual inflow needed to keep salinity at or below 25 parts per thousand near the mouths of the Colorado and Lavaca Rivers. These inflow needs are termed critical since they provide a fishery sanctuary habitat during droughts.

Results of the needs analysis indicate that target inflows need to be approximately 2.0 million ac-ft/yr. Of this, it is estimated that the Colorado River will need to contribute 1,033,100 ac-ft annually. For critical inflow needs, approximately 171,000 ac-ft of the total required 287,400 ac-ft/yr must come from the Colorado River. Both the target and critical monthly freshwater inflow needs from the Colorado River are indicated in *Table 2.17*. A revised freshwater inflow needs study is currently underway and results of that study will be incorporated in the next planning round. Draft results indicate a greater need for target and critical freshwater flows.

Total commitments of the Combined Firm Yield from the Highland Lakes for bays and estuaries (estuarine inflows) will be an average of 3,090 ac-ft/yr, with a maximum of 11,200 ac-ft in any one year; 19,700 ac-ft in any two consecutive years; 24,200 ac-ft in any three or four consecutive years; 28,200 ac-ft in any 5 consecutive years, and 30,900 ac-ft in any 6 to 10 consecutive years (LCRA's bay and estuary commitments are in accordance with LCRA's current water management plan).

Table 2.17 Colorado River Target and Critical Freshwater Inflow Needs for the Matagorda Bay System

Month	Target Needs (ac-ft)	Critical Needs (ac-ft)
January	44,100	14,260
February	45,300	14,260
March	129,100	14,260
April	150,700	14,260
May	162,200	14,260
June	159,300	14,260
July	107,000	14,260
August	59,400	14,260
September	38,800	14,260
October	47,400	14,260
November	44,400	14,260
December	45,200	14,260
Total	1,033,100	171,100

Source: LCRA, March 1999, *Water Management Plan.*

2.4.4 Current Ongoing Environmental Flow Projects and Studies

There are several ongoing studies, workgroups, and legislative committees, whose findings may affect the way environmental flow needs are met, what those flow requirements will be, and other factors. The LCRWPG offers this section as a tool to water planners and suppliers to forecast future water planning and to meet environmental water needs. The following items are all in progress. They will conclude close to or after the end of this planning cycle.

- LCRA Water Management Plan
- Freshwater Inflow Needs Study for Matagorda Bay
- The LCRA-SAWS Water Project Scientific Studies
- Environmental Flows Study Commission
- Senate Committee on Water Policy
- Pending Large Water Rights Permits
- Colorado-Brazos Contribution

LCRA Water Management Plan

LCRA currently operates the lower Colorado River under provisions of the 1999 WMP. This plan is approved by TCEQ as a condition of the LCRA's water rights permits for Lakes Buchanan and Travis, the two major water supply reservoirs in the Highland Lakes. Recommended amendments to the plan were developed through a stakeholder process that began in early 2001 and are currently under review by TCEQ. Several parties have contested this round of amendments.

General information and a copy of the recommended updates can be found on the LCRA's website at http://www.lcra.org/water/wmp.html.

Freshwater Inflow Needs Study for Matagorda Bay

The study is a reassessment of freshwater inflows needs for Matagorda Bay, including a review and update of a bay system study conducted in 1997. It is a joint effort of LCRA, Lavaca-Navidad River Authority, TPWD, TWDB, and TCEQ. Each study partner is represented on a FINS advisory committee. The FINS began on April 1, 2002, and was scheduled for completion by June 30, 2005. Although draft results are available, the study is not yet finalized. State agencies will use the results to evaluate a number of strategies for meeting freshwater inflow needs in accordance with their statutory responsibilities. When the study is complete, LCRA will consider the study results to determine whether to seek further revisions to the WMP.

The LCRA-SAWS Water Project Scientific Studies

LCRA and the San Antonio Water System (SAWS) have undertaken the study of the project's water supply potential, construction and operational costs, and environmental effects. During this study period, the proposal will be re-examined, refined with current information, examined with public input, and expanded from the levels of previous preliminary studies. This study period started in 2004 and is scheduled for completion in 2010. Annual project viability assessments will be conducted each November. The assessments as well as monthly update reports can be found at the project website at: http://www.lcra.org/lswp. At the end of the study period, if LCRA and SAWS determine the project is technically feasible, environmentally sound, and cost effective, the implementation period will follow. For answers to specific questions, contact lcrasawswaterproject@lcra.org.

Study Commission on Water for Environmental Flows

The 78th Texas Legislature established a Study Commission on Water for Environmental Flows, which is composed of 18 members. The Governor, the Lieutenant Governor, and the Speaker of the House each appointed five members, and three other positions on the panel are filled by the directors of TCEQ, TWDB, and TPWD. The Study Commission is charged with conducting public hearings and studying implications of public policy to balance the demands on water resources by a growing population with the requirements of the riverine and bay and estuarine systems. The Study Commission was required to appoint a Scientific Advisory Committee to assist this effort. The Scientific Advisory Committee submitted a final report to the Study Commission October 26, 2004. The Study Commission submitted their interim report on December 21, 2004. These reports as well as the latest developments can be found at the Senate website at: http://www.senate.state.tx.us/75r/senate/commit/c890/c890.htm.

Senate Committee on Water Policy

Lieutenant Governor David Dewhurst created the Senate Committee on Water Policy in the fall of 2003. The chair of this committee is Senator Kenneth Armbrister. The committee is charged to study all issues related to ground and surface water law, policy, and management. Issues such as the role of Federal, State, regional, and local governments and their coordination in setting consistent, nondiscriminatory water policies; the authority of TCEQ as it relates to water contracts; the role of the Edwards aquifer Authority; the role of groundwater conservation districts; the regional water planning process; conjunctive use of both ground and surface water resources; rule of capture; historic use standards; water infrastructure and financing; inter-basin transfers; junior water rights; conservation; water quality standards; drought preparedness; and water marketing. The committee was not limited to these topics. The committee submitted their interim report on December 13, 2004.

Information on the committee's activities and their report can be found at:
http://www.senate.state.tx.us/75r/senate/commit/c750/c750.htm.

The Lieutenant Governor also created the Senate Subcommittee on the Lease of State Water Rights. The subcommittee is charged to study the following proposals:

- Lease permanent school funds and permanent university lands and their water rights for the purposes of developing and marketing water.
- Analyze the present and future effects of such proposals on local aquifers, historic stream flows, local underground water conservation districts, and other public and private water interests.
- Study the process by which the General Land Office considers proposals to lease state water right, including methodology for holding open meetings, obtaining public input, meeting competitive bidding requirements, and coordination with TCEQ and other governmental units with possible regulatory oversight.

Information on the committee's activities and its report can be found at:
http://www.senate.state.tx.us/75r/Senate/commit/c755/c755.htm.

Pending Large Water Rights Permits

The TCEQ is the State's Water Rights permitting agency. TCEQ's Internet database lists 120 pending water rights applications (as of 10/20/2004) across the state. There are six large-scale pending water rights applications in the lower Colorado Basin area. Each is briefly described below:

Pending Large Water Right Permits (as of 10/20/2004):

LCRA Flood Flows Application (#5731):
Application was filed March 31, 1999, was declared administratively complete on February 20, 2001 and public notice was issued August 22, 2001. The application is in the technical review process. LCRA seeks authorization to divert, store and use flood waters up to 853,514 AF/year.

LCRA Garwood Application (#14-5434E):
The application was filed August 26, 2002, was declared administratively complete on February 5, 2003 and public notice was issued on May 22, 2003. The application is in the technical review process. LCRA seeks to add diversion locations throughout the basin, including the Highland Lakes, to LCRA's water right, which was formerly owned by the Garwood Irrigation Company. LCRA's Garwood water right is a 133,000 AF/yr water right with a priority date of 1900 and is currently permitted to be diverted in Colorado County, in the agricultural region of the basin.

LCRA Water Management Plan (#5838):
The amendment application was filed May 16, 2003, was declared administratively complete and public notice was issued on September 14, 2004. The application is in the technical review process. The LCRA water management plan defines LCRA's water management programs and policies and charts the manner in which LCRA manages surface water in the Colorado River Basin.

LCRA Return Flows Application (#14-5478D and 14-5482D):
The application was filed November 12, 2002, was declared administratively complete on March 10, 2003, and public notice was issued on April 30, 2004. The application is in the technical review process. LCRA seeks appropriation of the City of Austin's historical, current, and future return flows.

STP Nuclear Operating Company (#14-5437A):
The application was filed October 29, 2002, was declared administratively complete on March 7, 2003, and public notice was issued on December 2, 2003. The application is in the technical review process. The applicant seeks authorization to divert up to 102,000 acre-feet/year for the South Texas Project Electric Generation Station.

City of Austin Bed and Banks Application (#5779):
The application was filed April 5, 2002, and was declared administratively complete on July 22, 2002, and public notice was issued on August 13, 2003. The application is in the technical review process. The City seeks authorization to transport and reuse up to 103,350 AF/yr of return flows via the bed and banks of the Colorado river to transport water to downstream City of Austin locations for beneficial uses including Austin Energy power plant needs and municipal and industrial needs. The City proposes to use the bed and banks of the River to convey water (like a pipeline). A portion of the return flows (16,350 AF/year) will be dedicated to the State Water Trust with the Texas Parks and Wildlife Department as trustee.

Note that LCRA did have an additional permit application on file, referred to as an environmental flow application, however, earlier this year, the TCEQ determined that the agency currently can not approve this type of permit, therefore, all pending permits of this type were dismissed.

2.5 WHOLESALE WATER PROVIDERS

LCRWPG has designated two entities as "wholesale water providers," the LCRA and the COA. The COA is also a water customer of the LCRA, and together they supply a large portion of Region K's water needs. This distinction was made to satisfy TWDB guidelines that require each RWPG to identify and designate "wholesale water providers," which is defined by TWDB as an entity "which delivers and sells a significant amount of raw or treated water for municipal and/or manufacturing use on a wholesale and/or retail basis."

The intent of TWDB requirements is to ensure that there is an adequate future supply of water for each entity that receives all or a significant portion of its current water supply from another entity. This requires an analysis of projected water demands and currently available water supplies for the primary supplier, each of its wholesale customers, and all of the suppliers in the aggregate as a "system." For example, a city that serves both retail customers within its corporate limits as well as other nearby public water systems would need to have a supply source(s) that is adequate for the combined total of future retail water sales and future wholesale water sales. If there is a "system" deficit currently or in the future, then recommendations are to be included in the regional water plan with regard to strategies for meeting the "system" deficit.

2.5.1 City of Austin

The City of Austin provides water for municipal, manufacturing, and steam-electric water uses. The City's existing service area covers portions of Travis, Williamson, and Hays Counties. *Table 2.18* presents the municipal and manufacturing water demands for the COA. These water demands consist of the City's service area water demands and its wholesale water commitments. The wholesale commitments represent contract amounts, which become zero when the contract expiration dates are reached. For a complete list of the COA wholesale water commitments and expiration dates refer to Chapter 3.

Table 2.18 Projected Municipal and Manufacturing Water Demands for City of Austin service area (ac-ft/yr)

County/WUG	2000	2010	2020	2030	2040	2050	2060
Hays County							
Wholesale Commitments [1]	992	0	0	0	0	0	0
Travis County							
Austin	126,388	150,180	183,509	214,242	241,074	268,462	293,095
Wholesale Commitments [2]	25,889	12,903	12,028	1,120	0	0	0
County-Other [3]	7,403	5,343	4,186	3,252	2,100	1,119	1,209
Manufacturing	15,102	21,925	27,217	37,431	49,406	56,626	63,575
Williamson County							
Austin	2,315	3,993	5,964	8,286	10,786	13,479	16,338
Wholesale Commitments [4]	8,564	983	968	0	0	0	0
County-Other [5]	2,123	2,401	2,729	3,118	3,536	3,989	4,469
Total	**188,776**	**197,728**	**236,601**	**267,449**	**306,902**	**343,675**	**378,686**

[1] The wholesale commitments in Hays County include the following WUGs: a portion of Hill Country WSC.

[2] The wholesale commitments in Travis County include the following WUGs: Creedmoor-Maha WSC, Lost Creek MUD, Manor, Manville WSC, a portion of North Austin MUD #1, Pflugerville, Rollingwood, Round Rock, Shady Hollow MUD, Wells Branch MUD, West Lake Hills, and Windermere Utility.

[3] County-Other in Travis County consists of several small communities, which are too small to be considered WUGs.

[4] The wholesale commitments in Williamson County include the following WUGs: Anderson Mill MUD, a portion of North Austin MUD #1, and Round Rock (Region G).

[5] County-Other in Travis County consists of several small communities, which are too small to be considered WUGs.

Travis County-Other water demands decrease due to annexations by the COA, which correspondingly increase the City's water demand. The COA is responsible for supplying a significant portion of the County-Other water in Travis County. This County-Other demand consists of demand for both individual service connections that are outside the city limits and demands for other public water systems served by the COA.

Table 2.19 presents the COA steam-electric water demand in Fayette and Travis Counties. COA's portion of the STP demand is included in the STP total steam-electric demand in Matagorda County

Table 2.19 Projected Steam-Electric Water Demands for City of Austin service area (ac-ft/yr)

County/WUG	2000	2010	2020	2030	2040	2050	2060
Fayette County							
Steam Electric [1]	7,102	14,222	14,302	17,602	25,739	25,739	31,649
Travis County							
Steam Electric	7,494	17,500	18,500	22,500	23,500	27,500	28,500
Total	**14,596**	**31,722**	**32,802**	**40,102**	**49,239**	**53,239**	**60,149**

[1] COA portion - based on estimated current supply levels and approved projections.

2.5.2 Lower Colorado River Authority

LCRA supplies water for municipal, irrigation, manufacturing, steam-electric, and mining water uses. The LCRA currently supplies water to entities in Bastrop, Burnet, Colorado, Fayette, Hays, Lampasas (Region G), Llano, Matagorda, San Saba, Travis, Wharton, and Williamson (the portion of Williamson in Region G) Counties. *Table 2.20* presents the projected water demands for each of the WUGs supplied by LCRA. LCRA is not the sole provider for several of these WUGs, so these water demands will not all be met by water provided by LCRA.

As with the COA, the municipal County-Other water demands actually consist of water that is supplied to several smaller wholesale water customers.

Table 2.20 LCRA Water Commitment Summary (ac-ft/yr)

County/WUG	2000	2010	2020	2030	2040	2050	2060
Bastrop County							
Aqua WSC	5,000	5,000	5,000	5,000	5,000	0	0
County-Other	2,092	2,050	700	700	700	700	700
Steam Electric	16,720	16,720	16,720	16,720	13,970	10,750	10,750
Burnet County							
Burnet	4,100	4,100	4,100	4,100	0	0	0
Cottonwood Shores	138	138	0	0	0	0	0
Granite Shoals	830	830	830	0	0	0	0
Lake LBJ MUD	1,789	1,789	1,789	1,789	1,789	0	0
Marble Falls	3,000	3,000	3,000	1,000	1,000	0	0
County-Other	901	556	330	280	250	250	250
Manufacturing	500	500	500	500	500	500	500
Colorado County							
Irrigation [1]	157,682	150,617	144,349	138,285	132,416	126,710	121,247
Fayette County							
County-Other	97	12	0	0	0	0	0
Steam Electric (LCRA)	38,101	38,101	38,101	38,101	38,101	38,101	38,101
Steam Electric (COA)	3,500	3,500	3,500	0	0	0	0
Hays County							
Dripping Springs WSC	560	560	560	560	560	0	0
County-Other	1,915	1,915	1,915	1,915	1,915	0	0
Lampasas County (Region G)							
County-Other	882	0	0	0	0	0	0
Llano County							
Kingsland WSC	500	500	500	500	500	500	0
Llano	87	87	87	87	0	0	0
Sunrise Beach Village [2]	278	278	278	278	278	278	278
County-Other	2,074	2,074	747	747	728	728	728
Steam Electric [3]	15,700	15,700	15,700	15,700	15,700	15,700	15,700

[1] The Colorado Irrigation commitment represents 75 percent of the Colorado County Irrigation demand.
[2] The value for Sunrise Beach Village was estimated based upon TCEQ maximum production capacity for system.
[3] The Llano Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI amount instead of the 15,000 ac-ft/yr, which LCRA has in the 1999 WMP.

Table 2.20 LCRA Water Commitment Summary (ac-ft/yr) (Continued)

County/WUG	2000	2010	2020	2030	2040	2050	2060
Matagorda County							
Manufacturing County	14,222	14,222	6,022	2,800	2,800	0	0
County-Other	15	15	0	0	0	0	0
Irrigation [4]	179,211	167,952	161,883	156,037	150,437	145,048	139,853
Steam Electric [5]	38,060	38,111	38,162	38,213	0	0	0
San Saba County							
County-Other	20	0	0	0	0	0	0
Travis County							
Austin - Municipal [6]	143,947	143,343	142,739	142,135	141,531	140,927	0
Austin - Steam Electric 7	30,860	30,994	31,128	31,262	31,396	31,530	0
Barton Creek West WSC	348	348	348	348	348	348	348
Bee Cave Village	241	241	241	241	241	241	241
Briar Cliff Village	300	300	300	300	0	0	0
Cedar Park [8]	594	670	290	384	443	0	0
Cedar Park [8] (Region G)	18,141	18,065	17,710	17,616	17,557	0	0
The Hills	1,600	1,600	1,600	0	0	0	0
Jonestown WSC	360	360	360	360	0	0	0
Lago Vista	6,770	6,770	6,500	0	0	0	0
Lakeway MUD	2,455	2,455	2,455	0	0	0	0
Loop 360 WSC	871	871	871	0	0	0	0
Pflugerville	12,000	12,000	12,000	12,000	12,000	0	0
River Place on Lake Austin	900	900	0	0	0	0	0
Travis County WCID #17	9,354	9,354	8,800	8,800	8,800	8,800	0
Travis County WCID #18	1,400	1,400	0	0	0	0	0
Travis County WCID #20	1,135	1,135	1,135	0	0	0	0
West Travis County Regional WS [9]	3,411	3,411	3,411	3,411	3,411	3,411	3,411
County-Other [10]	14,717	14,196	11,846	6,171	5,051	1,470	1,470
Manufacturing	910	0	0	0	0	0	0
Williamson County (Region G)							
Leander	6,400	6,400	6,400	0	0	0	0
County-Other	25,000	25,000	25,000	25,000	25,000	25,000	15,000
Wharton County							
Irrigation [11]	105,183	100,642	97,043	93,570	90,224	86,997	74,751
TOTAL	**874,871**	**848,782**	**814,950**	**764,910**	**702,646**	**637,989**	**423,328**

[4] The Matagorda Irrigation commitment represents 87 percent of the Matagorda County Irrigation demand.
[5] The Matagorda Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of the 5,680 ac-ft/yr LCRA contract value; Refer to *Table 3.1a*.
[6] The Austin-Municipal value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of 152,327 ac-ft/yr LCRA contract value.
[7] The Austin-Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of 35,197 ac-ft/yr LCRA contract value.
[8] Cedar Park is located in both Region K and Region G, and it serves Williamson-Travis Counties MUD #1 (WUG).
[9] West Travis County Regional WS is composed of multiple water user groups including the Village of Bee Cave, Barton Creek West WSC, and Hill Country WSC.
[10] Travis County-Other contains Travis County MUD District #4 who serves Travis County WCID #19 (WUG).
[11] The Wharton Irrigation commitment represents 55 percent of the total Wharton County Irrigation demand.

APPENDIX 2A

LCRWPG POPULATION AND WATER DEMAND PROJECTIONS
(By County/River Basin and City/County)

Region K Population Projections by Water User Group

WUG Name	County	River Basin	Population 2000	2010	2020	2030	2040	2050	2060
AQUA WSC	BASTROP	COLORADO	29,400	36,138	44,618	54,593	65,914	80,250	98,194
BASTROP	BASTROP	COLORADO	5,340	6,515	7,994	9,734	11,708	14,208	17,337
BASTROP COUNTY WCID #2	BASTROP	COLORADO	1,527	2,269	3,202	4,300	5,546	7,124	9,099
COUNTY-OTHER	BASTROP	BRAZOS	406	682	1,027	1,434	1,894	2,477	3,209
COUNTY-OTHER	BASTROP	COLORADO	9,932	16,644	25,091	35,027	46,304	60,584	78,458
COUNTY-OTHER	BASTROP	GUADALUPE	265	444	669	934	1,235	1,616	2,093
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	140	181	232	292	361	448	557
ELGIN	BASTROP	COLORADO	5,667	6,411	7,348	8,450	9,701	11,285	13,267
LEE COUNTY WSC	BASTROP	BRAZOS	263	336	428	537	660	816	1,011
LEE COUNTY WSC	BASTROP	COLORADO	410	524	668	837	1,029	1,272	1,576
MANVILLE WSC	BASTROP	COLORADO	330	501	717	971	1,259	1,624	2,080
POLONIA WSC	BASTROP	COLORADO	152	201	263	335	417	521	651
SMITHVILLE	BASTROP	COLORADO	3,901	4,540	5,344	6,290	7,364	8,724	10,426
BASTROP COUNTY TOTAL POPULATION			**57,733**	**75,386**	**97,601**	**123,734**	**153,392**	**190,949**	**237,958**
BLANCO	BLANCO	GUADALUPE	1,505	1,672	1,870	2,059	2,224	2,403	2,611
CANYON LAKE WSC	BLANCO	GUADALUPE	822	1,254	1,766	2,256	2,685	3,149	3,687
COUNTY-OTHER	BLANCO	COLORADO	3,185	3,684	4,274	4,839	5,334	5,868	6,489
COUNTY-OTHER	BLANCO	GUADALUPE	1,715	1,983	2,301	2,605	2,871	3,159	3,493
JOHNSON CITY	BLANCO	COLORADO	1,191	1,353	1,545	1,728	1,888	2,062	2,264
BLANCO COUNTY TOTAL POPULATION			**8,418**	**9,946**	**11,756**	**13,487**	**15,002**	**16,641**	**18,544**
BERTRAM	BURNET	BRAZOS	1,122	1,307	1,524	1,746	1,958	2,189	2,458
BURNET	BURNET	COLORADO	4,735	5,625	6,668	7,736	8,753	9,864	11,154
CHISHOLM TRAIL SUD	BURNET	BRAZOS	118	178	249	321	390	465	553
COTTONWOOD SHORES	BURNET	COLORADO	877	1,100	1,362	1,630	1,885	2,164	2,488
COUNTY-OTHER	BURNET	BRAZOS	4,164	5,227	6,473	7,750	8,962	10,289	11,830
COUNTY-OTHER	BURNET	COLORADO	13,151	16,506	20,440	24,468	28,303	32,492	37,359
GRANITE SHOALS	BURNET	COLORADO	2,040	2,489	3,015	3,554	4,067	4,627	5,278
KEMPNER WSC	BURNET	BRAZOS	666	884	1,140	1,402	1,652	1,925	2,242
KINGSLAND WSC	BURNET	COLORADO	315	366	426	487	545	608	682
LAKE LBJ MUD	BURNET	COLORADO	707	817	946	1,078	1,204	1,341	1,500
MARBLE FALLS	BURNET	COLORADO	4,959	5,604	6,361	7,136	7,874	8,680	9,616
MEADOWLAKES	BURNET	COLORADO	1,293	1,821	2,440	3,074	3,678	4,337	5,103
BURNET COUNTY TOTAL POPULATION			**34,147**	**41,924**	**51,044**	**60,382**	**69,271**	**78,981**	**90,263**
COLUMBUS	COLORADO	COLORADO	3,916	4,053	4,231	4,331	4,371	4,379	4,333
COUNTY-OTHER	COLORADO	BRAZOS-COLORADO	1,031	1,067	1,115	1,141	1,150	1,154	1,141
COUNTY-OTHER	COLORADO	COLORADO	6,572	6,801	7,101	7,268	7,336	7,349	7,272
COUNTY-OTHER	COLORADO	LAVACA	3,226	3,338	3,486	3,568	3,601	3,607	3,569
EAGLE LAKE	COLORADO	BRAZOS-COLORADO	1,108	1,147	1,197	1,225	1,237	1,239	1,226
EAGLE LAKE	COLORADO	COLORADO	2,556	2,645	2,762	2,827	2,853	2,858	2,828
WEIMAR	COLORADO	COLORADO	1,382	1,430	1,493	1,528	1,543	1,545	1,529
WEIMAR	COLORADO	LAVACA	599	620	647	662	669	670	663
COLORADO COUNTY TOTAL POPULATION			**20,390**	**21,101**	**22,032**	**22,550**	**22,760**	**22,801**	**22,561**

Region K Population Projections by Water User Group

WUG Name	County	River Basin	Population 2000	2010	2020	2030	2040	2050	2060
AQUA WSC	FAYETTE	COLORADO	420	602	787	939	1,057	1,193	1,372
COUNTY-OTHER	FAYETTE	BRAZOS	1	2	1	1	2	1	1
COUNTY-OTHER	FAYETTE	COLORADO	5,054	3,455	2,362	1,615	1,104	755	516
COUNTY-OTHER	FAYETTE	GUADALUPE	378	230	140	85	51	31	19
COUNTY-OTHER	FAYETTE	LAVACA	2,218	1,377	855	531	330	205	127
FAYETTE WSC	FAYETTE	COLORADO	3,755	6,570	9,424	11,773	13,600	15,691	18,459
FAYETTE WSC	FAYETTE	LAVACA	330	577	828	1,034	1,195	1,379	1,622
FLATONIA	FAYETTE	GUADALUPE	308	345	383	414	438	466	503
FLATONIA	FAYETTE	LAVACA	1,069	1,198	1,329	1,437	1,521	1,617	1,744
LA GRANGE	FAYETTE	COLORADO	4,478	5,546	6,629	7,520	8,213	9,007	10,057
LEE COUNTY WSC	FAYETTE	COLORADO	1,094	1,730	2,375	2,906	3,319	3,792	4,418
SCHULENBURG	FAYETTE	LAVACA	2,699	3,194	3,695	4,108	4,429	4,796	5,282
FAYETTE COUNTY TOTAL POPULATION			**21,804**	**24,826**	**28,808**	**32,363**	**35,259**	**38,933**	**44,120**
COUNTY-OTHER	GILLESPIE	COLORADO	11,504	13,314	15,205	15,943	15,943	15,943	15,943
COUNTY-OTHER	GILLESPIE	GUADALUPE	399	462	527	553	553	553	553
FREDERICKSBURG	GILLESPIE	COLORADO	8,911	10,313	11,778	12,349	12,349	12,349	12,349
GILLESPIE COUNTY TOTAL POPULATION			**20,814**	**24,089**	**27,510**	**28,845**	**28,845**	**28,845**	**28,845**
BUDA	HAYS	COLORADO	2,404	8,042	13,971	17,341	20,728	24,797	27,997
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	1,896	2,417	3,013	3,631	4,252	4,998	5,584
COUNTY-OTHER	HAYS	COLORADO	15,798	24,018	33,658	43,641	53,675	65,729	75,207
DRIPPING SPRINGS	HAYS	COLORADO	1,548	5,325	9,308	11,651	14,005	16,834	19,058
DRIPPING SPRINGS WSC	HAYS	COLORADO	1,481	2,487	3,639	4,832	6,031	7,471	8,604
HILL COUNTRY WSC	HAYS	COLORADO	1,427	3,117	5,051	7,054	9,067	11,485	13,387
MOUNTAIN CITY	HAYS	COLORADO	536	737	737	737	737	737	737
HAYS COUNTY TOTAL POPULATION			**25,090**	**46,143**	**69,377**	**88,887**	**108,495**	**132,051**	**150,574**
COUNTY-OTHER	LLANO	COLORADO	4,659	4,745	4,745	4,745	4,745	4,745	4,745
KINGSLAND WSC	LLANO	COLORADO	3,625	3,692	3,692	3,692	3,692	3,692	3,692
LAKE LBJ MUD	LLANO	COLORADO	4,731	4,819	4,819	4,819	4,819	4,819	4,819
LLANO	LLANO	COLORADO	3,325	3,387	3,387	3,387	3,387	3,387	3,387
SUNRISE BEACH VILLAGE	LLANO	COLORADO	704	717	717	717	717	717	717
LLANO COUNTY TOTAL POPULATION			**17,044**	**17,360**	**17,360**	**17,360**	**17,360**	**17,360**	**17,360**
BAY CITY	MATAGORDA	BRAZOS-COLORADO	18,667	19,921	21,292	22,126	22,586	22,521	22,316
COUNTY-OTHER	MATAGORDA	BRAZOS-COLORADO	6,934	7,400	7,909	8,219	8,389	8,365	8,289
COUNTY-OTHER	MATAGORDA	COLORADO	1,391	1,484	1,587	1,649	1,683	1,678	1,663
COUNTY-OTHER	MATAGORDA	COLORADO-LAVACA	5,113	5,456	5,832	6,061	6,186	6,169	6,113
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	24	26	27	28	29	29	29
PALACIOS	MATAGORDA	COLORADO-LAVACA	5,153	5,499	5,878	6,108	6,235	6,217	6,160
SOUTHWEST UTILITIES	MATAGORDA	BRAZOS-COLORADO	675	720	770	800	817	814	807
MATAGORDA COUNTY TOTAL POPULATION			**37,957**	**40,506**	**43,295**	**44,991**	**45,925**	**45,793**	**45,377**
BROOKSMITH SUD	MILLS	COLORADO	39	39	45	46	47	46	44
COUNTY-OTHER	MILLS	BRAZOS	1,342	1,337	1,421	1,441	1,460	1,448	1,417
COUNTY-OTHER	MILLS	COLORADO	1,968	1,962	2,085	2,112	2,139	2,121	2,077

Region K Population Projections by Water User Group

			Population						
WUG Name	**County**	**River Basin**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
GOLDTHWAITE	MILLS	BRAZOS	27	27	28	28	28	28	28
GOLDTHWAITE	MILLS	COLORADO	1,775	1,772	1,835	1,849	1,863	1,854	1,831
MILLS COUNTY TOTAL POPULATION			**5,151**	**5,137**	**5,414**	**5,476**	**5,537**	**5,497**	**5,397**
COUNTY-OTHER	SAN SABA	COLORADO	2,544	2,697	2,971	3,210	3,418	3,444	3,477
RICHLAND SUD	SAN SABA	COLORADO	1,005	1,050	1,130	1,200	1,261	1,268	1,278
SAN SABA	SAN SABA	COLORADO	2,637	2,640	2,645	2,649	2,653	2,653	2,654
SAN SABA COUNTY TOTAL POPULATION			**6,186**	**6,387**	**6,746**	**7,059**	**7,332**	**7,365**	**7,409**
ANDERSON MILL MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
AQUA WSC	TRAVIS	COLORADO	6,300	7,251	8,523	9,698	10,432	11,208	12,007
AUSTIN	TRAVIS	COLORADO	644,752	770,529	946,974	1,111,996	1,258,580	1,409,808	1,548,275
BARTON CREEK WEST WSC	TRAVIS	COLORADO	1,456	1,456	1,456	1,456	1,456	1,456	1,456
BEE CAVE VILLAGE	TRAVIS	COLORADO	656	948	1,339	1,700	1,926	2,165	2,411
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	895	1,289	1,817	2,305	2,609	2,931	3,263
CEDAR PARK	TRAVIS	COLORADO	541	922	1,432	1,903	2,197	2,508	2,828
COUNTY-OTHER	TRAVIS	COLORADO	44,009	33,658	27,846	23,120	17,206	12,120	12,629
COUNTY-OTHER	TRAVIS	GUADALUPE	7	7	7	7	7	7	7
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	4,837	5,812	7,117	8,322	9,075	9,871	10,691
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	125	150	184	215	234	255	276
ELGIN	TRAVIS	COLORADO	33	56	87	116	134	153	173
GOFORTH WSC	TRAVIS	COLORADO	217	288	383	471	526	584	644
HILL COUNTRY WSC	TRAVIS	COLORADO	991	1,689	2,623	3,486	4,025	4,595	5,182
JONESTOWN	TRAVIS	COLORADO	1,681	1,985	2,391	2,766	3,000	3,248	3,503
JONESTOWN WSC	TRAVIS	COLORADO	779	926	1,123	1,305	1,419	1,539	1,663
LAGO VISTA	TRAVIS	COLORADO	4,507	6,132	8,307	10,316	11,571	12,898	14,265
LAKEWAY	TRAVIS	COLORADO	8,002	10,789	14,519	17,965	20,117	22,394	24,738
LAKEWAY MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
LOOP 360 WSC	TRAVIS	COLORADO	1,802	2,803	2,803	2,803	2,803	2,803	2,803
LOST CREEK MUD	TRAVIS	COLORADO	4,354	4,372	4,372	4,372	4,372	4,372	4,372
MANOR	TRAVIS	COLORADO	1,204	1,319	1,473	1,615	1,704	1,798	1,895
MANVILLE WSC	TRAVIS	COLORADO	9,293	12,987	17,931	22,498	25,350	28,367	31,474
MUSTANG RIDGE	TRAVIS	COLORADO	323	384	466	542	589	639	690
MUSTANG RIDGE	TRAVIS	GUADALUPE	86	102	124	144	157	170	184
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	780	780	780	780	780	780	780
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	2,121	3,615	5,614	7,460	8,613	9,833	11,089
PFLUGERVILLE	TRAVIS	COLORADO	16,335	24,709	35,916	46,268	52,733	59,572	66,614
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	2,763	4,449	5,250	5,250	5,250	5,250	5,250
ROLLINGWOOD	TRAVIS	COLORADO	1,403	1,414	1,428	1,441	1,449	1,458	1,467
ROUND ROCK	TRAVIS	COLORADO	1,076	1,806	2,782	3,684	4,247	4,843	5,456
SHADY HOLLOW MUD	TRAVIS	COLORADO	4,732	4,732	4,732	4,732	4,732	4,732	4,732
THE HILLS	TRAVIS	COLORADO	1,492	2,301	3,000	3,000	3,000	3,000	3,000
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	11,023	15,838	22,283	28,236	31,954	35,887	39,936
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	4,915	6,291	8,133	9,834	10,896	12,020	13,177

Region K Population Projections by Water User Group

			Population						
WUG Name	**County**	**River Basin**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	553	716	716	716	716	716	716
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	990	1,140	1,140	1,140	1,140	1,140	1,140
WELLS BRANCH MUD	TRAVIS	COLORADO	8,211	8,211	8,211	8,211	8,211	8,211	8,211
WEST LAKE HILLS	TRAVIS	COLORADO	3,116	3,520	4,061	4,561	4,873	5,203	5,543
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	3,260	4,881	7,051	9,055	10,307	11,631	12,994
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	1,179	1,699	2,395	3,037	3,438	3,862	4,299
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	11,481	17,999	18,710	18,710	18,710	18,710	18,710
TRAVIS COUNTY TOTAL POPULATION			**812,280**	**969,955**	**1,185,499**	**1,385,236**	**1,550,538**	**1,722,737**	**1,888,543**
COUNTY-OTHER	WHARTON	BRAZOS-COLORADO	11,073	11,711	12,378	12,810	13,057	13,063	12,923
COUNTY-OTHER	WHARTON	COLORADO	4,176	4,416	4,668	4,831	4,924	4,926	4,874
COUNTY-OTHER	WHARTON	COLORADO-LAVACA	2,235	2,364	2,499	2,585	2,635	2,637	2,609
WHARTON	WHARTON	BRAZOS-COLORADO	6,339	6,704	7,087	7,333	7,475	7,478	7,399
WHARTON	WHARTON	COLORADO	2,898	3,065	3,240	3,352	3,417	3,419	3,383
WHARTON COUNTY TOTAL POPULATION			**26,721**	**28,260**	**29,872**	**30,911**	**31,508**	**31,523**	**31,188**
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	8,831	8,831	8,831	8,831	8,831	8,831	8,831
AUSTIN	WILLIAMSON	BRAZOS	11,810	20,486	30,775	43,008	56,310	70,782	86,303
COUNTY-OTHER	WILLIAMSON	BRAZOS	10,829	12,317	14,082	16,181	18,463	20,946	23,609
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	7,023	7,023	7,023	7,023	7,023	7,023	7,023
WILLIAMSON COUNTY TOTAL POPULATION			**38,493**	**48,657**	**60,711**	**75,043**	**90,627**	**107,582**	**125,766**
REGION K TOTAL POPULATION			**1,132,228**	**1,359,677**	**1,657,025**	**1,936,324**	**2,181,851**	**2,447,058**	**2,713,905**

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr) D2000	D2010	D2020	D2030	D2040	D2050	D2060
AQUA WSC	BASTROP	COLORADO	4,578	5,424	6,547	7,827	9,377	11,326	13,859
BASTROP	BASTROP	COLORADO	1,226	1,460	1,755	2,115	2,518	3,040	3,709
BASTROP COUNTY WCID #2	BASTROP	COLORADO	238	341	473	626	801	1,029	1,315
COUNTY-OTHER	BASTROP	BRAZOS	56	93	140	194	257	336	435
COUNTY-OTHER	BASTROP	COLORADO	1,380	2,275	3,429	4,747	6,276	8,211	10,634
COUNTY-OTHER	BASTROP	GUADALUPE	37	61	91	127	167	219	284
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	15	19	23	29	35	43	54
ELGIN	BASTROP	COLORADO	971	1,063	1,193	1,344	1,521	1,757	2,066
LEE COUNTY WSC	BASTROP	BRAZOS	40	49	61	75	92	112	139
LEE COUNTY WSC	BASTROP	COLORADO	62	77	95	117	143	175	217
MANVILLE WSC	BASTROP	COLORADO	46	67	94	125	161	207	266
POLONIA WSC	BASTROP	COLORADO	15	18	23	29	35	44	55
SMITHVILLE	BASTROP	COLORADO	651	732	838	972	1,122	1,319	1,577
Total Municipal Water Demand			**9,315**	**11,679**	**14,762**	**18,327**	**22,505**	**27,818**	**34,610**
IRRIGATION	BASTROP	BRAZOS	102	89	78	68	59	52	45
IRRIGATION	BASTROP	COLORADO	1,744	1,521	1,329	1,158	1,013	882	769
IRRIGATION	BASTROP	GUADALUPE	0	0	0	0	0	0	0
Total Irrigation Water Demand			**1,846**	**1,610**	**1,407**	**1,226**	**1,072**	**934**	**814**
LIVESTOCK	BASTROP	BRAZOS	259	259	259	259	259	259	259
LIVESTOCK	BASTROP	COLORADO	1,202	1,202	1,202	1,202	1,202	1,202	1,202
LIVESTOCK	BASTROP	GUADALUPE	61	61	61	61	61	61	61
Total Livestock Water Demand			**1,522**	**1,522**	**1,522**	**1,522**	**1,522**	**1,522**	**1,522**
MANUFACTURING	BASTROP	BRAZOS	0	0	0	0	0	0	0
MANUFACTURING	BASTROP	COLORADO	64	84	101	119	137	155	167
MANUFACTURING	BASTROP	GUADALUPE	6	8	10	11	13	14	16
Total Manufacturing Water Demand			**70**	**92**	**111**	**130**	**150**	**169**	**183**
MINING	BASTROP	BRAZOS	8	10	9	10	11	11	11
MINING	BASTROP	COLORADO	14	5,016	5,018	5,018	18	19	20
MINING	BASTROP	GUADALUPE	6	7	8	8	8	8	8
Total Mining Water Demand			**28**	**5,033**	**5,035**	**5,036**	**37**	**38**	**39**
STEAM ELECTRIC POWER	BASTROP	BRAZOS	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	BASTROP	COLORADO	7,846	12,000	14,000	16,000	18,000	19,500	19,500
STEAM ELECTRIC POWER	BASTROP	GUADALUPE	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**7,846**	**12,000**	**14,000**	**16,000**	**18,000**	**19,500**	**19,500**
BASTROP COUNTY TOTAL WATER DEMAND			**20,627**	**31,936**	**36,837**	**42,241**	**43,286**	**49,981**	**56,668**
BLANCO	BLANCO	GUADALUPE	280	303	331	360	381	409	445
CANYON LAKE WSC	BLANCO	GUADALUPE	126	188	263	334	397	466	545
COUNTY-OTHER	BLANCO	COLORADO	332	363	407	450	484	526	581
COUNTY-OTHER	BLANCO	GUADALUPE	179	195	219	242	260	283	313
JOHNSON CITY	BLANCO	COLORADO	288	320	360	397	429	467	512
Total Municipal Water Demand			**1,205**	**1,369**	**1,580**	**1,783**	**1,951**	**2,151**	**2,396**
IRRIGATION	BLANCO	COLORADO	57	54	52	48	45	44	43
IRRIGATION	BLANCO	GUADALUPE	16	15	14	14	13	12	12
Total Irrigation Water Demand			**73**	**69**	**66**	**62**	**58**	**56**	**55**
LIVESTOCK	BLANCO	COLORADO	341	341	341	341	341	341	341
LIVESTOCK	BLANCO	GUADALUPE	102	102	102	102	102	102	102
Total Livestock Water Demand			**443**	**443**	**443**	**443**	**443**	**443**	**443**
MANUFACTURING	BLANCO	COLORADO	1	1	1	1	1	1	1
MANUFACTURING	BLANCO	GUADALUPE	1	1	1	1	1	1	1
Total Manufacturing Water Demand			**2**	**2**	**2**	**2**	**2**	**2**	**2**

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr) D2000	D2010	D2020	D2030	D2040	D2050	D2060
MINING	BLANCO	COLORADO	6	5	5	5	5	5	5
MINING	BLANCO	GUADALUPE	0	0	0	0	0	0	0
Total Mining Water Demand			**6**	**5**	**5**	**5**	**5**	**5**	**5**
STEAM ELECTRIC POWER	BLANCO	COLORADO	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	BLANCO	GUADALUPE	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**0**	**0**	**0**	**0**	**0**	**0**	**0**
BLANCO COUNTY TOTAL WATER DEMAND			**1,729**	**1,888**	**2,096**	**2,295**	**2,459**	**2,657**	**2,901**
BERTRAM	BURNET	BRAZOS	226	258	295	334	371	412	463
BURNET	BURNET	COLORADO	849	983	1,143	1,300	1,461	1,635	1,849
CHISHOLM TRAIL SUD	BURNET	BRAZOS	15	28	40	53	66	79	94
COTTONWOOD SHORES	BURNET	COLORADO	121	147	177	208	239	271	312
COUNTY-OTHER	BURNET	BRAZOS	392	468	566	660	753	853	981
COUNTY-OTHER	BURNET	COLORADO	1,237	1,479	1,786	2,083	2,378	2,693	3,097
GRANITE SHOALS	BURNET	COLORADO	327	385	453	525	592	669	763
KEMPNER WSC	BURNET	BRAZOS	228	298	381	466	548	636	741
KINGSLAND WSC	BURNET	COLORADO	49	55	63	70	77	85	95
LAKE LBJ MUD	BURNET	COLORADO	200	227	261	293	324	359	402
MARBLE FALLS	BURNET	COLORADO	1,616	1,795	2,016	2,238	2,452	2,693	2,984
MEADOWLAKES	BURNET	COLORADO	492	687	916	1,150	1,372	1,618	1,903
Total Municipal Water Demand			**5,752**	**6,810**	**8,097**	**9,380**	**10,633**	**12,003**	**13,684**
IRRIGATION	BURNET	BRAZOS	0	0	0	0	0	0	0
IRRIGATION	BURNET	COLORADO	103	101	100	98	96	95	93
Total Irrigation Water Demand			**103**	**101**	**100**	**98**	**96**	**95**	**93**
LIVESTOCK	BURNET	BRAZOS	409	409	409	409	409	409	409
LIVESTOCK	BURNET	COLORADO	426	426	426	426	426	426	426
Total Livestock Water Demand			**835**	**835**	**835**	**835**	**835**	**835**	**835**
MANUFACTURING	BURNET	BRAZOS	0	0	0	0	0	0	0
MANUFACTURING	BURNET	COLORADO	743	963	1,109	1,248	1,384	1,502	1,636
Total Manufacturing Water Demand			**743**	**963**	**1,109**	**1,248**	**1,384**	**1,502**	**1,636**
MINING	BURNET	BRAZOS	54	61	64	66	67	69	70
MINING	BURNET	COLORADO	1,671	1,895	1,985	2,032	2,078	2,121	2,165
Total Mining Water Demand			**1,725**	**1,956**	**2,049**	**2,098**	**2,145**	**2,190**	**2,235**
STEAM ELECTRIC POWER	BURNET	BRAZOS	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	BURNET	COLORADO	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**0**	**0**	**0**	**0**	**0**	**0**	**0**
BURNET COUNTY TOTAL WATER DEMAND			**9,158**	**10,665**	**12,190**	**13,659**	**15,093**	**16,625**	**18,483**
COLUMBUS	COLORADO	COLORADO	1,009	1,026	1,057	1,067	1,062	1,060	1,048
COUNTY-OTHER	COLORADO	BRAZOS-COLORADO	113	114	115	114	111	110	109
COUNTY-OTHER	COLORADO	COLORADO	721	724	732	725	707	700	692
COUNTY-OTHER	COLORADO	LAVACA	354	355	359	356	347	343	340
EAGLE LAKE	COLORADO	BRAZOS-COLORADO	171	173	176	176	173	172	170
EAGLE LAKE	COLORADO	COLORADO	395	400	405	405	399	397	393
WEIMAR	COLORADO	COLORADO	235	237	241	241	239	237	235
WEIMAR	COLORADO	LAVACA	102	103	104	105	103	103	102
Total Municipal Water Demand			**3,100**	**3,132**	**3,189**	**3,189**	**3,141**	**3,122**	**3,089**
IRRIGATION	COLORADO	BRAZOS-COLORADO	58,027	55,427	53,120	50,889	48,729	46,629	44,619
IRRIGATION	COLORADO	COLORADO	28,172	26,910	25,791	24,707	23,659	22,639	21,663
IRRIGATION	COLORADO	LAVACA	124,043	118,485	113,554	108,784	104,167	99,678	95,381
Total Irrigation Water Demand			**210,242**	**200,822**	**192,465**	**184,380**	**176,555**	**168,946**	**161,663**

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr) D2000	D2010	D2020	D2030	D2040	D2050	D2060
LIVESTOCK	COLORADO	BRAZOS-COLORADO	103	103	103	103	103	103	103
LIVESTOCK	COLORADO	COLORADO	899	899	899	899	899	899	899
LIVESTOCK	COLORADO	LAVACA	471	471	471	471	471	471	471
Total Livestock Water Demand			**1,473**	**1,473**	**1,473**	**1,473**	**1,473**	**1,473**	**1,473**
MANUFACTURING	COLORADO	BRAZOS-COLORADO	0	0	0	0	0	0	0
MANUFACTURING	COLORADO	COLORADO	144	176	192	205	217	227	245
MANUFACTURING	COLORADO	LAVACA	0	0	0	0	0	0	0
Total Manufacturing Water Demand			**144**	**176**	**192**	**205**	**217**	**227**	**245**
MINING	COLORADO	BRAZOS-COLORADO	113	119	122	123	124	125	126
MINING	COLORADO	COLORADO	17,928	18,958	19,316	19,515	19,704	19,885	20,044
MINING	COLORADO	LAVACA	1,633	1,727	1,759	1,778	1,795	1,811	1,826
Total Mining Water Demand			**19,674**	**20,804**	**21,197**	**21,416**	**21,623**	**21,821**	**21,996**
STEAM ELECTRIC POWER	COLORADO	BRAZOS-COLORADO	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	COLORADO	COLORADO	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	COLORADO	LAVACA	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**0**	**0**	**0**	**0**	**0**	**0**	**0**
COLORADO COUNTY TOTAL WATER DEMAND			**234,633**	**226,407**	**218,516**	**210,663**	**203,009**	**195,589**	**188,466**
AQUA WSC	FAYETTE	COLORADO	65	90	115	135	150	168	194
COUNTY-OTHER	FAYETTE	BRAZOS	0	0	0	0	0	0	0
COUNTY-OTHER	FAYETTE	COLORADO	702	464	307	206	137	93	64
COUNTY-OTHER	FAYETTE	GUADALUPE	53	31	18	11	6	4	2
COUNTY-OTHER	FAYETTE	LAVACA	308	185	111	68	41	25	16
FAYETTE WSC	FAYETTE	COLORADO	509	846	1,193	1,464	1,676	1,933	2,274
FAYETTE WSC	FAYETTE	LAVACA	45	74	105	129	147	170	200
FLATONIA	FAYETTE	GUADALUPE	69	76	82	88	92	97	105
FLATONIA	FAYETTE	LAVACA	239	263	286	306	319	337	363
LA GRANGE	FAYETTE	COLORADO	803	963	1,129	1,264	1,362	1,483	1,656
LEE COUNTY WSC	FAYETTE	COLORADO	167	254	338	407	461	522	609
SCHULENBURG	FAYETTE	LAVACA	562	644	733	801	853	919	1,012
Total Municipal Water Demand			**3,522**	**3,890**	**4,417**	**4,879**	**5,244**	**5,751**	**6,495**
IRRIGATION	FAYETTE	BRAZOS	0	0	0	0	0	0	0
IRRIGATION	FAYETTE	COLORADO	749	702	657	615	575	539	506
IRRIGATION	FAYETTE	GUADALUPE	0	0	0	0	0	0	0
IRRIGATION	FAYETTE	LAVACA	40	37	35	33	31	29	27
Total Irrigation Water Demand			**789**	**739**	**692**	**648**	**606**	**568**	**533**
LIVESTOCK	FAYETTE	BRAZOS	24	24	24	24	24	24	24
LIVESTOCK	FAYETTE	COLORADO	1,774	1,774	1,774	1,774	1,774	1,774	1,774
LIVESTOCK	FAYETTE	GUADALUPE	144	144	144	144	144	144	144
LIVESTOCK	FAYETTE	LAVACA	455	455	455	455	455	455	455
Total Livestock Water Demand			**2,397**	**2,397**	**2,397**	**2,397**	**2,397**	**2,397**	**2,397**
MANUFACTURING	FAYETTE	BRAZOS	0	0	0	0	0	0	0
MANUFACTURING	FAYETTE	COLORADO	0	0	0	0	0	0	0
MANUFACTURING	FAYETTE	GUADALUPE	0	0	0	0	0	0	0
MANUFACTURING	FAYETTE	LAVACA	162	205	230	254	277	297	322
Total Manufacturing Water Demand			**162**	**205**	**230**	**254**	**277**	**297**	**322**
MINING	FAYETTE	BRAZOS	30	29	29	29	29	29	29
MINING	FAYETTE	COLORADO	4	4	4	4	4	4	4
MINING	FAYETTE	GUADALUPE	7	7	7	7	7	7	7
MINING	FAYETTE	LAVACA	2	2	2	2	2	2	2
Total Mining Water Demand			**43**	**42**	**42**	**42**	**42**	**42**	**42**

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr) D2000	D2010	D2020	D2030	D2040	D2050	D2060
STEAM ELECTRIC POWER	FAYETTE	BRAZOS	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	FAYETTE	COLORADO	21,306	42,720	43,200	52,500	63,840	63,840	69,750
STEAM ELECTRIC POWER	FAYETTE	GUADALUPE	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	FAYETTE	LAVACA	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**21,306**	**42,720**	**43,200**	**52,500**	**63,840**	**63,840**	**69,750**
FAYETTE COUNTY TOTAL WATER DEMAND			**28,219**	**49,993**	**50,978**	**60,720**	**72,406**	**72,895**	**79,539**
COUNTY-OTHER	GILLESPIE	COLORADO	1,417	1,581	1,754	1,786	1,750	1,732	1,732
COUNTY-OTHER	GILLESPIE	GUADALUPE	49	55	61	62	61	60	60
FREDERICKSBURG	GILLESPIE	COLORADO	2,455	2,796	3,153	3,265	3,237	3,223	3,223
Total Municipal Water Demand			**3,921**	**4,432**	**4,968**	**5,113**	**5,048**	**5,015**	**5,015**
IRRIGATION	GILLESPIE	COLORADO	2,065	2,039	2,013	1,987	1,960	1,936	1,912
IRRIGATION	GILLESPIE	GUADALUPE	0	0	0	0	0	0	0
Total Irrigation Water Demand			**2,065**	**2,039**	**2,013**	**1,987**	**1,960**	**1,936**	**1,912**
LIVESTOCK	GILLESPIE	COLORADO	1,041	1,041	1,041	1,041	1,041	1,041	1,041
LIVESTOCK	GILLESPIE	GUADALUPE	21	21	21	21	21	21	21
Total Livestock Water Demand			**1,062**	**1,062**	**1,062**	**1,062**	**1,062**	**1,062**	**1,062**
MANUFACTURING	GILLESPIE	COLORADO	440	506	539	566	591	612	655
MANUFACTURING	GILLESPIE	GUADALUPE	0	0	0	0	0	0	0
Total Manufacturing Water Demand			**440**	**506**	**539**	**566**	**591**	**612**	**655**
MINING	GILLESPIE	COLORADO	9	8	8	8	8	8	8
MINING	GILLESPIE	GUADALUPE	0	0	0	0	0	0	0
Total Mining Water Demand			**9**	**8**	**8**	**8**	**8**	**8**	**8**
STEAM ELECTRIC POWER	GILLESPIE	COLORADO	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	GILLESPIE	GUADALUPE	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**0**	**0**	**0**	**0**	**0**	**0**	**0**
GILLESPIE COUNTY TOTAL WATER DEMAND			**7,497**	**8,047**	**8,590**	**8,736**	**8,669**	**8,633**	**8,652**
BUDA	HAYS	COLORADO	385	1,252	2,128	2,603	3,088	3,666	4,140
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	327	403	489	582	676	789	882
COUNTY-OTHER	HAYS	COLORADO	2,407	3,551	4,864	6,208	7,576	9,277	10,615
DRIPPING SPRINGS	HAYS	COLORADO	321	1,080	1,856	2,297	2,745	3,300	3,736
DRIPPING SPRINGS WSC	HAYS	COLORADO	217	348	501	660	817	1,013	1,166
HILL COUNTRY WSC	HAYS	COLORADO	209	440	702	980	1,249	1,582	1,844
MOUNTAIN CITY	HAYS	COLORADO	89	118	116	116	115	115	115
Total Municipal Water Demand			**3,955**	**7,192**	**10,656**	**13,446**	**16,266**	**19,742**	**22,498**
IRRIGATION	HAYS	COLORADO	12	11	11	11	11	11	11
LIVESTOCK	HAYS	COLORADO	220	220	220	220	220	220	220
MANUFACTURING	HAYS	COLORADO	509	691	809	928	1,048	1,156	1,255
MINING	HAYS	COLORADO	18	12	6	2	0	0	0
STEAM ELECTRIC POWER	HAYS	COLORADO	0	0	0	0	0	0	0
HAYS COUNTY TOTAL WATER DEMAND			**4,714**	**8,126**	**11,702**	**14,607**	**17,545**	**21,129**	**23,984**
COUNTY-OTHER	LLANO	COLORADO	976	983	978	978	973	967	967
KINGSLAND WSC	LLANO	COLORADO	560	554	546	533	521	517	517
LAKE LBJ MUD	LLANO	COLORADO	1,335	1,339	1,328	1,312	1,296	1,290	1,290
LLANO	LLANO	COLORADO	998	1,005	994	983	971	964	964
SUNRISE BEACH VILLAGE	LLANO	COLORADO	173	173	172	170	168	167	167
Total Municipal Water Demand			**4,042**	**4,054**	**4,018**	**3,976**	**3,929**	**3,905**	**3,905**

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr) D2000	D2010	D2020	D2030	D2040	D2050	D2060
IRRIGATION	LLANO	COLORADO	995	979	963	946	930	915	900
LIVESTOCK	LLANO	COLORADO	751	751	751	751	751	751	751
MANUFACTURING	LLANO	COLORADO	2	3	3	3	3	3	3
MINING	LLANO	COLORADO	152	149	148	148	148	148	148
STEAM ELECTRIC POWER	LLANO	COLORADO	1,271	1,057	843	985	1,159	1,371	1,629
LLANO COUNTY TOTAL WATER DEMAND			**7,213**	**6,993**	**6,726**	**6,809**	**6,920**	**7,093**	**7,336**
BAY CITY	MATAGORDA	BRAZOS-COLORADO	3,136	3,236	3,387	3,445	3,441	3,406	3,375
COUNTY-OTHER	MATAGORDA	BRAZOS-COLORADO	769	787	815	819	808	796	789
COUNTY-OTHER	MATAGORDA	COLORADO	154	158	164	164	162	160	158
COUNTY-OTHER	MATAGORDA	COLORADO-LAVACA	567	581	601	604	596	587	582
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	2	2	2	2	2	2	2
PALACIOS	MATAGORDA	COLORADO-LAVACA	716	745	777	787	789	780	773
SOUTHWEST UTILITIES	MATAGORDA	BRAZOS-COLORADO	79	81	84	85	85	84	83
Total Municipal Water Demand			**5,423**	**5,590**	**5,830**	**5,906**	**5,883**	**5,815**	**5,762**
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	96,815	90,733	87,454	84,296	81,271	78,359	75,553
IRRIGATION	MATAGORDA	COLORADO	12,359	11,583	11,164	10,761	10,375	10,003	9,645
IRRIGATION	MATAGORDA	COLORADO-LAVACA	96,816	90,732	87,454	84,296	81,270	78,360	75,552
Total Irrigation Water Demand			**205,990**	**193,048**	**186,072**	**179,353**	**172,916**	**166,722**	**160,750**
LIVESTOCK	MATAGORDA	BRAZOS-COLORADO	529	529	529	529	529	529	529
LIVESTOCK	MATAGORDA	COLORADO	136	136	136	136	136	136	136
LIVESTOCK	MATAGORDA	COLORADO-LAVACA	486	486	486	486	486	486	486
Total Livestock Water Demand			**1,151**	**1,151**	**1,151**	**1,151**	**1,151**	**1,151**	**1,151**
MANUFACTURING	MATAGORDA	BRAZOS-COLORADO	5,415	6,369	6,930	7,316	7,680	7,979	8,507
MANUFACTURING	MATAGORDA	COLORADO	4,940	5,811	6,323	6,675	7,006	7,280	7,760
MANUFACTURING	MATAGORDA	COLORADO-LAVACA	0	0	0	0	0	0	0
Total Manufacturing Water Demand			**10,355**	**12,180**	**13,253**	**13,991**	**14,686**	**15,259**	**16,267**
MINING	MATAGORDA	BRAZOS-COLORADO	6	5	5	5	5	5	5
MINING	MATAGORDA	COLORADO	0	0	0	0	0	0	0
MINING	MATAGORDA	COLORADO-LAVACA	190	172	167	164	162	160	158
Total Mining Water Demand			**196**	**177**	**172**	**169**	**167**	**165**	**163**
STEAM ELECTRIC POWER	MATAGORDA	BRAZOS-COLORADO	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	65,948	80,000	80,000	102,000	102,000	102,000	102,000
STEAM ELECTRIC POWER	MATAGORDA	COLORADO-LAVACA	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**65,948**	**80,000**	**80,000**	**102,000**	**102,000**	**102,000**	**102,000**
MATAGORDA COUNTY TOTAL WATER DEMAND			**289,063**	**292,146**	**286,478**	**302,570**	**296,803**	**291,112**	**286,093**
BROOKSMITH SUD	MILLS	COLORADO	7	7	8	8	8	8	7
COUNTY-OTHER	MILLS	BRAZOS	165	160	166	163	160	157	154
COUNTY-OTHER	MILLS	COLORADO	242	235	243	239	235	230	226
GOLDTHWAITE	MILLS	BRAZOS	9	9	9	9	9	8	8
GOLDTHWAITE	MILLS	COLORADO	569	560	573	572	570	563	556
Total Municipal Water Demand			**992**	**971**	**999**	**991**	**982**	**966**	**951**
IRRIGATION	MILLS	BRAZOS	330	323	316	309	302	296	289
IRRIGATION	MILLS	COLORADO	2,671	2,613	2,556	2,501	2,447	2,393	2,342
Total Irrigation Water Demand			**3,001**	**2,936**	**2,872**	**2,810**	**2,749**	**2,689**	**2,631**
LIVESTOCK	MILLS	BRAZOS	367	367	367	367	367	367	367
LIVESTOCK	MILLS	COLORADO	551	551	551	551	551	551	551
Total Livestock Water Demand			**918**	**918**	**918**	**918**	**918**	**918**	**918**
MANUFACTURING	MILLS	BRAZOS	0	0	0	0	0	0	0
MANUFACTURING	MILLS	COLORADO	1	1	1	1	1	1	1
Total Manufacturing Water Demand			**1**	**1**	**1**	**1**	**1**	**1**	**1**

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr)						
			D2000	D2010	D2020	D2030	D2040	D2050	D2060
MINING	MILLS	BRAZOS	0	0	0	0	0	0	0
MINING	MILLS	COLORADO	0	0	0	0	0	0	0
Total Mining Water Demand			**0**	**0**	**0**	**0**	**0**	**0**	**0**
STEAM ELECTRIC POWER	MILLS	BRAZOS	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	MILLS	COLORADO	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**0**	**0**	**0**	**0**	**0**	**0**	**0**
MATAGORDA COUNTY TOTAL WATER DEMAND			**4,912**	**4,826**	**4,790**	**4,720**	**4,650**	**4,574**	**4,501**
COUNTY-OTHER	SAN SABA	COLORADO	219	227	240	252	264	262	265
RICHLAND SUD	SAN SABA	COLORADO	185	188	199	207	213	213	215
SAN SABA	SAN SABA	COLORADO	892	884	877	869	862	856	856
Total Municipal Water Demand			**1,296**	**1,299**	**1,316**	**1,328**	**1,339**	**1,331**	**1,336**
IRRIGATION	SAN SABA	COLORADO	3,349	3,240	3,136	3,035	2,937	2,841	2,749
LIVESTOCK	SAN SABA	COLORADO	1,191	1,191	1,191	1,191	1,191	1,191	1,191
MANUFACTURING	SAN SABA	COLORADO	24	28	30	31	32	33	35
MINING	SAN SABA	COLORADO	163	163	163	163	163	163	163
STEAM ELECTRIC POWER	SAN SABA	COLORADO	0	0	0	0	0	0	0
SAN SABA COUNTY TOTAL WATER DEMAND			**6,023**	**5,921**	**5,836**	**5,748**	**5,662**	**5,559**	**5,474**
ANDERSON MILL MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
AQUA WSC	TRAVIS	COLORADO	981	1,088	1,251	1,390	1,484	1,582	1,695
AUSTIN	TRAVIS	COLORADO	126,388	150,180	183,509	214,242	241,074	268,462	293,095
BARTON CREEK WEST WSC	TRAVIS	COLORADO	403	401	398	395	393	391	391
BEE CAVE VILLAGE	TRAVIS	COLORADO	343	493	694	880	995	1,118	1,245
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	183	254	350	439	494	552	614
CEDAR PARK	TRAVIS	COLORADO	112	188	290	384	443	506	570
COUNTY-OTHER	TRAVIS	COLORADO	8,627	6,560	5,396	4,454	3,296	2,308	2,391
COUNTY-OTHER	TRAVIS	GUADALUPE	1	1	1	1	1	1	1
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	531	612	717	820	884	951	1,030
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	14	16	19	21	23	25	27
ELGIN	TRAVIS	COLORADO	6	9	14	18	21	24	27
GOFORTH WSC	TRAVIS	COLORADO	24	30	39	47	52	58	63
HILL COUNTRY WSC	TRAVIS	COLORADO	145	238	364	484	555	633	714
JONESTOWN	TRAVIS	COLORADO	245	280	329	372	400	429	463
JONESTOWN WSC	TRAVIS	COLORADO	107	122	145	164	176	190	205
LAGO VISTA	TRAVIS	COLORADO	1,494	2,006	2,698	3,340	3,733	4,161	4,602
LAKEWAY	TRAVIS	COLORADO	2,653	3,529	4,716	5,796	6,467	7,199	7,953
LAKEWAY MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
LOOP 360 WSC	TRAVIS	COLORADO	795	1,228	1,225	1,221	1,218	1,218	1,218
LOST CREEK MUD	TRAVIS	COLORADO	951	935	921	906	891	882	882
MANOR	TRAVIS	COLORADO	266	285	312	336	351	369	388
MANVILLE WSC	TRAVIS	COLORADO	1,291	1,731	2,350	2,898	3,237	3,622	4,019
MUSTANG RIDGE	TRAVIS	COLORADO	80	93	111	128	139	150	162
MUSTANG RIDGE	TRAVIS	GUADALUPE	21	25	30	34	37	40	43
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	112	109	107	106	103	102	102
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	314	514	792	1,045	1,196	1,366	1,540
PFLUGERVILLE	TRAVIS	COLORADO	2,909	4,318	6,196	7,930	8,978	10,143	11,342
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	919	1,470	1,723	1,723	1,717	1,717	1,717
ROLLINGWOOD	TRAVIS	COLORADO	380	377	376	374	372	371	373
ROUND ROCK	TRAVIS	COLORADO	242	399	605	792	909	1,036	1,167
SHADY HOLLOW MUD	TRAVIS	COLORADO	763	747	731	716	700	694	694
THE HILLS	TRAVIS	COLORADO	371	567	733	733	729	729	729
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	2,037	2,856	3,944	4,966	5,584	6,271	6,979

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr) D2000	D2010	D2020	D2030	D2040	D2050	D2060
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	688	853	1,075	1,278	1,404	1,535	1,683
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	293	376	374	372	371	371	371
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	404	462	460	457	456	455	455
WELLS BRANCH MUD	TRAVIS	COLORADO	1,527	1,508	1,490	1,472	1,444	1,435	1,435
WEST LAKE HILLS	TRAVIS	COLORADO	1,435	1,605	1,833	2,049	2,178	2,320	2,471
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	537	782	1,114	1,420	1,605	1,811	2,023
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	144	198	274	344	385	433	482
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	1,415	2,157	2,222	2,201	2,180	2,180	2,180
Total Municipal Water Demand			**160,151**	**189,602**	**229,928**	**266,748**	**296,675**	**327,840**	**357,541**
IRRIGATION	TRAVIS	COLORADO	1,089	1,002	920	846	778	716	659
IRRIGATION	TRAVIS	GUADALUPE	135	124	114	105	97	89	82
Total Irrigation Water Demand			**1,224**	**1,126**	**1,034**	**951**	**875**	**805**	**741**
LIVESTOCK	TRAVIS	COLORADO	676	676	676	676	676	676	676
LIVESTOCK	TRAVIS	GUADALUPE	28	28	28	28	28	28	28
Total Livestock Water Demand			**704**	**704**	**704**	**704**	**704**	**704**	**704**
MANUFACTURING	TRAVIS	COLORADO	16,179	23,002	28,294	38,508	50,483	57,703	64,652
MANUFACTURING	TRAVIS	GUADALUPE	0	0	0	0	0	0	0
Total Manufacturing Water Demand			**16,179**	**23,002**	**28,294**	**38,508**	**50,483**	**57,703**	**64,652**
MINING	TRAVIS	COLORADO	1,285	1,531	1,649	1,727	1,804	1,880	1,935
MINING	TRAVIS	GUADALUPE	0	0	0	0	0	0	0
Total Mining Water Demand			**1,285**	**1,531**	**1,649**	**1,727**	**1,804**	**1,880**	**1,935**
STEAM ELECTRIC POWER	TRAVIS	COLORADO	7,494	17,500	18,500	22,500	23,500	27,500	28,500
STEAM ELECTRIC POWER	TRAVIS	GUADALUPE	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**7,494**	**17,500**	**18,500**	**22,500**	**23,500**	**27,500**	**28,500**
TRAVIS COUNTY TOTAL WATER DEMAND			**187,037**	**233,465**	**280,109**	**331,138**	**374,041**	**416,432**	**454,073**
COUNTY-OTHER	WHARTON	BRAZOS-COLORADO	1,315	1,338	1,373	1,378	1,360	1,346	1,332
COUNTY-OTHER	WHARTON	COLORADO	496	505	518	519	513	508	502
COUNTY-OTHER	WHARTON	COLORADO-LAVACA	265	270	277	278	274	272	269
WHARTON	WHARTON	BRAZOS-COLORADO	1,101	1,141	1,175	1,191	1,189	1,181	1,169
WHARTON	WHARTON	COLORADO	503	522	537	544	544	540	534
Total Municipal Water Demand			**3,680**	**3,776**	**3,880**	**3,910**	**3,880**	**3,847**	**3,806**
IRRIGATION	WHARTON	BRAZOS-COLORADO	104,210	99,711	96,144	92,703	89,390	86,193	74,059
IRRIGATION	WHARTON	COLORADO	54,108	51,772	49,921	48,135	46,413	44,753	38,454
IRRIGATION	WHARTON	COLORADO-LAVACA	32,923	31,502	30,376	29,289	28,241	27,231	23,398
Total Irrigation Water Demand			**191,241**	**182,985**	**176,441**	**170,127**	**164,044**	**158,177**	**135,911**
LIVESTOCK	WHARTON	BRAZOS-COLORADO	321	321	321	321	321	321	321
LIVESTOCK	WHARTON	COLORADO	247	247	247	247	247	247	247
LIVESTOCK	WHARTON	COLORADO-LAVACA	160	160	160	160	160	160	160
Total Livestock Water Demand			**728**	**728**	**728**	**728**	**728**	**728**	**728**
MANUFACTURING	WHARTON	BRAZOS-COLORADO	51	62	68	73	78	82	88
MANUFACTURING	WHARTON	COLORADO	105	129	141	150	160	168	181
MANUFACTURING	WHARTON	COLORADO-LAVACA	100	122	134	143	152	160	173
Total Manufacturing Water Demand			**256**	**313**	**343**	**366**	**390**	**410**	**442**
MINING	WHARTON	BRAZOS-COLORADO	627	724	766	791	815	836	856
MINING	WHARTON	COLORADO	1	1	1	1	1	1	1
MINING	WHARTON	COLORADO-LAVACA	5	6	6	6	6	7	7
Total Mining Water Demand			**633**	**731**	**773**	**798**	**822**	**844**	**864**
STEAM ELECTRIC POWER	WHARTON	BRAZOS-COLORADO	0	0	0	0	0	0	0
STEAM ELECTRIC POWER	WHARTON	COLORADO	10	245	351	411	483	572	679
STEAM ELECTRIC POWER	WHARTON	COLORADO-LAVACA	0	0	0	0	0	0	0
Total Steam Electric Power Water Demand			**10**	**245**	**351**	**411**	**483**	**572**	**679**
WHARTON COUNTY TOTAL WATER DEMAND			**196,548**	**188,778**	**182,516**	**176,340**	**170,347**	**164,578**	**142,430**

Region K Water Demand Projections by Water User Group

WUG Name	County	River Basin	Water Demand (ac-ft/yr) D2000	D2010	D2020	D2030	D2040	D2050	D2060
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	1,504	1,464	1,434	1,405	1,375	1,355	1,355
AUSTIN	WILLIAMSON	BRAZOS	2,315	3,993	5,964	8,286	10,786	13,479	16,338
COUNTY-OTHER	WILLIAMSON	BRAZOS	2,123	2,401	2,729	3,118	3,536	3,989	4,469
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	1,007	983	968	952	928	920	920
Total Municipal Water Demand			**6,949**	**8,841**	**11,095**	**13,761**	**16,625**	**19,743**	**23,082**
IRRIGATION	WILLIAMSON	BRAZOS	0	0	0	0	0	0	0
LIVESTOCK	WILLIAMSON	BRAZOS	0	0	0	0	0	0	0
MANUFACTURING	WILLIAMSON	BRAZOS	0	0	0	0	0	0	0
MINING	WILLIAMSON	BRAZOS	13	9	5	1	0	0	0
STEAM ELECTRIC POWER	WILLIAMSON	BRAZOS	0	0	0	0	0	0	0
WILLIAMSON COUNTY TOTAL WATER DEMAND			**6,962**	**8,850**	**11,100**	**13,762**	**16,625**	**19,743**	**23,082**
REGION K TOTAL WATER DEMAND			**1,004,335**	**1,078,041**	**1,118,464**	**1,194,008**	**1,237,515**	**1,276,600**	**1,301,682**

Region K Water Demand Totals:

Municipal	213,303	252,637	304,735	352,737	394,101	439,049	484,170
Irrigation	620,930	589,705	567,272	545,634	524,809	504,695	468,763
Livestock	13,395	13,395	13,395	13,395	13,395	13,395	13,395
Manufacturing	28,887	38,162	44,916	56,233	69,264	77,374	85,698
Mining	23,945	30,620	31,252	31,613	26,964	27,304	27,598
Steam Electric Power	103,875	153,522	156,894	194,396	208,982	214,783	222,058

APPENDIX 2B

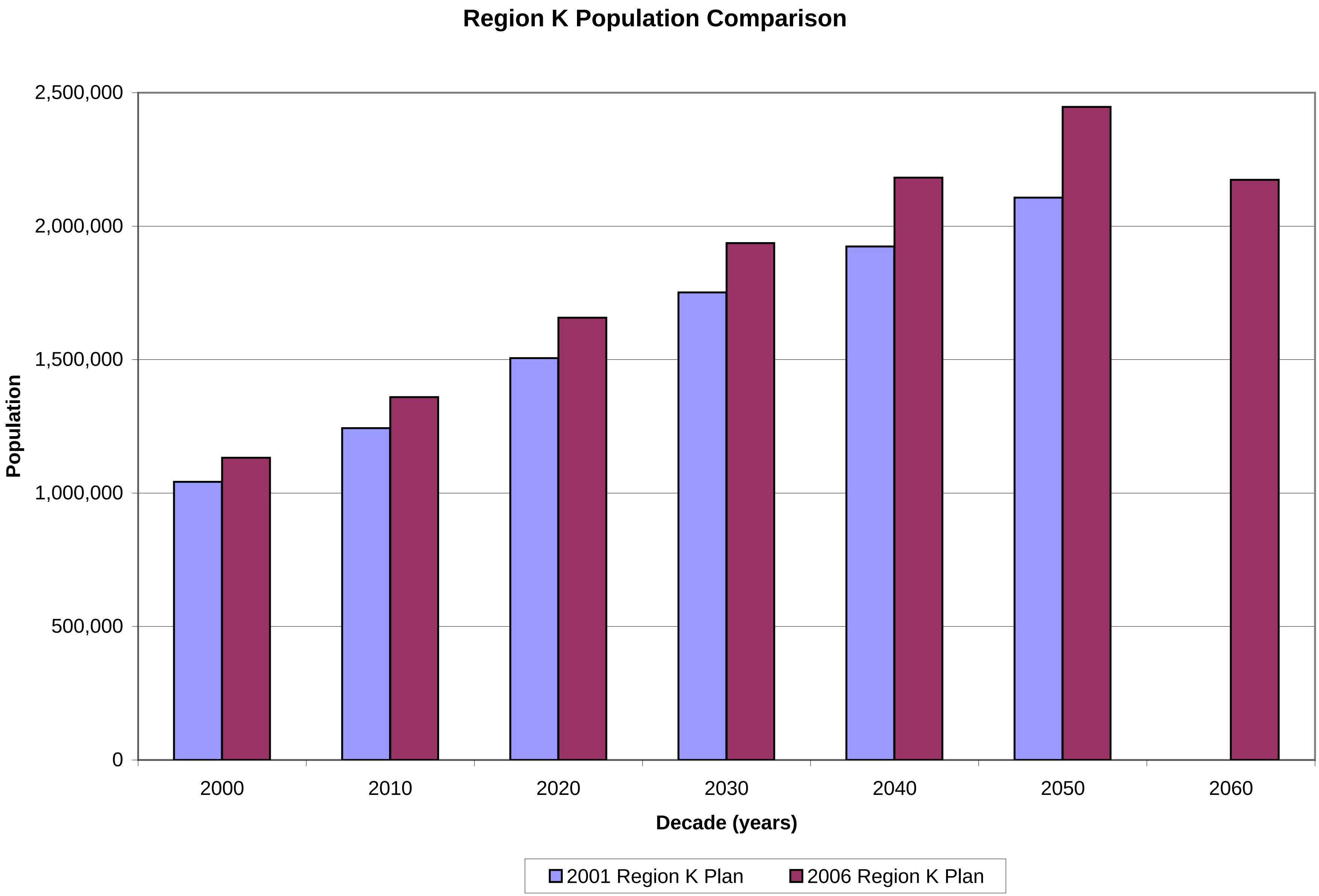
LCRWPG POPULATION AND WATER DEMAND COMPARISONS
(2001 Plan versus 2006 Plan)

Population

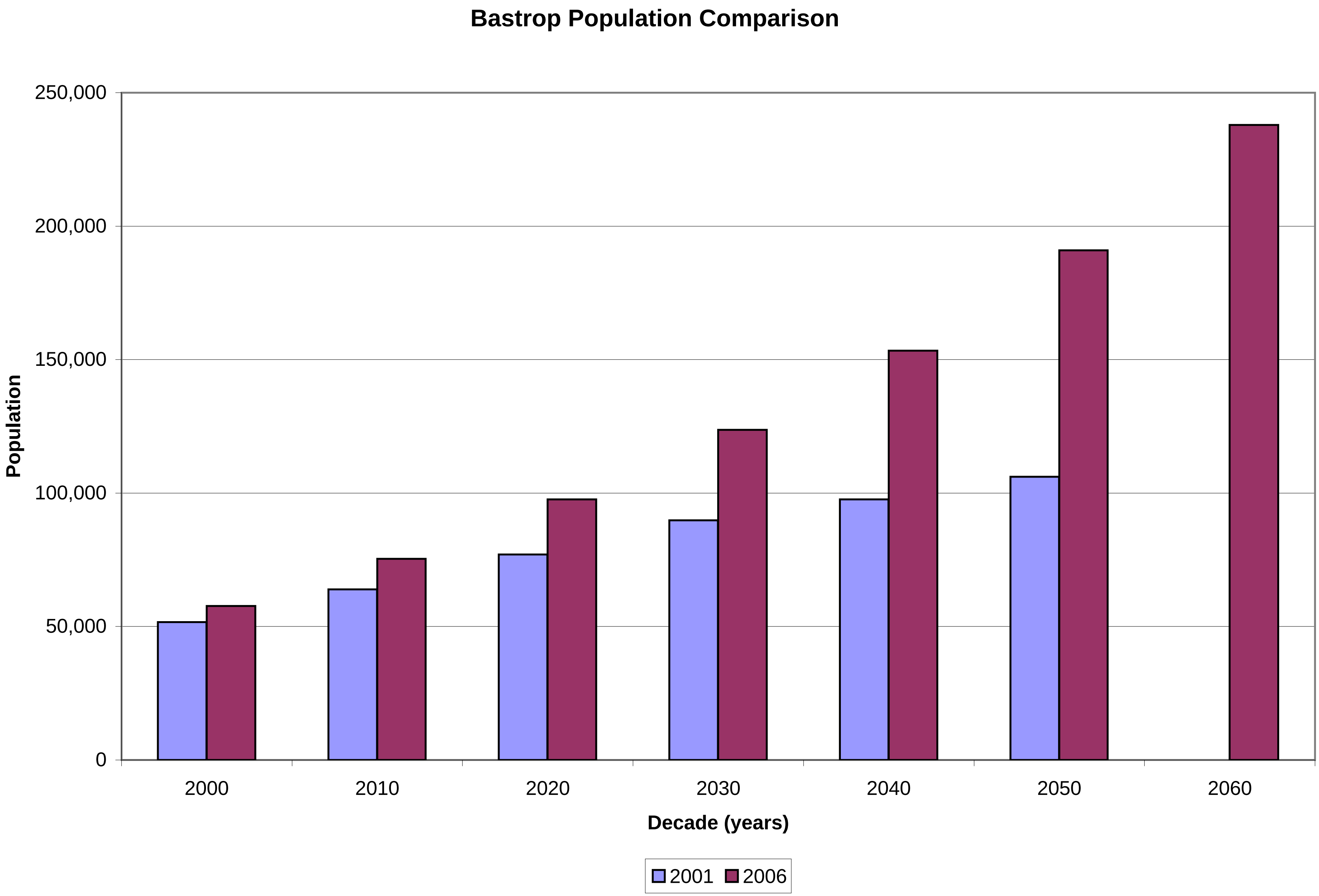
RWP	2000	2010	2020	2030	2040	2050	2060
Region K							
2001	1,041,948	1,243,247	1,505,722	1,751,931	1,923,941	2,107,106	NA
2006	1,132,228	1,359,677	1,657,025	1,936,324	2,181,851	2,447,058	2,173,905
Difference	90,280	116,430	151,303	184,393	257,910	339,952	NA
% Change	8.7	9.4	10.0	10.5	13.4	16.1	NA
Bastrop							
2001	51,627	63,901	77,030	89,779	97,624	106,153	NA
2006	57,733	75,386	97,601	123,734	153,392	190,949	237,958
Difference	6,106	11,485	20,571	33,955	55,768	84,796	NA
% Change	11.8	18.0	26.7	37.8	57.1	79.9	NA
Blanco							
2001	8,253	9,874	11,644	12,964	13,688	13,799	NA
2006	8,418	9,946	11,756	13,487	15,002	16,641	18,544
Difference	165	72	112	523	1,314	2,842	NA
% Change	2.0	0.7	1.0	4.0	9.6	20.6	NA
Burnet							
2001	33,874	40,994	48,782	55,228	57,511	59,891	NA
2006	34,147	41,924	51,044	60,382	69,271	78,981	90,263
Difference	273	930	2,262	5,154	11,760	19,090	NA
% Change	0.8	2.3	4.6	9.3	20.4	31.9	NA
Colorado							
2001	20,462	21,496	22,972	23,664	24,481	25,094	NA
2006	20,390	21,101	22,032	22,550	22,760	22,801	22,561
Difference	-72	-395	-940	-1,114	-1,721	-2,293	NA
% Change	-0.4	-1.8	-4.1	-4.7	-7.0	-9.1	NA
Fayette							
2001	22,964	25,600	29,127	32,647	36,352	40,994	NA
2006	21,804	24,826	28,808	32,363	35,259	38,933	44,120
Difference	-1,160	-774	-319	-284	-1,093	-2,061	NA
% Change	-5.1	-3.0	-1.1	-0.9	-3.0	-5.0	NA
Gillespie							
2001	21,710	23,820	26,644	28,435	32,841	36,006	NA
2006	20,814	24,089	27,510	28,845	28,845	28,845	28,845
Difference	-896	269	866	410	-3,996	-7,161	NA
% Change	-4.1	1.1	3.3	1.4	-12.2	-19.9	NA
Hays							
2001	22,111	33,448	42,429	53,138	65,106	73,578	NA
2006	25,090	46,143	69,377	88,887	108,495	132,051	150,574
Difference	2,979	12,695	26,948	35,749	43,389	58,473	NA
% Change	13.5	38.0	63.5	67.3	66.6	79.5	NA

Population

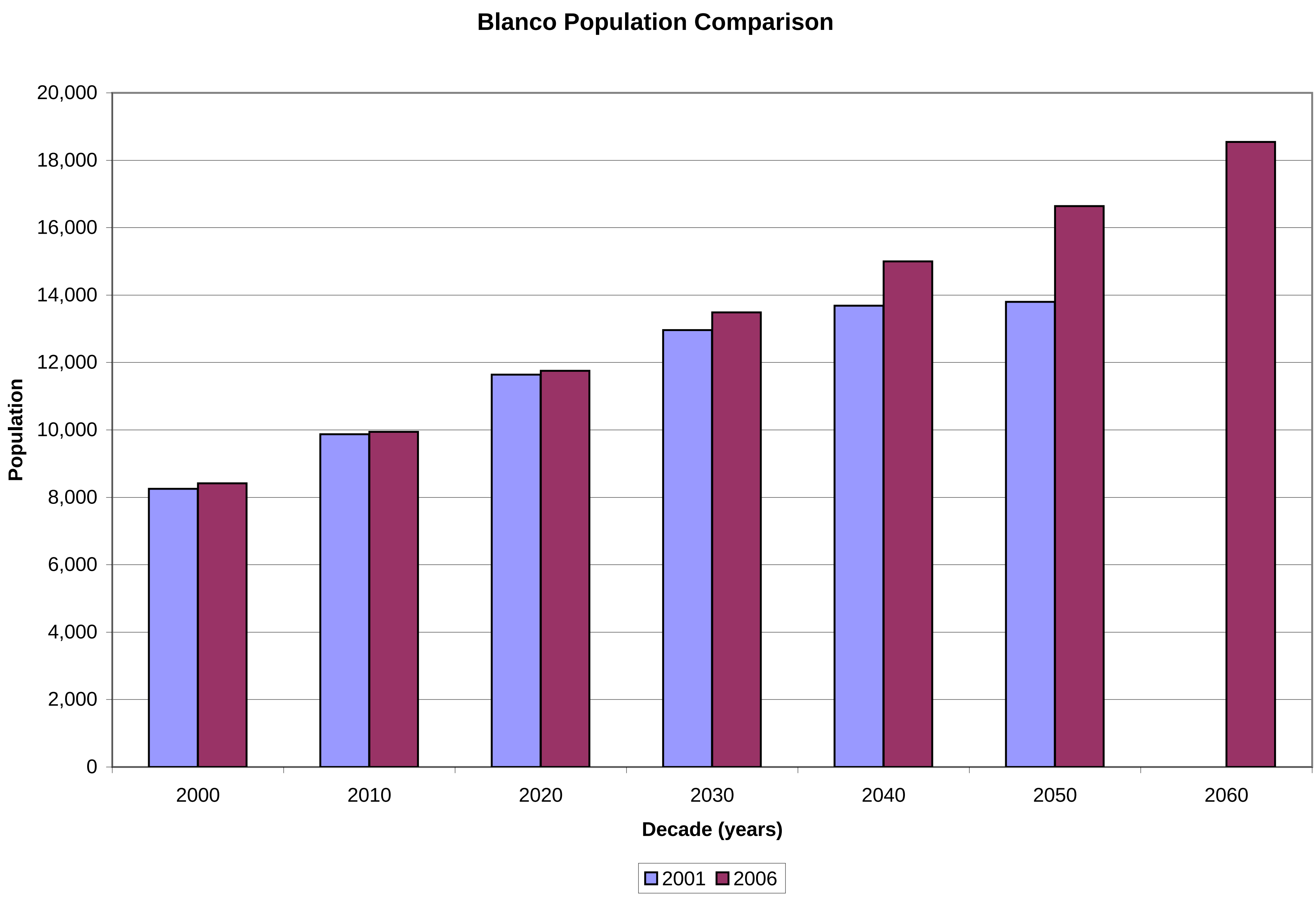
RWP	2000	2010	2020	2030	2040	2050	2060
Llano							
2001	13,685	14,207	15,474	15,770	16,368	17,865	NA
2006	17,044	17,360	17,360	17,360	17,360	17,360	17,360
Difference	3,359	3,153	1,886	1,590	992	-505	NA
% Change	24.5	22.2	12.2	10.1	6.1	-2.8	NA
Matagorda							
2001	41,146	45,947	51,165	57,008	63,405	71,119	NA
2006	37,957	40,506	43,295	44,991	45,925	45,793	45,377
Difference	-3,189	-5,441	-7,870	-12,017	-17,480	-25,326	NA
% Change	-7.8	-11.8	-15.4	-21.1	-27.6	-35.6	NA
Mills							
2001	5,575	5,708	5,898	6,021	6,074	6,129	NA
2006	5,151	5,137	5,414	5,476	5,537	5,497	5,397
Difference	-424	-571	-484	-545	-537	-632	NA
% Change	-7.6	-10.0	-8.2	-9.1	-8.8	-10.3	NA
San Saba							
2001	5,802	5,802	5,802	5,802	5,802	5,802	NA
2006	6,186	6,387	6,746	7,059	7,332	7,365	7,409
Difference	384	585	944	1,257	1,530	1,563	NA
% Change	6.6	10.1	16.3	21.7	26.4	26.9	NA
Travis							
2001	744,080	892,047	1,096,329	1,288,441	1,413,420	1,550,521	NA
2006	812,280	969,955	1,185,499	1,385,236	1,550,538	1,722,737	1,888,543
Difference	68,200	77,908	89,170	96,795	137,118	172,216	NA
% Change	9.2	8.7	8.1	7.5	9.7	11.1	NA
Wharton							
2001	29,130	31,918	34,687	37,655	40,652	43,969	NA
2006	26,721	28,260	29,872	30,911	31,508	31,523	31,188
Difference	-2,409	-3,658	-4,815	-6,744	-9,144	-12,446	NA
% Change	-8.3	-11.5	-13.9	-17.9	-22.5	-28.3	NA
Williamson							
2001	21,529	28,485	37,739	45,379	50,617	56,186	NA
2006	38,493	48,657	60,711	75,043	90,627	107,582	125,766
Difference	16,964	20,172	22,972	29,664	40,010	51,396	NA
% Change	78.8	70.8	60.9	65.4	79.0	91.5	NA



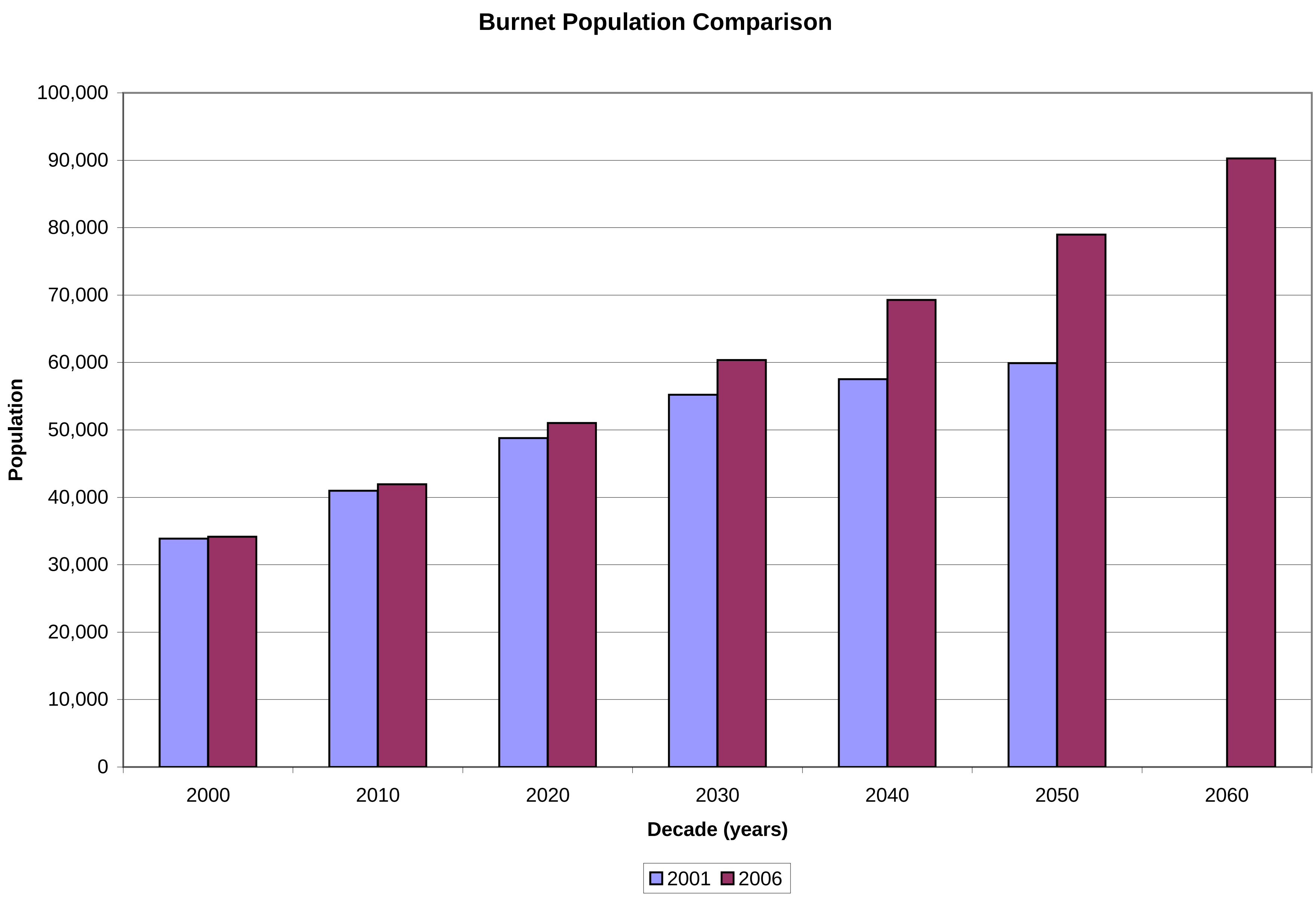
Region K Population Comparison
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001 Region K Plan
2006 Region K Plan

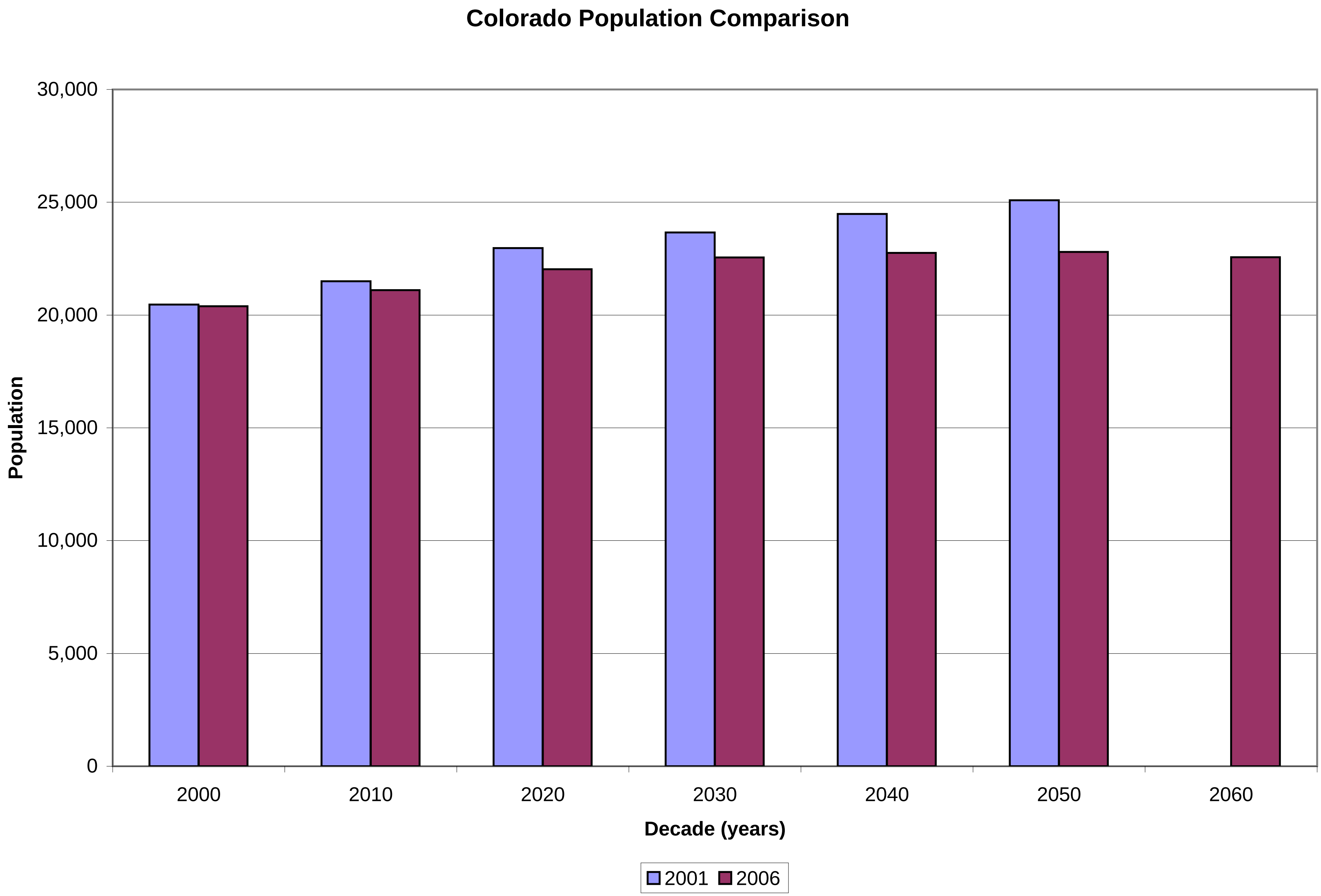


Bastrop Population Comparison
250,000
200,000
150,000
100,000
50,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

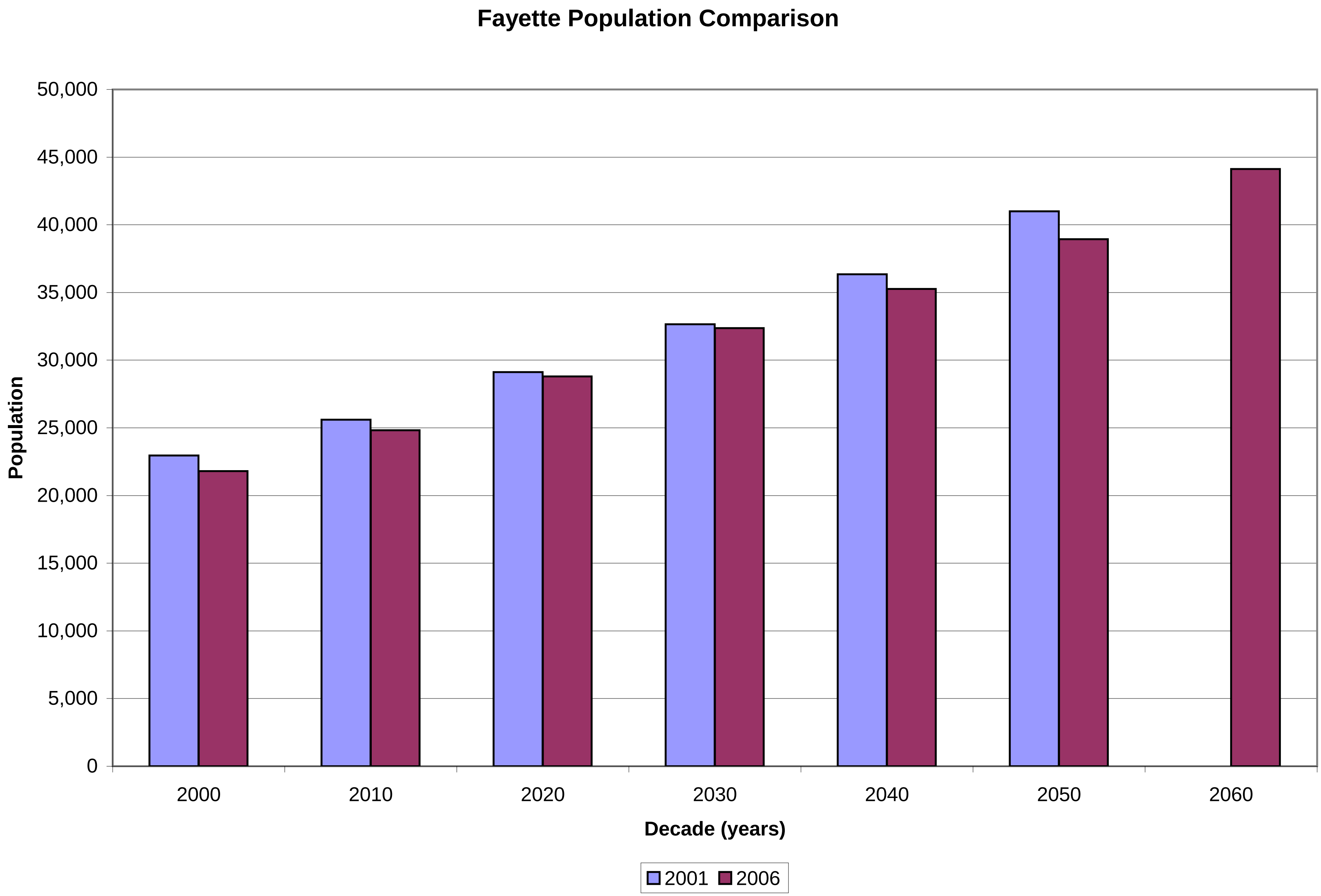


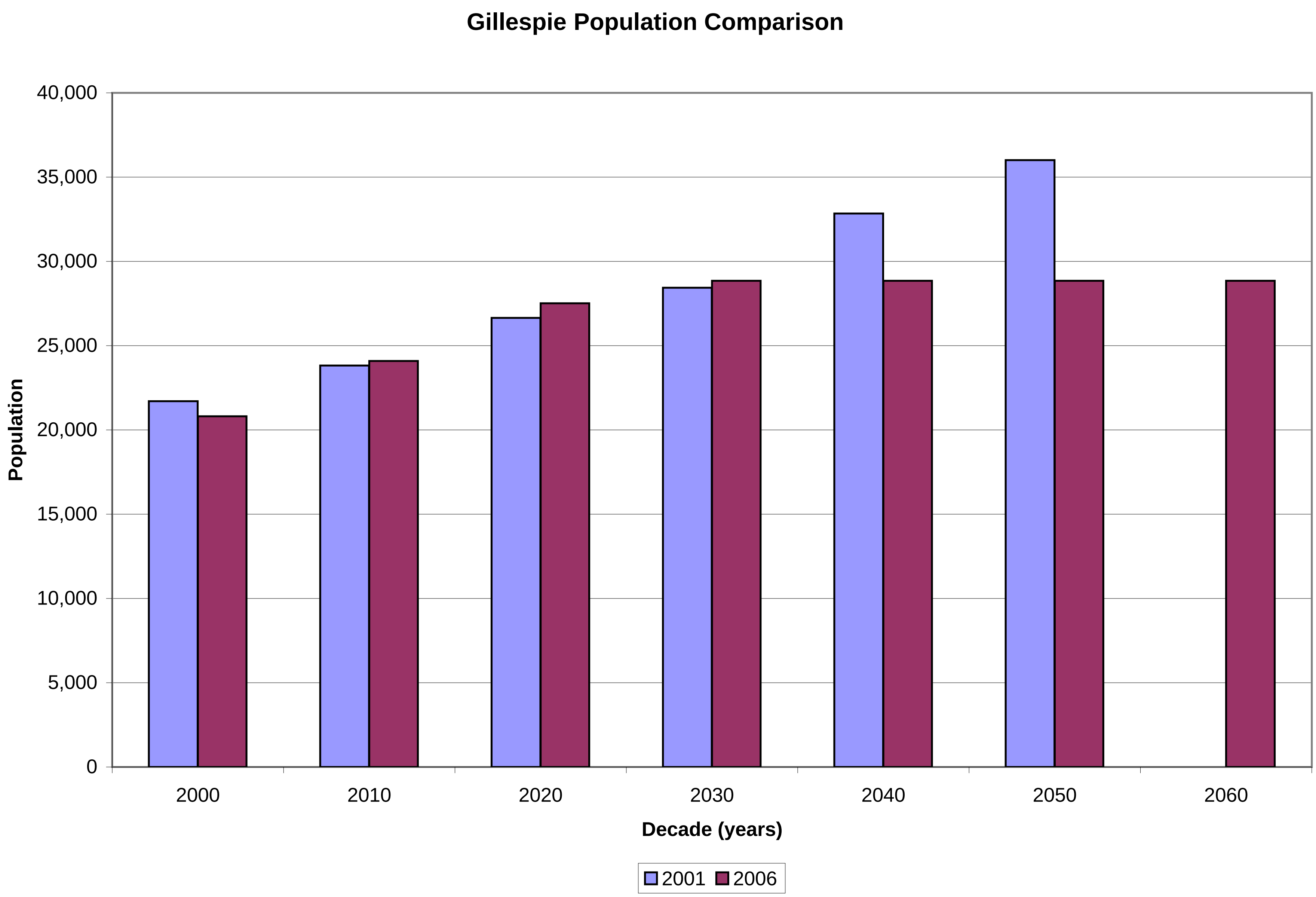
Blanco Population Comparison
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006


Burnet Population Comparison
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

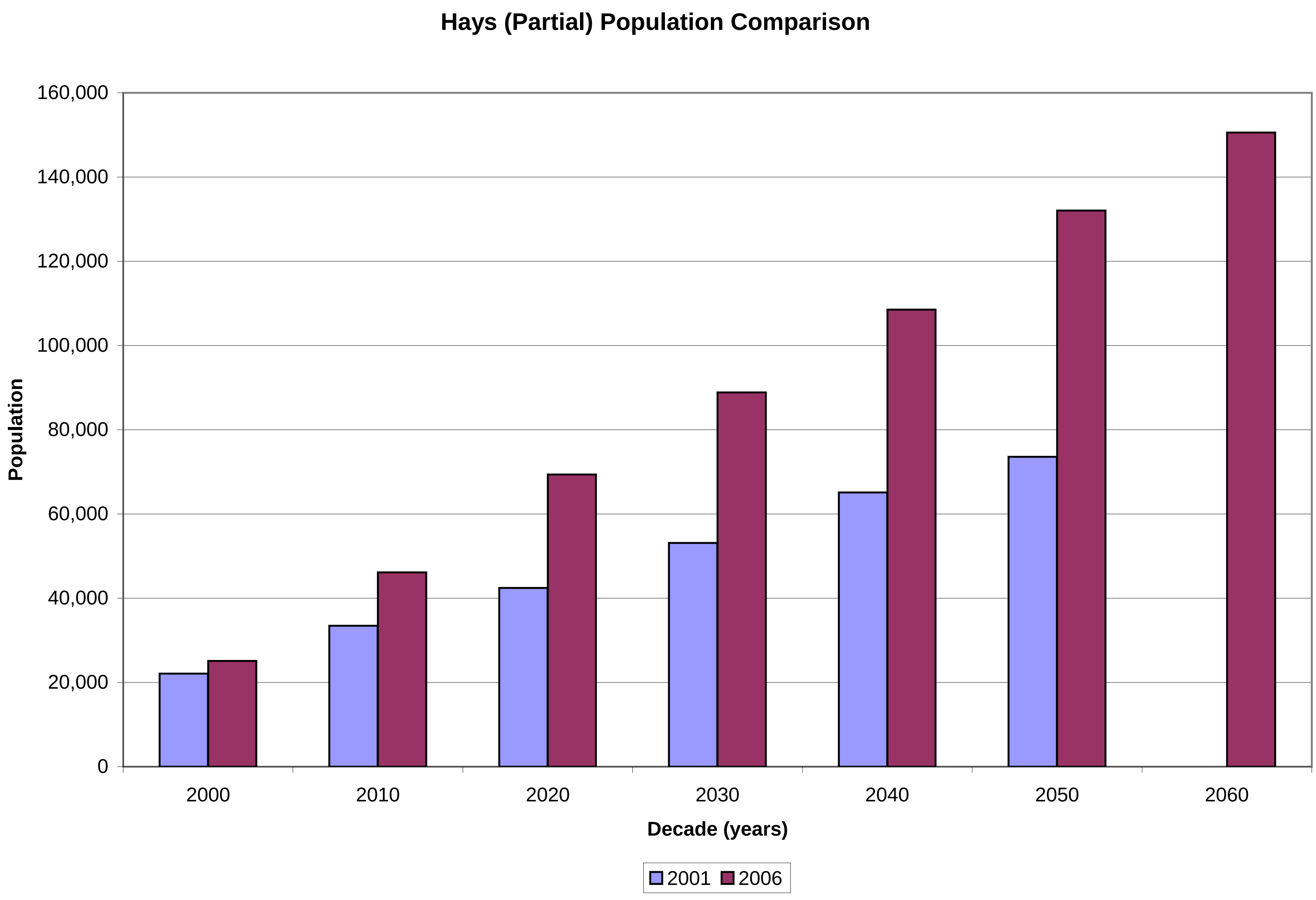


Colorado Population Comparison
30,000
25,000
20,000
15,000
10,000
5,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

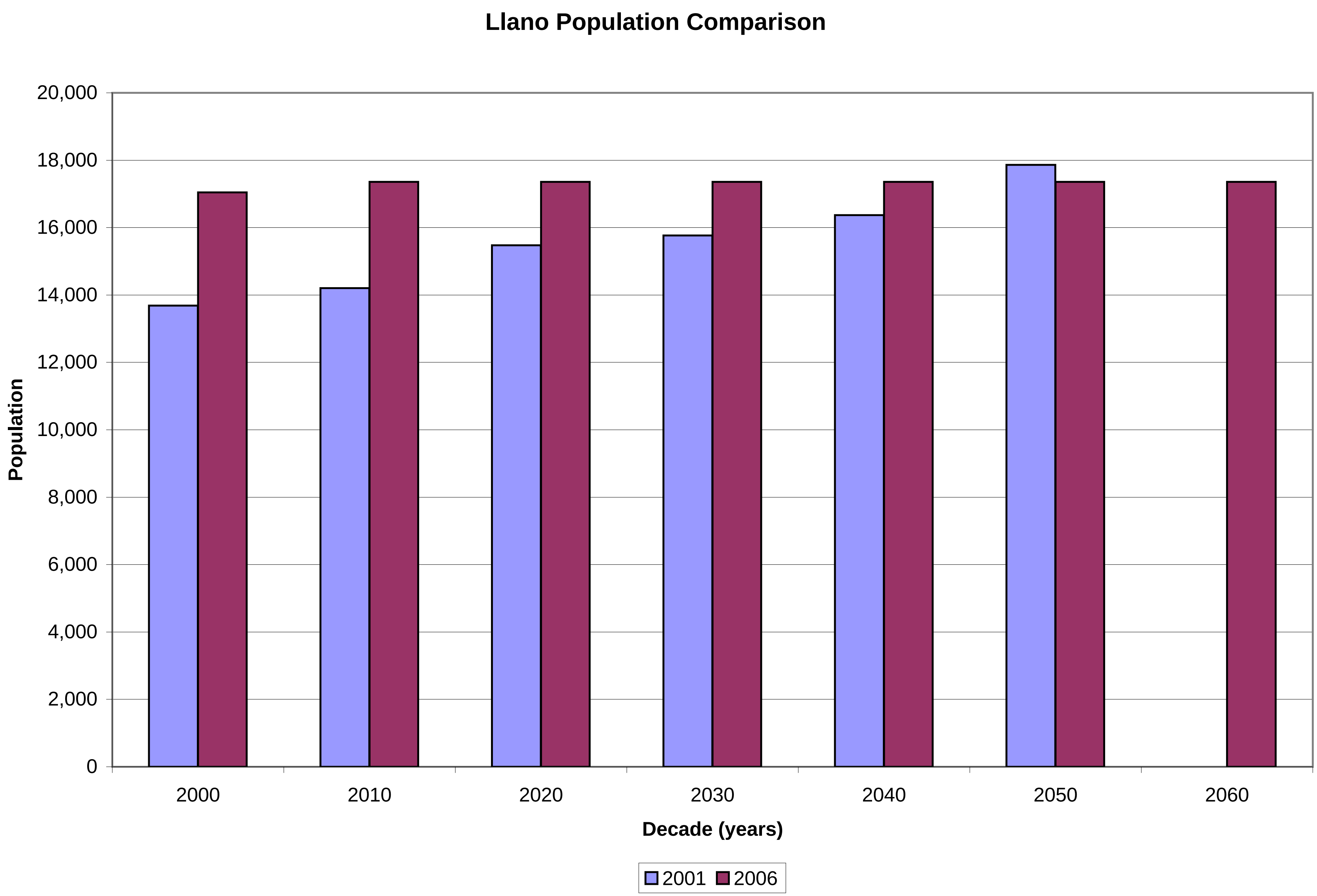

Fayette Population Comparison
Population
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006



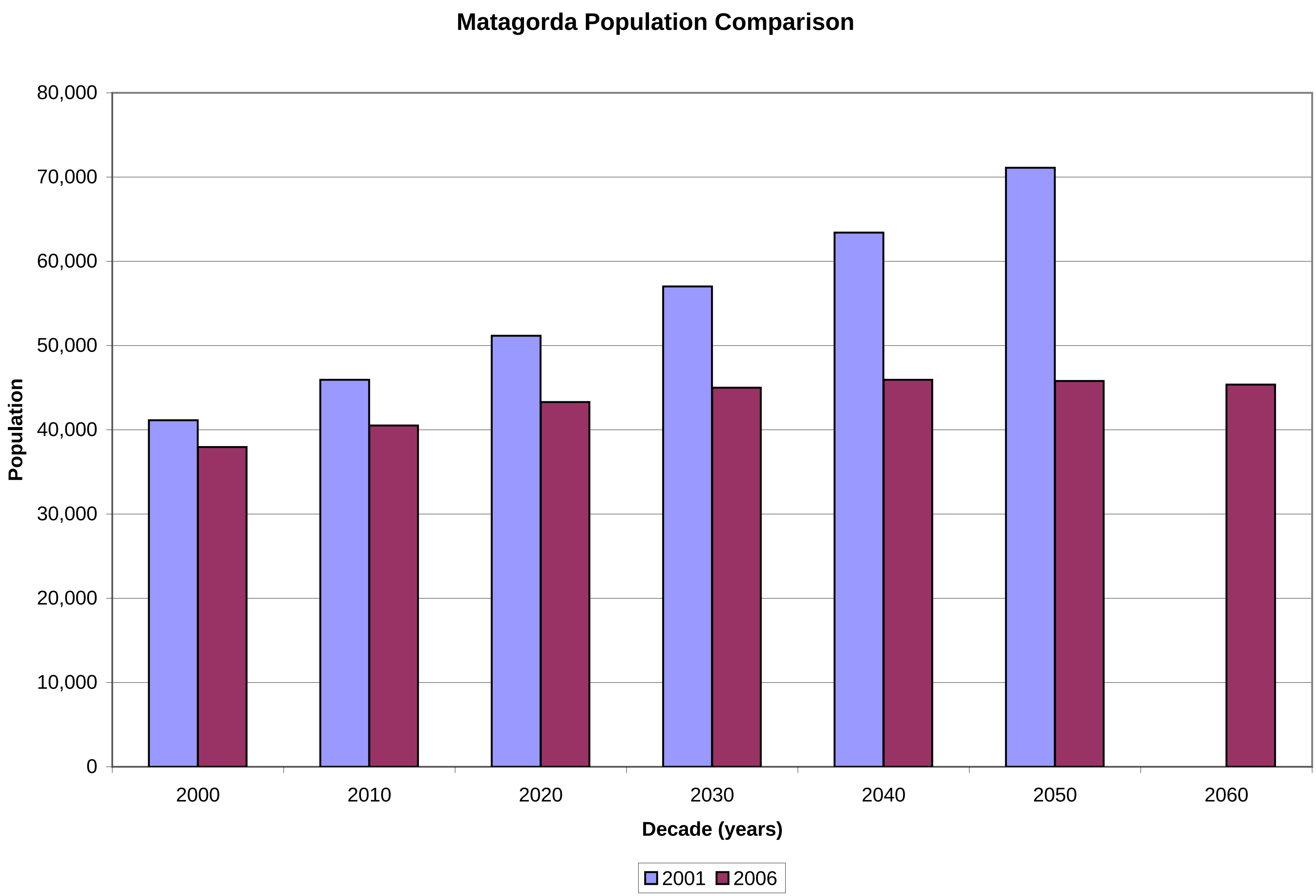
Gillespie Population Comparison
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

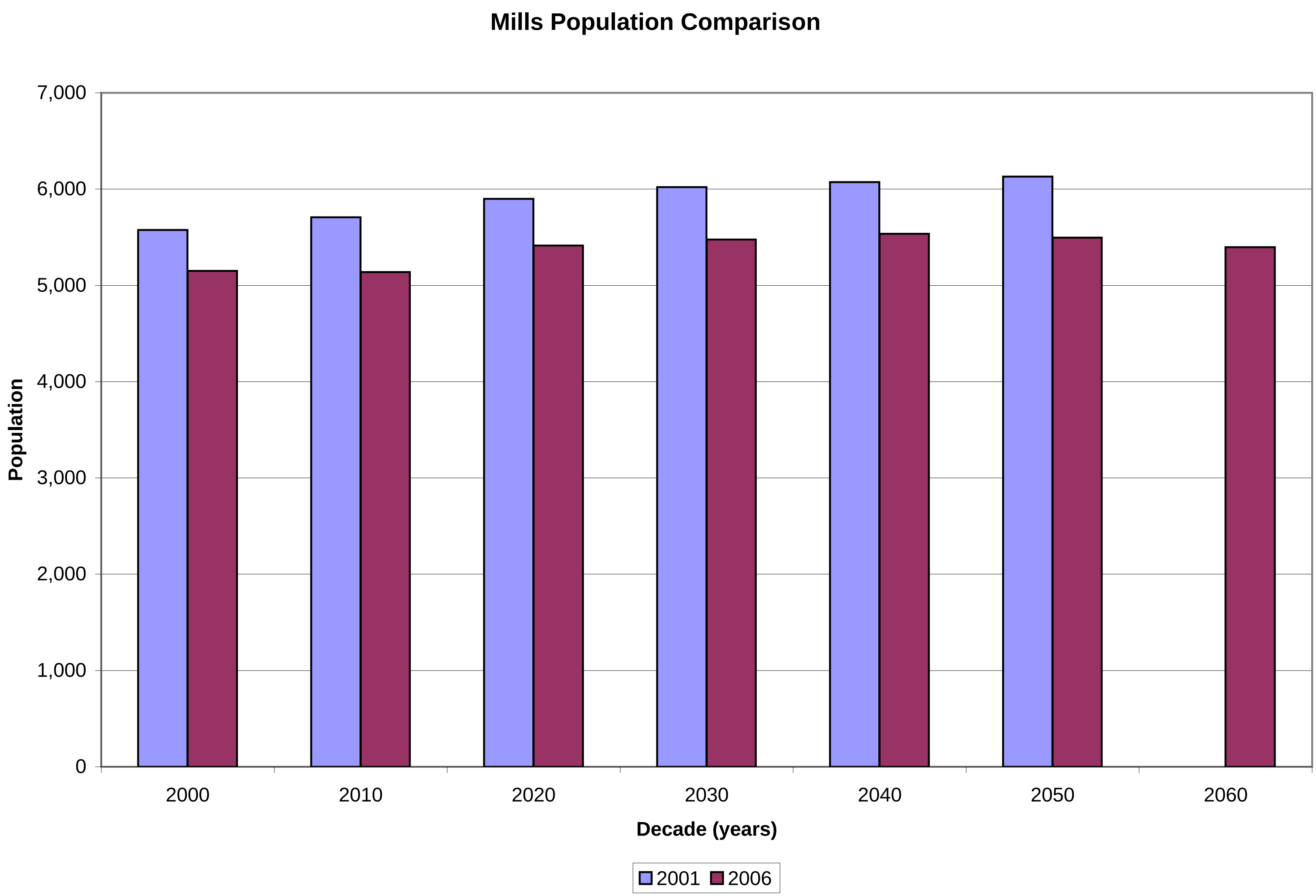


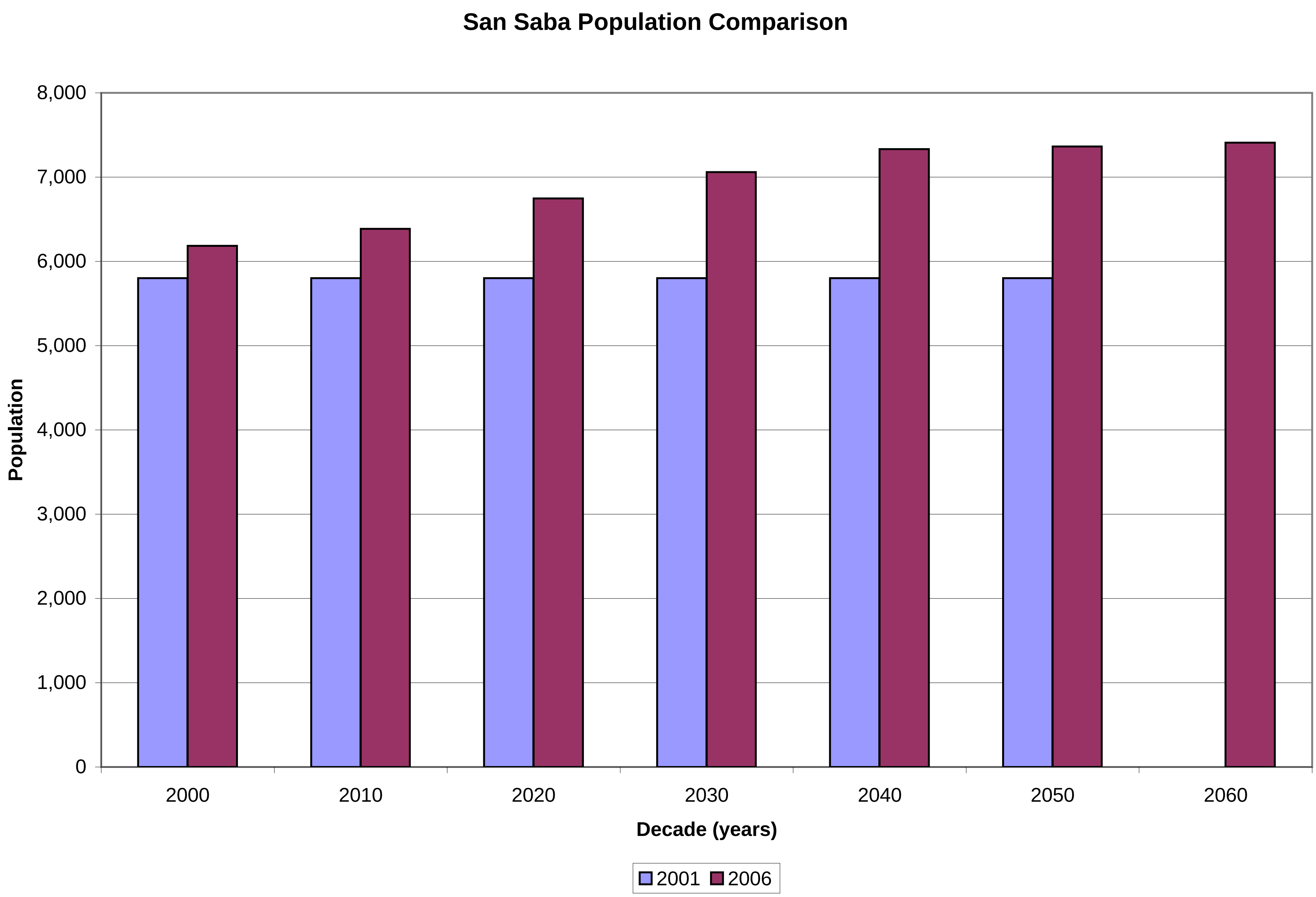
Hays (Partial) Population Comparison
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006



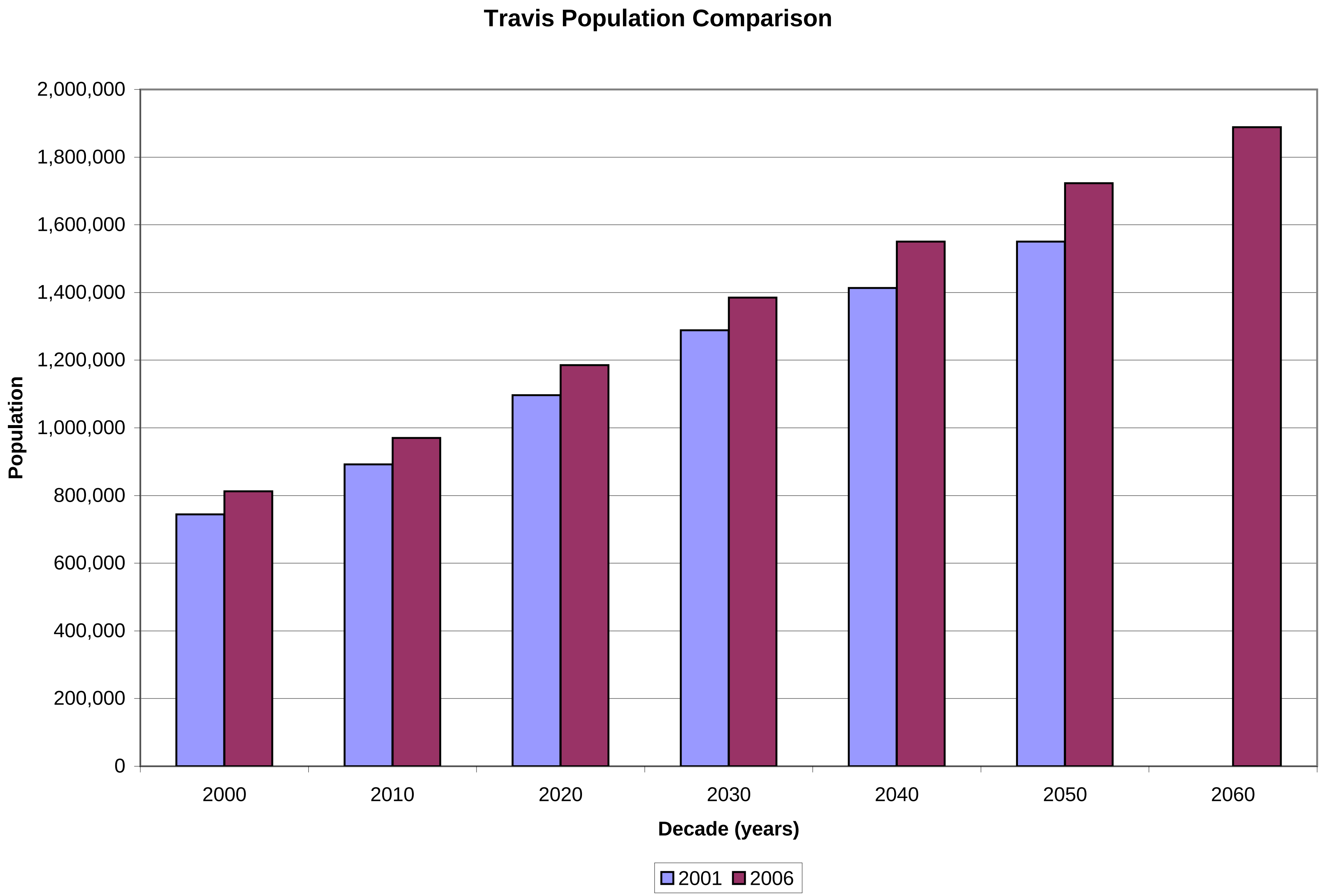
Llano Population Comparison
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

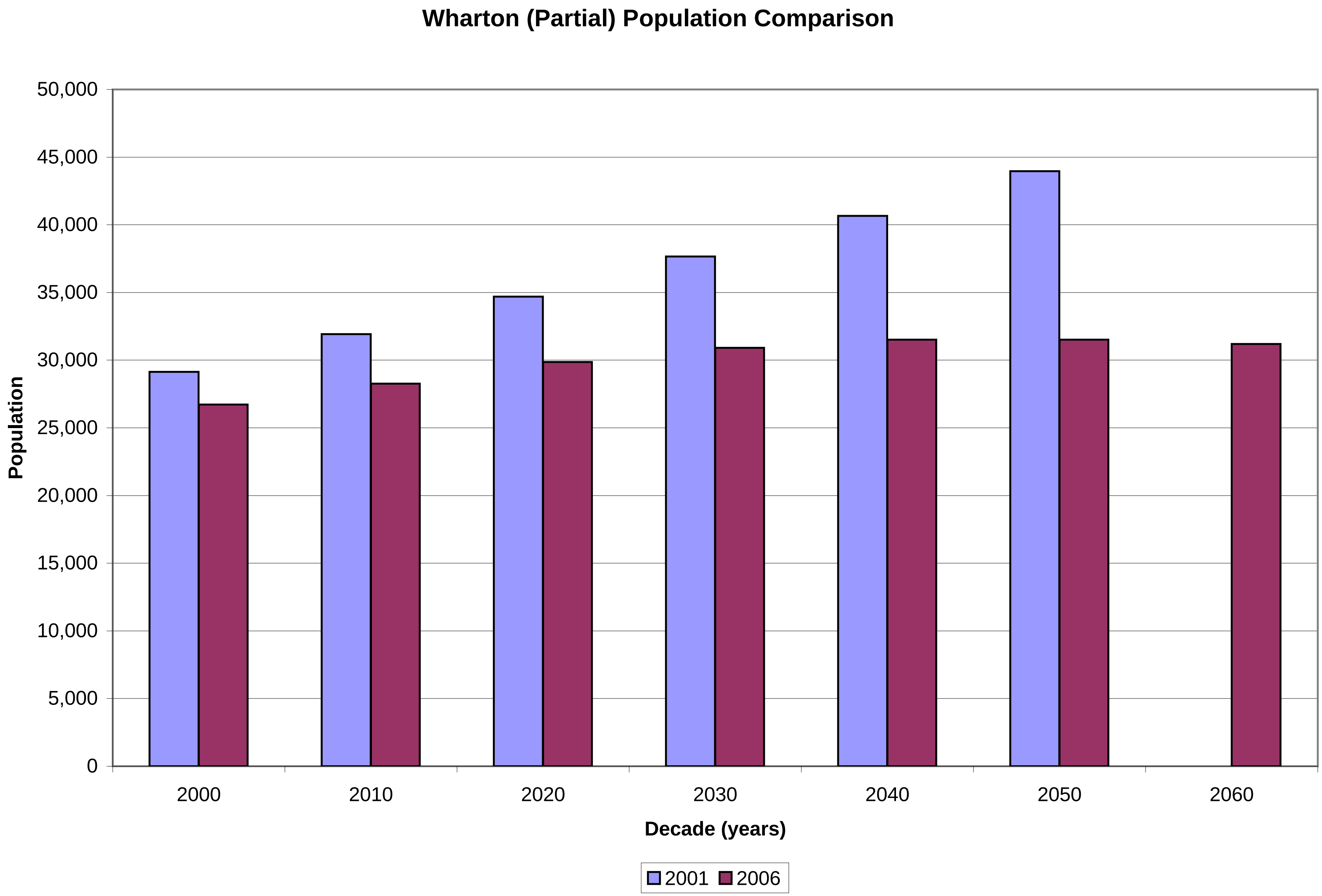

Matagorda Population Comparison
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

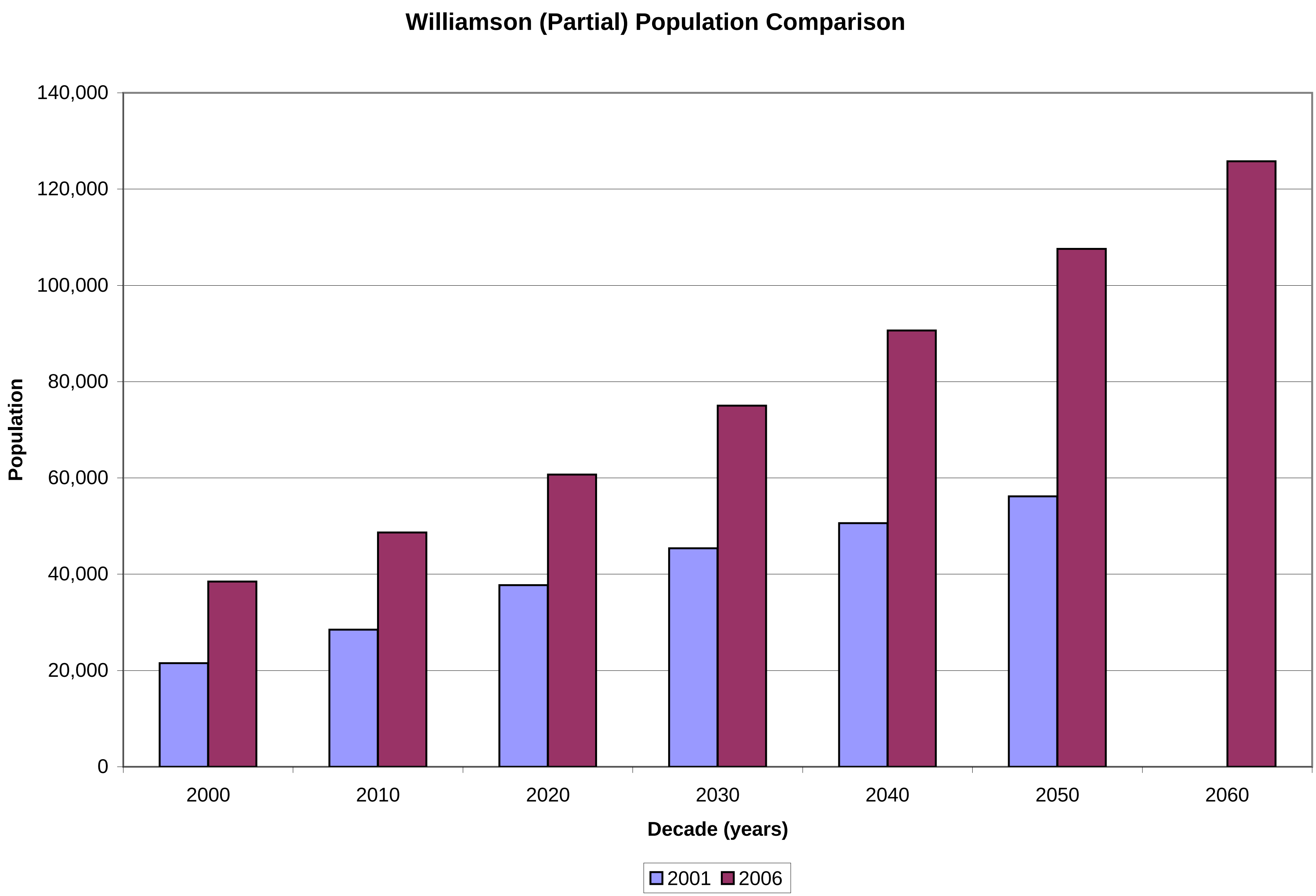

Mills Population Comparison
Population
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006



San Saba Population Comparison
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006


Travis Population Comparison
Population
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006


Wharton (Partial) Population Comparison
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

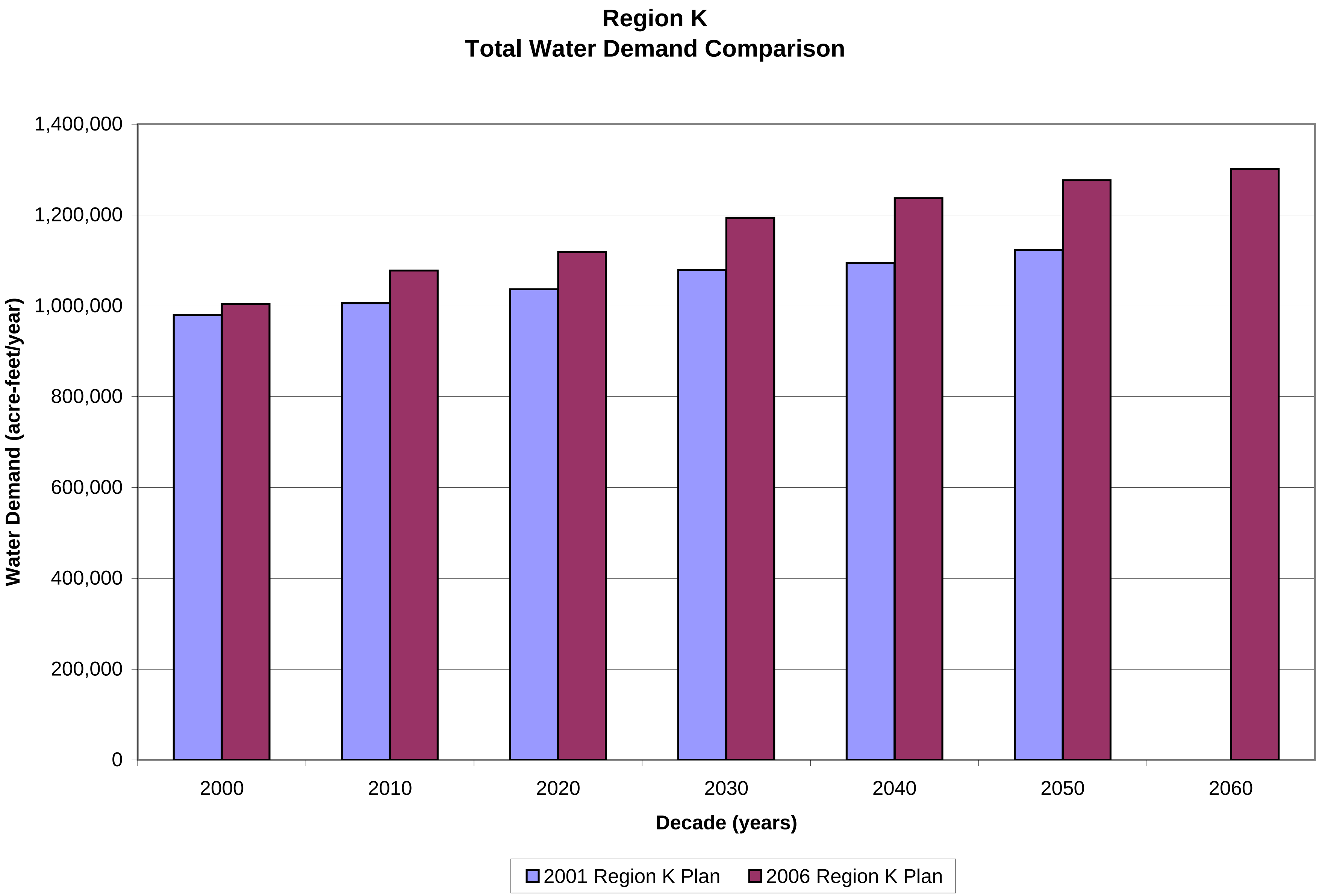

Williamson (Partial) Population Comparison
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Population
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

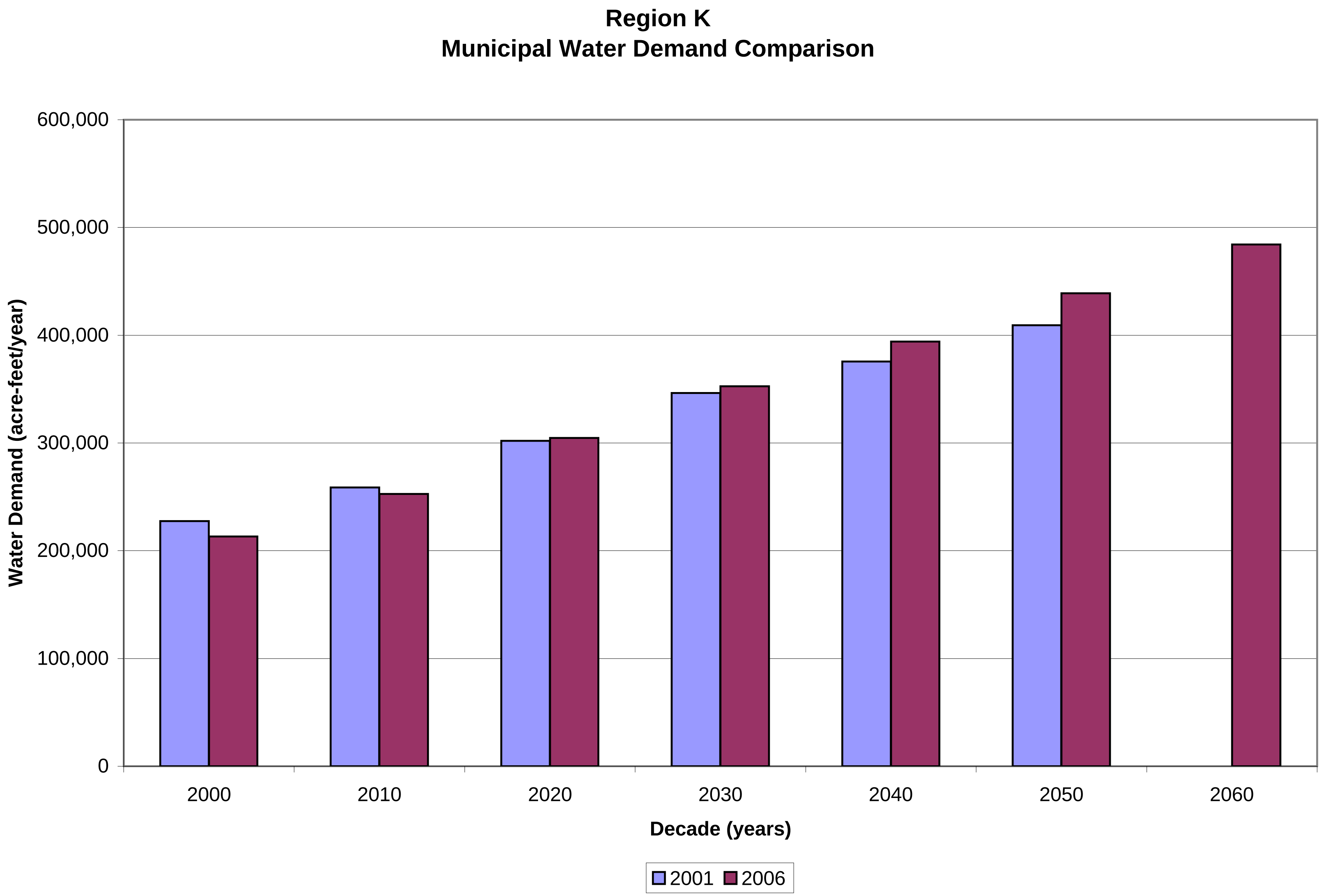
Water Demands* (in acre-feet per year) by WUG Category
Region K

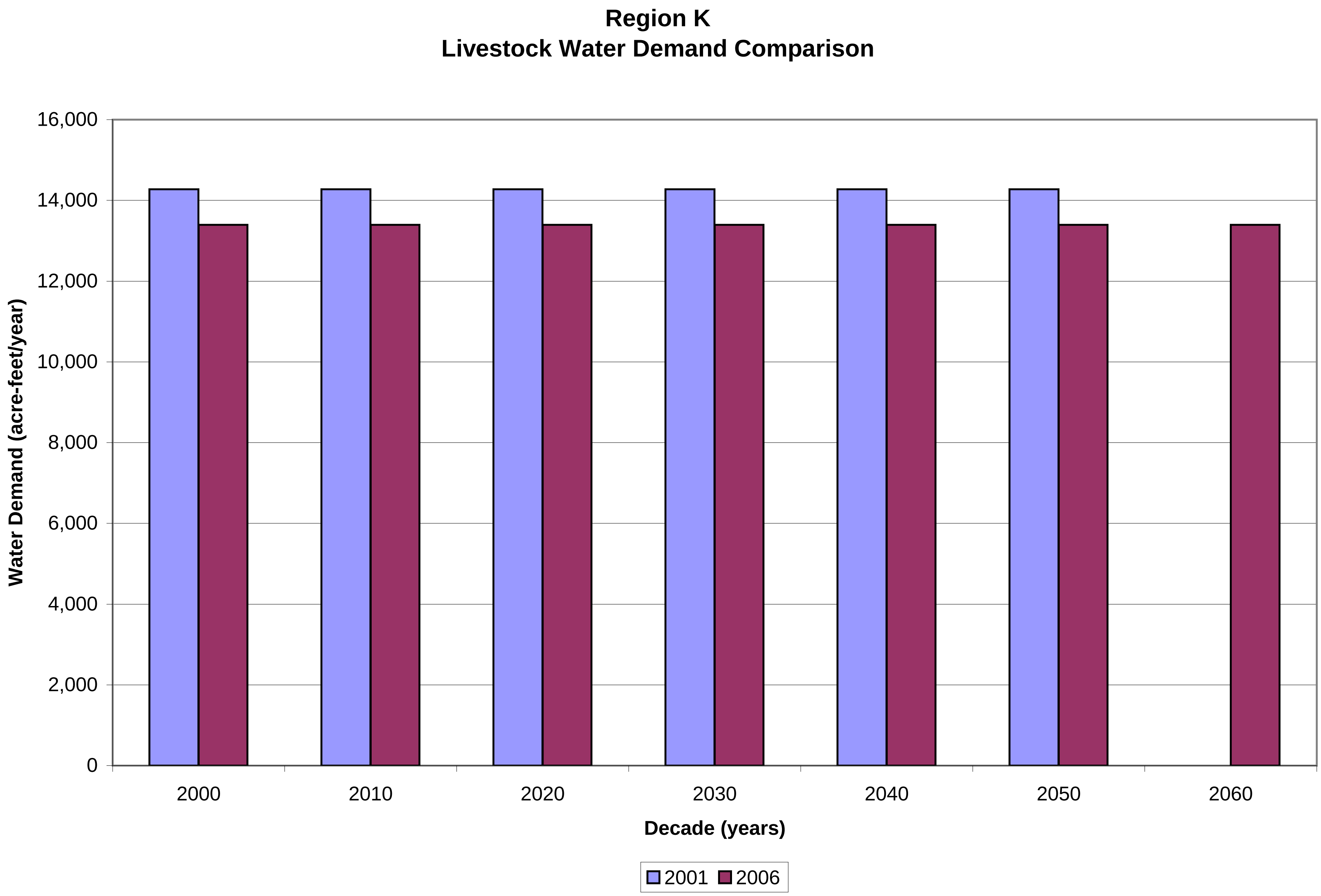
RWP	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Municipal							
2001	227,616	258,794	302,075	346,430	375,510	409,297	NA
2006	213,303	252,637	304,735	352,737	394,101	439,049	484,170
Difference	-14,313	-6,157	2,660	6,307	18,591	29,752	NA
% Change	-6.3	-2.4	0.9	1.8	5.0	7.3	NA
Livestock							
2001	14,275	14,275	14,275	14,275	14,275	14,275	NA
2006	13,395	13,395	13,395	13,395	13,395	13,395	13,395
Difference	-880	-880	-880	-880	-880	-880	NA
% Change	-6.2	-6.2	-6.2	-6.2	-6.2	-6.2	NA
Irrigation							
2001	588,635	559,238	538,196	517,895	498,331	479,453	NA
2006	620,930	589,705	567,272	545,634	524,809	504,695	468,763
Difference	32,295	30,467	29,076	27,739	26,478	25,242	NA
% Change	5.5	5.4	5.4	5.4	5.3	5.3	NA
Manufacturing							
2001	33,833	55,841	57,903	60,165	63,185	66,962	NA
2006	28,887	38,162	44,916	56,233	69,264	77,374	85,698
Difference	-4,946	-17,679	-12,987	-3,932	6,079	10,412	NA
% Change	-14.6	-31.7	-22.4	-6.5	9.6	15.5	NA
Mining							
2001	34,554	26,879	28,353	30,072	32,229	34,820	NA
2006	23,945	30,620	31,252	31,613	26,964	27,304	27,598
Difference	-10,609	3,741	2,899	1,541	-5,265	-7,516	NA
% Change	-30.7	13.9	10.2	5.1	-16.3	-21.6	NA
Steam-Electric Power Generation							
2001	81,000	90,500	95,500	110,500	110,500	118,500	NA
2006	103,875	153,522	156,894	194,396	208,982	214,783	222,058
Difference	22,875	63,022	61,394	83,896	98,482	96,283	NA
% Change	28.2	69.6	64.3	75.9	89.1	81.3	NA

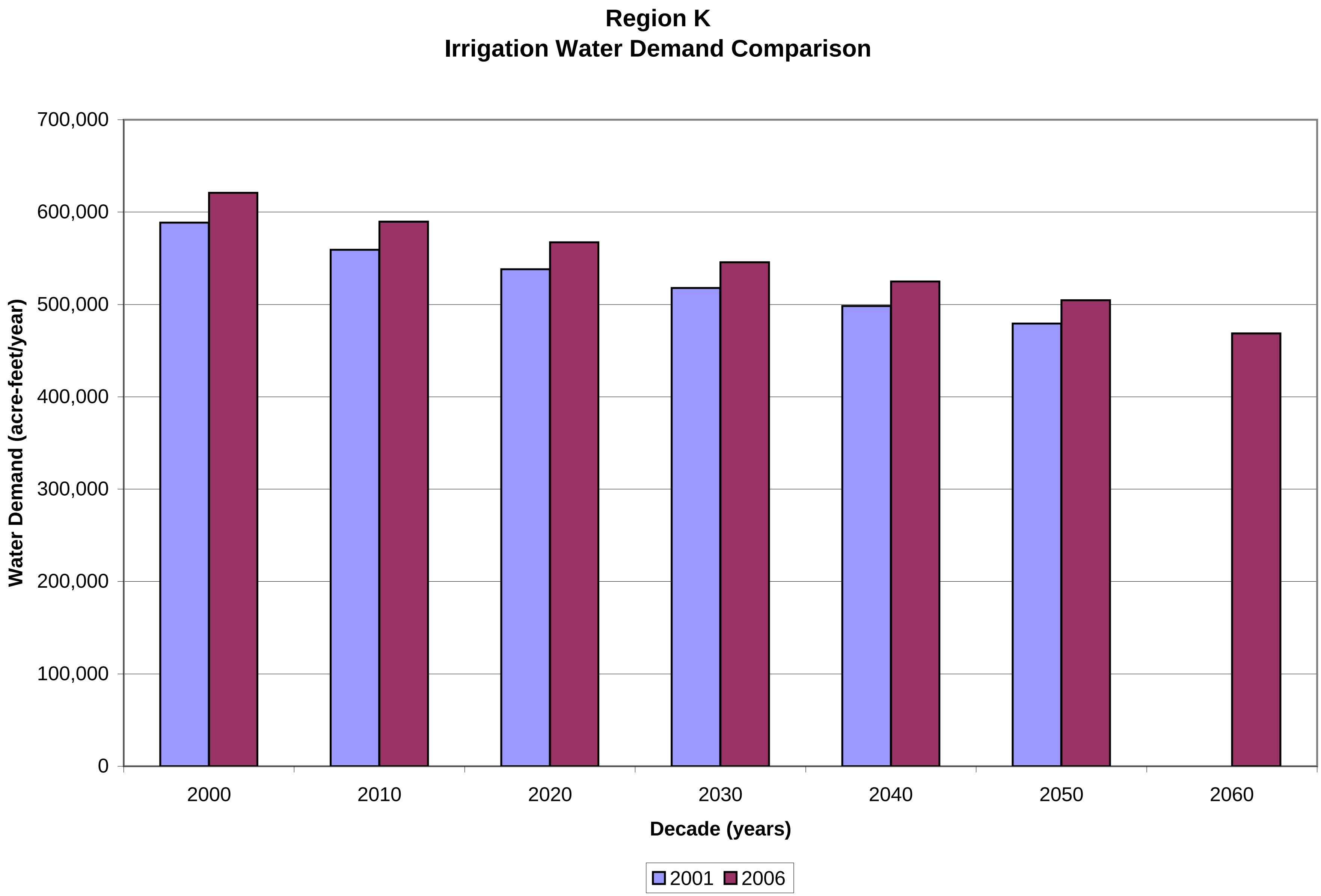
*All values are presented in acre-feet per year

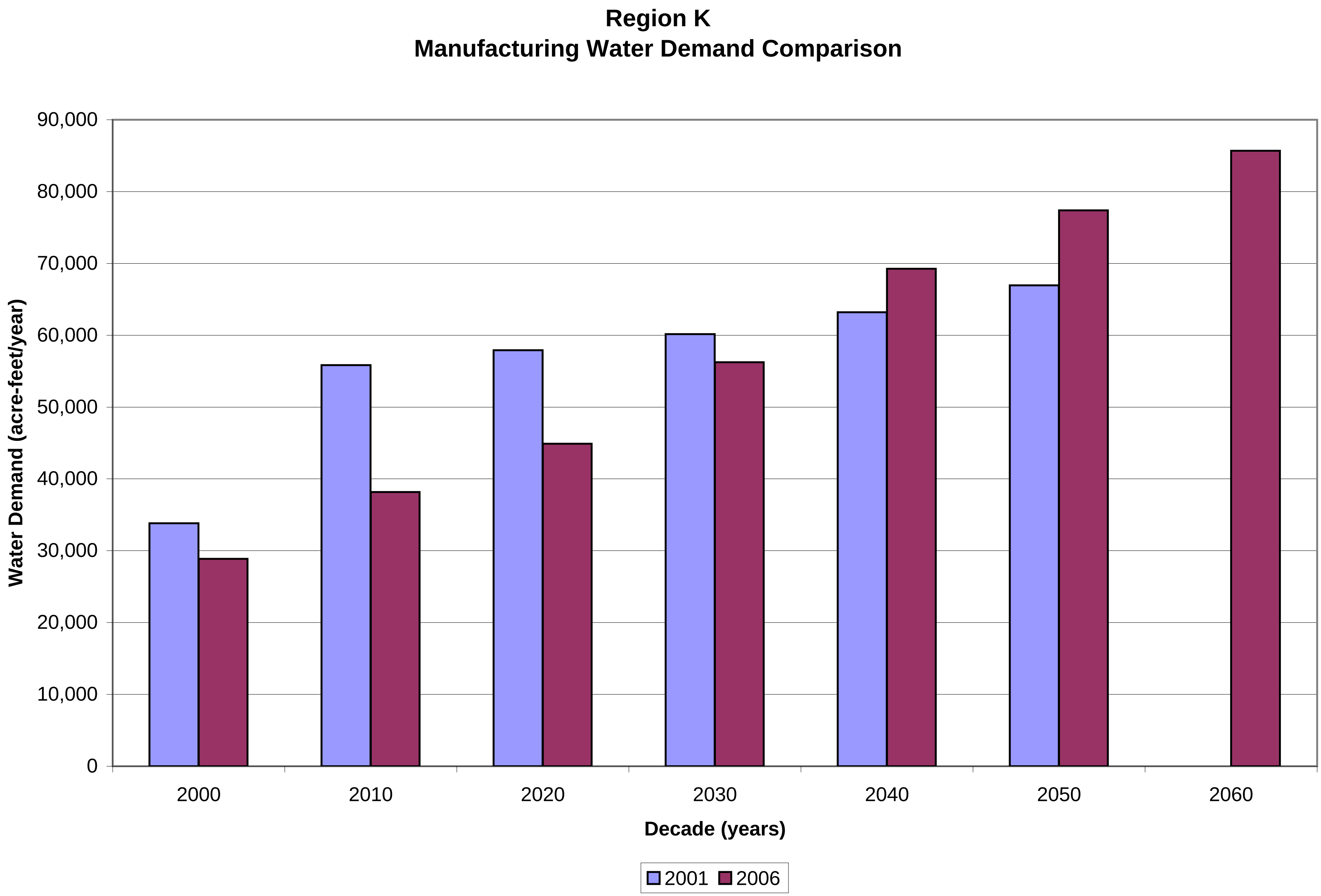
Total Water Demand							
2001	979,913	1,005,527	1,036,302	1,079,337	1,094,030	1,123,307	NA
2006	1,004,335	1,078,041	1,118,464	1,194,008	1,237,515	1,276,600	1,301,682
Difference	24,422	72,514	82,162	114,671	143,485	153,293	NA
% Change	2.5	7.2	7.9	10.6	13.1	13.6	NA

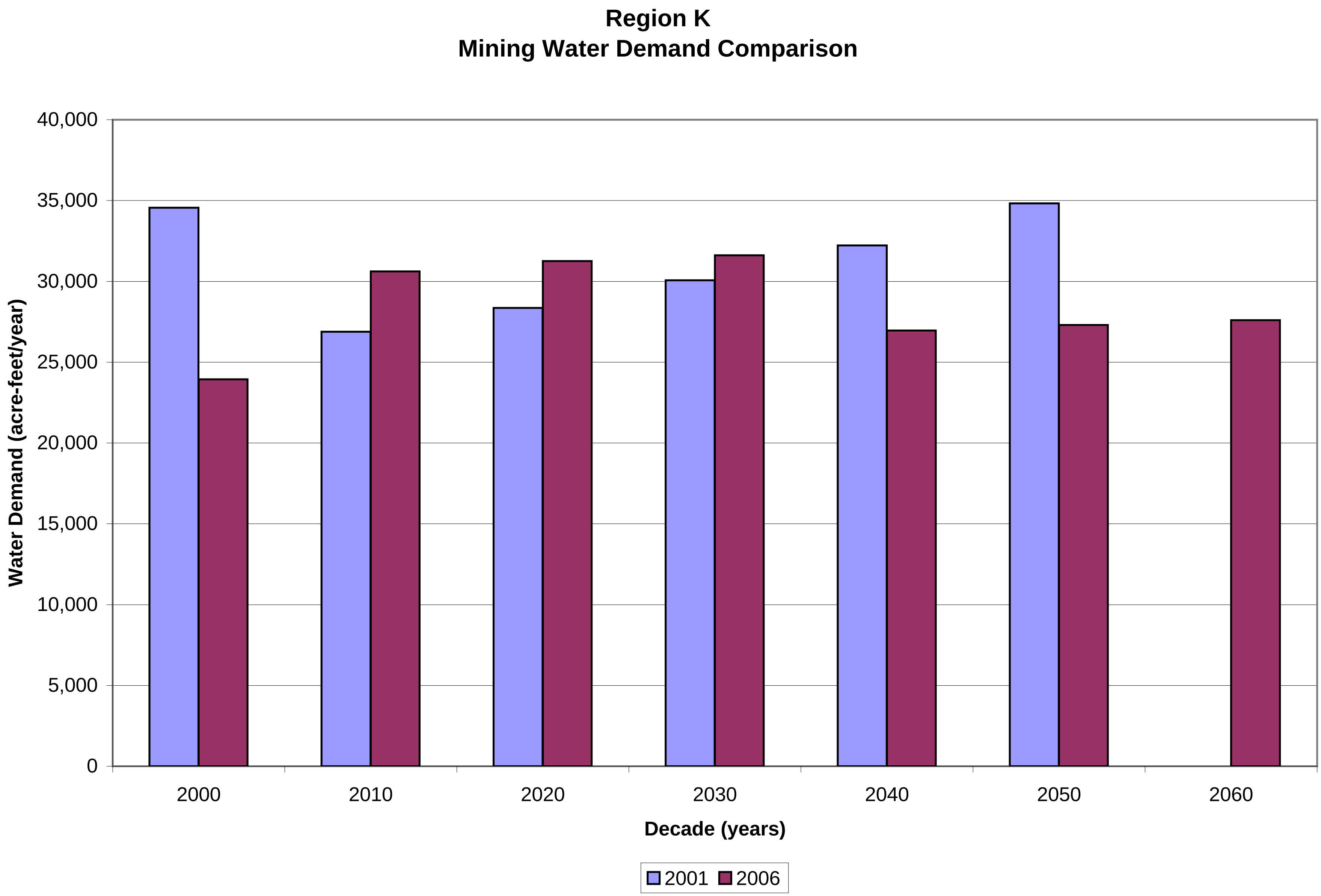

Region K
Total Water Demand Comparison
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001 Region K Plan
2006 Region K Plan


Region K
Municipal Water Demand Comparison
600,000
500,000
400,000
300,000
200,000
100,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

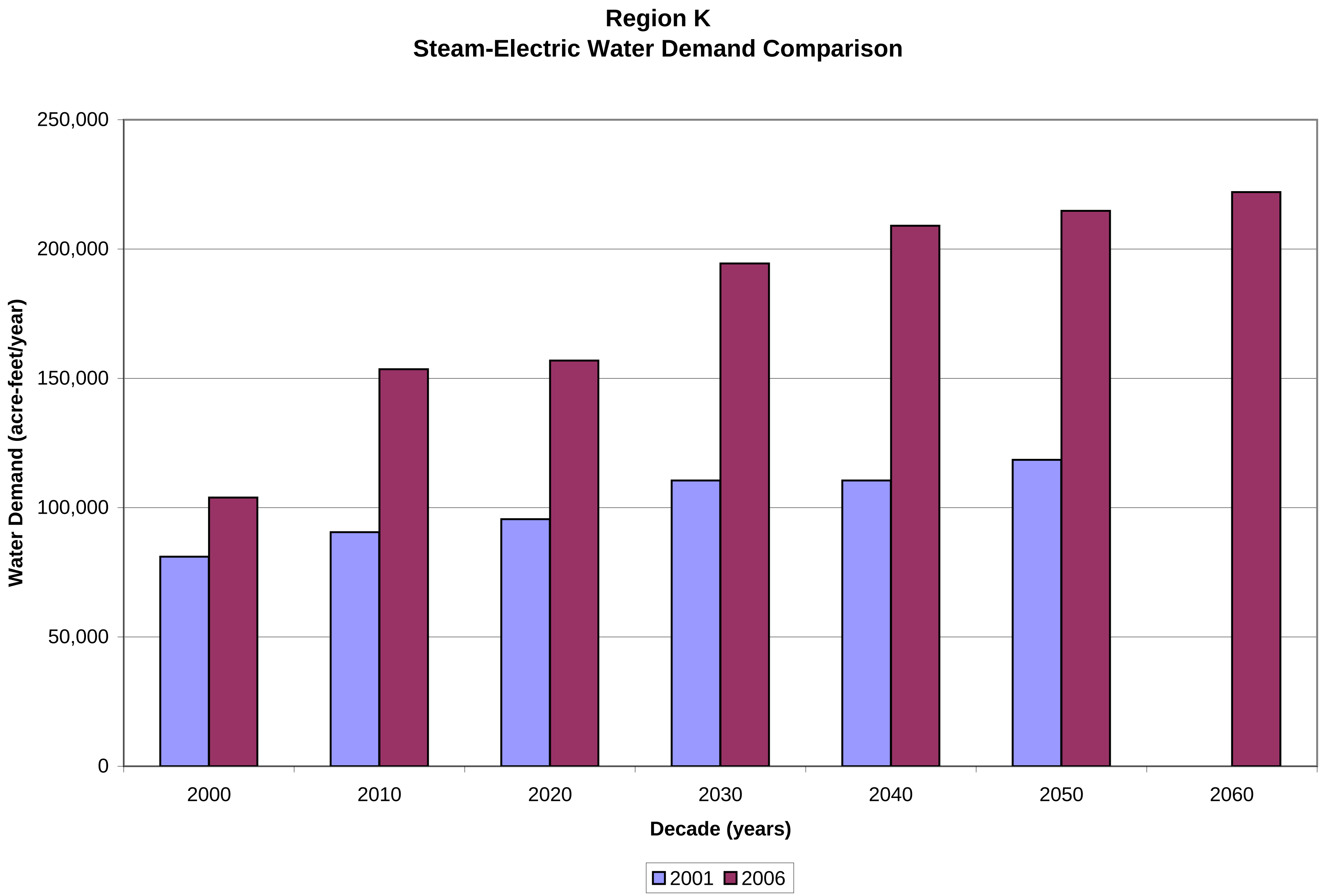

Region K
Livestock Water Demand Comparison
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006


Region K
Irrigation Water Demand Comparison
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006


Region K
Manufacturing Water Demand Comparison
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006



Region K
Mining Water Demand Comparison
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

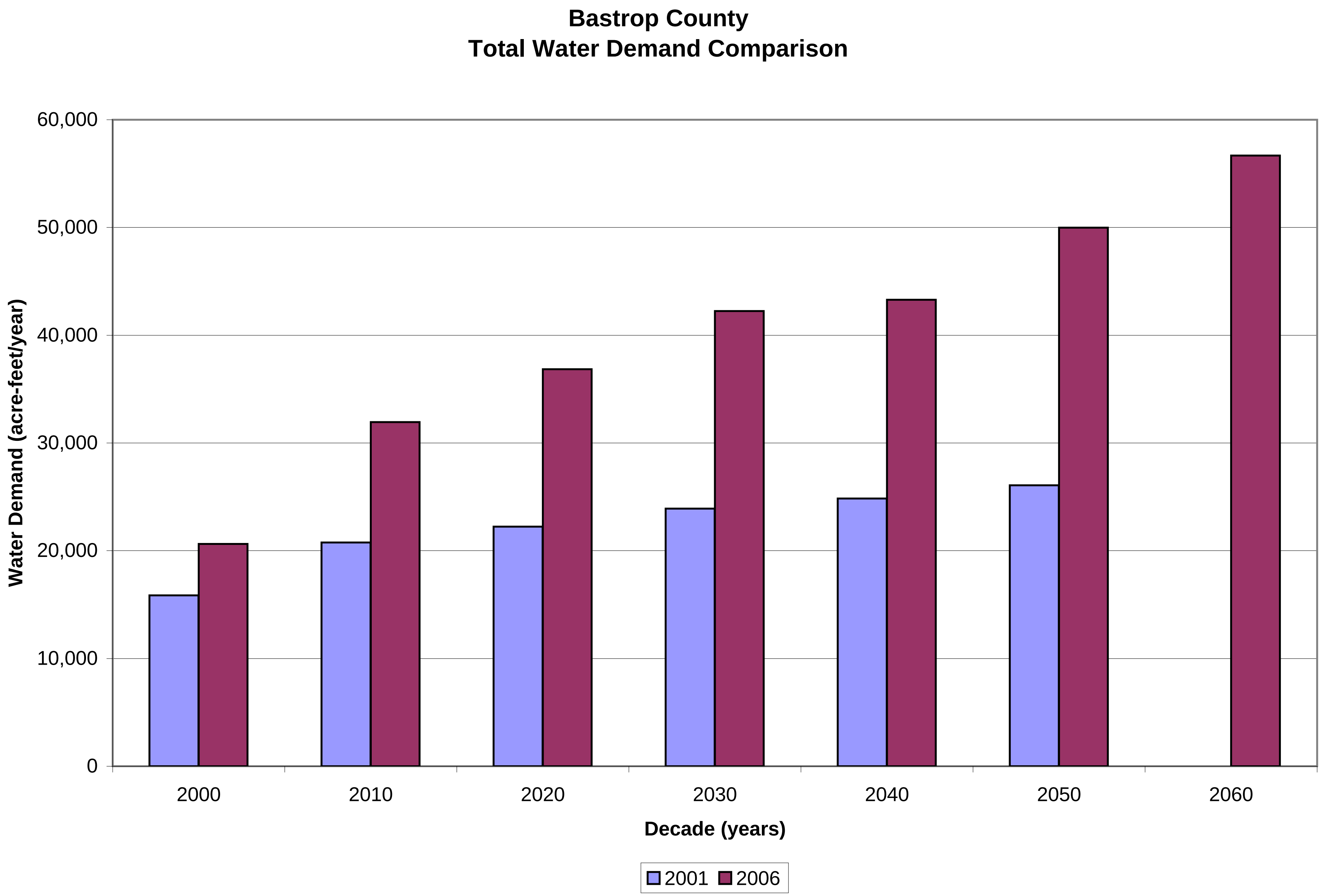

Region K
Steam-Electric Water Demand Comparison
250,000
200,000
150,000
100,000
50,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Bastrop County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	9,186	10,660	12,203	13,924	14,902	16,138	NA
2006	9,315	11,679	14,762	18,327	22,505	27,818	34,610
Difference	129	1,019	2,559	4,403	7,603	11,680	NA
% Change	1.4	9.6	21.0	31.6	51.0	72.4	NA
Livestock							
2001	1,525	1,525	1,525	1,525	1,525	1,525	NA
2006	1,522	1,522	1,522	1,522	1,522	1,522	1,522
Difference	-3	-3	-3	-3	-3	-3	NA
% Change	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	NA
Irrigation							
2001	563	491	429	374	327	285	NA
2006	1,846	1,610	1,407	1,226	1,072	934	814
Difference	1,283	1,119	978	852	745	649	NA
% Change	227.9	227.9	228.0	227.8	227.8	227.7	NA
Manufacturing							
2001	33	40	48	57	67	78	NA
2006	70	92	111	130	150	169	183
Difference	37	52	63	73	83	91	NA
% Change	112.1	130.0	131.3	128.1	123.9	116.7	NA
Mining							
2001	56	46	38	33	34	43	NA
2006	28	5,033	5,035	5,036	37	38	39
Difference	-28	4,987	4,997	5,003	3	-5	NA
% Change	-50.0	10841.3	13150.0	15160.6	8.8	-11.6	NA
Steam-Electric Power Generation							
2001	4,500	8,000	8,000	8,000	8,000	8,000	NA
2006	7,846	12,000	14,000	16,000	18,000	19,500	19,500
Difference	3,346	4,000	6,000	8,000	10,000	11,500	NA
% Change	74.4	50.0	75.0	100.0	125.0	143.8	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	15,863	20,762	22,243	23,913	24,855	26,069	NA
2006	20,627	31,936	36,837	42,241	43,286	49,981	56,668
Difference	4,764	11,174	14,594	18,328	18,431	23,912	NA
% Change	30.0	53.8	65.6	76.6	74.2	91.7	NA



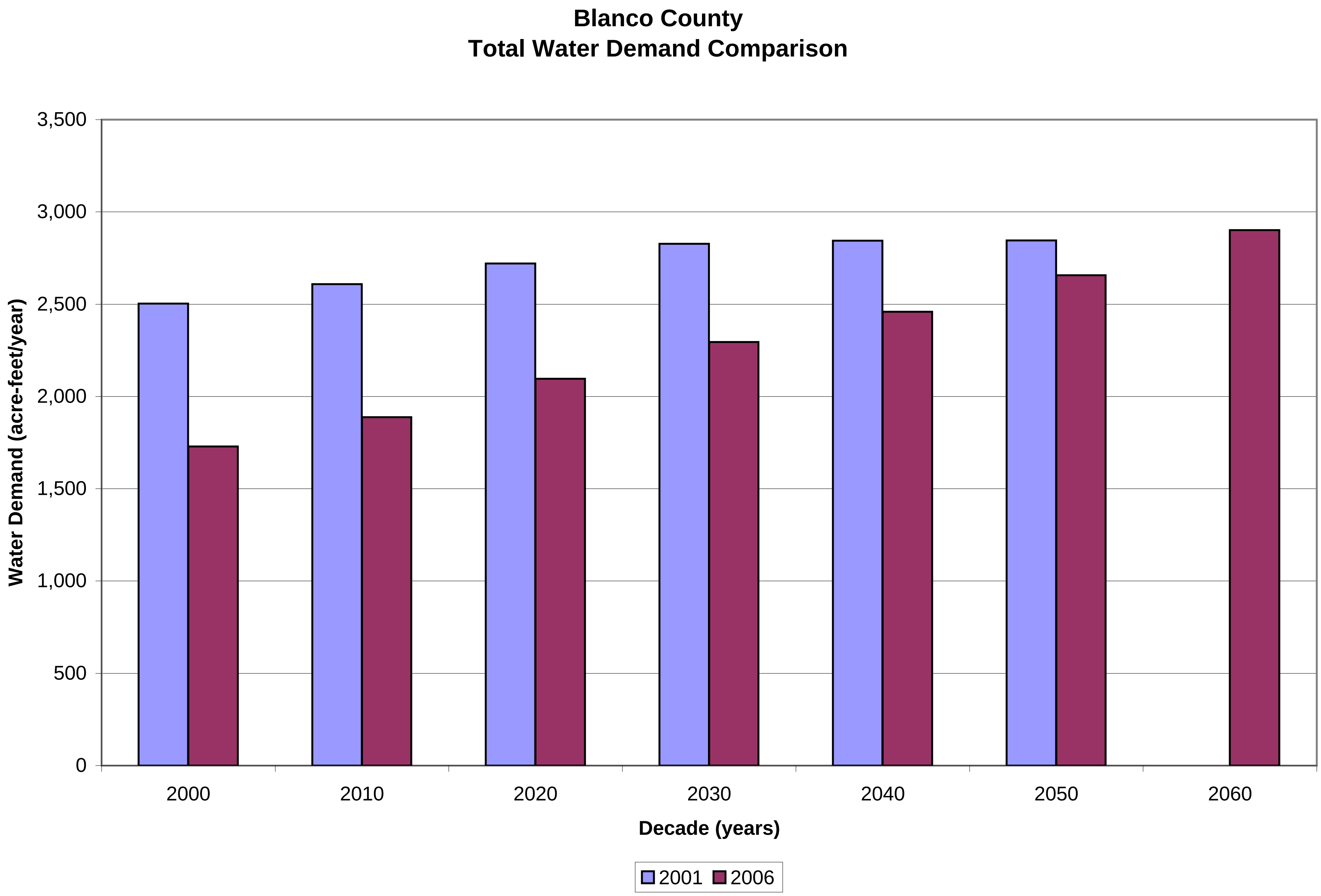
Bastrop County
Total Water Demand Comparison
60,000
50,000
40,000
30,000
20,000
10,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Blanco County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	1,362	1,495	1,633	1,764	1,812	1,823	NA
2006	1,205	1,369	1,580	1,783	1,951	2,151	2,396
Difference	-157	-126	-53	19	139	328	NA
% Change	-11.5	-8.4	-3.2	1.1	7.7	18.0	NA
Livestock							
2001	670	670	670	670	670	670	NA
2006	443	443	443	443	443	443	443
Difference	-227	-227	-227	-227	-227	-227	NA
% Change	-33.9	-33.9	-33.9	-33.9	-33.9	-33.9	NA
Irrigation							
2001	458	435	413	392	362	353	NA
2006	73	69	66	62	58	56	55
Difference	-385	-366	-347	-330	-304	-297	NA
% Change	-84.1	-84.1	-84.0	-84.2	-84.0	-84.1	NA
Manufacturing							
2001	0	0	0	0	0	0	NA
2006	2	2	2	2	2	2	2
Difference	2	2	2	2	2	2	NA
% Change	NA	NA	NA	NA	NA	NA	NA
Mining							
2001	13	9	5	1	0	0	NA
2006	6	5	5	5	5	5	5
Difference	-7	-4	0	4	5	5	NA
% Change	-53.8	-44.4	0.0	400.0	NA	NA	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	2,503	2,609	2,721	2,827	2,844	2,846	NA
2006	1,729	1,888	2,096	2,295	2,459	2,657	2,901
Difference	-774	-721	-625	-532	-385	-189	NA
% Change	-30.9	-27.6	-23.0	-18.8	-13.5	-6.6	NA



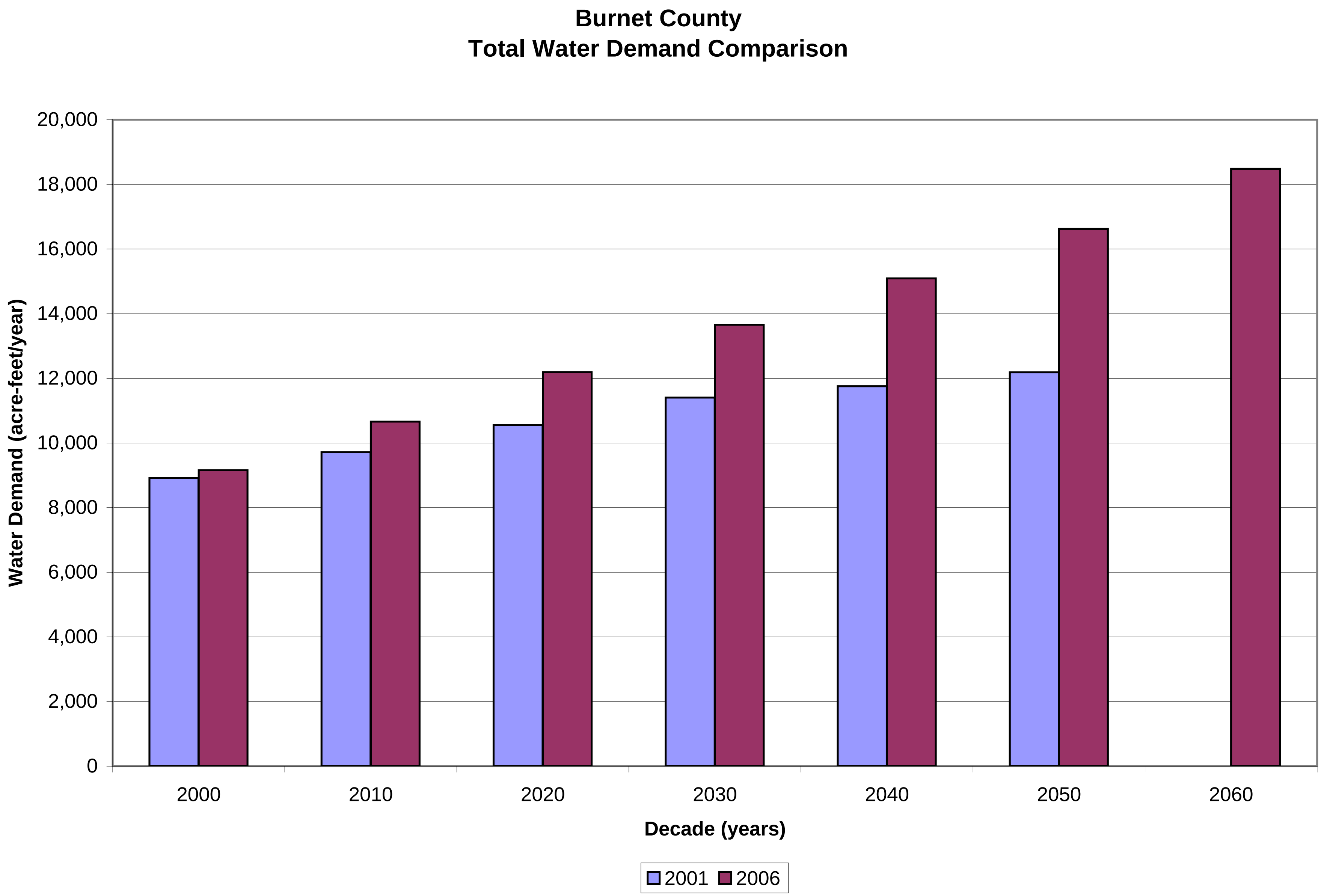
Blanco County
Total Water Demand Comparison
Water Demand (acre-feet/year)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Burnet County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	5,564	6,270	6,962	7,646	7,826	8,086	NA
2006	5,752	6,810	8,097	9,380	10,633	12,003	13,684
Difference	188	540	1,135	1,734	2,807	3,917	NA
% Change	3.4	8.6	16.3	22.7	35.9	48.4	NA
Livestock							
2001	794	794	794	794	794	794	NA
2006	835	835	835	835	835	835	835
Difference	41	41	41	41	41	41	NA
% Change	5.2	5.2	5.2	5.2	5.2	5.2	NA
Irrigation							
2001	295	290	285	280	275	271	NA
2006	103	101	100	98	96	95	93
Difference	-192	-189	-185	-182	-179	-176	NA
% Change	-65.1	-65.2	-64.9	-65.0	-65.1	-64.9	NA
Manufacturing							
2001	1,246	1,377	1,514	1,655	1,800	1,947	NA
2006	743	963	1,109	1,248	1,384	1,502	1,636
Difference	-503	-414	-405	-407	-416	-445	NA
% Change	-40.4	-30.1	-26.8	-24.6	-23.1	-22.9	NA
Mining							
2001	1,013	987	1,006	1,028	1,058	1,091	NA
2006	1,725	1,956	2,049	2,098	2,145	2,190	2,235
Difference	712	969	1,043	1,070	1,087	1,099	NA
% Change	70.3	98.2	103.7	104.1	102.7	100.7	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	8,912	9,718	10,561	11,403	11,753	12,189	NA
2006	9,158	10,665	12,190	13,659	15,093	16,625	18,483
Difference	246	947	1,629	2,256	3,340	4,436	NA
% Change	2.8	9.7	15.4	19.8	28.4	36.4	NA


Burnet County
Total Water Demand Comparison
Water Demand (acre-feet/year)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

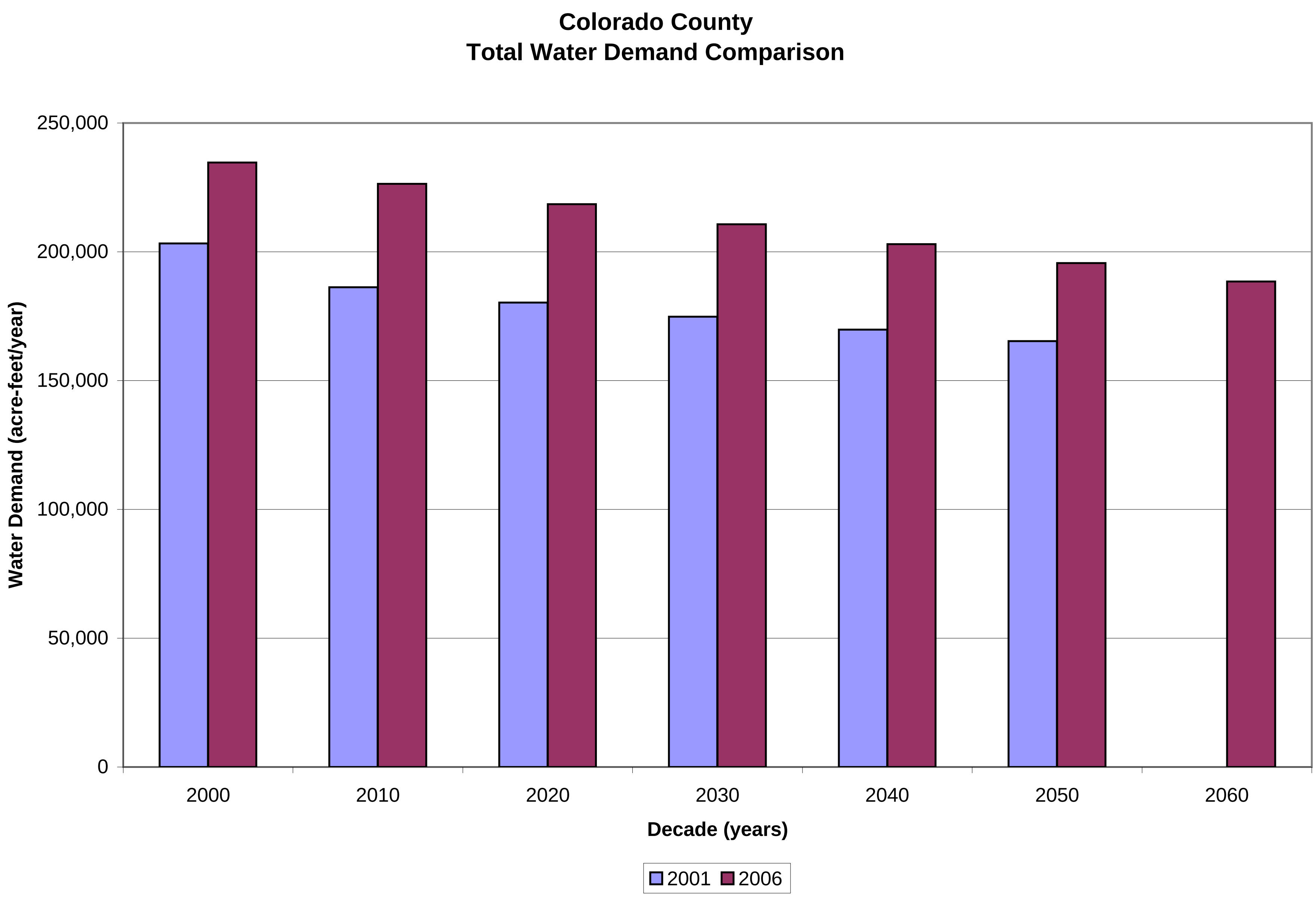
Comparison Between 2001 RWP and 2006 RWP

Water Demands* (in acre-feet per year) by WUG Category
Colorado County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	3,286	3,283	3,318	3,390	3,433	3,523	NA
2006	3,100	3,132	3,189	3,189	3,141	3,122	3,089
Difference	-186	-151	-129	-201	-292	-401	NA
% Change	-5.7	-4.6	-3.9	-5.9	-8.5	-11.4	NA
Livestock							
2001	1,447	1,447	1,447	1,447	1,447	1,447	NA
2006	1,473	1,473	1,473	1,473	1,473	1,473	1,473
Difference	26	26	26	26	26	26	NA
% Change	1.8	1.8	1.8	1.8	1.8	1.8	NA
Irrigation							
2001	176,879	168,953	161,922	155,121	148,537	142,135	NA
2006	210,242	200,822	192,465	184,380	176,555	168,946	161,663
Difference	33,363	31,869	30,543	29,259	28,018	26,811	NA
% Change	18.9	18.9	18.9	18.9	18.9	18.9	NA
Manufacturing							
2001	1,150	1,224	1,297	1,369	1,438	1,508	NA
2006	144	176	192	205	217	227	245
Difference	-1,006	-1,048	-1,105	-1,164	-1,221	-1,281	NA
% Change	-87.5	-85.6	-85.2	-85.0	-84.9	-84.9	NA
Mining							
2001	20,486	11,378	12,334	13,473	14,926	16,677	NA
2006	19,674	20,804	21,197	21,416	21,623	21,821	21,996
Difference	-812	9,426	8,863	7,943	6,697	5,144	NA
% Change	-4.0	82.8	71.9	59.0	44.9	30.8	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	203,248	186,285	180,318	174,800	169,781	165,290	NA
2006	234,633	226,407	218,516	210,663	203,009	195,589	188,466
Difference	31,385	40,122	38,198	35,863	33,228	30,299	NA
% Change	15.4	21.5	21.2	20.5	19.6	18.3	NA

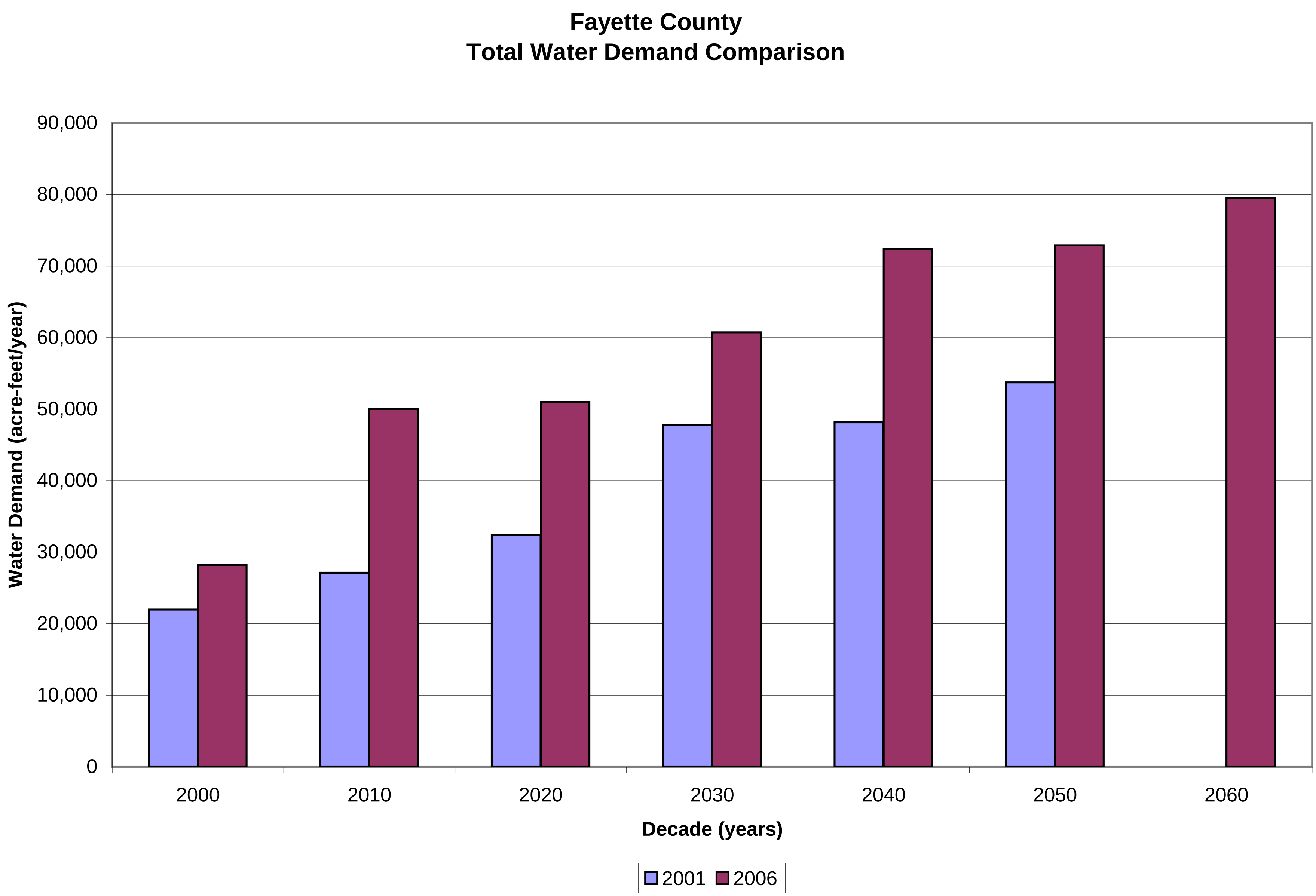

Colorado County
Total Water Demand Comparison
250,000
200,000
150,000
100,000
50,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Fayette County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	3,857	4,056	4,343	4,728	5,165	5,756	NA
2006	3,522	3,890	4,417	4,879	5,244	5,751	6,495
Difference	-335	-166	74	151	79	-5	NA
% Change	-8.7	-4.1	1.7	3.2	1.5	-0.1	NA
Livestock							
2001	2,621	2,621	2,621	2,621	2,621	2,621	NA
2006	2,397	2,397	2,397	2,397	2,397	2,397	2,397
Difference	-224	-224	-224	-224	-224	-224	NA
% Change	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	NA
Irrigation							
2001	375	351	329	308	288	270	NA
2006	789	739	692	648	606	568	533
Difference	414	388	363	340	318	298	NA
% Change	110.4	110.5	110.3	110.4	110.4	110.4	NA
Manufacturing							
2001	37	44	50	55	63	71	NA
2006	162	205	230	254	277	297	322
Difference	125	161	180	199	214	226	NA
% Change	337.8	365.9	360.0	361.8	339.7	318.3	NA
Mining							
2001	92	64	46	17	7	3	NA
2006	43	42	42	42	42	42	42
Difference	-49	-22	-4	25	35	39	NA
% Change	-53.3	-34.4	-8.7	147.1	500.0	1300.0	NA
Steam-Electric Power Generation							
2001	15,000	20,000	25,000	40,000	40,000	45,000	NA
2006	21,306	42,720	43,200	52,500	63,840	63,840	69,750
Difference	6,306	22,720	18,200	12,500	23,840	18,840	NA
% Change	42.0	113.6	72.8	31.3	59.6	41.9	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	21,982	27,136	32,389	47,729	48,144	53,721	NA
2006	28,219	49,993	50,978	60,720	72,406	72,895	79,539
Difference	6,237	22,857	18,589	12,991	24,262	19,174	NA
% Change	28.4	84.2	57.4	27.2	50.4	35.7	NA

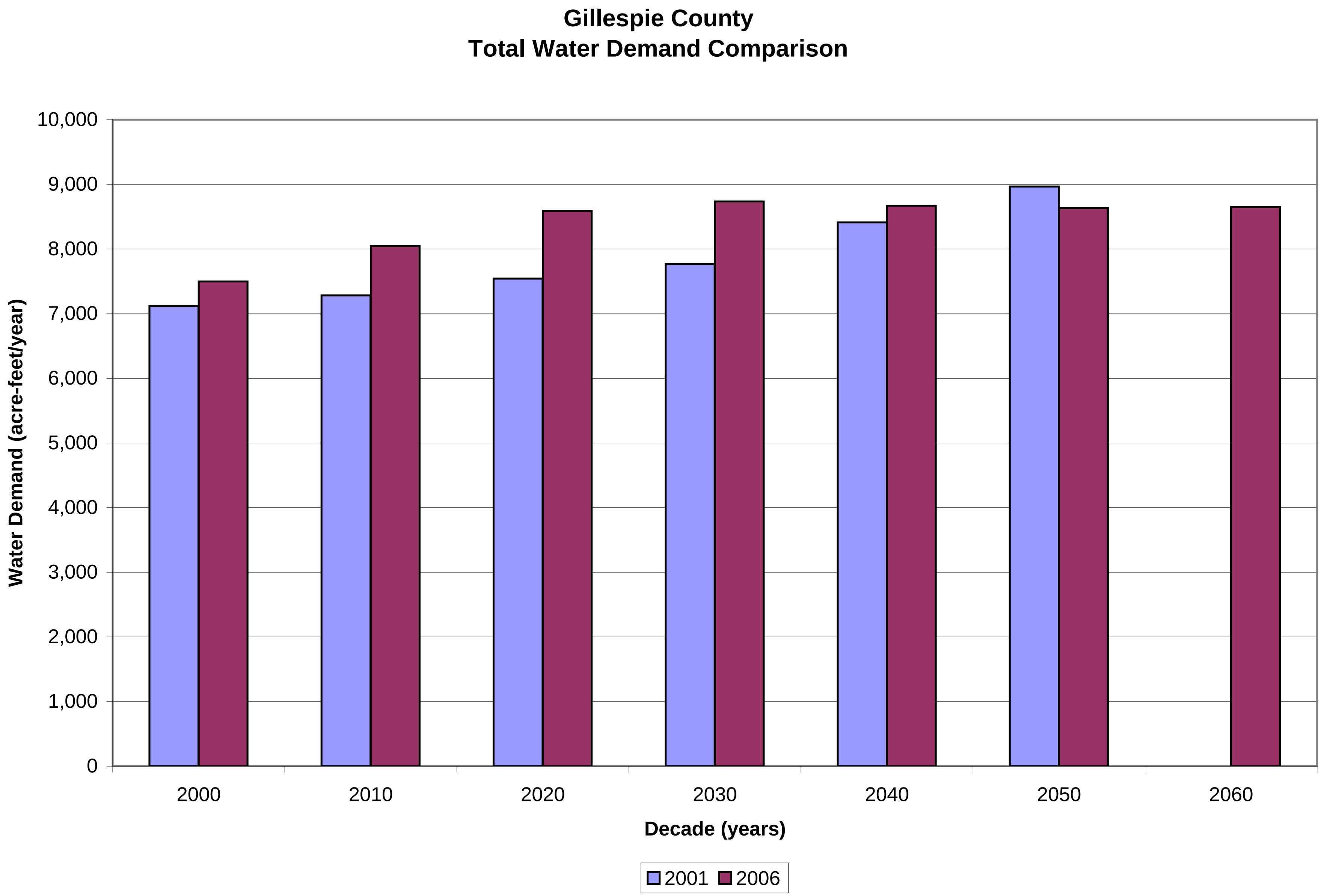

Fayette County
Total Water Demand Comparison
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Gillespie County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	4,130	4,259	4,487	4,675	5,268	5,768	NA
2006	3,921	4,432	4,968	5,113	5,048	5,015	5,015
Difference	-209	173	481	438	-220	-753	NA
% Change	-5.1	4.1	10.7	9.4	-4.2	-13.1	NA
Livestock							
2001	1,294	1,294	1,294	1,294	1,294	1,294	NA
2006	1,062	1,062	1,062	1,062	1,062	1,062	1,062
Difference	-232	-232	-232	-232	-232	-232	NA
% Change	-17.9	-17.9	-17.9	-17.9	-17.9	-17.9	NA
Irrigation							
2001	1,184	1,169	1,154	1,139	1,124	1,110	NA
2006	2,065	2,039	2,013	1,987	1,960	1,936	1,912
Difference	881	870	859	848	836	826	NA
% Change	74.4	74.4	74.4	74.5	74.4	74.4	NA
Manufacturing							
2001	502	556	608	657	727	795	NA
2006	440	506	539	566	591	612	655
Difference	-62	-50	-69	-91	-136	-183	NA
% Change	-12.4	-9.0	-11.3	-13.9	-18.7	-23.0	NA
Mining							
2001	5	3	1	0	0	0	NA
2006	9	8	8	8	8	8	8
Difference	4	5	7	8	8	8	NA
% Change	80.0	166.7	700.0	#DIV/0!	#DIV/0!	#DIV/0!	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	7,115	7,281	7,544	7,765	8,413	8,967	NA
2006	7,497	8,047	8,590	8,736	8,669	8,633	8,652
Difference	382	766	1,046	971	256	-334	NA
% Change	5.4	10.5	13.9	12.5	3.0	-3.7	NA



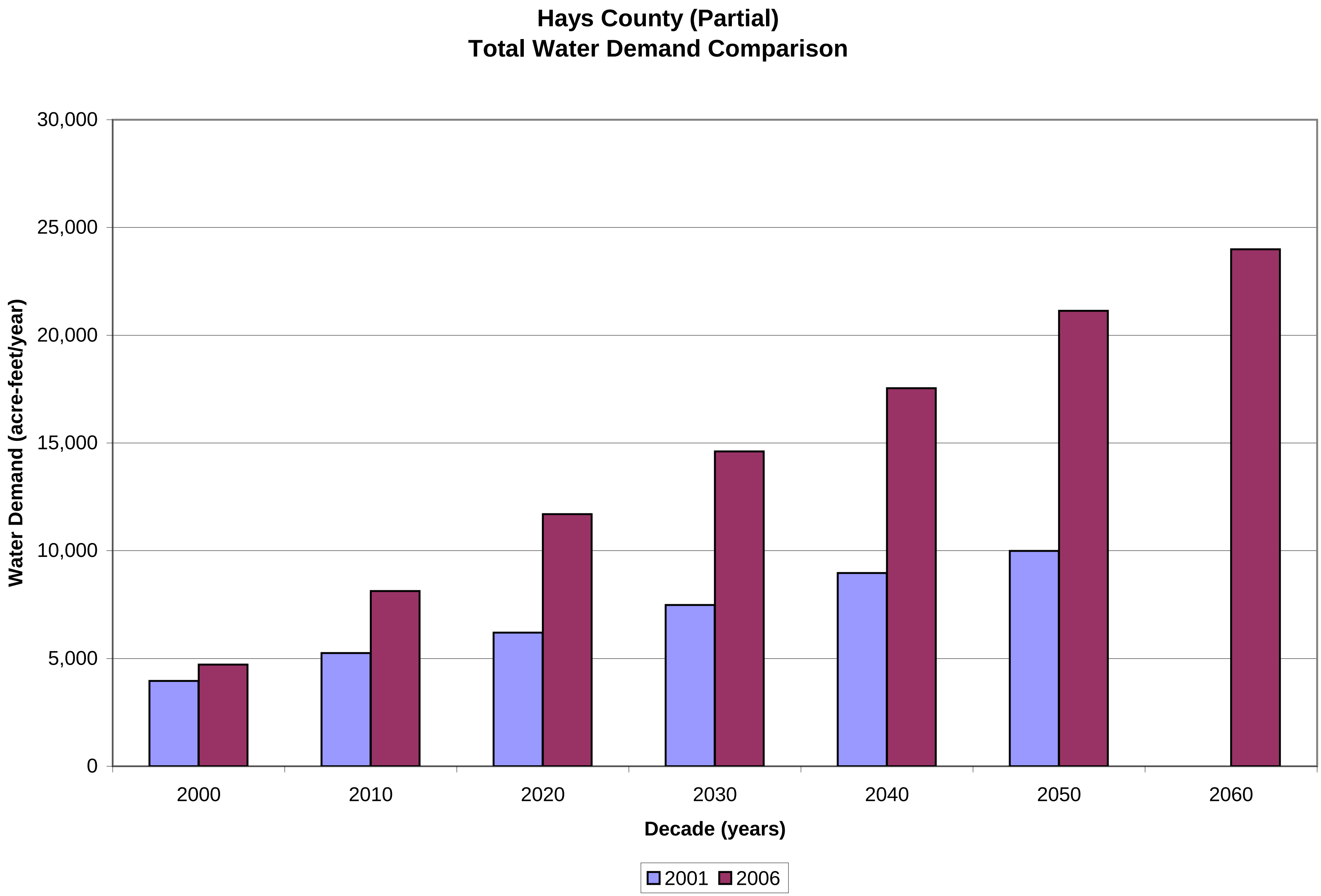
Gillespie County
Total Water Demand Comparison
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Hays County (partial)

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	3,421	4,667	5,571	6,807	8,249	9,231	NA
2006	3,955	7,192	10,656	13,446	16,266	19,742	22,498
Difference	534	2,525	5,085	6,639	8,017	10,511	NA
% Change	15.6	54.1	91.3	97.5	97.2	113.9	NA
Livestock							
2001	213	213	213	213	213	213	NA
2006	220	220	220	220	220	220	220
Difference	7	7	7	7	7	7	NA
% Change	3.3	3.3	3.3	3.3	3.3	3.3	NA
Irrigation							
2001	23	22	22	22	22	22	NA
2006	12	11	11	11	11	11	11
Difference	-11	-11	-11	-11	-11	-11	NA
% Change	-47.8	-50.0	-50.0	-50.0	-50.0	-50.0	NA
Manufacturing							
2001	288	340	389	435	478	523	NA
2006	509	691	809	928	1,048	1,156	1,255
Difference	221	351	420	493	570	633	NA
% Change	76.7	103.2	108.0	113.3	119.2	121.0	NA
Mining							
2001	12	8	4	1	0	0	NA
2006	18	12	6	2	0	0	0
Difference	6	4	2	1	0	0	NA
% Change	50.0	50.0	50.0	100.0	NA	NA	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	3,957	5,250	6,199	7,478	8,962	9,989	NA
2006	4,714	8,126	11,702	14,607	17,545	21,129	23,984
Difference	757	2,876	5,503	7,129	8,583	11,140	NA
% Change	19.1	54.8	88.8	95.3	95.8	111.5	NA

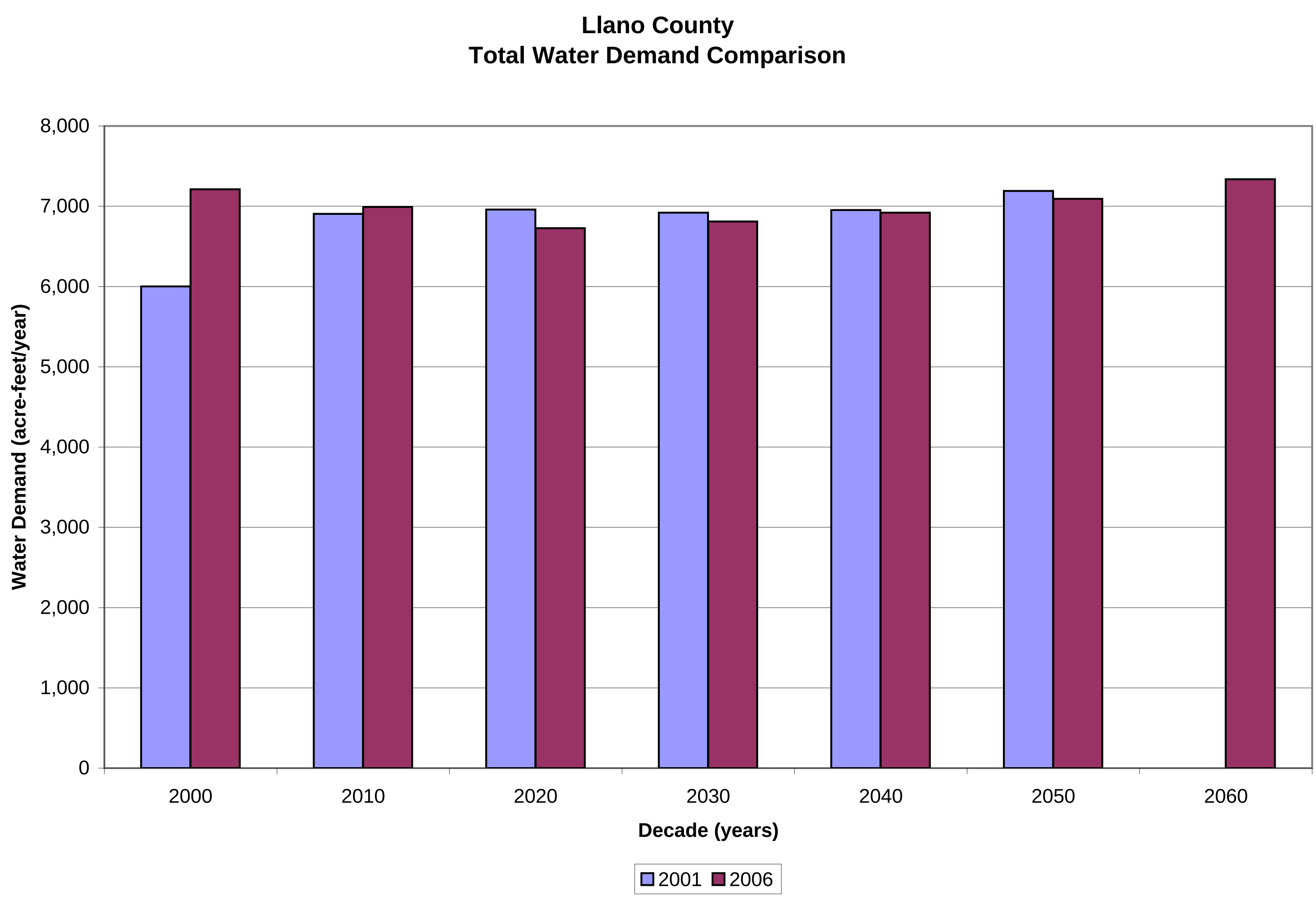

Hays County (Partial)
Total Water Demand Comparison
Water Demand (acre-feet/year)
30,000
25,000
20,000
15,000
10,000
5,000
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Llano County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	3,067	3,020	3,103	3,086	3,140	3,393	NA
2006	4,042	4,054	4,018	3,976	3,929	3,905	3,905
Difference	975	1,034	915	890	789	512	NA
% Change	31.8	34.2	29.5	28.8	25.1	15.1	NA
Livestock							
2001	689	689	689	689	689	689	NA
2006	751	751	751	751	751	751	751
Difference	62	62	62	62	62	62	NA
% Change	9.0	9.0	9.0	9.0	9.0	9.0	NA
Irrigation							
2001	1,103	1,085	1,067	1,049	1,031	1,014	NA
2006	995	979	963	946	930	915	900
Difference	-108	-106	-104	-103	-101	-99	NA
% Change	-9.8	-9.8	-9.7	-9.8	-9.8	-9.8	NA
Manufacturing							
2001	0	0	0	0	0	0	NA
2006	2	3	3	3	3	3	3
Difference	2	3	3	3	3	3	NA
% Change	NA	NA	NA	NA	NA	NA	NA
Mining							
2001	143	112	99	95	92	95	NA
2006	152	149	148	148	148	148	148
Difference	9	37	49	53	56	53	NA
% Change	6.3	33.0	49.5	55.8	60.9	55.8	NA
Steam-Electric Power Generation							
2001	1,000	2,000	2,000	2,000	2,000	2,000	NA
2006	1,271	1,057	843	985	1,159	1,371	1,629
Difference	271	-943	-1,157	-1,015	-841	-629	NA
% Change	27.1	-47.2	-57.9	-50.8	-42.1	-31.5	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	6,002	6,906	6,958	6,919	6,952	7,191	NA
2006	7,213	6,993	6,726	6,809	6,920	7,093	7,336
Difference	1,211	87	-232	-110	-32	-98	NA
% Change	20.2	1.3	-3.3	-1.6	-0.5	-1.4	NA

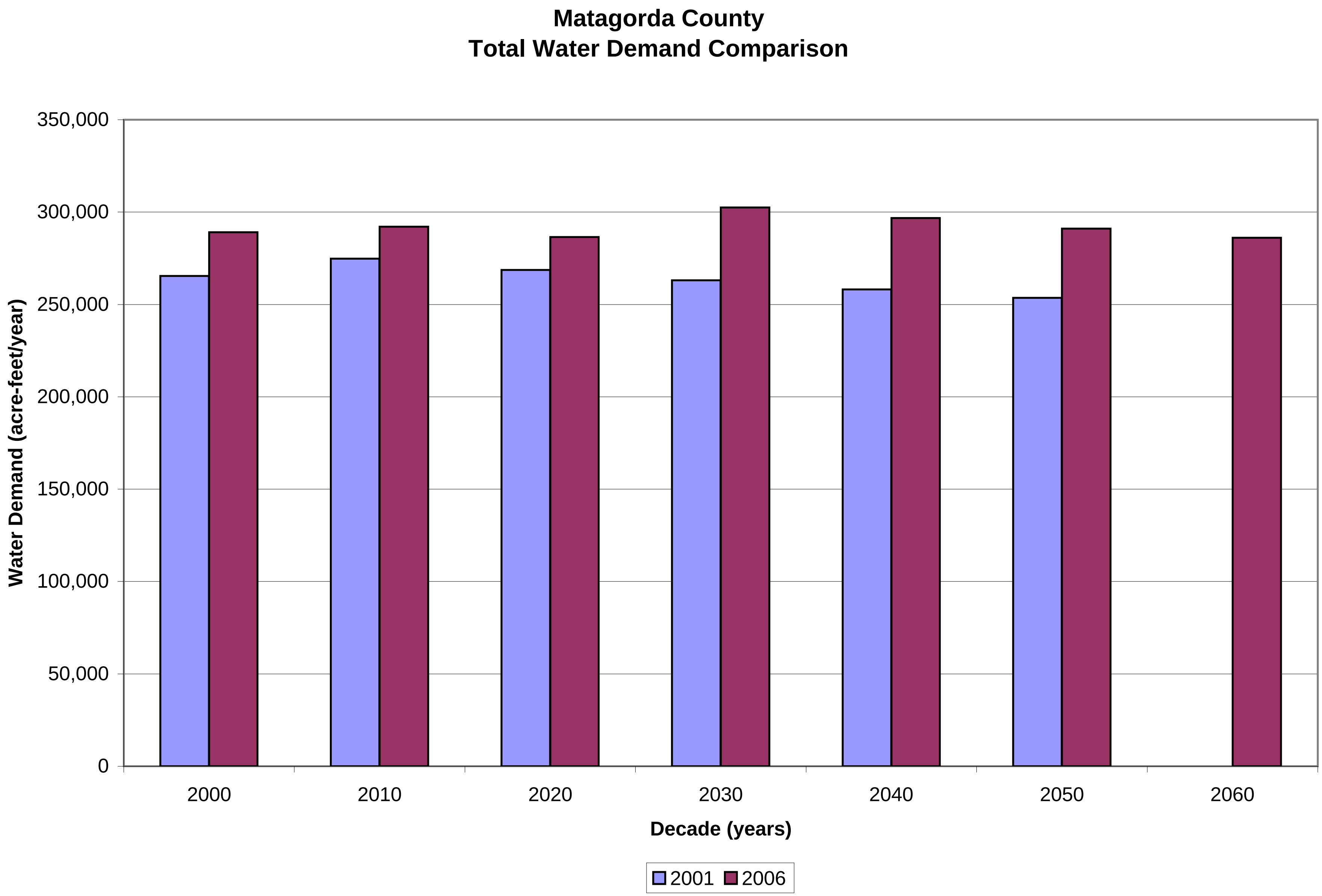

Llano County
Total Water Demand Comparison
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Matagorda County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	6,072	6,363	6,649	7,200	7,777	8,606	NA
2006	5,423	5,590	5,830	5,906	5,883	5,815	5,762
Difference	-649	-773	-819	-1,294	-1,894	-2,791	NA
% Change	-10.7	-12.1	-12.3	-18.0	-24.4	-32.4	NA
Livestock							
2001	1,023	1,023	1,023	1,023	1,023	1,023	NA
2006	1,151	1,151	1,151	1,151	1,151	1,151	1,151
Difference	128	128	128	128	128	128	NA
% Change	12.5	12.5	12.5	12.5	12.5	12.5	NA
Irrigation							
2001	192,987	180,861	174,326	168,031	162,000	156,197	NA
2006	205,990	193,048	186,072	179,353	172,916	166,722	160,750
Difference	13,003	12,187	11,746	11,322	10,916	10,525	NA
% Change	6.7	6.7	6.7	6.7	6.7	6.7	NA
Manufacturing							
2001	13,022	32,532	32,715	32,835	33,352	33,849	NA
2006	10,355	12,180	13,253	13,991	14,686	15,259	16,267
Difference	-2,667	-20,352	-19,462	-18,844	-18,666	-18,590	NA
% Change	-20.5	-62.6	-59.5	-57.4	-56.0	-54.9	NA
Mining							
2001	5,299	6,956	6,945	6,942	6,942	6,949	NA
2006	196	177	172	169	167	165	163
Difference	-5,103	-6,779	-6,773	-6,773	-6,775	-6,784	NA
% Change	-96.3	-97.5	-97.5	-97.6	-97.6	-97.6	NA
Steam-Electric Power Generation							
2001	47,000	47,000	47,000	47,000	47,000	47,000	NA
2006	65,948	80,000	80,000	102,000	102,000	102,000	102,000
Difference	18,948	33,000	33,000	55,000	55,000	55,000	NA
% Change	40.3	70.2	70.2	117.0	117.0	117.0	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	265,403	274,735	268,658	263,031	258,094	253,624	NA
2006	289,063	292,146	286,478	302,570	296,803	291,112	286,093
Difference	23,660	17,411	17,820	39,539	38,709	37,488	NA
% Change	8.9	6.3	6.6	15.0	15.0	14.8	NA


Matagorda County
Total Water Demand Comparison
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

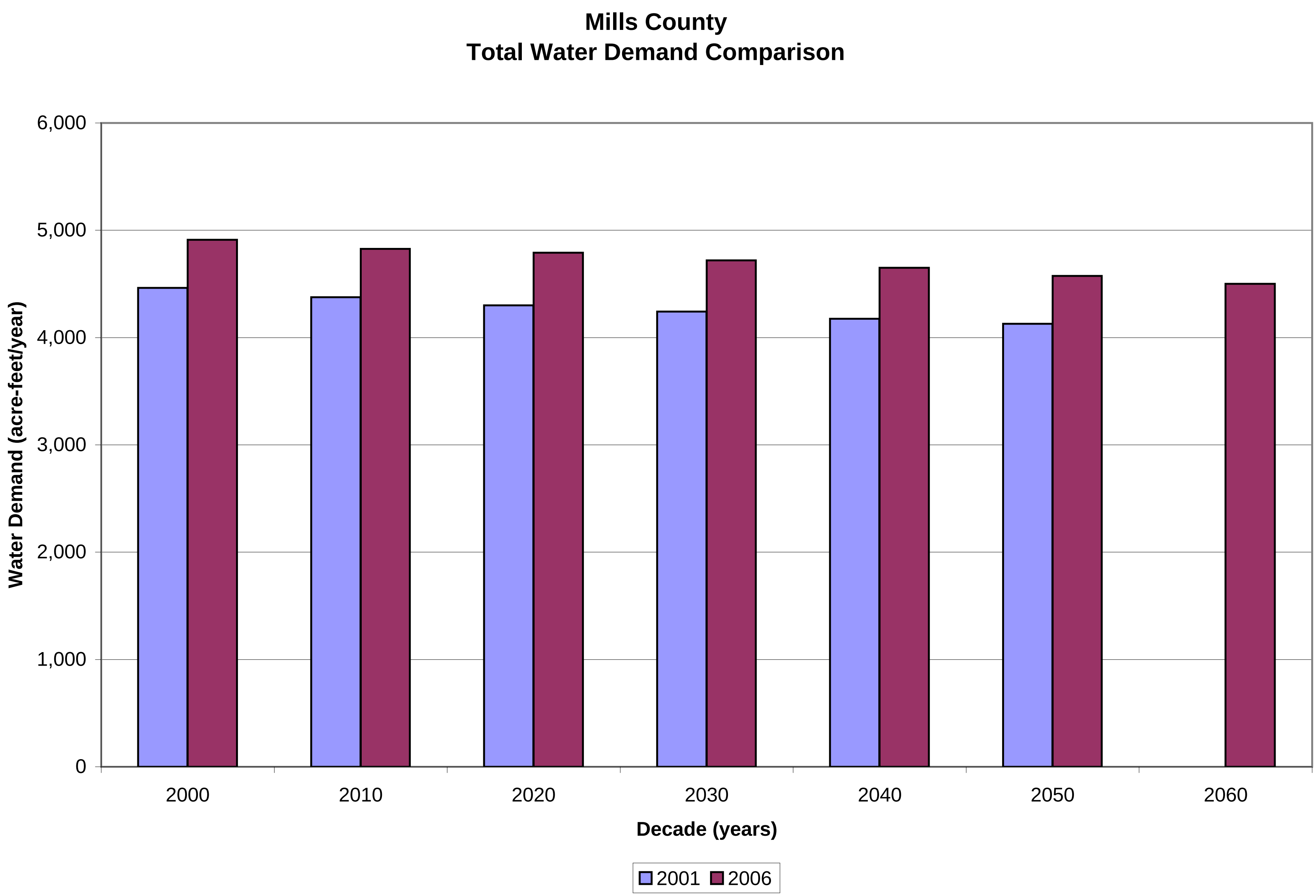
Comparison Between 2001 RWP and 2006 RWP

Water Demands* (in acre-feet per year) by WUG Category
Mills County

RWP	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Municipal							
2001	999	964	941	933	914	916	NA
2006	992	971	999	991	982	966	951
Difference	-7	7	58	58	68	50	NA
% Change	-0.7	0.7	6.2	6.2	7.4	5.5	NA
Livestock							
2001	1,048	1,048	1,048	1,048	1,048	1,048	NA
2006	918	918	918	918	918	918	918
Difference	-130	-130	-130	-130	-130	-130	NA
% Change	-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	NA
Irrigation							
2001	2,416	2,364	2,312	2,262	2,213	2,165	NA
2006	3,001	2,936	2,872	2,810	2,749	2,689	2,631
Difference	585	572	560	548	536	524	NA
% Change	24.2	24.2	24.2	24.2	24.2	24.2	NA
Manufacturing							
2001	0	0	0	0	0	0	NA
2006	1	1	1	1	1	1	1
Difference	1	1	1	1	1	1	NA
% Change	NA	NA	NA	NA	NA	NA	NA
Mining							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	4,463	4,376	4,301	4,243	4,175	4,129	NA
2006	4,912	4,826	4,790	4,720	4,650	4,574	4,501
Difference	449	450	489	477	475	445	NA
% Change	10.1	10.3	11.4	11.2	11.4	10.8	NA



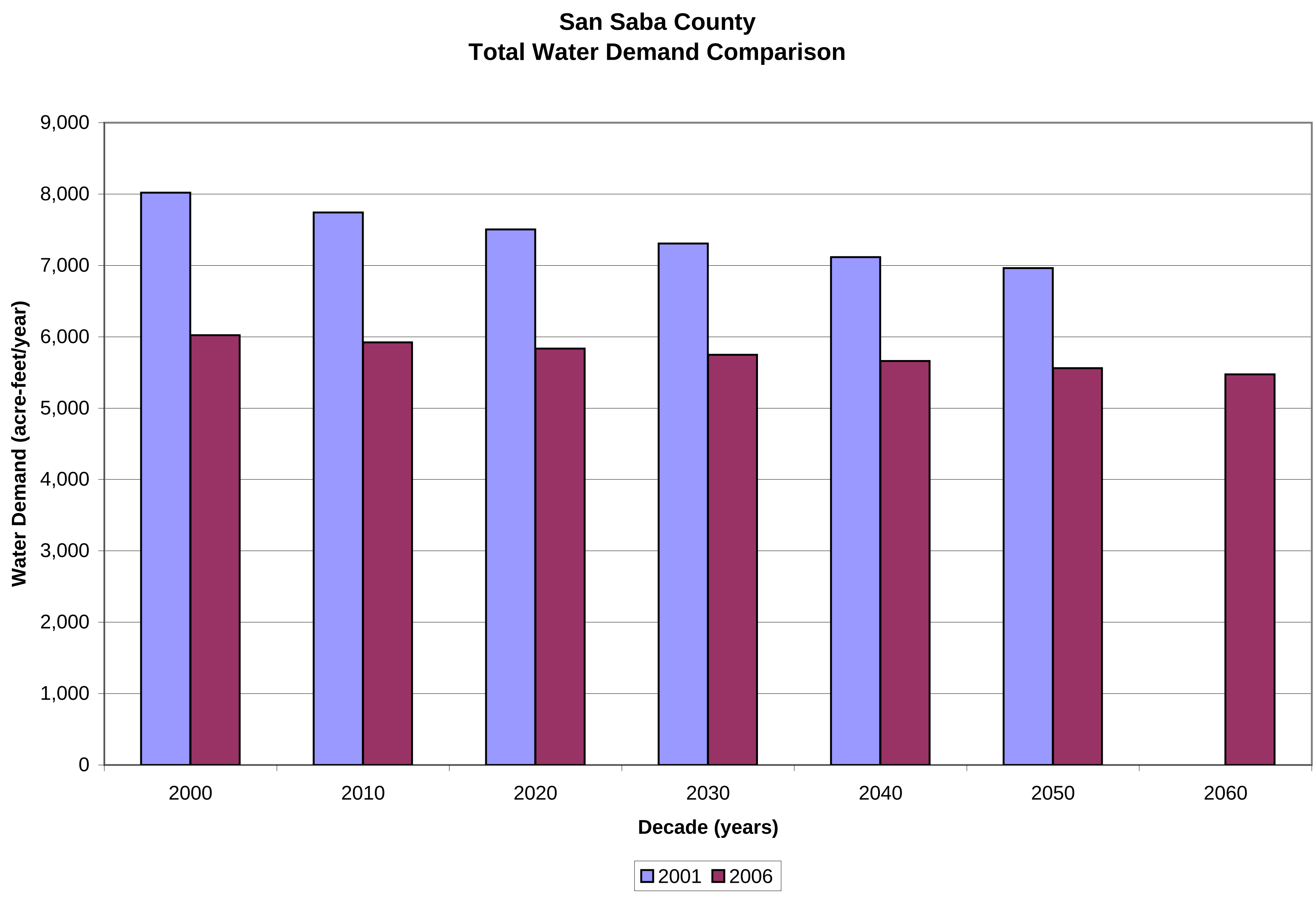
Mills County
Total Water Demand Comparison
Water Demand (acre-feet/year)
6,000
5,000
4,000
3,000
2,000
1,000
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
San Saba County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	1,100	1,040	985	957	927	927	NA
2006	1,296	1,299	1,316	1,328	1,339	1,331	1,336
Difference	196	259	331	371	412	404	NA
% Change	17.8	24.9	33.6	38.8	44.4	43.6	NA
Livestock							
2001	1,200	1,200	1,200	1,200	1,200	1,200	NA
2006	1,191	1,191	1,191	1,191	1,191	1,191	1,191
Difference	-9	-9	-9	-9	-9	-9	NA
% Change	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	NA
Irrigation							
2001	5,549	5,369	5,196	5,028	4,866	4,708	NA
2006	3,349	3,240	3,136	3,035	2,937	2,841	2,749
Difference	-2,200	-2,129	-2,060	-1,993	-1,929	-1,867	NA
% Change	-39.6	-39.7	-39.6	-39.6	-39.6	-39.7	NA
Manufacturing							
2001	0	0	0	0	0	0	NA
2006	24	28	30	31	32	33	35
Difference	24	28	30	31	32	33	NA
% Change	NA	NA	NA	NA	NA	NA	NA
Mining							
2001	172	133	124	123	122	126	NA
2006	163	163	163	163	163	163	163
Difference	-9	30	39	40	41	37	NA
% Change	-5.2	22.6	31.5	32.5	33.6	29.4	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	8,021	7,742	7,505	7,308	7,115	6,961	NA
2006	6,023	5,921	5,836	5,748	5,662	5,559	5,474
Difference	-1,998	-1,821	-1,669	-1,560	-1,453	-1,402	NA
% Change	-24.9	-23.5	-22.2	-21.3	-20.4	-20.1	NA

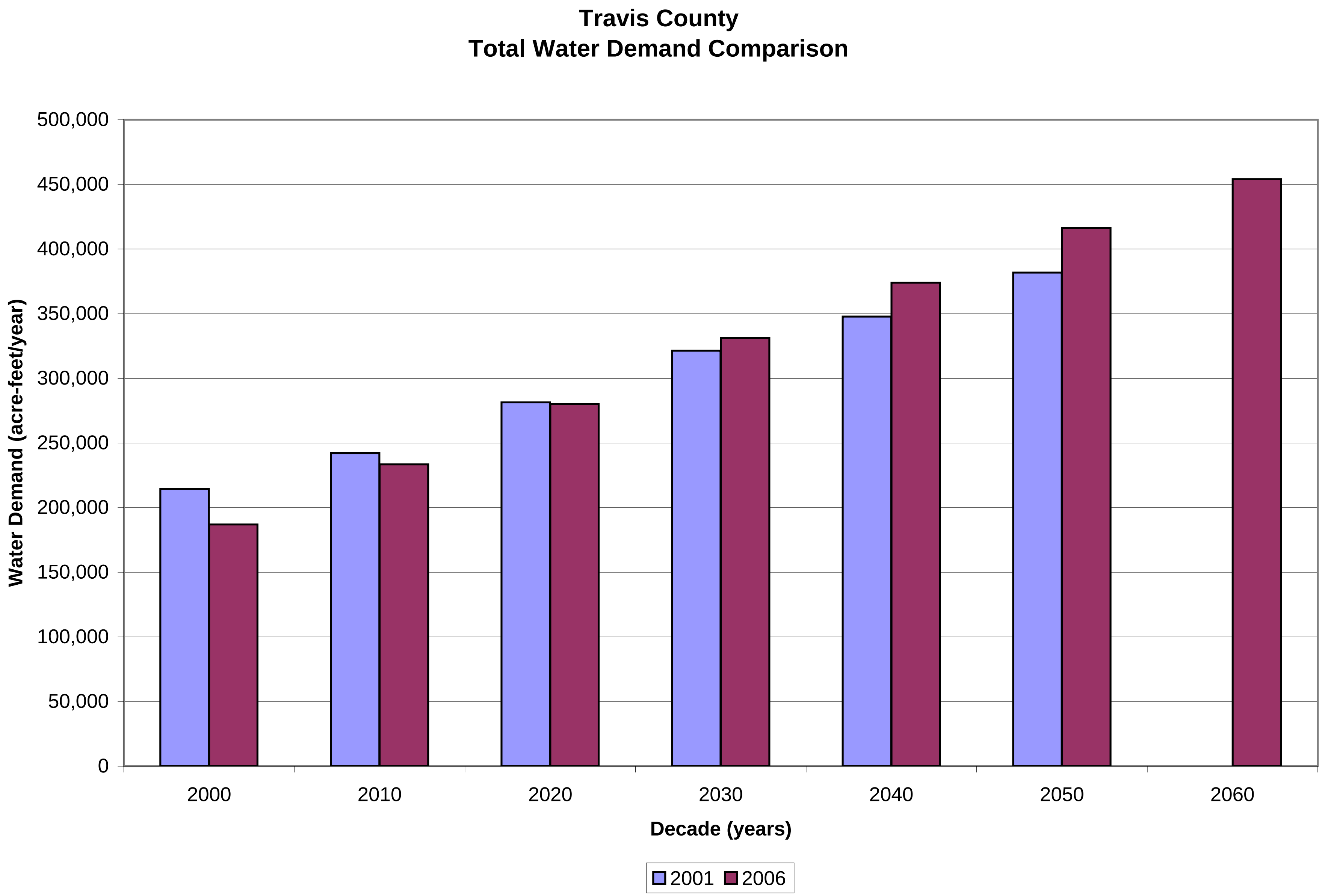

San Saba County
Total Water Demand Comparison
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Travis County

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	177,264	202,958	240,232	278,011	301,638	329,189	NA
2006	160,151	189,602	229,928	266,748	296,675	327,840	357,541
Difference	-17,113	-13,356	-10,304	-11,263	-4,963	-1,349	NA
% Change	-9.7	-6.6	-4.3	-4.1	-1.6	-0.4	NA
Livestock							
2001	906	906	906	906	906	906	NA
2006	704	704	704	704	704	704	704
Difference	-202	-202	-202	-202	-202	-202	NA
% Change	-22.3	-22.3	-22.3	-22.3	-22.3	-22.3	NA
Irrigation							
2001	736	677	622	572	526	484	NA
2006	1,224	1,126	1,034	951	875	805	741
Difference	488	449	412	379	349	321	NA
% Change	66.3	66.3	66.2	66.3	66.3	66.3	NA
Manufacturing							
2001	17,186	19,320	20,843	22,633	24,757	27,654	NA
2006	16,179	23,002	28,294	38,508	50,483	57,703	64,652
Difference	-1,007	3,682	7,451	15,875	25,726	30,049	NA
% Change	-5.9	19.1	35.7	70.1	103.9	108.7	NA
Mining							
2001	4,880	4,746	5,246	5,791	6,407	7,116	NA
2006	1,285	1,531	1,649	1,727	1,804	1,880	1,935
Difference	-3,595	-3,215	-3,597	-4,064	-4,603	-5,236	NA
% Change	-73.7	-67.7	-68.6	-70.2	-71.8	-73.6	NA
Steam-Electric Power Generation							
2001	13,500	13,500	13,500	13,500	13,500	16,500	NA
2006	7,494	17,500	18,500	22,500	23,500	27,500	28,500
Difference	-6,006	4,000	5,000	9,000	10,000	11,000	NA
% Change	-44.5	29.6	37.0	66.7	74.1	66.7	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	214,472	242,107	281,349	321,413	347,734	381,849	NA
2006	187,037	233,465	280,109	331,138	374,041	416,432	454,073
Difference	-27,435	-8,642	-1,240	9,725	26,307	34,583	NA
% Change	-12.8	-3.6	-0.4	3.0	7.6	9.1	NA

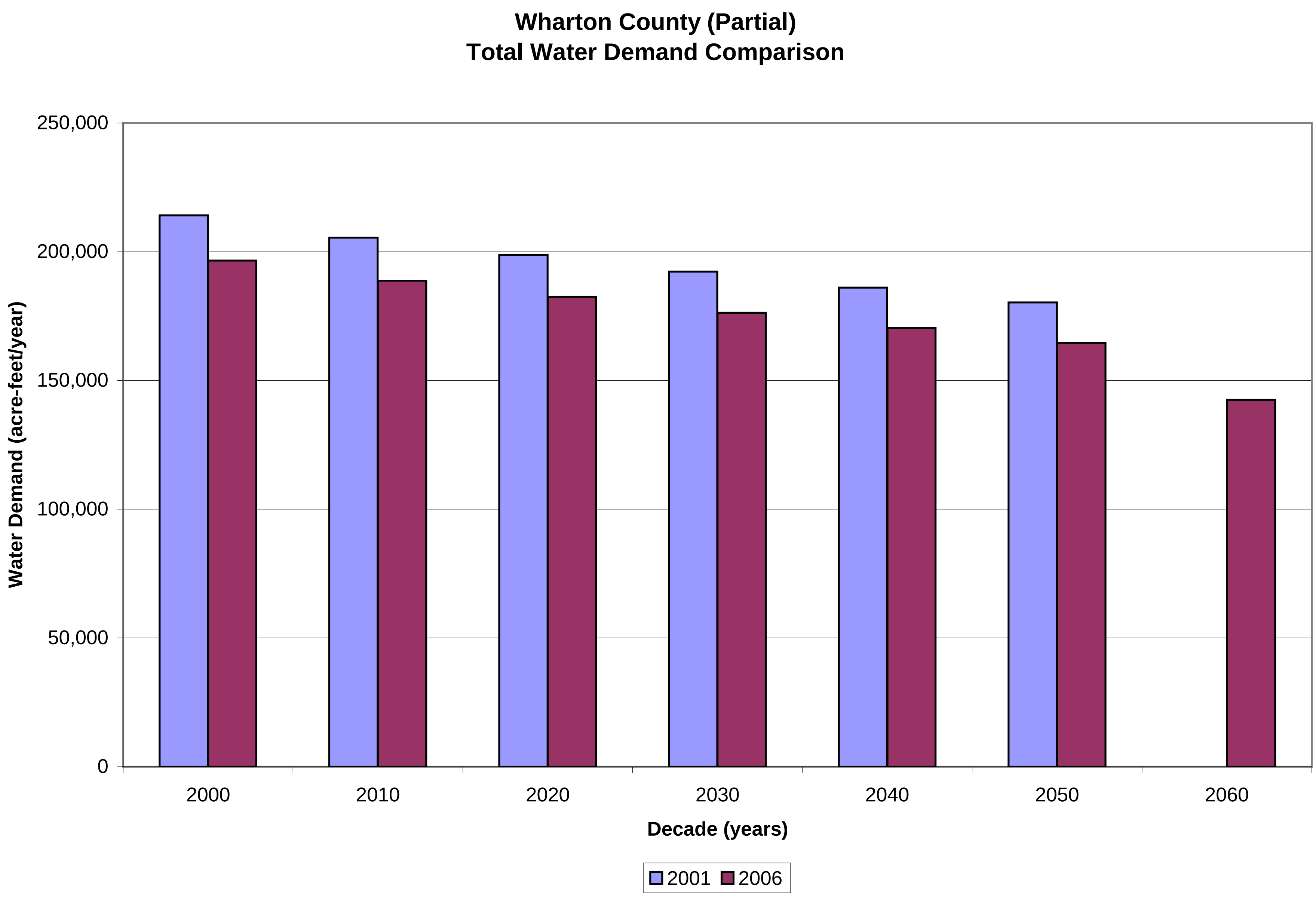

Travis County
Total Water Demand Comparison
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Wharton County (partial)

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	4,494	4,644	4,804	5,053	5,323	5,754	NA
2006	3,680	3,776	3,880	3,910	3,880	3,847	3,806
Difference	-814	-868	-924	-1,143	-1,443	-1,907	NA
% Change	-18.1	-18.7	-19.2	-22.6	-27.1	-33.1	NA
Livestock							
2001	844	844	844	844	844	844	NA
2006	728	728	728	728	728	728	728
Difference	-116	-116	-116	-116	-116	-116	NA
% Change	-13.7	-13.7	-13.7	-13.7	-13.7	-13.7	NA
Irrigation							
2001	206,067	197,171	190,119	183,317	176,760	170,439	NA
2006	191,241	182,985	176,441	170,127	164,044	158,177	135,911
Difference	-14,826	-14,186	-13,678	-13,190	-12,716	-12,262	NA
% Change	-7.2	-7.2	-7.2	-7.2	-7.2	-7.2	NA
Manufacturing							
2001	369	408	439	469	503	537	NA
2006	256	313	343	366	390	410	442
Difference	-113	-95	-96	-103	-113	-127	NA
% Change	-30.6	-23.3	-21.9	-22.0	-22.5	-23.6	NA
Mining							
2001	2,370	2,428	2,500	2,567	2,641	2,720	NA
2006	633	731	773	798	822	844	864
Difference	-1,737	-1,697	-1,727	-1,769	-1,819	-1,876	NA
% Change	-73.3	-69.9	-69.1	-68.9	-68.9	-69.0	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	10	245	351	411	483	572	679
Difference	10	245	351	411	483	572	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	214,144	205,495	198,706	192,250	186,071	180,294	NA
2006	196,548	188,778	182,516	176,340	170,347	164,578	142,430
Difference	-17,596	-16,717	-16,190	-15,910	-15,724	-15,716	NA
% Change	-8.2	-8.1	-8.1	-8.3	-8.5	-8.7	NA

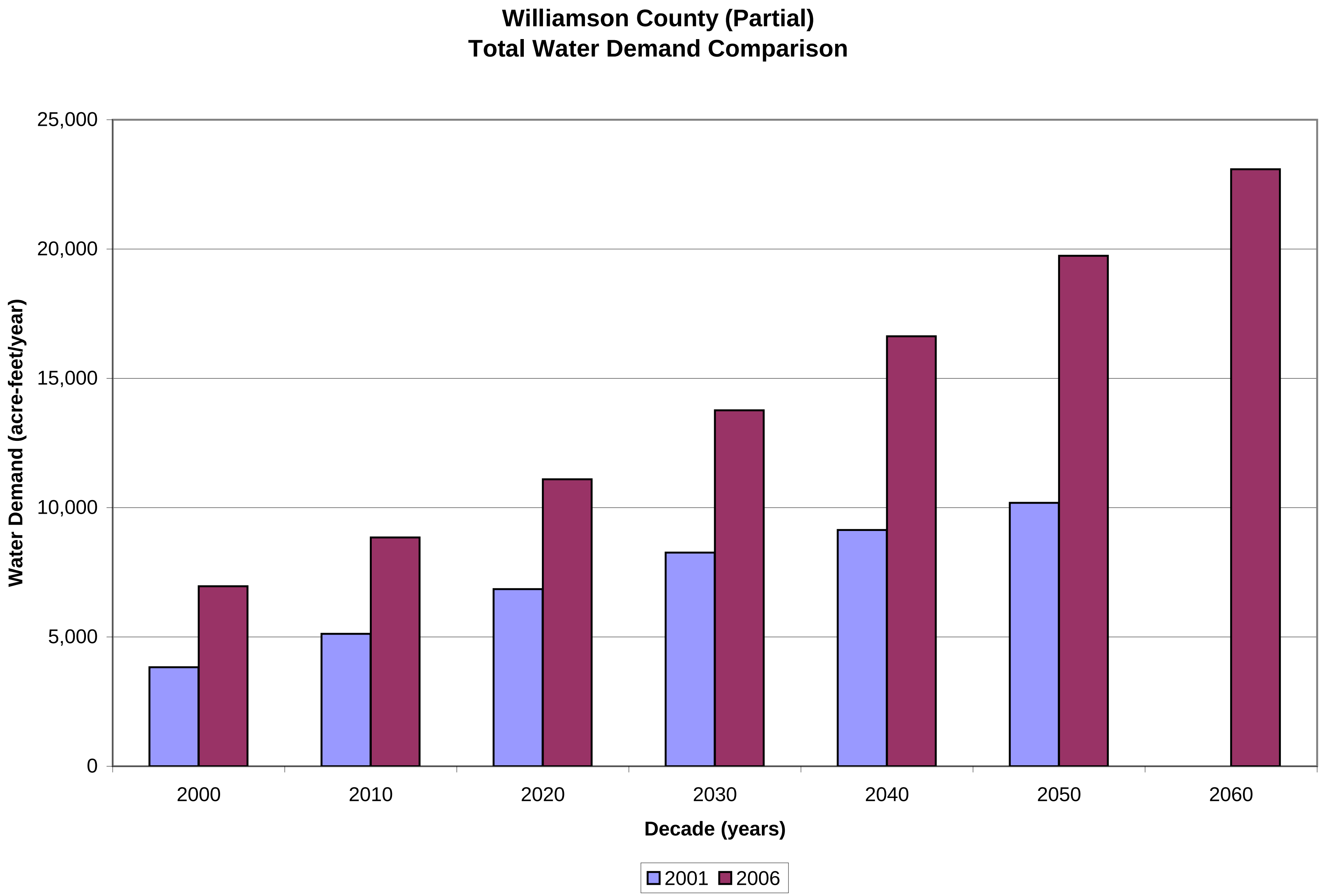

Wharton County (Partial)
Total Water Demand Comparison
Water Demand (acre-feet/year)
250,000
200,000
150,000
100,000
50,000
0
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

Water Demands* (in acre-feet per year) by WUG Category
Williamson County (partial)

RWP	2000	2010	2020	2030	2040	2050	2060
Municipal							
2001	3,814	5,115	6,844	8,256	9,136	10,187	NA
2006	6,949	8,841	11,095	13,761	16,625	19,743	23,082
Difference	3,135	3,726	4,251	5,505	7,489	9,556	NA
% Change	82.2	72.8	62.1	66.7	82.0	93.8	NA
Livestock							
2001	1	1	1	1	1	1	NA
2006	0	0	0	0	0	0	0
Difference	-1	-1	-1	-1	-1	-1	NA
% Change	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	NA
Irrigation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA
Manufacturing							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA
Mining							
2001	13	9	5	1	0	0	NA
2006	13	9	5	1	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	0.0	0.0	0.0	0.0	#DIV/0!	#DIV/0!	NA
Steam-Electric Power Generation							
2001	0	0	0	0	0	0	NA
2006	0	0	0	0	0	0	0
Difference	0	0	0	0	0	0	NA
% Change	NA	NA	NA	NA	NA	NA	NA

*All values are presented in acre-feet per year

Total Water Demand							
2001	3,828	5,125	6,850	8,258	9,137	10,188	NA
2006	6,962	8,850	11,100	13,762	16,625	19,743	23,082
Difference	3,134	3,725	4,250	5,504	7,488	9,555	NA
% Change	81.9	72.7	62.0	66.7	82.0	93.8	NA



Williamson County (Partial)
Total Water Demand Comparison
25,000
20,000
15,000
10,000
5,000
0
Water Demand (acre-feet/year)
2000
2010
2020
2030
2040
2050
2060
Decade (years)
2001
2006

APPENDIX 2C

LCRWPG GALLONS PER CAPITA DAY (GPCD)

			Estimated Gallons per Capita Day*						
WUG Name	**County**	**River Basin**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
AQUA WSC	BASTROP	COLORADO	139	134	131	128	127	126	126
BASTROP	BASTROP	COLORADO	205	200	196	194	192	191	191
BASTROP COUNTY WCID #2	BASTROP	COLORADO	139	134	132	130	129	129	129
COUNTY-OTHER	BASTROP	BRAZOS	123	122	122	121	121	121	121
COUNTY-OTHER	BASTROP	COLORADO	124	122	122	121	121	121	121
COUNTY-OTHER	BASTROP	GUADALUPE	125	123	121	121	121	121	121
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	96	94	89	89	87	86	87
ELGIN	BASTROP	COLORADO	153	148	145	142	140	139	139
LEE COUNTY WSC	BASTROP	BRAZOS	136	130	127	125	124	123	123
LEE COUNTY WSC	BASTROP	COLORADO	135	131	127	125	124	123	123
MANVILLE WSC	BASTROP	COLORADO	124	119	117	115	114	114	114
POLONIA WSC	BASTROP	COLORADO	88	80	78	77	75	75	75
SMITHVILLE	BASTROP	COLORADO	149	144	140	138	136	135	135
BLANCO	BLANCO	GUADALUPE	166	162	158	156	153	152	152
CANYON LAKE WSC	BLANCO	GUADALUPE	137	134	133	132	132	132	132
COUNTY-OTHER	BLANCO	COLORADO	93	88	85	83	81	80	80
COUNTY-OTHER	BLANCO	GUADALUPE	93	88	85	83	81	80	80
JOHNSON CITY	BLANCO	COLORADO	216	211	208	205	203	202	202
BERTRAM	BURNET	BRAZOS	180	176	173	171	169	168	168
BURNET	BURNET	COLORADO	160	156	153	150	149	148	148
CHISHOLM TRAIL SUD	BURNET	BRAZOS	113	140	143	147	151	152	152
COTTONWOOD SHORES	BURNET	COLORADO	123	119	116	114	113	112	112
COUNTY-OTHER	BURNET	BRAZOS	84	80	78	76	75	74	74
COUNTY-OTHER	BURNET	COLORADO	84	80	78	76	75	74	74
GRANITE SHOALS	BURNET	COLORADO	143	138	134	132	130	129	129
KEMPNER WSC	BURNET	BRAZOS	306	301	298	297	296	295	295
KINGSLAND WSC	BURNET	COLORADO	139	134	132	128	126	125	124
LAKE LBJ MUD	BURNET	COLORADO	253	248	246	243	240	239	239
MARBLE FALLS	BURNET	COLORADO	291	286	283	280	278	277	277
MEADOWLAKES	BURNET	COLORADO	340	337	335	334	333	333	333
COLUMBUS	COLORADO	COLORADO	230	226	223	220	217	216	216
COUNTY-OTHER	COLORADO	BRAZOS-COLORADO	98	95	92	89	86	85	85
COUNTY-OTHER	COLORADO	COLORADO	98	95	92	89	86	85	85
COUNTY-OTHER	COLORADO	LAVACA	98	95	92	89	86	85	85
EAGLE LAKE	COLORADO	BRAZOS-COLORADO	138	135	131	128	125	124	124
EAGLE LAKE	COLORADO	COLORADO	138	135	131	128	125	124	124
WEIMAR	COLORADO	COLORADO	152	148	144	141	138	137	137
WEIMAR	COLORADO	LAVACA	152	148	144	142	137	137	137
AQUA WSC	FAYETTE	COLORADO	138	133	130	128	127	126	126

			Estimated Gallons per Capita Day*						
WUG Name	County	River Basin	2000	2010	2020	2030	2040	2050	2060
COUNTY-OTHER	FAYETTE	BRAZOS	0	0	0	0	0	0	0
COUNTY-OTHER	FAYETTE	COLORADO	124	120	116	114	111	110	111
COUNTY-OTHER	FAYETTE	GUADALUPE	125	120	115	116	105	115	94
COUNTY-OTHER	FAYETTE	LAVACA	124	120	116	114	111	109	112
FAYETTE WSC	FAYETTE	COLORADO	121	115	113	111	110	110	110
FAYETTE WSC	FAYETTE	LAVACA	122	114	113	111	110	110	110
FLATONIA	FAYETTE	GUADALUPE	200	197	191	190	188	186	186
FLATONIA	FAYETTE	LAVACA	200	196	192	190	187	186	186
LA GRANGE	FAYETTE	COLORADO	160	155	152	150	148	147	147
LEE COUNTY WSC	FAYETTE	COLORADO	136	131	127	125	124	123	123
SCHULENBURG	FAYETTE	LAVACA	186	180	177	174	172	171	171
COUNTY-OTHER	GILLESPIE	COLORADO	110	106	103	100	98	97	97
COUNTY-OTHER	GILLESPIE	GUADALUPE	110	106	103	100	98	97	97
FREDERICKSBURG	GILLESPIE	COLORADO	246	242	239	236	234	233	233
BUDA	HAYS	COLORADO	143	139	136	134	133	132	132
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	154	149	145	143	142	141	141
COUNTY-OTHER	HAYS	COLORADO	136	132	129	127	126	126	126
DRIPPING SPRINGS	HAYS	COLORADO	185	181	178	176	175	175	175
DRIPPING SPRINGS WSC	HAYS	COLORADO	131	125	123	122	121	121	121
HILL COUNTRY WSC	HAYS	COLORADO	131	126	124	124	123	123	123
MOUNTAIN CITY	HAYS	COLORADO	148	143	141	141	139	139	139
COUNTY-OTHER	LLANO	COLORADO	187	185	184	184	183	182	182
KINGSLAND WSC	LLANO	COLORADO	138	134	132	129	126	125	125
LAKE LBJ MUD	LLANO	COLORADO	252	248	246	243	240	239	239
LLANO	LLANO	COLORADO	268	265	262	259	256	254	254
SUNRISE BEACH VILLAGE	LLANO	COLORADO	219	215	214	212	209	208	208
BAY CITY	MATAGORDA	BRAZOS-COLORADO	150	145	142	139	136	135	135
COUNTY-OTHER	MATAGORDA	BRAZOS-COLORADO	99	95	92	89	86	85	85
COUNTY-OTHER	MATAGORDA	COLORADO	99	95	92	89	86	85	85
COUNTY-OTHER	MATAGORDA	COLORADO-LAVACA	99	95	92	89	86	85	85
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	74	69	66	64	62	62	62
PALACIOS	MATAGORDA	COLORADO-LAVACA	124	121	118	115	113	112	112
SOUTHWEST UTILITIES	MATAGORDA	BRAZOS-COLORADO	104	100	97	95	93	92	92
BROOKSMITH SUD	MILLS	COLORADO	160	160	159	155	152	155	142
COUNTY-OTHER	MILLS	BRAZOS	110	107	104	101	98	97	97
COUNTY-OTHER	MILLS	COLORADO	110	107	104	101	98	97	97
GOLDTHWAITE	MILLS	BRAZOS	298	298	287	287	287	255	255
GOLDTHWAITE	MILLS	COLORADO	286	282	279	276	273	271	271

			Estimated Gallons per Capita Day*						
WUG Name	County	River Basin	2000	2010	2020	2030	2040	2050	2060
COUNTY-OTHER	SAN SABA	COLORADO	77	75	72	70	69	68	68
RICHLAND SUD	SAN SABA	COLORADO	164	160	157	154	151	150	150
SAN SABA	SAN SABA	COLORADO	302	299	296	293	290	288	288
ANDERSON MILL MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
AQUA WSC	TRAVIS	COLORADO	139	134	131	128	127	126	126
AUSTIN	TRAVIS	COLORADO	175	174	173	172	171	170	169
BARTON CREEK WEST WSC	TRAVIS	COLORADO	247	246	244	242	241	240	240
BEE CAVE VILLAGE	TRAVIS	COLORADO	467	464	463	462	461	461	461
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	183	176	172	170	169	168	168
CEDAR PARK	TRAVIS	COLORADO	185	182	181	180	180	180	180
COUNTY-OTHER	TRAVIS	COLORADO	175	174	173	172	171	170	169
COUNTY-OTHER	TRAVIS	GUADALUPE	128	128	128	128	128	128	128
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	98	94	90	88	87	86	86
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	100	95	92	87	88	88	87
ELGIN	TRAVIS	COLORADO	162	143	144	139	140	140	139
GOFORTH WSC	TRAVIS	COLORADO	99	93	91	89	88	89	87
HILL COUNTRY WSC	TRAVIS	COLORADO	131	126	124	124	123	123	123
JONESTOWN	TRAVIS	COLORADO	130	126	123	120	119	118	118
JONESTOWN WSC	TRAVIS	COLORADO	123	118	115	112	111	110	110
LAGO VISTA	TRAVIS	COLORADO	296	292	290	289	288	288	288
LAKEWAY	TRAVIS	COLORADO	296	292	290	288	287	287	287
LAKEWAY MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
LOOP 360 WSC	TRAVIS	COLORADO	394	391	390	389	388	388	388
LOST CREEK MUD	TRAVIS	COLORADO	195	191	188	185	182	180	180
MANOR	TRAVIS	COLORADO	197	193	189	186	184	183	183
MANVILLE WSC	TRAVIS	COLORADO	124	119	117	115	114	114	114
MUSTANG RIDGE	TRAVIS	COLORADO	221	216	213	211	211	210	210
MUSTANG RIDGE	TRAVIS	GUADALUPE	218	219	216	211	210	210	209
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	128	125	122	121	118	117	117
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	132	127	126	125	124	124	124
PFLUGERVILLE	TRAVIS	COLORADO	159	156	154	153	152	152	152
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	297	295	293	293	292	292	292
ROLLINGWOOD	TRAVIS	COLORADO	242	238	235	232	229	227	227
ROUND ROCK	TRAVIS	COLORADO	201	197	194	192	191	191	191
SHADY HOLLOW MUD	TRAVIS	COLORADO	144	141	138	135	132	131	131
THE HILLS	TRAVIS	COLORADO	222	220	218	218	217	217	217
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	165	161	158	157	156	156	156
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	125	121	118	116	115	114	114
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	473	469	466	464	463	463	463
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	364	362	360	358	357	356	356
WELLS BRANCH MUD	TRAVIS	COLORADO	166	164	162	160	157	156	156

			Estimated Gallons per Capita Day*						
WUG Name	County	River Basin	2000	2010	2020	2030	2040	2050	2060
WEST LAKE HILLS	TRAVIS	COLORADO	411	407	403	401	399	398	398
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	147	143	141	140	139	139	139
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	109	104	102	101	100	100	100
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	110	107	106	105	104	104	104
COUNTY-OTHER	WHARTON	BRAZOS-COLORADO	106	102	99	96	93	92	92
COUNTY-OTHER	WHARTON	COLORADO	106	102	99	96	93	92	92
COUNTY-OTHER	WHARTON	COLORADO-LAVACA	106	102	99	96	93	92	92
WHARTON	WHARTON	BRAZOS-COLORADO	155	152	148	145	142	141	141
WHARTON	WHARTON	COLORADO	155	152	148	145	142	141	141
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	152	148	145	142	139	137	137
AUSTIN	WILLIAMSON	BRAZOS	175	174	173	172	171	170	169
COUNTY-OTHER	WILLIAMSON	BRAZOS	175	174	173	172	171	170	169
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	128	125	123	121	118	117	117

Note: (daily per capita water-use rate, gallons per capita day, GPCD) = Municipal Water Demand (ac-ft/yr) / Population * (1 year / 365 days) * (325,851 gallons / 1 ac-ft)

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CHAPTER 3.0: IDENTIFICATION OF CURRENTLY AVAILABLE WATER SUPPLIES

A key task in the preparation of the Lower Colorado Regional Water Plan (LCRWP) is to determine the current available water supplies within the region. This information, when compared to the population and water demand projections, is critical in projecting water supply shortfalls and surpluses for the region, including the amount of shortfall, when a shortfall is expected to occur, and the county in which the shortfall is expected.

As presented in Chapter 2, the expected water demand in the Lower Colorado Regional Water Planning Area (LCRWPA) is projected to increase by approximately 23 percent while the population is projected to more than double over the next 60 years. Therefore, the need to accurately identify available water supplies is a critical component of developing the regional plan.

The following sections of the chapter describe the methodologies utilized in developing estimates of currently available water supplies for the LCRWPA. This chapter also presents regional water supplies by county, wholesale water providers of municipal water, and the six Texas Water Development Board (TWDB) specified water-use categories.

3.1 TWDB GUIDELINES FOR REVISIONS TO WATER SUPPLIES

The Texas Water Development Board (TWDB) has promulgated rules for regional planning and has provided specific guidance to Regional Water Planning Groups (RWPGs) concerning the development of estimates of currently available water supplies. The guidance clearly indicates that the estimates of currently available water supplies shall reflect water that is reliably available to the area during a repeat of the "drought-of-record" (DOR) conditions. The specific methods used in determining the amount of currently available water vary depending upon whether it is a groundwater or surface water resource. A summary of TWDB guidelines and methods for estimating currently available water supply is presented below.

3.2 AVAILABLE WATER SOURCES TO THE LCRWPA

In accordance with the TWDB guidelines, five basic types of water supply exist within the LCRWPA. The types are as follows:

- Surface water supplies
- Groundwater supplies
- Supplies available through contractual arrangements
- Supplies available through the operation of a system of reservoirs or other supplies
- Reclaimed water

Since supplies available through the last three categories originated from either surface or groundwater sources, all available water supplies will be discussed in terms of being either of surface water origin or groundwater origin. The following sections present information concerning the available supply of water within the LCRWPA. That is to say, water that is physically present within the LCRWPA, whether it is present due to natural circumstances, or it is present as a result of facilities constructed by one or more water users within the LCRWPA.

3.2.1 Surface Water Availability

Surface water sources include any water resource where water is obtained directly from a surface water body. This would include rivers, streams, creeks, lakes, ponds, and tanks. In the State of Texas, all waters contained in a watercourse (rivers, natural streams, and lakes, and the storm water, flood water, and rainwater of every river, natural stream, canyon, ravine, depression, and watershed) are waters of the State and thus belong to the State. The State grants individuals, municipalities, water suppliers, and industries the right to divert and use this water through water rights permits. Water rights are considered property rights and can be bought, sold, or transferred with state approval. These permits are issued based on the concept of prior appropriation, or "first-in-time, first-in-right." Water rights issued by the State generally fall into two major categories:

- Run-of-River (ROR) Rights – Allow diversions of water directly from a water body as long as there is water in the stream and that water is not needed to meet a senior downstream water right. ROR rights are greatly impacted by drought conditions, particularly in the upper portions of a river basin.

- Stored Water Rights – Allow the impoundment of water by a permittee in a reservoir. Water can be held for storage as long as the inflow is not needed to meet a senior downstream water right. Water stored in the reservoir can be withdrawn by the permittee at a later date to meet water demands. The storage of water in a reservoir gives the permittee a buffer against drought conditions.

A list of active water rights within the LCRWPA is contained in *Appendix 3A*.

In addition to the water rights permits issued by the State, individual landowners may use state waters without a specific permit for certain types of use. The most common of these uses is domestic and livestock use. Landowners are also allowed to construct impoundments on their own property with up to 200 acre-feet (ac-ft) of storage for domestic and livestock or certain wildlife management purposes. These types of water sources are generally referred to as "Local Supply Sources." Many individuals with land along a river or stream that still have an old riparian right can also divert a reasonable amount of water for domestic and livestock uses without a permit.

Water availability in Region K will be determined for the purposes of regional planning as prescribed by the TWDB water planning guidelines. The TWDB guidance requires that the amount of surface water available from each source be determined with the following assumptions:

- Water availability will be estimated based on a "firm yield" analysis. For a reservoir system, this analysis would produce the average annual withdrawals available during a repeat of the drought of record considering the long-term storage capabilities, projected inflows, and evaporation. For water rights based solely on run-of-river, the drought of record corresponds to the driest period on record. Without available storage, water is no longer available if the river goes dry. In addition, a run-of-river right may not be able to divert even if there is water in the river or stream due to the constraints of the prior appropriation system or environmental flow limitations.

- Water availability will be based on the assumption that all senior water rights in the basin are being fully utilized. That is, water user groups cannot depend on "borrowing" water from unused water rights.

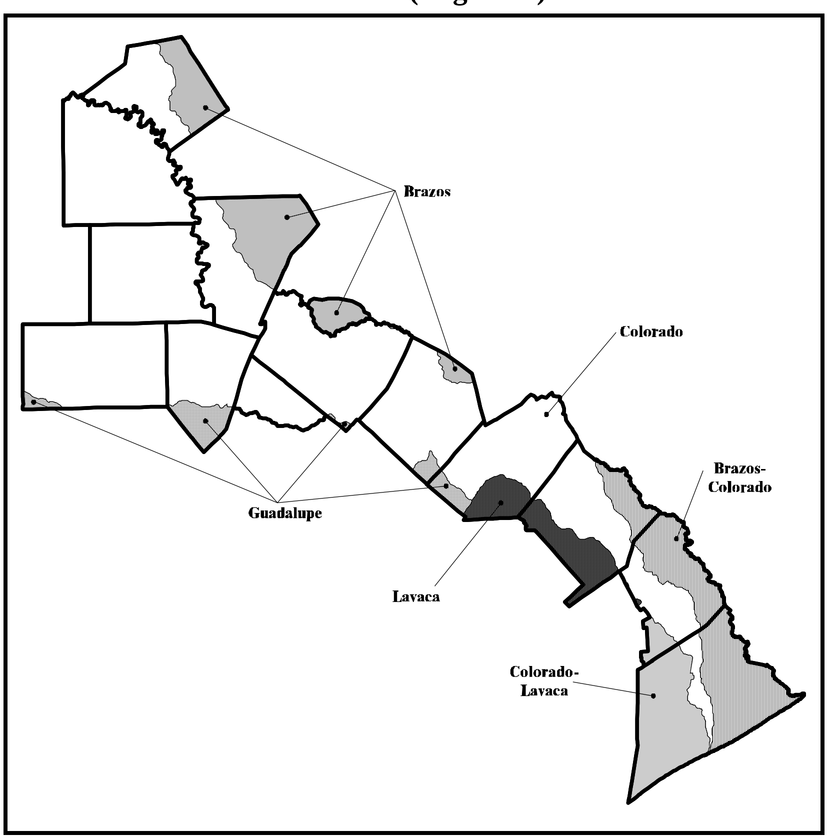
- Water supply is based on the infrastructure that is in place. For example, water would not be considered to be a supply from a reservoir if a user still needed to construct the water intake and pipeline to convey the water from the reservoir to the area of need.

It should be noted that state directives (summarized above) to regional water planners on how they are to determine water availability in meeting future water supply needs may impose unrealistic assumptions on how water is actually used or will be used over the planning period. This methodology requires local water planners to assume that every water right holder will simultaneously divert and totally consume the water up to their full authorizations. These directives have the potential to over estimate water shortages.

Although "worst case" conservative assumptions may be appropriate to avoid the theoretical "over permitting" of water, it may be unrealistic to use this methodology alone for planning purposes. Rather local and regional planners should be allowed, and are to some extent by the existing process, to bring their knowledge, experience, and common sense to the "planning effort" to determine realistic water availability assumptions, something Senate Bill 1 was intended to provide by establishing a "bottom-up" approach to replace the previous "top-down" state planning approach.

The LCRWPA traverses six different river basins, including the Brazos, Brazos-Colorado Coastal, Colorado, Colorado-Lavaca Coastal, Lavaca, and Guadalupe River Basins. *Figure 3.1* illustrates the location of each of these basins. The following sections discuss the available water sources in each river basin within the LCRWPA.

Figure 3.1: River Basins Within the LCRWPA (Region K)



3.2.1.1 Colorado River Basin

The majority of the LCRWPA is contained in the Colorado River Basin. The primary sources of water within this basin are the Highland Lakes and run-of-river water from the Colorado River. However, several water user groups obtain water from tributaries or off-channel ponds.

The availability (firm supplies available during a drought of record) of existing surface water supplies in the Colorado River Basin, specifically major run-of-river rights and reservoirs firm yields, were calculated using the Texas Commission on Environmental Quality's (TCEQ) Colorado River Basin Water Availability Model (WAM), dated November 2004. The results were viewed using the July 2004 version of the WRAP modeling program, created by Dr. Ralph Wurbs with Texas A&M University.

The Run 3 version of the model was used, which assumes full utilization of all water rights. Full utilization is defined as 100 percent of the authorized diversion with 100 percent reuse of return flows, i.e. no return flow to the river. This is the most conservative version of the model and will provide the most conservative results. It is important to note that the LCRA Water Management Plan does take return flows into consideration.

The WAM Run 3 was used in its existing state to determine the 2000 water availability and was used with adjusted reservoir area-capacity curves to project the availability for 2010 through 2060. The reservoir area-capacity information was obtained from the LCRA, Freese and Nichols, Inc. (Region F consultant) and by using the December 2001 *Water Availability Modeling for the Colorado/Brazos-Colorado Basin Modeling Report* prepared by R.J. Brandes Company.

The results showing the availability of firm water supplies and the need for firm water backup for some ROR rights are significantly different from the initial regional water plan. The most significant differences between the LCRA RESPONSE Model (which was utilized for the 2001 Plan and developed, in part, from data contained in the Texas Water Commission's legacy model, LP-60) and the WAM are:

1. The availability of inflows above Ivie Reservoir in the WAM

2. The inclusion of the priority of the storage right as well as the diversion right for the Highland Lakes in the WAM

3. Differences in the underlying hydrology (naturalized flow) between the models

Other differences are outlined in *Appendix 3B*.

In addition to the standard WAM Run 3 described above, the Regional Planning Group also authorized the development of an alternative WAM run which will be referred to as the "No Call" WAM Run 3. The No Call WAM was developed as a result of a request from the Region F Planning Group. The November 2004 WAM indicated a lack of water available on a firm yield basis in a number of Region F's reservoirs as compared to the last planning cycle. In addition, there was some similarity between the No Call WAM and the current operations of the river system. The No Call WAM and a more definitive explanation of the reasons for its use are presented in Section 3.2.1.2, and in *Appendix 3C*. The Colorado River surface water availability amounts developed through the No Call WAM are the amounts used in developing this plan. These availability numbers are presented starting on page 3-15.

3.2.1.1.1 Highland Lakes System

The Highland Lakes System is composed of two major water storage reservoirs – Lakes Buchanan and Travis. These lakes are owned and operated by the LCRA. In addition, the system contains three intermediary lakes owned and operated by the LCRA – Inks Lake, Lake LBJ, and Lake Marble Falls. Lake Austin, the last in the Highland Lakes System, is owned by the City of Austin and is operated by the LCRA through an agreement.

The LCRA operates the Highland Lakes as a system to provide a reliable source of water to downstream customers. The LCRA developed a "Water Management Plan for the Lower Colorado River Basin" in response to requirements contained in a final order of adjudication of water rights to the LCRA for the Highland Lakes. The Water Management Plan (WMP) was originally adopted in 1989 and has been amended several times, most recently in March 1999, and proposed amendments to the WMP submitted in May 2003 are currently undergoing TCEQ review. As part of the original WMP, LCRA determined the combined firm yield of Lakes Buchanan and Travis based on a detailed analysis of the water availability for Lakes Buchanan and Travis during a repeat of the drought of record. The WMP also contains a management strategy for meeting the 10-year projected demands of its firm municipal and industrial customers, while continuing to provide water for environmental needs and agricultural purposes, largely on an interruptible basis. The LCRA's WMP determines the amount of interruptible water supply that can be made available while continuing to ensure the availability of water for firm demands in a repeat of a drought of records using a system of curtailment triggers that are linked to actual water in storage on January 1 of each year. The interruptible supply is generally comprised of uncommitted firm supply, committed firm supply that is not projected to be used in the ten year planning period covered by the plan, and flood flows. As firm commitments and demands for water under those commitments increase over time, interruptible supplies must be reduced more often even at higher storage levels to ensure the availability of water to firm customers in a DOR. The November 2004 TCEQ Colorado Basin WAM model was developed using the LCRA 1999 WMP, and therefore that is the version of the WMP that was used for the development of water availability in this regional water plan.

The firm yield of the Highland Lakes System was determined by using the Colorado River Basin WAM and adding up the various components of the Highland Lakes System. The model, which was developed by TCEQ with help from the LCRA to include their Water Management Plan, took the following factors into account:

- Water rights were protected based on prior appropriation doctrine
- The hydrologic conditions in the 1940-1998 period are repeated
- Downstream, senior water rights are being fully utilized during this period. The water rights in the Lower Colorado Region are included in *Appendix 3A*
- The LCRA cannot impose its priority rights for Lakes Buchanan and Travis against any upstream, junior water right with a priority date senior to November 1, 1987, so long as interruptible supplies are not curtailed
- Historical net evaporation rates for the period of 1940 through 1998
- Downstream water demands were assumed to be met with inflows to the river below the Highland Lakes, to the extent possible

- The firm yield of the Highland Lakes is reduced by a certain amount due to the agreement with the Colorado River Municipal Water District and the operation of the O.H. Ivie Reservoir.

The method (2004 WAM) used to determine the firm yield of Lakes Buchanan and Travis in this plan differs from the method used to calculate the combined firm yield approved by the Texas Water Commission as part of LCRA's WMP in 1989 in at least three ways. First, the 1989 calculation imposed no curtailment triggers for interruptible supply whereas the 2004 WAM incorporated these triggers. Similarly, the second difference is that criteria for meeting certain environmental flow needs are embedded in the 2004 WAM whereas the 1989 calculations contained no conditions allocating flows to environmental needs or any other particular demand. Third, the 1989 calculation assumed a return flow factor of about 55 percent for the City of Austin's municipal water right, backed up by stored water from LCRA, whereas the 2004 WAM assumes zero return flows from water diverted by Austin.

Table 3.1 Components of the Highland Lakes System Firm Yield

Entity or Use	Firm Yield Commitment, Ac-Ft/Yr [1]						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
O.H. Ivie Reservoir Yield Reduction	85,700	82,100	78,700	76,100	74,000	73,500	77,500
Backup of City of Austin Water Rights	65,731	65,498	65,499	65,501	65,309	65,658	65,592
Highland Lakes Contracts	85,789	85,789	85,789	85,789	85,789	85,789	85,789
LCRA Cooling Water	64,551	64,551	64,551	64,551	64,551	64,551	64,551
South Texas Nuclear Project	45,316	43,530	43,529	43,528	43,535	43,537	43,537
Instream Flow Requirements	13,141	13,138	13,133	13,114	16,081	16,053	16,031
Bay and Estuary Flow Requirements	6,416	6,408	6,406	6,404	6,682	8,117	8,115
Additional Highland Lakes Contracts	62,282	62,282	62,282	62,282	62,282	62,282	62,282
Total System Commitment	428,926	423,296	419,889	417,269	418,229	419,487	423,397
Uncommitted System Yield	92,511	78,111	74,611	70,211	65,811	60,911	55,711
Total System Yield	**521,437**	**501,407**	**494,500**	**487,480**	**484,040**	**480,398**	**479,108**

Data Source: Colorado WAM provided by TCEQ, November 2004, Run 3. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.

[1] A description of this system and an explanation of all of the components is provided in Section 3.2.1.1.1. Using the 1999 WMP triggers for curtailment, interruptible supplies are also still available.

Table 3.1 above shows the components that make up the firm yield of the Highland Lakes System. The November 2004 Run 3 version of the Colorado River Basin WAM was used to determine the values in the table. The results were viewed using the July 2004 version of the WRAP modeling program. The firm yields were calculated for the 10-year DOR period (May 1947 to April 1957), which was identified as the most severe drought period since 1898. The firm yield commitments are releases from system storage; they do not consist of run-of-river water. The following describes the methods used to determine the values in *Table 3.1*.

O.H. Ivie Reservoir Yield Reduction

The end-of-period (EOP) content of the Travis/Buchanan reservoirs was looked at to determine which month and year during the simulation the reservoirs went dry. The portion of the WAM that allows water at Lake Buchanan's priority date to be captured by Ivie Reservoir to allow a firm diversion of 113,000 ac-ft/yr was removed, and the LCRA remaining firm yield authorized diversion (61405482001C) was increased until the reservoirs were again dry or nearly dry.[1] The difference between the new remaining firm yield authorized diversion (61405482001C) and the original was calculated. This difference is the effect that Ivie has on the Highland Lakes system.

Backup of City of Austin Water Rights
The three LCRA backup amounts for the City of Austin municipal water rights were summed. These water rights are 61405471005RMBU (39,208 ac-ft), 61405471005LMBU (10,803 ac-ft), and 61405489003MBU (15,720 ac-ft for the year 2000).

Highland Lakes Contracts
The amount listed in the 1999 LCRA Water Management Plan was used.

LCRA Cooling Water
The availability for water rights 61405480001 (15,700 ac-ft), 61405473001 (10,750 ac-ft), and 61405474001 (38,101 ac-ft) was summed.

South Texas Nuclear Project
This is water right 61405437001BU (45,316 ac-ft).

Instream Flow Requirements
In 1992, LCRA, working with the state natural resource agencies, completed an instream flow needs study. The study was later approved by the Texas Water Commission, predecessor agency to the TCEQ, as incorporated into LCRA's Water Management Plan. The results of that study included two sets of instream flow needs: Critical and Target instream flow needs. The quantity of water committed by the LCRA Highland Lakes System under the Water Management Plan to instream flows consists of (1) the passage of inflows to meet the Target and Critical instream flow criteria that might otherwise be available to store in the Highland lakes; and, (2) the release of stored water to help meet the Critical instream flow criteria. In order to determine the quantity of inflow the LCRA Highland Lakes System bypassed for instream flows in the WAM, the quantity of inflow available to the LCRA's Highland Lakes System before and after an environmental need is engaged, is computed and the inflow reduction to the LCRA Highland Lakes System due to each environmental need is attributed as water bypassed for each environmental need. To determine the quantity of additional stored water released for critical instream flows, the exact quantity of water released from the LCRA Highland Lakes System Storage to help meet each environmental need is extracted from the WAM output and attributed as stored water released for each environmental need. Once all of these components have been extracted and tabulated, the total quantity of water dedicated to instream flows is determined.

The 1999 LCRA Water Management Plan states:
"Total commitments of the Combined Firm Yield from the Highland Lakes for instream flow maintenance will be an average of 12,860 acre-feet per year, with a maximum of 36,720 acre-feet in any one year; 58,700 acre-feet in any two consecutive years; 76,800 acre-feet in any three or four consecutive years; 106,100 acre-feet in any five consecutive years and 128,600 acre-feet in any six to ten consecutive years."

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[1] The November 2004 WAM does not currently allow a firm diversion of 113,000 ac-ft/yr. This is a remaining technical issue to be addressed.

Bay and Estuary Flow Requirements
This amount was the DOR average of BEC-IN (Bay and Estuary Critical – In) minus BEC-OT (Bay and Estuary Critical – Out) from the model output (6,416 ac-ft in the year 2000 scenario).

Critical inflow is the amount of water needed to provide a fishery sanctuary habitat near the mouth of the Colorado River during times of drought. From this sanctuary, fish, shellfish and oysters could be expected to recover and repopulate the bay when more normal weather conditions return.

The 1999 LCRA Water Management Plan states:
"Total commitments of the Combined Firm Yield from the Highland Lakes for bays and estuaries (estuarine inflows) will be an average of 3,090 acre-feet per year, with a maximum of 11,200 acre-feet in any one year; 19,700 in any two consecutive years; 24,200 acre-feet in any three or four consecutive years; 28,200 acre-feet in any five consecutive years and 30,900 acre-feet in any 6 to 10 consecutive years.

The total firm stored water commitment for both purposes (instream flow and bays and estuaries) will be an average of 15,950 acre-feet per year. Estimated interruptible stored water supplied during the critical drought for both purposes will be an additional 40,060 acre-feet per year."

Additional Highland Lakes Contracts
This amount includes contracts LCRA is maintaining that were not included in the 1999 Water Management Plan that have separate water rights associated with them. The components are the Cities of Cedar Park (18,000 ac-ft), Leander (6,400 ac-ft), Lometa (882 ac-ft), Pflugerville (12,000 ac-ft), and the Brazos River Authority (25,000 ac-ft).

Uncommitted System Yield
This was determined by subtracting the Highland Lakes Contracts amount (85,789 ac-ft) from the LCRA remaining firm yield (61405482001C) in the WAM. This amount includes any additional firm commitments LCRA has made since the 1999 WMP was approved that do not have separate water rights associated with them.

Highland Lakes
The total system yield decreases over time due to sedimentation of the reservoirs. The Highland Lakes firm yield is equal to the Total System Yield minus the O.H. Ivie Reservoir commitment, and is shown in *Table 3.2*.

3.2.1.1.2 Reservoirs

The estimated firm yields for all reservoirs within the Colorado River Basin are presented in *Table 3.2*.

Table 3.2 Reservoir Yields in the Colorado Basin (ac-ft/yr)

Reservoir Name	Firm Yield [1]						
	2000	2010	2020	2030	2040	2050	2060
Highland Lakes	**435,737**	**419,307**	**415,800**	**411,380**	**410,040**	**406,898**	**401,608**
City of Goldthwaite	125	125	125	125	125	125	125
City of Llano	99	99	99	99	99	99	99
Walter E. Long (Decker Lake)	0	0	0	0	0	0	0
Lake Bastrop	0	0	0	0	0	0	0
Lake Fayette	0	0	0	0	0	0	0
City of Lometa	0	0	0	0	0	0	0
STP Reservoir	0	0	0	0	0	0	0
Minor Reservoir Subtotal	**224**	**224**	**224**	**224**	**224**	**224**	**224**
TOTAL	**435,961**	**419,531**	**416,024**	**411,604**	**410,264**	**407,122**	**401,832**

Data Source: Colorado WAM provided by TCEQ, November 2004, Run 3. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.

[1] A description of each minor reservoir and an explanation of the firm yield is provided in Section 3.2.1.1.2. The Highland Lakes are discussed in Section 3.2.1.1.1.

The Highland Lakes firm yield is discussed in detail in Section 3.2.1.1.1. Several smaller reservoirs in the LCRWPA are also located within the Colorado River Basin. Estimates for the firm yield of these reservoirs are based on the TCEQ WAM Run 3 modeling and a detailed discussion is provided below.

- The **City of Goldthwaite** owns and operates a two-reservoir system as part of its water supply facilities. The reservoirs include a small reservoir with a capacity of 40 ac-ft adjacent to the river and a larger reservoir with a capacity of 200 ac-ft, which is located off-channel. The city pumps water from the Colorado River into the smaller reservoir and then pumps it into the larger reservoir, from which water is drawn for treatment. The size of the reservoirs are relatively small in comparison to the city's water demand, which is projected to decline from approximately 580 ac-ft in the year 2000 scenario to 565 ac-ft in the year 2060. Based on the limited storage available, the firm yields of the reservoirs are dependent upon continued river flows throughout the year. It is estimated that the available storage would be depleted within four months once the river ceases flowing. Based on the TCEQ WAM Run 3, it was determined that the Goldthwaite reservoir system has a firm yield of 125 ac-ft/yr (water rights 61402553401, 61402553402, and 61402553001).

- The **City of Llano** owns and operates two reservoirs on the Llano River: City Lake and City Park Lake, both of which are small channel dams. The two reservoirs were estimated to have a combined capacity of 503 ac-ft in 1988. This is significantly less than the original design capacity of 700 ac-ft. The decreased capacity is due to sedimentation rates in the two reservoirs. The firm yield estimated by the TCEQ WAM was 99 ac-ft/yr (water rights 61401650001 and 61401650002).

- **Lake Walter E. Long (Decker Lake)** is owned and operated by the City of Austin. The lake is formed by a dam on Decker Creek, which is a tributary to the Colorado River in Travis County. The City of Austin uses Decker to supply cooling water for an electrical generating plant. The City of

Austin supplements the water supply to Decker by pumping water from the Colorado River based on run-of-river rights and a water supply contract with LCRA for stored water from the Highland Lakes. Therefore, because the water from Decker Lake has already been accounted for in run-of-river and LCRA backup amounts, the firm yield of the lake itself due to the TCEQ WAM is considered 0 ac-ft/yr.

- **Lake Bastrop** is owned and operated by the LCRA. The lake is formed by a dam on Spicer Creek, which is a tributary to Piney Creek and the Colorado River in Bastrop County. The LCRA uses water from Lake Bastrop for cooling purposes at its Sam Gideon Power Generating Station. The LCRA supplements the water supply at this lake by pumping water into the lake from the Colorado River. The water pumped into the lake is stored water from the Highland Lakes. Therefore, because the water from Lake Bastrop has already been accounted for in run-of-river and LCRA backup amounts, the firm yield of the lake itself due to the TCEQ WAM is considered 0 ac-ft/yr.

- **Lake Fayette** is owned and operated by the LCRA. The lake is formed by a dam on Cedar Creek, which is a tributary to the Colorado River in Fayette County. The LCRA uses water from Lake Fayette for cooling purposes at the Fayette Power Project. The LCRA supplements the water supply at this lake by pumping water into the reservoir from the Colorado River. A portion of the water pumped is run-of-river water rights held by the City of Austin, which is co-owner in the Fayette Power Project. The remainder of the water pumped into the reservoir is stored water from the Highland Lakes. Therefore, because the water from Lake Fayette has already been accounted for in run-of-river and LCRA backup amounts, the firm yield of the lake itself due to the TCEQ WAM is considered 0 ac-ft/yr.

- **Lometa Reservoir** is owned and operated by the LCRA. The reservoir is formed by a dam on Salt Creek, which is a tributary to the Colorado River in Lampasas County. The LCRA uses water from Lometa Reservoir for municipal purposes within the service area of the City of Lometa. The reservoir has a normal maximum operating capacity of 554.6 ac-ft. A maximum of 882 ac-ft of water is available for diversion from the Colorado River, including 476 ac-ft for municipal demands and 406 ac-ft to off set evaporative losses. Because this amount is included as part of the Highland Lakes firm yield, the reported firm yield of the Lometa Reservoir is 0 ac-ft/yr.

- **South Texas Project Reservoir**: The Main Cooling Reservoir associated with the South Texas Project Electric Generating Station is a 7,000-acre (surface area) off-channel reservoir located in Matagorda County. At the maximum design operating level, the reservoir has a capacity of 202,600 ac-ft, or 9.6 percent of the total capacity of Lakes Travis and Buchanan as stated in the LCRA Water Management Plan. The firm yield from the TCEQ WAM is considered to be 0 ac-ft/yr since the reservoir firm yield is supplied by the STP run-of-river right (STP Nuclear Operating Co. et al.) and LCRA stored water from Lakes Buchanan and Travis, and the amount of water from the run-of-river right and LCRA's Highland Lakes has already been included in the water availability analysis for Region K (refer to *Tables 3.1* and *3.3*). If both the run-of-river right and the reservoir firm yield were included, then the water would be double counted since the water available to the reservoir is based on the diversions from the river.

  Reservoir water is withdrawn from the Colorado River adjacent to the site. Pumping from the river is intermittent, and this diversion normally occurs during periods of high river flow. The reservoir design incorporates storage to account for periods during which river water is unavailable for the reservoir in order to support operation through a repeat of the drought of record.

3.2.1.1.3 Run-of-River Water

Historically, the State of Texas has granted run-of-river rights through an adjudication process that considered historical uses. As a result, some run-of-river rights may have been granted for more water than is available in a river during drought conditions. The use of water during drought conditions is controlled by the priority system, with the oldest water rights having first call on whatever water is in the river. The TCEQ Colorado River Basin WAM was developed to simulate the amount of water available in the Colorado River under the basin water management scenarios. Major factors used to calculate available water include:

- Senior downstream water rights are assumed to be fully utilized
- Stored waters are released to the river based on the drought conditions
- Inflows to the Highland Lakes are passed through the lakes to the extent that the water is needed to satisfy senior water rights downstream.

The results of this analysis for major run-of-river rights holders are presented in *Table 3.3*. The water availability presented in the table for most of the major run-of-river rights is based on the amount of run-of-river water that would be available during the driest year of the DOR (1952 in the WAM). The water availability for the City of Austin and STNP water rights is based on the average water availability during the 10-year DOR period. This average availability was used since the City of Austin has contracted with LCRA to supply stored water to firm up its water rights during drought conditions. The STNP has also contracted for backup from LCRA, in addition to having a reservoir that allows for potential storage of water over the DOR period instead of having to use all of the water that is received in a particular year.

Table 3.3 Major Run-of-the-River Rights in the Colorado Basin (ac-ft/yr)

Water Right ID Numbers	Water Rights Holder	Maximum Permitted Diversion	Priority Date	Water Availability During Drought of Record [1]	
				2000	2060
61405434201RR	LCRA - Garwood	133,000	Nov 1, 1900	133,000	133,000
61405475001LRRS	LCRA - Lakeside #1 [2]	52,500	Jan 4, 1901	16,908	16,908
61405475001LRRL			Jun 29, 1913	4,075	4,075
61405475001LRRR			Mar 8, 1938	0	0
61405475001LRRJ		78,750	Nov 1, 1987	4,977	4,977
61405476003RRS	LCRA - Gulf Coast [2]	228,570	Dec 1, 1900	42,140	42,140
61405476003RRL			Jun 29, 1913	77,428	77,428
61405476003RRR			Mar 8, 1938	0	0
61405476003RRJ		33,930	Nov 1, 1987	2,952	2,952
61405477001RR	LCRA - Pierce Ranch [2]	55,000	Sep 1, 1907	20,589	20,589
61405477001RRL			Jun 29, 1913	1,648	1,648
61405477001RRR			Mar 8, 1938	0	0
61405475001WRR	LCRA - Lakeside #2 [2]	55,000	Sep 2, 1907	21,923	21,923
61405475001WRRL			Jun 29, 1913	1,648	1,648
61405475001RRRR			Mar 8, 1938	0	0
61405471005SMRR	City of Austin - (mun.) [3]	250,000	Jun 30, 1913	159,503	159,503
61405471005SBU	City of Austin - (mun.) [3]		Jun 30, 1913	51,289	51,289
61405471005LMRR	City of Austin - (mun.) [3]	21,403	Jun 27, 1914	10,600	10,600
61405471001P	City of Austin - (stm.)	24,000	Jun 27, 1914	14,894	14,894
61405471002P	City of Austin - (stm.)		Jun 27, 1914	1,901	1,901
61405489003M	City of Austin - (mun.) [3]	20,300	Aug 20, 1945	4,580	4,719
61405489003P	City of Austin - (stm.)	16,156	Aug 20, 1945	0	0
61405489003PBU	City of Austin - (stm.)		Aug 20, 1945	1,346	0
61405437001RIV	STP Nuclear Operating Co. et al. [3]	102,000	Jun 10, 1974	42,291	43,736
61405434102	City of Corpus Christi	35,000	Nov 2, 1900	31,579	31,579
Totals		**1,105,609**		**645,271**	**645,509**

Data Source: Colorado WAM provided by TCEQ, November 2004, Run 3. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.

[1] Downstream water availability reflects minimum year during the drought unless otherwise noted and does not include return flows. An explanation of the firm yield calculations in provided in Section 3.2.1.1.3.

[2] The low reliability of the LCRA irrigation rights is due to a subordination agreement with the City of Austin.

[3] The water availability was averaged over the DOR.

Table 3.3 above shows the water availability during the DOR for the major run-of-river rights. The November 2004 Run 3 version of the Colorado River Basin WAM was used to determine the values in the table. The following describes the methods used to determine the values in *Table 3.3.*

Irrigators

Garwood was 100 percent reliable for its full authorized diversion amount of 133,000 ac-ft.

Lakeside #1, Gulf Coast, Pierce Ranch, and Lakeside #2 each have several water rights, both run-of-river and backup. The run-of-river rights are listed in *Table 3.3*. The run-of-river water rights were summed for each irrigator to determine which year in the model had the minimum total diversion. The water right amounts for that year are listed in the table.

City of Austin
The City of Austin has four municipal water rights shown in the table. These are 61405471005SMRR, 61405471005SBU, 61405471005LMRR, and 61405489003M. Because these water rights are backed up by LCRA each year, an average during the DOR was used.

The City of Austin has steam-electric water rights as shown in the table. These are 61405471001P, 61405471002P, and 61405489003P (61405489003PBU). The water availability for these rights was determined by using the minimum amount of water available in any year during the DOR.

STP Nuclear Operating Company et al.
The run-of-river water right, 61405437001RIV, was determined by taking the average over the DOR period. This was done because there is a contract for backup from LCRA, and there is a reservoir that allows for storage of water over the DOR period, rather than having to use the entire amount of water received in a particular year. It should be noted that in any year, the sum of the run-of-river amount plus the amount of backup provided by LCRA (61405437001BU in *Table 3.1*) will never be more than 102,000 ac-ft, but can be less. The STNP diversion point is within the tidal reaches of the Gulf of Mexico. Required diversions at low flow rates during the DOR period will have a negative effect on the water quality diverted at this point.

Corpus Christi
The water availability for this run-of-river water right was determined by using the minimum amount of water available in any year during the DOR.

3.2.1.1.4 Local Surface Water Sources

The final category of available surface water is local supply sources. This category includes small diversions from the river or tributaries to the river, as well as stock ponds that have captured diffuse surface water located on individual's property. Information concerning these sources is limited. As a result, the information available from the TWDB developed during the first planning cycle was used as an initial estimate of the water availability. However, in several instances the availability numbers were increased to match the projected demands with the assumption that the supply and demand for local water will be self-limiting. The results of this process are presented in *Table 3.4* and are organized by county. These numbers were developed for the 2001 Region K Plan and since better information has not become available they have remained unchanged.

Table 3.4 Other Surface Water Sources in the Colorado Basin (ac-ft/yr)

Local Supply Source Name	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Livestock - basinwide	6,262	6,262	6,262	6,262	6,262	6,262	6,262
Other - basinwide	27,642	19,282	20,890	22,717	24,883	27,470	27,470
Irrig. - Bastrop Co.	786	786	786	786	786	786	786
Irrig. - Blanco Co.	67	67	67	67	67	67	67
Irrig. - Burnet Co.	276	276	276	276	276	276	276
Irrig. - Colorado Co.	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Irrig. - Fayette Co.	534	534	534	534	534	534	534
Irrig. - Gillespie Co.	880	880	880	880	880	880	880
Irrig. - Hays Co.	41	41	41	41	41	41	41
Irrig. - Llano Co.	440	440	440	440	440	440	440
Irrig. - Matagorda Co.	900	900	900	900	900	900	900
Irrig. - Mills Co.	2,378	2,378	2,378	2,378	2,378	2,378	2,378
Irrig. - San Saba Co.	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Irrig. - Travis Co.	880	880	880	880	880	880	880
Irrig. - Wharton Co.	7,650	7,650	7,650	7,650	7,650	7,650	7,650
Totals	**60,536**	**52,176**	**53,784**	**55,611**	**57,777**	**60,364**	**60,364**

Note: All of the sources listed in the table above are Local Supply Sources, which were determined in the 2001 Plan.

It was assumed that the 2060 supplies were equal to the 2050 supplies due to the lack of better information or tools to determine availability in 2060.

3.2.1.2 Colorado River Basin Availability Adjustments for Planning Purposes

The water availability modeling using the November 2004 WAM, as described above in Section 3.2.1.1, showed a significant increase in the amount of firm yield and run of river water in the Lower Basin as compared to the amount shown as being available in the 2001 plan. There are a number of possible explanations for these differences. Likely reasons for these differences are further discussed in Section 3.2.1.1. Region F, which includes the upstream portion of the Colorado Basin, also used the November 2004 Colorado Basin WAM for 2006 water plan development. Under the Run 3 scenario, many of the reservoirs in Region F showed little to no firm yield. These reservoirs are the only source of supply to numerous communities in Region F, and the water supply scarcities are such that there are currently few additional economically viable alternatives for supply. One strategy that Region F identified to meet these needs was subordination of downstream senior water rights in Region K, and some Region F members approached Region K water rights holders regarding this issue.[2]

The issues noted above were presented to the LCRWPG at a meeting on March 9, 2005. Both the Region F and Region K groups recognized the need for coordination between the two regions. Due to the lack of time and funding, it was suggested that the impacts of temporarily implementing a "No Call" assumption could be examined as a potential "quick fix" in order to meet the mandatory deadlines of the 2006 planning cycle. Consequently, Planning Group members voted to proceed with a joint modeling effort on the part of Region F and Region K consultants. The modeling that was to be conducted would be a "WHAT IF" scenario that would generally assume that, during the 50-year planning period, certain large downstream senior water rights holders would not call for water they were legally entitled to by

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[2] While LCRA does have several agreements with major upstream municipal water rights holders, these agreements do not comprehensively give up the call on inflows that is contemplated by the "No Call" assumptions being modeled in this round of planning. Nonetheless, a summary of these agreements is warranted to add further clarification of the existing operating conditions of the river and legal obligations that do exist. In 1957, LCRA entered into a subordination agreement with the San Angelo Water Supply Corporation that allows San Angelo WSC to impound water (subject to certain conditions) in Twin Buttes Reservoir or Nasworthy Reservoir that LCRA would otherwise have impounded in its storage reservoirs. LCRA has also entered into several agreements with the Colorado River Municipal Water District (CRMWD) relating to the impoundment of water in Spence & Ivie Reservoirs. In 1985, LCRA agreed to allow CRMWD to impound certain inflows in Ivie Reservoir that LCRA would otherwise have been allowed to store in Lake Buchanan. In 1998, the parties further amended their agreements to eliminate any obligation by CRMWD to release to LCRA water it had previously stored pursuant to the agreements. With the limited exception of Ivie Reservoir as noted above, nothing in the agreements affects CRMWD's obligation under the prior appropriation doctrine to pass inflows to meet LCRA's downstream senior water rights. CRMWD's obligation to pass inflows to meet priority calls by Corpus Christi was mitigated by LCRA in 1998, when LCRA agreed to provide the required inflow releases on behalf of CRMWD from any water sources available to LCRA should Corpus Christi make such a call when the surface elevation in Ivie is below 1530.5 msl.

LCRA also entered into agreements with CRMWD and Brown County WID No. 1 (Brown County) in 2001 that affect the relative priority of water rights or water rights amendments that LCRA might obtain in the future. First, LCRA agreed to subordinate any water rights that it may receive under its "Excess Flows" application currently pending before TCEQ (Application No. 5731) to CRMWD's and Brown County's water rights and any other existing water rights above Lake Brownwood and Ivie Reservoir. Additionally, if LCRA amends its irrigation water rights to authorize the use of Colorado River water outside of LCRA's existing water service area (for example, for the LCRA-SAWS Water Project), LCRA agreed to subordinate only the amended portions of those rights authorized for inter-basin transfer outside LCRA's existing service area to any water rights holders upstream of Lake Brownwood and Ivie Reservoir.

virtue of their priority and would instead allow that water to be impounded in upstream Region F reservoirs.

The joint modeling effort proposal was presented to the Region K group in the following manner:

1. Region K would be able to review the numbers produced from the joint modeling effort and determine whether to use those revised numbers for the shortages and surpluses analysis in place of the numbers contained in Section 3.2.1.1.

2. The effort would be a planning exercise only. No legal positions would be changed or waived as a result of this exercise. No downstream water right holders would be asked or required to formally cede or amend any of their water rights as a result of this planning exercise. In other words, the availability adjustments would have no legal effect and would be temporary in nature.

3.2.1.2.1 Other Considerations Regarding Adjustments to Availability

As the joint modeling effort proceeded, other considerations and factors regarding the rationale for making adjustments to the availability numbers became apparent:

1. Region K agreed to look at the No Call scenario in order to avoid a conflict between the two regions. If Region F utilized a No Call assumption and reported a firm yield from its reservoirs while Region K continued to assume the availability of those flows, then TWDB would be required to resolve the conflict between the two plans. The TWDB encouraged, and the planning groups preferred, to coordinate regarding the modeling methodology and to avoid the creation of a conflict.

2. In addition, if the WAM results as originally modeled were used to determine surpluses and shortages in the Lower Basin, then potential shortages in irrigation, environmental, and other needs would not be identified, and there would be no attempt to identify strategies to meet those shortages.

3. Some water rights permitting actions require consistency with the state water plan. If a WUG in the Lower Basin wishes to permit a management strategy, the plan with the adjusted numbers will show that there is a shortage and that additional water is needed.

4. TWDB funding for implementation of projects is limited to those activities that are included in the approved regional water plan. A WUG with a shortage identified with the adjusted numbers would still be able to compete for TWDB funding.

5. Major downstream senior water rights holders generally believe that it is unlikely that they will make a priority call on upstream inflows during the 50-year planning period under current projections for water supplies and demands in the Lower Basin.

6. LCRA agreed to the No Call assumptions with the understanding that return flows would be made available as a strategy similar to how those return flows were expressly treated in the 2001 plan. By agreeing to this approach, Austin, LCRA, Corpus Christi, and STPNOC have agreed that no party will be deemed to have waived any legal arguments and that the assumptions on availability of upstream inflows or return flows in this round of planning will not be used to argue that any permits pending at TCEQ are consistent or inconsistent with the regional plan.

3.2.1.2.2 Guidelines and Methodology Followed in Adjusting Availability with No Call Assumption

In order to perform the necessary modeling and develop revised availability numbers, the consultants followed guidelines that included:

1. Region F consultants would take the lead in developing the modeling tools to be used in evaluating the No Call assumption. A detailed description of this method is contained in *Appendix 3C*.

2. The No Call assumption would apply only to those Region K water rights holders with priority dates senior to May 8, 1938, because these rights have the biggest potential to call on inflows from Region F under WAM Run 3. A table of the Region K water rights included in the No Call analysis are shown below in *Table 3.5*:

Table 3.5 Region K Water Rights Included in the No Call Analysis

Senior Water Right Group	Water Rights Number	Priority Date	Maximum Permitted Diversion (ac-ft/yr)
LCRA- Garwood and Corpus Christi	5434	Nov. 1, 1900 Nov. 2, 1900	168,000
LCRA- Gulf Coast *	5476	Dec. 1, 1900	228,570
LCRA- Lakeside #1 *	5475	Jan. 4, 1901	52,500
LCRA- Lakeside #2 *	5475	Sept. 2, 1907	55,000
LCRA- Pierce Ranch *	5477	Sept. 1, 1907	55,000
LCRA		March 27, 1926	Target and Critical Flows
	5478	March 29, 1926	Refill Lake Buchanan
		Dec. 31, 1929	532
		March 7, 1938	560,000
	5480	March 29, 1926	Refill LBJ
	5479	March 29, 1926	Refill Inks Lake
	5715	March 29, 1926	Refill Marble Falls & Lometa Reservoir
	5482	March 29, 1926	Refill Lake Travis
		March 7, 1938	Variable*
City of Austin	5471	June 30, 1913	250,000
		June 30, 1913	150
		June 27, 1914	21,403
		June 27, 1914	24,000
		Dec. 31, 1928	Refill Barton Springs

* Note: Except for Garwood, LCRA's irrigation rights are subordinated to the City of Austin's 250,000 ac-ft/yr municipal water right.

3. Region F modeling would determine availability for Region F reservoirs. Further Region K modeling would be needed to determine Region K availability for the water rights involved in the No Call scenario. This further modeling was to be performed by the Region K consultant in coordination with the consultants from LCRA, City of Austin, and STPNOC. For further details, see *Appendix 3D*.

4. Return flows from the City of Austin would not be included in the base runs performed by the Region F consultant. Modeling was conducted to determine whether downstream return flows made a significant difference to water users in the Upper Basin with the No Call assumption in place. The

Region F consultants determined that, with the No Call assumption in place, the presence or absence of return flows within Region K made little difference to Region F.

5. The No Call scenario would seek to preserve a "safe yield" amount for Region F reservoirs. For this exercise, Region F consultants defined "safe yield" as reserving one year of supply in the reservoir at the lowest point in the simulation period.

6. Region F reservoirs would receive water in the upstream to downstream order, instead of preserving the priority order.

3.2.1.2.3 Highland Lakes System Availability After Implementing the No Call Assumption

The Highland Lakes System is composed of two major water storage reservoirs – Lakes Buchanan and Travis. These lakes are owned and operated by the LCRA. In addition, the system contains three intermediary lakes owned and operated by the LCRA – Inks Lake, Lake LBJ, and Lake Marble Falls. Lake Austin, the last in the Highland Lakes System, is owned by the City of Austin and is operated by the LCRA through an agreement.

The LCRA operates the Highland Lakes as a system to provide a reliable source of water to downstream customers. The LCRA developed a "Water Management Plan for the Lower Colorado River Basin" in response to requirements contained in a final order of adjudication of water rights to the LCRA for the Highland Lakes. The Water Management Plan (WMP) was originally adopted in 1989 and has been amended several times, most recently in March 1999, and proposed amendments to the WMP submitted in May 2003 are currently undergoing TCEQ review. As part of the original WMP, LCRA determined the combined firm yield of Lakes Buchanan and Travis based on a detailed analysis of the water availability for Lakes Buchanan and Travis during a repeat of the drought of record. The WMP also contains a management strategy for meeting the ten-year projected demands of its firm municipal and industrial customers, while continuing to provide water for environmental needs and agricultural purposes, largely on an interruptible basis. The LCRA's WMP determines the amount of interruptible water supply that can be made available while continuing to ensure the availability of water for firm demands in a repeat of a drought of records using a system of curtailment triggers that are linked to actual water in storage on January 1 of each year. The interruptible supply is generally comprised of uncommitted firm supply, committed firm supply that is not projected to be used in the ten year planning period covered by the plan, and flood flows. As firm commitments and demands for water under those commitments increase over time, interruptible supplies must be reduced more often even at higher storage levels to ensure the availability of water to firm customers in a DOR. The November 2004 TCEQ Colorado Basin WAM model was developed using the LCRA 1999 WMP, and therefore that is the version of the WMP that was used for the development of water availability in this regional water plan.

The firm yield of the Highland Lakes System for this regional plan was determined by using the Colorado River Basin WAM and adding up the various components of the Buchanan/Travis System. The model, which was developed by TCEQ with help from the LCRA to include their Water Management Plan and modified by FNI, took the following factors into account:

- Water rights were protected based on prior appropriation doctrine
- The hydrologic conditions in the 1940-1998 period are repeated

- Downstream, senior water rights are being fully utilized during this period. The water rights in the Lower Colorado Region are included in *Appendix 3A*
- The LCRA cannot impose its priority rights for Lakes Buchanan and Travis against any upstream, junior water right with a priority date senior to November 1, 1987, so long as interruptible supplies are not curtailed
- Historical net evaporation rates for the period of 1940 through 1998
- Downstream water demands were assumed to be met with inflows to the river below the Highland Lakes, to the extent possible
- No Call assumption for major downstream water rights with regards to Region F reservoirs
- The total system yield decreases over time due to sedimentation of the reservoirs

The method used to determine the firm yield of Lakes Buchanan and Travis in this plan differs from the method used to calculate the combined firm yield approved by the Texas Water Commission as part of LCRA's WMP in 1989 in at least three ways. First, the 1989 calculation imposed no curtailment triggers for interruptible supply whereas the 2004 WAM incorporates these triggers. Similarly, the second difference is that criteria for meeting certain environmental flow needs are embedded in the 2004 WAM whereas the 1989 calculations contained no conditions allocating flows to environmental needs or any other particular demand. Third, the 1989 calculation assumed a return flow factor of about 55 percent for the City of Austin's municipal water right, backed up by stored water from LCRA, whereas the 2004 WAM assumes zero return flows from Austin and LCRA municipal water rights.

Table 3.1a Components of the Highland Lakes System Firm Yield With No Call Assumption

Entity or Use	Firm Yield Commitment (ac-ft/yr) [1, 2, 3, 4]						
	2000	2010	2020	2030	2040	2050	2060
O.H. Ivie Reservoir Yield Reduction [6]	0	0	0	0	0	0	0
Backup of City of Austin Water Rights [5, 7]	110,650	110,046	109,442	108,838	108,234	107,630	107,026
Highland Lakes Contracts [8]	78,750	79,542	80,334	81,126	81,918	82,710	83,500
LCRA Cooling Water [5]	64,551	64,551	64,551	64,551	64,551	64,551	64,551
South Texas Nuclear Project [5]	38,060	38,111	38,162	38,213	38,264	38,315	38,363
Instream Flow Requirements [5, 9]	18,661	18,024	17,387	16,750	16,113	15,476	14,838
Bay and Estuary Flow Requirements [5, 9]	10,845	9,863	8,881	7,899	6,917	5,935	4,952
Additional Highland Lakes Contracts [5]	61,407	61,408	61,409	61,410	61,411	61,412	61,412
Total System Commitment	382,924	381,545	380,166	378,787	377,408	376,029	374,642
Uncommitted System Yield	0	0	0	0	0	0	0
Total System Yield	**382,924**	**381,545**	**380,166**	**378,787**	**377,408**	**376,029**	**374,642**

Data Source: Colorado WAM provided by TCEQ, November 2004, Run 3 Modified by FNI. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.

[1] Water availability does not include return flows or interruptible supplies.
A description of this system and an explanation of all of the components is provided in Chapter 3 Section 3.2.1.2.4.

[2] Refer to *Appendix 3D* for the drought triggers used for the No Call models versus the pre-No Call models.

[3] The No Call model Drought-of-Record (DOR) is May 1945 - Apr 1957, the pre-No Call model DOR was May 1947 - Apr 1957.

[4] The No Call values for 2010 - 2050 were developed by interpolating between the 2000 and 2060 values.

[5] The water availability was averaged over the DOR period.

[6] FNI took the O.H. Ivie subordination out when they modeled the No Call assumption; refer to *Appendix 3C* page 14 of 23.

[7] The COA Backups went up in value to make up for COA MUN ROR decrease (refer to *Table 3.3* and *3.3a*).

[8] The Highland Lakes Contracts are set at 85,789 ac-ft/yr in the Nov. 2004 WAM. This amount was reduced as a result of the reduced availability determined using the No Call assumption.

[9] Refer to the Instream Flow Requirements and the Bay and Estuary Flow Requirements on page 3-21.

Table 3.1b Difference Between the WAM and No Call WAM

Entity or Use	Firm Yield Commitment (ac-ft/yr)					
	WAM	No Call WAM	Difference (No Call - w/o)	WAM	No Call WAM	Difference (No Call - w/o)
	2000	2000		2060	2060	
Highland Lakes	435,737	382,924	(52,813)	401,608	374,642	(26,966)

Note: The Highland Lakes firm yield is equal to the Total System Yield minus the O.H. Ivie Reservoir commitment, and is shown in *Tables 3.1* and *3.1a*.

Table 3.1a above shows the components that make up the firm yield of the Highland Lakes System. The FNI modified November 2004 Run 3 version of the Colorado River Basin WAM was used to determine the values in the table. The results were viewed using the July 2004 version of the WRAP modeling program. The firm yields were calculated for the 12-year DOR period (May 1945 to April 1957), which was identified as the most severe drought period since 1898. The firm yield commitments are releases from system storage; they do not consist of run-of-river water. The following describes the methods used to determine the values in *Table 3.1a*.

O.H. Ivie Reservoir Yield Reduction
FNI took the O.H. Ivie subordination out when they modeled the No Call assumption.

Backup of City of Austin Water Rights
The three LCRA backup amounts for the City of Austin municipal water rights were summed. These water rights are 61405471005RMBU (83,638 ac-ft), 61405471005LMBU (11,942 ac-ft), and 61405489003MBU (15,070 ac-ft for the year 2000).

Highland Lakes Contracts
Since the No Call model assumed zero interruptible supplies all of the remaining yield was supplied to the Highland Lakes Contracts, and the Uncommitted System Yield was assumed to be zero.

LCRA Cooling Water
The availability for water rights 61405480001 (15,700 ac-ft), 61405473001 (10,750 ac-ft), and 61405474001 (38,101 ac-ft) was summed.

South Texas Nuclear Project
This is water right 61405437001BU (38,060 ac-ft in the year 2000).

Instream Flow Requirements
In 1992, LCRA, working with the state natural resource agencies, completed an instream flow needs study. The study was later approved by the Texas Water Commission, predecessor agency to the TCEQ, as incorporated into LCRA's Water Management Plan. The results of that study included two sets of instream flow needs: Critical and Target instream flow needs. The quantity of water committed by the LCRA Highland Lakes System under the Water Management Plan to instream flows consists of (1) the passage of inflows to meet the Target and Critical instream flow criteria that might otherwise be available to store in the Highland lakes; and, (2) the release of stored water to help meet the Critical instream flow criteria. In order to determine the quantity of inflow the LCRA Highland Lakes System bypassed for instream flows in the WAM, the quantity of inflow available to the LCRA's Highland Lakes System before and after an environmental need is engaged, is computed and the inflow reduction to the LCRA Highland Lakes System due to each environmental need is attributed as water bypassed for each environmental need. To determine the quantity of additional stored water released for critical instream flows, the exact quantity of water released from the LCRA Highland Lakes System Storage to help meet each environmental need is extracted from the WAM output and attributed as stored water released for each environmental need. Once all of these components have been extracted and tabulated, the total quantity of water dedicated to instream flows is determined.

The 1999 LCRA Water Management Plan states:
"Total commitments of the Combined Firm Yield from the Highland Lakes for instream flow maintenance will be an average of 12,860 acre-feet per year, with a maximum of 36,720 acre-feet in any one year; 58,700 acre-feet in any two consecutive years; 76,800 acre-feet in any three or four consecutive years; 106,100 acre-feet in any five consecutive years and 128,600 acre-feet in any six to ten consecutive years."

Bay and Estuary Flow Requirements
This amount was the DOR average of BEC-IN (Bay and Estuary Critical – In) minus BEC-OT (Bay and Estuary Critical – Out) from the model output (10,845 ac-ft in the year 2000 scenario).

Critical inflow is the amount of water needed to provide a fishery sanctuary habitat near the mouth of the Colorado River during times of drought. From this sanctuary, fish, shellfish and oysters could be expected to recover and repopulate the bay when more normal weather conditions return.

The 1999 LCRA Water Management Plan states:
"Total commitments of the Combined Firm Yield from the Highland Lakes for bays and estuaries (estuarine inflows) will be an average of 3,090 acre-feet per year, with a maximum of 11,200 acre-feet in any one year; 19,700 in any two consecutive years; 24,200 acre-feet in any three or four consecutive years; 28,200 acre-feet in any five consecutive years and 30,900 acre-feet in any six to ten consecutive years. The total firm stored water commitment for both purposes (instream flow and bays and estuaries) will be an average of 15,950 acre-feet per year. Estimated interruptible stored water supplied during the critical drought for both purposes will be an additional 40,060 acre-feet per year."

Additional Highland Lakes Contracts
This amount includes contracts LCRA is maintaining that were not included in the 1999 Water Management Plan that have separate water rights associated with them. The components are the Cities of Cedar Park (18,000 ac-ft), Leander (6,400 ac-ft), Lometa (7 ac-ft in the year 2000), Pflugerville (12,000 ac-ft), and the Brazos River Authority (25,000 ac-ft).

Uncommitted System Yield
Since the No Call model assumed zero interruptible supplies all of the remaining yield was supplied to the Highland Lakes Contracts, and the Uncommitted System Yield was assumed to be zero. It should be noted that, while the No Call scenario has no interruptible supplies, the curtailment trigger for meeting bay and estuary requirements were not changed from the 1999 WMP and thus some water is still provided to meet even target freshwater inflow needs when water in storage exceeds 1.7 million acre-feet (see *Appendix 3D*).

3.2.1.2.4 Reservoirs Availability After Implementing the No Call Assumption

The estimated firm yields for all reservoirs within the Colorado River Basin are presented in *Table 3.2a*.

Table 3.2a Reservoir Yields in the Colorado Basin with the No Call Assumption (ac-ft/yr)

Entity or Use	Firm Yield (ac-ft/yr) [1, 2, 3, 4]						
	2000	2010	2020	2030	2040	2050	2060
Highland Lakes [5]	**382,924**	**381,545**	**380,166**	**378,787**	**377,408**	**376,029**	**374,642**
City of Goldthwaite [5]	144	144	144	145	145	145	145
City of Llano [5]	187	178	169	160	151	142	135
Walter E. Long (Decker Lake)	0	0	0	0	0	0	0
Lake Bastrop	0	0	0	0	0	0	0
Lake Fayette	0	0	0	0	0	0	0
City of Lometa	0	0	0	0	0	0	0
STP Reservoir	0	0	0	0	0	0	0
Minor Reservoir Subtotal	**331**	**322**	**313**	**305**	**296**	**287**	**280**
TOTAL	**383,255**	**381,867**	**380,479**	**379,092**	**377,704**	**376,316**	**374,922**

Data Source: Colorado WAM provided by TCEQ, November 2004, Run 3 Modified by FNI. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.

[1] Water availability does not include return flows or interruptible supplies.
A description of each minor reservoir and an explanation of the firm yield is provided in Section 3.2.1.2.5. The Highland Lakes are discussed in Section 3.2.1.2.4.

[2] Refer to *Appendix 3D* for the drought triggers used for the No Call models and the pre- No Call models.

[3] The No Call model Drought-of-Record (DOR) is May 1945 - Apr 1957, and the pre- No Call model DOR is May 1947 - Apr 1957.

[4] The No Call values for 2010 - 2050 were developed by interpolating between the 2000 and 2060 values.

[5] The water availability was averaged over the DOR period.

Table 3.2b Difference between the WAM and No Call WAM

Entity or Use	Firm Yield Commitment (ac-ft/yr)					
	WAM 2000	No Call WAM 2000	Difference (No Call - w/o)	WAM 2060	No Call WAM 2060	Difference (No Call - w/o)
City of Goldthwaite	125	144	19	125	145	20
City of Llano	99	187	88	99	135	36

The Highland Lakes firm yield is discussed in detail in Section 3.2.1.1.1. Several smaller reservoirs in the LCRWPA are also located within the Colorado River Basin. Estimates for the firm yield of these reservoirs are based on the TCEQ WAM Run 3 modeling and a detailed discussion is provided below.

- The **City of Goldthwaite** owns and operates a two-reservoir system as part of its water supply facilities. The reservoirs include a small reservoir with a capacity of 40 ac-ft adjacent to the river and a larger reservoir with a capacity of 200 ac-ft, which is located off-channel. The city pumps water from the Colorado River into the smaller reservoir and then pumps it into the larger reservoir, from which water is drawn for treatment. The size of the reservoirs are relatively small in comparison to the city's water demand, which is projected to decline from approximately 580 ac-ft in the year 2000 scenario to 565 ac-ft in the year 2060. Based on the limited storage available, the firm yields of the reservoirs are dependent upon continued river flows throughout the year. It is estimated that the available storage would be depleted within four months once the river ceases flowing. Based on the FNI modified TCEQ WAM Run 3, it was determined that the Goldthwaite reservoir system has a firm yield of 144 ac-ft for the year 2000 scenario (water rights 61402553401, 61402553402, and 61402553001).

- The **City of Llano** owns and operates two reservoirs on the Llano River: City Lake and City Park Lake, both of which are small channel dams. The two reservoirs were estimated to have a combined capacity of 503 ac-ft in 1988. This is significantly less than the original design capacity of 700 ac-ft. The decreased capacity is due to sedimentation rates in the two reservoirs. The firm yield estimated by the FNI modified TCEQ WAM Run 3 was 187 ac-ft for the year 2000 scenario (water rights 61401650001 and 61401650002).

- **Lake Walter E. Long (Decker Lake)** is owned and operated by the City of Austin. The lake is formed by a dam on Decker Creek, which is a tributary to the Colorado River in Travis County. The City of Austin uses Decker to supply cooling water for an electrical generating plant. The City of Austin supplements the water supply to Decker by pumping water from the Colorado River based on run-of-river rights and a water supply contract with LCRA for stored water from the Highland Lakes. Therefore, because the water from Decker Lake has already been accounted for in run-of-river and LCRA backup amounts, the firm yield of the lake itself due to the TCEQ WAM is considered 0 ac-ft/yr.

- **Lake Bastrop** is owned and operated by the LCRA. The lake is formed by a dam on Spicer Creek, which is a tributary to Piney Creek and the Colorado River in Bastrop County. The LCRA uses water from Lake Bastrop for cooling purposes at its Sam Gideon Power Generating Station. The LCRA supplements the water supply at this lake by pumping water into the lake from the Colorado River. The water pumped into the lake is stored water from the Highland Lakes. Therefore, because the water from Lake Bastrop has already been accounted for in run-of-river and LCRA backup amounts, the firm yield of the lake itself due to the TCEQ WAM is considered 0 ac-ft/yr.

- **Lake Fayette** is owned and operated by the LCRA. The lake is formed by a dam on Cedar Creek, which is a tributary to the Colorado River in Fayette County. The LCRA uses water from Lake Fayette for cooling purposes at the Fayette Power Project. The LCRA supplements the water supply at this lake by pumping water into the reservoir from the Colorado River. A portion of the water pumped is run-of-river water rights held by the City of Austin, which is co-owner in the Fayette Power Project. The remainder of the water pumped into the reservoir is stored water from the Highland Lakes. Therefore, because the water from Lake Fayette has already been accounted for in run-of-river and LCRA backup amounts, the firm yield of the lake itself due to the TCEQ WAM is considered 0 ac-ft/yr.

- **Lometa Reservoir** is owned and operated by the LCRA. The reservoir is formed by a dam on Salt Creek, which is a tributary to the Colorado River in Lampasas County. The LCRA uses water from Lometa Reservoir for municipal purposes within the service area of the City of Lometa. The reservoir has a normal maximum operating capacity of 554.6 ac-ft. A maximum of 882 ac-ft of water is available for diversion from the Colorado River, including 476 ac-ft for municipal demands and 406 ac-ft to off-set evaporative losses. Because this amount is included as part of the Highland Lakes firm yield, the reported firm yield of the Lometa Reservoir is 0 ac-ft/yr.

- **South Texas Project Reservoir**: The Main Cooling Reservoir associated with the South Texas Project Electric Generating Station is a 7,000-acre (surface area) off-channel reservoir located in

Matagorda County. At the maximum design operating level, the reservoir has a capacity of 202,600 ac-ft, or 9.6 percent of the total capacity of Lakes Travis and Buchanan as stated in the LCRA Water Management Plan. The firm yield from the TCEQ WAM is considered to be 0 ac-ft/yr since the reservoir firm yield is supplied by the STP run-of-river right (STP Nuclear Operating Co. et al.) and LCRA stored water from Lakes Buchanan and Travis, and the amount of water from the run-of-river right and LCRA's Highland Lakes has already been included in the water availability analysis for Region K (refer to *Tables 3.1a* and *3.3a*). If both the run-of-river right and the reservoir firm yield were included, then the water would be double counted since the water available to the reservoir is based on the diversions from the river.

Reservoir water is withdrawn from the Colorado River adjacent to the site. Pumping from the river is intermittent, and this diversion normally occurs during periods of high river flow. The reservoir design incorporates storage to account for periods during which river water is unavailable for the reservoir in order to support operation through a repeat of the drought of record.

<u>3.2.1.2.5 Run-of River Water After Implementing the No Call Assumption</u>

Historically, the State of Texas has granted run-of-river rights through an adjudication process that considered historical uses. As a result, some run-of-river rights may have been granted for more water than is available in a river during drought conditions. The use of water during drought conditions is controlled by the priority system, with the oldest water rights having first call on whatever water is in the river. The TCEQ Colorado River Basin WAM was developed to simulate the amount of water available in the Colorado River under the basin water management scenarios. Major factors used to calculate available water include:

- Senior downstream water rights are assumed to be fully utilized
- Stored waters are released to the river based on the drought conditions
- Inflows to the Highland Lakes are passed through the lakes to the extent that the water is needed to satisfy senior water rights downstream
- The most senior rights in the Lower Basin were subordinated to Region F reservoirs

The results of this analysis for major run-of-river rights holders are presented in *Table 3.3a*. The water availability presented in the table for most of the major run-of-river rights is based on the amount of run-of-river water that would be available during the driest year of the DOR. The water availability for the City of Austin and STNP water rights is based on the average water availability during the 12-year DOR period. This average availability was used since the City of Austin has contracted with LCRA to supply stored water to firm up its water rights during drought conditions. The STNP has also contracted for backup from LCRA, in addition to having a reservoir that allows for potential storage of water over the DOR period instead of having to use all of the water that is received in a particular year.

Table 3.3a Major Run-of-the-River Rights in the Colorado Basin with the No Call Assumption

Water Right ID Numbers	Water Rights Holder	Maximum Permitted Diversion	Priority Date	Water Availability During Drought of Record (ac-ft/yr) [1, 2, 3, 4]	
				2000	2060
61405434201RR	LCRA - Garwood	133,000	Nov 1, 1900	111,740	111,740
61405475001LRRS	LCRA - Lakeside #1	52,500	Jan 4, 1901	10,570	10,570
61405475001LRRL			Jun 29, 1913	6,274	6,274
61405475001LRRR			Mar 8, 1938	0	0
61405475001LRRJ		78,750	Nov 1, 1987	2,925	2,925
61405476003RRS	LCRA - Gulf Coast	228,570	Dec 1, 1900	14,554	14,554
61405476003RRL			Jun 29, 1913	58,058	58,058
61405476003RRR			Mar 8, 1938	0	0
61405476003RRJ		33,930	Nov 1, 1987	1,525	1,444
61405477001RR	LCRA - Pierce Ranch	55,000	Sep 1, 1907	4,231	4,231
61405477001RRL			Jun 29, 1913	6,538	6,538
61405477001RRR			Mar 8, 1938	0	0
61405475001WRR	LCRA - Lakeside #2	55,000	Sep 2, 1907	4,231	4,231
61405475001WRRL			Jun 29, 1913	6,538	6,538
61405475001RRRR			Mar 8, 1938	0	0
61405471005SMRR	City of Austin - (mun.) [5]	250,000	Jun 30, 1913	119,468	121,062
61405471005SBU	City of Austin - (mun.) [5]		Jun 30, 1913	46,894	47,592
61405471005LMRR	City of Austin - (mun.) [5]	21,403	Jun 27, 1914	9,461	10,030
61405471001P	City of Austin - (stm.)	24,000	Jun 27, 1914	5,283	5,361
61405471002P	City of Austin - (stm.)		Jun 27, 1914	1,426	741
61405489003M	City of Austin - (mun.) [5]	20,300	Aug 20, 1945	5,230	5,993
61405489003P	City of Austin - (stm.)	16,156	Aug 20, 1945	317	304
61405489003PBU	City of Austin - (stm.)		Aug 20, 1945	2,587	2,389
61405437001RIV	STP Nuclear Operating Co. et al. [5]	102,000	Jun 10, 1974	49,089	48,791
61405434102	City of Corpus Christi	35,000	Nov 2, 1900	25,021	25,021
Totals		**1,105,609**		**491,960**	**494,387**

Data Source: Colorado WAM provided by TCEQ, November 2004, Run 3 Modified by FNI. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.

[1] Water availability reflects minimum year during the drought unless otherwise noted and does not include return flows or interruptible supplies.
An explanation of the firm yield calculations in provided in Chapter 3 Section 3.2.1.2.6.

[2] Refer to *Appendix 3D* for the drought triggers used for the No Call models and pre- No Call models.

[3] The No Call models Drought-of-Record (DOR) is May 1945 - Apr 1957, and the pre- No Call models DOR is May 1947 - Apr 1957.

[4] The No Call values for 2010 - 2050 were developed by interpolating between the 2000 and 2060 values.

[5] The water availability was averaged over the DOR period.

Table 3.3b Difference between the WAM and No Call WAM

Entity or Use	Firm Yield Commitment (ac-ft/yr)					
	WAM 2000	No Call WAM 2000	Difference (No Call - w/o)	WAM 2060	No Call WAM 2060	Difference (No Call - w/o)
Table 3.3 and *3.3a* TOTALS (Major Colorado Basin Run-of-River Rights)	645,271	491,960	(153,311)	645,509	494,387	(151,122)

Table 3.3a above shows the water availability during the DOR for the major run-of-river rights. The FNI modified November 2004 Run 3 version of the Colorado River Basin WAM was used to determine the values in the table. The following describes the methods used to determine the values in *Table 3.3a.*

Irrigators
Garwood, Lakeside #1, Gulf Coast, Pierce Ranch, and Lakeside #2 each have several water rights, both run-of-river and backup. The run-of-river rights are listed in *Table 3.3a.* The run-of-river water rights were summed for each irrigator to determine which year in the model had the minimum total diversion. The water right amounts for that year are listed in the table.

City of Austin
The City of Austin has four municipal water rights shown in the table. These are 61405471005SMRR, 61405471005SBU, 61405471005LMRR, and 61405489003M. Because these water rights are backed up by LCRA each year, an average during the DOR was used.

The City of Austin has three steam-electric water rights shown in the table. These are 61405471001P, 61405471002P, and 61405489003P (61405489003PBU). The water availability for these rights was determined by using the minimum amount of water available in any year during the DOR.

STP Nuclear Operating Company et al.
The run-of-river water right, 61405437001RIV, was determined by taking the average over the DOR period. This was done because there is a contract for backup from LCRA, and there is a reservoir that allows for storage of water over the DOR period, rather than having to use the entire amount of water received in a particular year. It should be noted that in any year, the sum of the run-of-river amount plus the amount of backup provided by LCRA (61405437001BU in *Table 3.1a*) will never be more than 102,000 ac-ft, but can be less. The STNP diversion point is within the tidal reaches of the Gulf of Mexico. Required diversions at low flow rates during the DOR period will have a negative effect on the water quality diverted at this point.

Corpus Christi
The water availability for this run-of-river water right was determined by using the minimum amount of water available in any year during the DOR.

3.2.1.2.6 Remaining Issues and Concerns

While the Region K group adopted the adjusted numbers for use in determining Region K surpluses and shortages for the current planning cycle, significant concerns remain:

1. Due to the time frame and technique employed, the numbers that have been developed are approximations that may still have some amount of error in them. One clear example of this is that junior water rights in Region K that are not subject to the No Call assumption appear to experience an increase in reliability, which should not occur. Further, the Planning group had remaining questions about the assumptions used by Region F's consultants for allocation of water among various users within Region F itself and the use of safe yield, which could have affected availability of water in Region K to some degree.

2. Overall, the No Call modeling approach resulted in an allocation of stored water among LCRA firm customers and environmental commitments that does not represent the LCRA's likely operations to meet existing legal commitments to provide firm water. Some of the inaccuracies that are being experienced in the model now are a result of the model using a monthly time step and other simplifying assumptions embedded in the underlying WAM. The WAM's treatment of environmental flow requirements in LCRA's Water Management Plan, for example, appears to send additional flow during a month even if the commitment is satisfied mid-month. Further, the modeling approach assumed that the biggest impact should be borne by the most junior of these water rights, that being the LCRA's rights for Lakes Buchanan and Travis. This assumption resulted in apparent shortages in Highland Lakes firm commitments largely as a result of the manner in which the WAM allocates firm supply from the Highland Lakes to LCRA's various customers and the environment. LCRA, in reality, does not operate its system of various water rights today in this manner. Because LCRA's irrigation customers are largely served through annual interruptible contracts instead of long term, firm contracts, a No Call assumption that takes more water from the LCRA's irrigation run-of-river rights while preserving more of the Highland Lakes firm yield would probably have been more appropriate if time had allowed for further refinement of the No Call model approach.

3. There is concern among the group members regarding the impact of the No Call assumption on environmental flows. Two critical issues of concern are as follows. First, the timing of the request and the availability of the numbers is such that there is neither time nor budget for a thorough review of the impact on the environmental flows in the basin. Second, the No Call assumption appears to suggest that LCRA will not have any interruptible water supply available to meet environmental flow needs. While the group recognizes that a full water rights and contract demand without return flows is not projected to occur for some time and consequently, interruptible supply and return flows will, in fact, be available during this planning period to meet some level of environmental flow needs, members feel that a thorough review and analysis of the impact of the No Call assumption on instream flows and bay and estuary inflows is needed as soon as possible.

4. There has been a lengthy debate among the regional planning group members concerning the inclusion of the No Call adjustments in the water availability chapter in the Region K Plan. Region K normally operates on a consensus basis, with all members agreeing to move forward with actions, although some may have reservations. With this issue, there has been a clear division among the group. Some members expressed frustration that the short timeframe of the joint-modeling effort made it very difficult to develop a thorough understanding of the results and impacts. Further,

members struggled with whether the No Call adjustments should be handled as a management strategy instead of an adjustment to the availability in Region K.

5. During the process, the group identified several technical issues with the WAM (discussed below) that could affect the magnitude or ultimate need for a No Call assumption.

3.2.1.2.7 Interim Activities and Future Plans

A number of technical issues regarding the WAM have been identified as requiring further consideration and analysis. Due to the lack of time and funding, it was not possible to fully explore these issues in time for them to be addressed in the current plan. The Region K group recommends, however, that these issues be further examined during future rounds of planning. These issues generally include enhancements to the WAM routines, updates to the datasets, and a review of fundamental assumptions. Some specific examples of issues that have been identified to date for further review include, without limitation:

a. The WAM's approach to modeling environmental flow restrictions on water rights

b. The naturalized flows used in the WAM

c. The WAM's incorporation (or lack thereof) of channel gains and losses

d. The WAM's treatment (or lack thereof) of "futile call" issues

e. The WAM's incorporation of existing subordination or similar agreements and ability to model these types of agreements

f. The WAM's backup of Austin's steam electric water rights with LCRA stored water

g. The WAM's representation of a zero firm yield for several major reservoirs in the basin

It is recognized that a few of the above listed issues have been under investigation for betterment of the model. For example, during May 2005, TCEQ revised some of the naturalized flow estimates for the Lower Basin; however, it was not feasible to incorporate the revision in the datasets in this round of planning.

Region K group members understand that a TWDB stakeholder process regarding the regional water planning process is likely to be initiated in the summer of 2006. A topic of discussion will be the possible changes to modeling assumptions used in regional water planning.

3.2.1.3 Brazos River Basin

A portion of the LCRWPA is located within the Brazos River Basin. This area is limited to portions of Bastrop, Burnet, Fayette, Mills, Travis, and Williamson Counties. The portion of Williamson County in Region K is completely contained within the City of Austin service area. The remainder of Williamson County is located in Region G.

Surface water sources for these areas are limited to local sources. There are no major reservoirs within the LCRWPA portion of the Brazos River Basin. *Table 3.6* contains a summary of the surface water available to the LCRWPA from the Brazos River Basin.

Table 3.6 Surface Water Sources in the Brazos River Basin (ac-ft/yr)

Source Name	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Livestock - basinwide	566	566	566	566	566	566	566
Totals	**566**	**566**	**566**	**566**	**566**	**566**	**566**

Note: All of the sources listed in the table above are Local Supply Sources, which were determined in the 2001 Plan.

It was assumed that the 2060 supplies were equal to the 2050 supplies due to the lack of better information or tools to determine availability in 2060.

3.2.1.4 Brazos-Colorado Coastal Basin

A portion of the LCRWPA is located within the Brazos-Colorado Coastal Basin. This area is limited to portions of Colorado, Matagorda, and Wharton Counties. Surface water sources for these areas are limited to local sources and a run-or-river water right from the San Bernard River. There are no major reservoirs within the LCRWPA portion of the Brazos-Colorado Coastal Basin. *Table 3.7* contains a summary of the surface water available to the LCRWPA from the Brazos-Colorado Coastal Basin.

Table 3.7 Surface Water Sources in the Brazos-Colorado Coastal Basin (ac-ft/yr)

Source Name	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
San Bernard ROR [1]	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Livestock - basinwide	394	394	394	394	394	394	394
Other - basinwide	1,655	1,696	1,746	1,793	1,844	1,900	1,900
Irrig. - Matagorda Co.	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Irrig. - Wharton Co.	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Totals	**9,649**	**9,690**	**9,740**	**9,787**	**9,838**	**9,894**	**9,894**

Note: All of the sources listed in the table above except for the San Bernard ROR are Local Supply Sources, which were determined in the 2001 Plan.
[1] Based on TCEQ water rights database; Reliability of the water right has not been verified.

It was assumed that the 2060 supplies were equal to the 2050 supplies due to the lack of better information or tools to determine availability in 2060.

3.2.1.5 Colorado-Lavaca Coastal Basin

A portion of the LCRWPA is located within the Colorado-Lavaca Coastal Basin. This area is limited to portions of Matagorda and Wharton Counties. Surface water sources for these areas are limited to local sources. There are no major reservoirs within the LCRWPA portion of the Colorado-Lavaca Coastal Basin, and there are no WUGs with rights to water from reservoirs in the Colorado-Lavaca Coastal Basin. Return flows originating in the Colorado Basin from agriculture are sent to the Colorado-Lavaca Coastal Basin for use, but since Run 3 of the TCEQ WAM assumes full utilization of water rights and no return unless explicitly stated in the water right, these return flows were not taken into consideration for the

Region K water availability analysis. *Table 3.8* contains a summary of the surface water available to the LCRWPA from the Colorado-Lavaca Coastal Basin.

Table 3.8 Surface Water Sources in the Colorado-Lavaca Coastal Basin (ac-ft/yr)

Source Name	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Livestock - basinwide	289	289	289	289	289	289	289
Irrig. - Matagorda Co.	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Totals	**4,289**	**4,289**	**4,289**	**4,289**	**4,289**	**4,289**	**4,289**

Note: All of the sources listed in the table above are Local Supply Sources, which were determined in the 2001 Plan.

It was assumed that the 2060 supplies were equal to the 2050 supplies due to the lack of better information or tools to determine availability in 2060.

3.2.1.6 Lavaca River Basin

A portion of the LCRWPA is located within the Lavaca River Basin. This area is limited to portions of Colorado and Fayette Counties. Surface water sources for these areas are limited to local sources. There are no major reservoirs within the LCRWPA portion of the Lavaca River Basin, and there are no WUGs with rights to water from reservoirs in the Lavaca River Basin. *Table 3.9* contains a summary of the surface water available to the LCRWPA from the Lavaca River Basin.

Table 3.9 Surface Water Sources in the Lavaca River Basin (ac-ft/yr)

Source Name	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Livestock - basinwide	649	649	649	649	649	649	649
Irrig. - Colorado Co.	4,002	4,002	4,002	4,002	4,002	4,002	4,002
Irrig. - Fayette Co.	20	20	20	20	20	20	20
Totals	**4,671**	**4,671**	**4,671**	**4,671**	**4,671**	**4,671**	**4,671**

Note: All of the sources listed in the table above are Local Supply Sources, which were determined in the 2001 Plan.

It was assumed that the 2060 supplies were equal to the 2050 supplies due to the lack of better information or tools to determine availability in 2060.

3.2.1.7 Guadalupe River Basin

A portion of the LCRWPA is located within the Guadalupe River Basin. This area is limited to portions of Bastrop, Blanco, Fayette, Hays, and Travis Counties. Most of the surface water sources for these areas are limited to local sources. There are no major reservoirs within the LCRWPA portion of the Guadalupe River Basin. However, the City of Blanco owns and operates two, small, on-channel reservoirs on the Blanco River. The two reservoirs have a combined storage capacity of 168 ac-ft.

Anecdotal information provided by the City of Blanco indicates that the Blanco River has ceased flowing in the past, most notably during the summer of 1996. Information provided by the City of Blanco indicates that flow in the Blanco River ceased for a three-month period during that summer. The relatively small storage capacity of the two reservoirs will not sustain the projected demands from the City of Blanco for more than a four-month period when the river has ceased flowing.

Based on the Guadalupe River Basin WAM from TCEQ, dated February 2005, Run 3, the firm yield of the reservoir system is 596 ac-ft (water right C3877_1).

Table 3.10 contains a summary of the surface water available to the LCRWPA from the Guadalupe River Basin.

Table 3.10 Surface Water Sources in the Guadalupe River Basin (ac-ft/yr)

Source Name	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060	Data Source
Livestock - basinwide [1]	298	298	298	298	298	298	298	2001 Plan
Irrig. - Blanco Co. [1]	9	9	9	9	9	9	9	2001 Plan
Blanco Reservoirs [2]	596	596	596	596	596	596	596	TCEQ WAM
Totals	**903**	**903**	**903**	**903**	**903**	**903**	**903**	

[1] Local Supply Sources determined in the 2001 Plan

[2] Firm Yield Data Source: Guadalupe River Basin WAM provided by TCEQ, February 2005, Run 3. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.

It was assumed that the 2060 supplies were equal to the 2050 supplies due to the lack of better information or tools to determine availability in 2060.

3.2.2 Groundwater Availability

The groundwater resources located in the region have been traditionally divided into those aquifers that yield large quantities of water over a relatively large area (major aquifers) and those aquifers yielding smaller quantities of water over smaller areas (minor aquifers). In the LCRWPA there are five major aquifers and five minor aquifers that provide usable groundwater supplies. The following discussion of the groundwater resources of the LCRWPA is divided into these two categories.

3.2.2.1 Major Aquifers

The major aquifers in the LCRWPA are the Edwards-Trinity (Plateau), Trinity Group, Edwards, Carrizo, and the Gulf Coast. These five aquifers provide a significant component of the water supply used within the LCRWPA beyond that provided by the Colorado River.

The Groundwater Conservation Districts (GCDs) in the LCRWPA were given the opportunity to express if the groundwater availability values in the GCD groundwater management plan were preferred for use in the LCRWP. Groundwater Availability Model (GAM) runs were performed for the major aquifers outside of a GCD, or where the GCD preferred a revised availability value and a GAM was available for the aquifer. The following Groundwater Availability Models were run for the LCRWPA:

1. *The Trinity Hill Country Aquifer GAM* was run for availability from the Trinity aquifer in Hays and Travis Counties.

2. *The Edwards-Trinity (Plateau) Aquifer GAM* was run for availability from the Trinity aquifer in Burnet, Hays and Travis Counties.

3. *Northern Edwards (BFZ) Aquifer GAM* was run for availability from the Edwards aquifer in Travis and Williamson Counties.

4. *Northern Trinity-Woodbine Aquifer GAM* was run for availability from the Trinity aquifer in Burnet, Travis and Williamson Counties.

Groundwater availability values were determined for each county or portion of a county located in Region K for each of the GAMs. The general approach to determine groundwater availability values from the GAM runs were to maintain 90 percent of the streamflow contribution from the aquifer compared to a no pumpage run during the worst drought of record year. This approach was approved by the Region K Water Modeling Committee to minimize adverse effect on streamflow during drought of record condition. Specific criteria were needed to determine availability for some of the GAMs due to the unique nature of each model. The modeling approaches are discussed in detail in the *availability* sections for the Edwards (BFZ) and Trinity aquifers. The portions of the LCRWPA where no GAM is available or did not have an availability value adopted by a GCD in a Groundwater Management Plan, utilized the values previously adopted by Lower Colorado Regional Water Planning Group (LCRWPG) in 2000 Region K Water Supply Plan.

All the TWDB GAMs are developed for a predictive period of 2000 to 2050. It is assumed for the purpose of the water supply planning that groundwater availability in 2060 is equal to the availability in 2050 due to the lack of better information or tools to determine availability in 2060.

Most of the cities in the planning region draw their water supply from one of the five major aquifers. Due to the differences in each aquifer and the amount of information available for each aquifer, different approaches were applied to determine the water available from each aquifer (where a GAM is not available or no GCD exists). The technical approach applied to a specific aquifer is described in the section pertaining to each of the aquifers below.

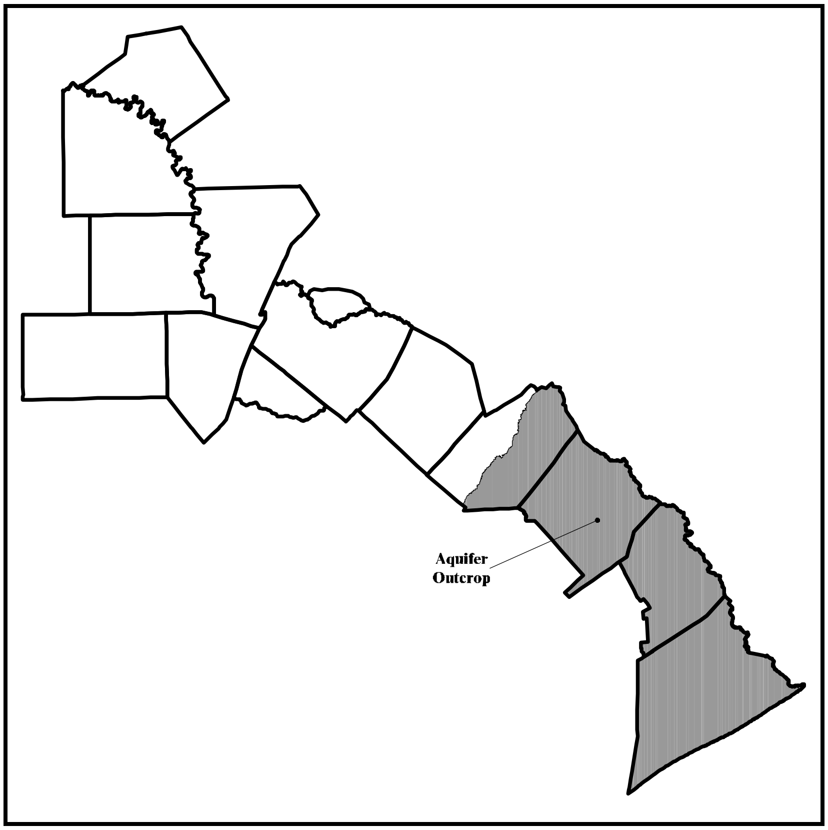
3.2.2.1.1 Gulf Coast Aquifer

Location and Use

The Gulf Coast aquifer forms an irregularly shaped belt along the Gulf of Mexico from Florida to Mexico. In Texas, the aquifer provides water to all or parts of 54 counties and extends from the Rio Grande northeastward to the Louisiana-Texas border.

Groundwater use from the Gulf Coast aquifer within the LCRWPA occurs in Colorado, Fayette, Matagorda, and Wharton Counties. TWDB records indicate that total groundwater pumpage from the Gulf Coast aquifer in these counties was 195,761 ac-ft for the year 2000. Municipal uses accounted for 10 percent of the total, manufacturing accounted for 1 percent, power plants accounted for 1 percent, mining accounted for 1 percent, irrigation accounted for 86 percent, and livestock accounted for 1 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.2*.

Figure 3.2: Gulf Coast Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The Gulf Coast aquifer consists of complex interbedded clays, silts, sands, and gravels, which are hydrologically connected to form a large, leaky artesian aquifer system. The system has four major subdivisions in the LCRWPA. The Jasper aquifer is the lowermost or most landward component of the aquifer system. The Jasper aquifer is composed of the Oakville Sand and may also include upper portions of the Catahoula Sandstone. The Burkeville confining layer separates the top of the Jasper aquifer from the bottom of the Evangeline aquifer. The Evangeline aquifer is composed of the Fleming and Goliad Sands. The Chicot aquifer, or upper component of the Gulf Coast aquifer system, consists of the Lissie, Willis, and Beaumont Formations; and overlying alluvial deposits. Maximum total sand thickness ranges from about 700 feet in the south to 1,300 feet in the northern extent.

Water Quality

Water quality is generally good in the shallower portion of the aquifer. Groundwater containing less than 500 mg/l dissolved solids is usually encountered to a maximum depth of 3,200 feet in the aquifer from the San Antonio River Basin northeastward to Louisiana.

Availability

It was intended that a Gulf Coast aquifer GAM be run during this planning cycle to establish water availability from the aquifer. The LCRWPG preferred to use the Central Gulf Coast aquifer GAM for the LCRWP. However, neither the Northern Gulf Coast aquifer GAM predictive model nor the Central Gulf Coast aquifer GAM were available in time to be included in this water plan.

The availability values for the Gulf Coast aquifer in Fayette, Matagorda and Wharton Counties were taken from the groundwater management plans adopted by the Fayette County Groundwater Conservation District, Coastal Plains Groundwater Conservation District (Matagorda County), and Coastal Bend Groundwater Conservation District (Wharton County). Each of these groundwater management plans is certified as administratively complete by TWDB. The groundwater availability values adopted for the Gulf Coast aquifer in Colorado County in the 2001 Plan remain unchanged.

During planning cycle one, the LCRWPG established a policy for determining the availability of groundwater within the LCRWPA. The policy was that the long-term depletion of groundwater within the region is not consistent with the LCRWPG's sustainability goals. The groundwater availability from the Gulf Coast aquifer was based on an estimate of maximum usage in the year 2050 by WUGs that were currently using the aquifer as a source plus the average water use for future conjunctive water use at the Lakeside, Gulf Coast, and Pierce Ranch Irrigation Districts.

Based on the GCDs and the 2001 Plan criteria, the water availability for the Gulf Coast aquifer was defined as presented in *Table 3.11*.

Table 3.11 Water Availability in the Gulf Coast Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Colorado	Brazos-Colorado	11,506	11,506	11,506	11,506	11,506	11,506	11,506
Colorado	Colorado	17,436	17,436	17,436	17,436	17,436	17,436	17,436
Colorado	Lavaca	18,915	18,915	18,915	18,915	18,915	18,915	18,915
	County Total	***47,857***	***47,857***	***47,857***	***47,857***	***47,857***	***47,857***	***47,857***
Fayette	Brazos	65	65	65	65	65	65	65
Fayette	Colorado	3,300	3,300	3,300	3,300	3,300	3,300	3,300
Fayette	Guadalupe	144	144	144	144	144	144	144
Fayette	Lavaca	5,188	5,188	5,188	5,188	5,188	5,188	5,188
	County Total	***8,697***	***8,697***	***8,697***	***8,697***	***8,697***	***8,697***	***8,697***
Matagorda	Brazos-Colorado	22,423	22,423	22,423	22,423	22,423	22,423	22,423
Matagorda	Colorado	3,218	3,218	3,218	3,218	3,218	3,218	3,218
Matagorda	Colorado-Lavaca	23,580	23,580	23,580	23,580	23,580	23,580	23,580
	County Total	***49,221***	***49,221***	***49,221***	***49,221***	***49,221***	***49,221***	***49,221***
Wharton	Brazos-Colorado	42,295	42,295	42,295	42,295	42,295	42,295	42,295
Wharton	Colorado	41,812	41,812	41,812	41,812	41,812	41,812	41,812
Wharton	Colorado-Lavaca	8,543	8,543	8,543	8,543	8,543	8,543	8,543
	County Total	***92,650***	***92,650***	***92,650***	***92,650***	***92,650***	***92,650***	***92,650***
Region K	**Region Total**	**198,425**	**198,425**	**198,425**	**198,425**	**198,425**	**198,425**	**198,425**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.1.1 *Availability*.

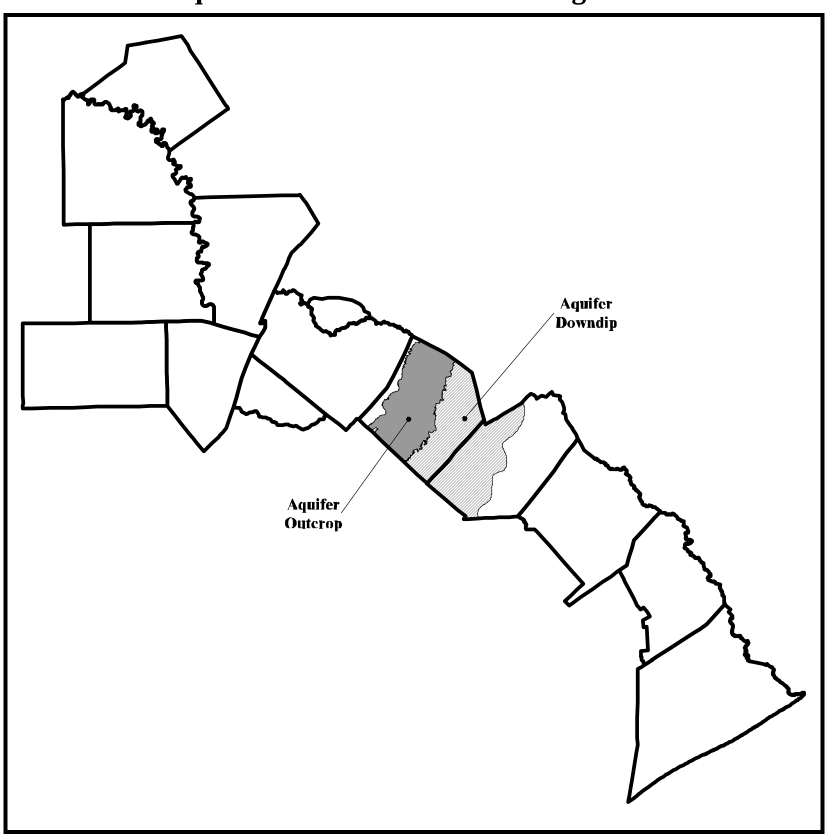
3.2.2.1.2 Carrizo-Wilcox Aquifer

Location and Use

The Wilcox Group and the overlying Carrizo Formation of the Claiborne Group form a hydrologically connected system known as the Carrizo-Wilcox aquifer. This aquifer extends from the Rio Grande in South Texas northeastward into Arkansas and Louisiana, providing water to all or parts of 60 counties in Texas. The Carrizo Sand and Wilcox Group occur at the surface along an outcrop band that parallels the Gulf Coast and dip beneath the land surface toward the coast except in the East Texas structural basin adjacent to the Sabine Uplift where the formations form a trough.

Use of water from the Carrizo-Wilcox aquifer in the LCRWPA occurs in Bastrop County and a portion of Fayette County. TWDB records indicate that the total groundwater pumpage from the Carrizo-Wilcox in the study area for 2000 was 10,533 ac-ft. Municipal uses accounted for 87 percent of the total, manufacturing uses accounted for 0.4 percent, mining accounted for 0.2 percent, irrigation accounted for 9 percent, and livestock accounted for 4 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.3*.

Figure 3.3: Carrizo-Wilcox Aquifer Within the Colorado Regional Water Planning Area



Hydrogeology

The Carrizo-Wilcox aquifer is predominantly composed of sand, locally interbedded with gravel, silt, clay, and lignite deposited during the Tertiary Period. North of the Colorado River, the Wilcox Group is generally divided into three distinct subdivisions. From the oldest and deepest to youngest these are the Hooper, Simsboro, and Calvert Bluff Formations. Of the three, the Simsboro Formation typically contains the most massive and coarsest sands and produces the largest quantities of water. South of the Colorado River, the Simsboro is absent as a distinct unit. The Wilcox portion of the aquifer varies significantly in thickness in the downdip artesian portion from 400 feet in portions of Fayette County (south of the Colorado River) to as much as 1,600 feet in Bastrop County. The Carrizo portion of the aquifer also varies in thickness in the downdip artesian portion from 200 feet to 400 feet across the LCRWPA.

Water Quality

Water from the Carrizo-Wilcox is fresh to slightly saline with quality problems limited to localized areas. In the outcrop the water is hard yet usually low in dissolved solids. Downdip, the water is softer, has a higher temperature, and contains increasing amounts of dissolved solids down-gradient. Hydrogen sulfide and methane may occur locally.

Availability

As previously discussed, the LCRWPG has established the sustainable use of groundwater resources as a policy for the region. The availability of the Carrizo-Wilcox aquifer in Bastrop County is taken from the Lost Pines Groundwater Conservation District Groundwater Management Plan. The availability in Fayette County is taken from the Fayette County Groundwater Conservation District Groundwater Management Plan. The available water, by river basin was established by proportioning the total availability value based on the area located in each river basin in a county using GIS. The availability estimates are presented in *Table 3.12*.

Table 3.12 Water Availability in the Carrizo-Wilcox Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Bastrop	Brazos	1,744	1,744	1,744	1,744	1,744	1,744	1,744
Bastrop	Colorado	24,916	24,916	24,916	24,916	24,916	24,916	24,916
Bastrop	Guadalupe	1,340	1,340	1,340	1,340	1,340	1,340	1,340
	County Total	***28,000***	***28,000***	***28,000***	***28,000***	***28,000***	***28,000***	***28,000***
Fayette	Colorado	290	290	290	290	290	290	290
Fayette	Guadalupe	66	66	66	66	66	66	66
Fayette	Lavaca	44	44	44	44	44	44	44
	County Total	***400***	***400***	***400***	***400***	***400***	***400***	***400***
Region K	**Region Total**	**28,400**	**28,400**	**28,400**	**28,400**	**28,400**	**28,400**	**28,400**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.1.2 *Availability*.

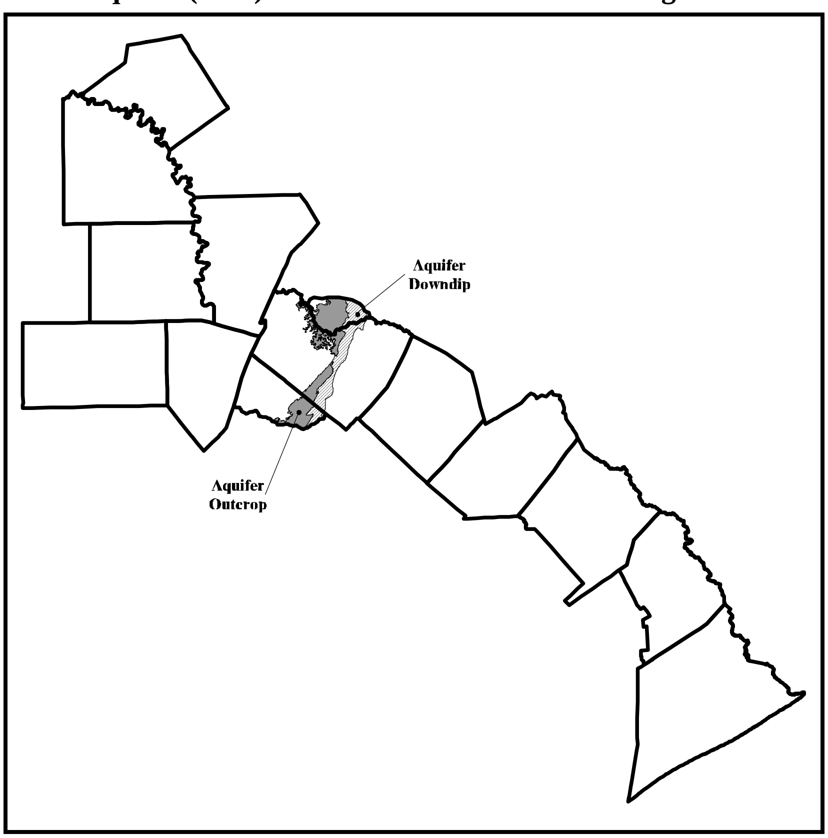
3.2.2.1.3 Edwards Aquifer (Balcones Fault Zone)

Location and Use

The Edwards aquifer (Balcones Fault Zone, or BFZ) covers approximately 4,350 square miles in parts of 11 counties. It forms a narrow belt extending along the base of the Balcones Escarpment from Kinney County through the San Antonio area northeastward to the Leon River in Bell County. A groundwater divide near Kyle in Hays County hydrologically separates the aquifer into the San Antonio and Barton Springs segments. The Colorado River divides the Barton Springs and Northern segments which are also considered hydrologically separate. The name Edwards aquifer (BFZ) distinguishes this aquifer from the Edwards-Trinity (Plateau) and Edwards-Trinity (High Plains) aquifers.

Groundwater use from the Edwards aquifer (BFZ) within the LCRWPA occurs in Hays, Travis, and Williamson Counties. TWDB records indicate that the total groundwater pumpage from the Edwards aquifer (BFZ) in these counties for 2000 was 32,464 ac-ft. Municipal uses accounted for 90 percent of the total, manufacturing accounted for 4 percent, mining accounted for 5 percent, and livestock accounted for 0.4 percent. Large springs feed several recreational areas and serve as habitat to several endangered species of plants and animals. Major river systems derive a significant amount of baseflow from Edwards aquifer (BFZ) spring flows that are utilized outside the Edwards region mainly for industrial and agricultural needs. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.4*.

Figure 3.4: Edwards Aquifer (BFZ) Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The Edwards aquifer (BFZ) is composed of limestone and dolomite deposited during the Cretaceous Period. The aquifer exists under water-table conditions in the outcrop and under artesian conditions where it dips into the subsurface and is confined below the overlying Del Rio Clay. The Edwards aquifer (BFZ) consists of the Georgetown Limestone and formations of the Edwards Group within the LCRWPA. Across the Edwards aquifer (BFZ) region, the aquifer thickness ranges from 200 to 600 feet.

Aquifer recharge occurs by the percolation of water on the aquifer outcrop (recharge zone). The recharge may occur by several methods: surface water percolating from streams and rivers draining the Edwards Plateau and which cross the outcrop; the percolation of rainfall runoff in ephemeral streams crossing the outcrop; and by direct infiltration of precipitation on the outcrop. This recharge reaches the aquifer through solution cavities, fracture crevices, faults, and sinkholes in the recharge zone. Unknown amounts of groundwater may enter the aquifer as lateral underflow from the Glen Rose Formation. Water in the aquifer generally moves from the recharge zone down-gradient and laterally toward natural discharge points such as Comal, San Marcos, Barton, and Salado springs.

A hydrologic divide occurs in the aquifer near Kyle in Hays County that separates the San Antonio segment of the aquifer from the Barton Springs and Northern segments of the aquifer. The Barton Springs segment is hydrologically bounded to the north by the Colorado River. The northern segment of the aquifer includes the area north of the Colorado River to Bell County. The area included in the LCRWPA is the area north of the Kyle groundwater divide and includes a portion of the Northern segment.

Groundwater moving through the aquifer system has dissolved large amounts of rock to create highly permeable zones in certain aquifer subdivisions and solution channels. Highly fractured areas near faults may be preferentially enhanced by solutioning to form conduits capable of transmitting large amounts of water. The solution features may facilitate rapid flow and augment the relatively high storage capacity of the aquifer. Due to the honeycombed and cavernous character of the aquifer, well yields are moderate to large. Several wells yield in excess of 16,000 gal/min and one well drilled in Bexar County flowed 37,000 gal/min from a 30-inch-diameter casing. The aquifer is significantly less permeable farther downdip where the concentration of dissolved solids in the water may abruptly exceed 1,000 mg/l.

Water Quality

The chemical quality of water in the aquifer is typically fresh, although hard, with dissolved solids concentrations averaging less than 500 mg/l. The downdip's relatively sharp interface between fresh and slightly saline water represents the extent of water containing less than 1,000 mg/l and is popularly known as the Bad Water Line (BWL). Within a relatively short distance down-gradient of the BWL, the groundwater becomes increasingly mineralized. The position of the bad water line generally coincides with the alignment of IH 35 in the LCRWPA.

Availability

Due to its highly permeable nature in the fresh water zone, the Edwards aquifer (BFZ) responds quickly to changes and extremes in stress placed upon the system. This is indicated by the rapid fluctuations in water levels over relatively short periods of time. During times of adequate rainfall and recharge, the Edwards aquifer (BFZ) is able to supply sufficient amounts of water for all demands as well as sustain springflows at many locations throughout its extent. However, when recharge is low, water withdrawn from wells and water discharged at the springs comes mainly from aquifer storage. If these conditions persist, water in storage within the aquifer continues to be depleted with corresponding water-level declines and reduced spring flows.

Availability for the northern segment of the Edwards aquifer (BFZ) was established using the Northern Edwards (BFZ) GAM. Availability values were determined for Travis County north of the Colorado River and the LCRWPA portion of Williamson County using this GAM. The general approach to applying the Northern Edwards aquifer GAM was consistent with the use of GAMs with the LCRWPA. In the Northern Edwards aquifer GAM the aquifer contribution to the surface water system is represented by the "Drain" value in the model water budget. The availability values derived from this GAM reflect a reduction of groundwater availability required to maintain 90 percent of the stream leakage (drain) value during the worst year of the drought of record as compared to a no pumping value (100 percent). Several iterative simulations were performed to determine the availability values which could maintain the 90 percent drain value.

The availability of the Barton Springs segment of the Edwards aquifer (BFZ) was determined by the Barton Springs Edwards Aquifer Conservation District (BSEACD) staff using the Barton Springs Edwards aquifer GAM. The BSEACD staff made revisions to the existing GAM (Scanlon et al, 2001) through an extensive cooperative process that included a technical advisory group with members from the Texas Water Development Board, the United States Geologic Survey, the City of Austin, the Bureau of Economic Geology, and the University of Texas at Austin. Through this cooperative process, the existing GAM was revised to better predict aquifer water levels and spring flow during the drought of record conditions. The approach to determining the availability value for the Barton Springs segment of the Edwards aquifer (BFZ) was to maintain a mean monthly spring flow of approximately 1 cubic foot per second (cfs) at Barton Springs. This level may not provide adequate flows for protection of endangered species. Further studies are required to establish minimum required flows. The total availability of the Barton Springs segment of the Edwards aquifer (BFZ) within the jurisdiction of BSEACD was proportioned by the BSEACD staff to provide the appropriate values for the area of Hays and Travis Counties within the LCRWPA. The Travis County availability value for the Edwards aquifer (BFZ) is a sum of the BSEACD value for the Travis County portion of the Barton Springs segment and the Travis County portion of the northern segment derived from the Northern Edwards aquifer GAM. The availability values for Edwards aquifer (BFZ) obtained from different GAMs are presented in *Table 3.13.*

Table 3.13 Summary of GAM Availability Values for the Edwards Aquifer (BFZ) (ac-ft/yr)

County	Data Source	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050
Hays	BSEACD	5,140	5,140	5,140	5,140	5,140	5,140
Travis	Northern Edwards GAM	860	860	860	860	860	860
Travis	BSEACD	2,100	2,100	2,100	2,100	2,100	2,100
	County Total	***2,960***	***2,960***	***2,960***	***2,960***	***2,960***	***2,960***
Williamson	Northern Edwards GAM	275	275	275	275	275	275
Region K	**Region Total**	**8,375**	**8,375**	**8,375**	**8,375**	**8,375**	**8,375**

The available water, by river basin was established by proportioning the total availability value based on the area located in each river basin in a county using GIS. This information is presented in *Table 3.14.*

Table 3.14 Water Availability in the Edwards Aquifer (BFZ) (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Hays	Colorado	5,140	5,140	5,140	5,140	5,140	5,140	5,140
Travis	Brazos	22	22	22	22	22	22	22
Travis	Colorado	2,913	2,913	2,913	2,913	2,913	2,913	2,913
Travis	Guadalupe	25	25	25	25	25	25	25
	County Total	***2,960***	***2,960***	***2,960***	***2,960***	***2,960***	***2,960***	***2,960***
Williamson	Brazos	265	265	265	265	265	265	265
Williamson	Colorado	10	10	10	10	10	10	10
	County Total	***275***	***275***	***275***	***275***	***275***	***275***	***275***
Region K	**Region Total**	**8,375**	**8,375**	**8,375**	**8,375**	**8,375**	**8,375**	**8,375**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.1.3 *Availability*.

In Colorado River Basin of Travis County, Groundwater availability from Edwards aquifer (BFZ) (2,913 ac-ft/yr) is significantly lower than water usage during year 2000 (8,304 ac-ft/yr) indicated in TWDB Water Use Survey. The availability value was obtained from BSEACD and Northern Edwards (BFZ) aquifer GAM. The BSEACD availability number is consistent with the pumpage in its area of jurisdiction as the conservation district enforces permitting. However, it appears that the usage of groundwater in the northern part of Travis County is significantly higher than the availability from the Edwards aquifer (BFZ) established by Northern Edwards (BFZ) aquifer GAM modeling, where the GAM modeling criteria was set to minimize adverse effect on stream flow during drought of record condition. It is anticipated that several current users of groundwater from Edwards aquifer (BFZ) in the northern part of Travis County will switch to surface water usage from groundwater in the future due to the expected growth of the City of Austin service/retail area.

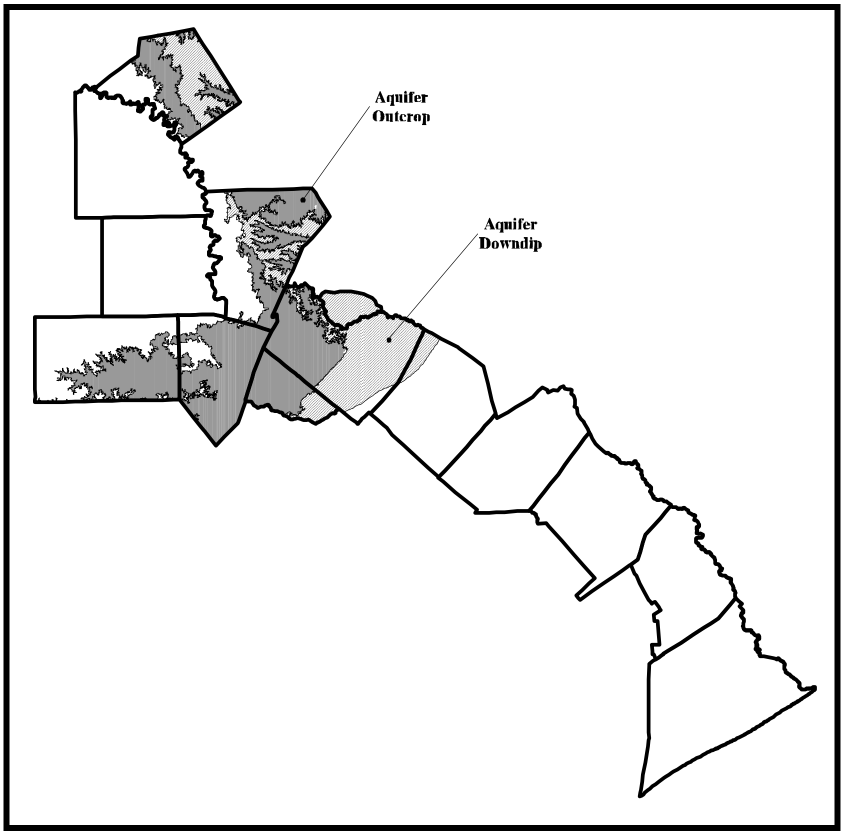
3.2.2.1.4 Trinity Aquifer

Location and Use

The Trinity aquifer consists of Cretaceous age rocks of the Trinity Group. The formations of the Trinity Group crop out in a band from the Red River in northern Texas to the Hill Country of South-Central Texas and provide water in all or parts of 55 counties. Trinity Group deposits also occur as far west as the Panhandle and Trans-Pecos regions where they are included as part of the Edwards-Trinity (High Plains) and Edwards-Trinity (Plateau) aquifers. Within much of the LCRWPA, the Trinity aquifer is exposed at the land surface as the erosion dissected margin of the Edwards Plateau.

Groundwater use from the Trinity aquifer in the LCRWPA occurs in Blanco, Burnet, Gillespie, Hays, Mills, and Travis Counties. TWDB records indicate that the total groundwater pumpage from the Trinity in these counties for 2000 was 10,554 ac-ft. Municipal uses accounted for 70 percent of the total, mining accounted for 2 percent, irrigation accounted for 13 percent, and livestock accounted for 15 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.5.*

Figure 3.5: Trinity Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The Trinity aquifer is composed of sand, clay, and limestone deposited during the Cretaceous Period. The aquifer in the LCRWPA is subdivided into the Upper, Middle, and Lower Trinity aquifers. The Upper Trinity is composed of the Upper Glen Rose Formation. The Middle Trinity aquifer is composed of the Lower Glen Rose Formation and the Hensell Sand and Cow Creek Limestone of the Travis Peak Formation. The Hammett Shale of the Travis Peak Formation is a confining zone between the Middle and Lower Trinity aquifers. The Lower Trinity aquifer is composed of the Sligo Limestone and the Hosston Formation (sand and conglomerate). The Glen Rose Formation and the Cow Creek Limestone are karsted but not as heavily solutioned as the Edwards aquifer (BFZ). There are evaporite mineral beds (principally anhydrite) associated with the contact of the Upper and Lower Glen Rose Formation that contribute to water quality issues in the certain areas of the Trinity aquifer within the LCRWPA. The formations of the Trinity aquifer thin from down-dip areas toward the outcrop. In some areas of the LCRWPA this thinning is pronounced. At the Balcones Escarpment the Trinity may be significantly displaced by the throw of faults associated with the Balcones Fault Zone. Trinity aquifer well yields typically range from less than 20 to more than 300 gallons per minute. The yields of wells in the Upper and Middle Trinity aquifers may be closely associated with the degree of local karst or solutioning features. The yield of wells from the Lower Trinity aquifer may be generally greater than the average yields of Upper or Lower Trinity aquifer wells.

Water Quality

Water quality from the Trinity aquifer is acceptable for most municipal and industrial purposes; however, excess concentrations of certain constituents in many places exceed drinking water standards. Heavy pumpage and water level declines in this region have contributed to deteriorating water quality in the aquifer. Wells completed in the Middle Trinity (especially the Hensell Sand) may exhibit levels of sodium, sulfate, and chloride, which are believed to be the result of leakage from the overlying Glen Rose. This is less likely to be true for wells completed in the Lower Trinity. The Hammett Shale acts as an aquitard and effectively prevents leakage from the overlying formations. In some areas, poor quality water occurs in and near wells that have not been properly cased. These wells may have deteriorated casings, insufficient casing or cement, or the casing may have been perforated at multiple depths in an effort to maximize the well yield. These wells serve as a conduit for poor quality water originating in the evaporite beds near the contact of the of the Upper and Lower Glen Rose Formations. Water quality declines in the downdip direction of all of the Trinity water-bearing units.

Availability

The groundwater availability estimate values for the Trinity aquifer in Burnet, Travis, Williamson, and Hays Counties are based on simulations performed using the Northern Trinity-Woodbine aquifer GAM and model layer 2 (Trinity aquifer) of the Edwards-Trinity (Plateau) aquifer GAM. The approach to using the Northern Trinity-Woodbine aquifer GAM and the Edwards-Trinity GAM followed the general approach of maintaining 90 percent of the drought of record contribution of the aquifer to the surface water system. In each of the models, a different combination of water budget values was required to capture the surface water contribution due to the unique construction of each model. In the Edwards-Trinity aquifer GAM, the availability value was based on a combination of the Stream Leakage and Drain values. For the Northern Trinity-Woodbine aquifer GAM, the aquifer contribution to the surface water system could be captured using the Stream Leakage value alone.

Both the Edwards-Trinity and Northern Trinity-Woodbine are large models and incorporate significant areas of the State outside of the LCRWPA. The predictive model pumping data sets reflect the adoption of surface water supply strategies in several planning regions with reduced pumping of the aquifer. This reduced pumping reflected in the predictive model data sets allowed for a general increase in the groundwater use of the LCRWPA while maintaining the surface water contribution maintenance targets. In the case of both models, the 90 percent criteria could not be reached even with significant increases of pumping within the LCRWPA due to the strong effect of the general reduction in pumping throughout significant portions of each model except for the small portion of Burnet County included in the Edwards-Trinity aquifer GAM. A meeting of the LCRWPA Modeling Committee was convened to reach consensus on the preferred values to be used and included representatives of the Hays Trinity GCD because the HTGCD had not completed a groundwater availability assessment for the District. The committee reached consensus on preferred availability values from each model and determined that the Trinity (Hill Country) aquifer GAM results would not be used in favor of more conservative values from the Edward-Trinity aquifer GAM. The Modeling Committee consensus values were summed for Burnet and Travis Counties to include the values from the portions of those counties in each of the Northern Trinity-Woodbine aquifer GAM and the Edwards-Trinity aquifer GAM. Hays and Williamson Counties are each located within the Edwards-Trinity and the Northern Trinity-Woodbine aquifer GAMs respectively. The modeling and consensus modeling results for the Trinity aquifer are presented in *Table 3.15*.

Table 3.15 Summary of GAM Availability Values for the Trinity Aquifer (ac-ft/yr)

County	Data Source	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050
Burnet	Edwards Trinity GAM	150	150	150	150	150	150
Burnet	Northern Trinity GAM	2,400	2,400	2,400	2,400	2,400	2,400
	County Total	***2,550***	***2,550***	***2,550***	***2,550***	***2,550***	***2,550***
Hays	Edwards Trinity GAM	2,500	2,500	2,500	2,500	2,500	2,500
	County Total	***2500***	***2,500***	***2,500***	***2,500***	***2,500***	***2,500***
Travis	Edwards Trinity GAM	3,000	3,000	3,000	3,000	3,000	3,000
Travis	Northern Trinity GAM	900	900	900	900	900	900
	County Total	***3,900***	***3,900***	***3,900***	***3,900***	***3,900***	***3,900***
Williamson	Northern Trinity GAM	60	60	60	60	60	60
	County Total	***60***	***60***	***60***	***60***	***60***	***60***

The available water, by river basin, was established by proportioning the total availability value based on the area located in each river basin in a county using GIS. This information is presented in *Table 3.16.*

Table 3.16 Water Availability for the Trinity Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Bastrop	Colorado	12	12	12	10	10	8	8
	County Total	***12***	***12***	***12***	***10***	***10***	***8***	***8***
Blanco	Colorado	1,149	1,149	1,149	1,149	1,149	942	942
Blanco	Guadalupe	451	451	451	451	451	373	373
	County Total	***1,600***	***1,600***	***1,600***	***1,600***	***1,600***	***1,315***	***1,315***
Burnet	Brazos	1,221	1,221	1,221	1,221	1,221	1,221	1,221
Burnet	Colorado	1,329	1,329	1,329	1,329	1,329	1,329	1,329
	County Total	***2,550***	***2,550***	***2,550***	***2,550***	***2,550***	***2,550***	***2,550***
Gillespie	Colorado	3,354	3,354	3,354	3,354	3,354	3,354	3,354
Gillespie	Guadalupe	46	46	46	46	46	46	46
	County Total	***3,400***	***3,400***	***3,400***	***3,400***	***3,400***	***3,400***	***3,400***
Hays	Colorado	2500	2500	2500	2500	2500	2500	2500
	County Total	***2,500***	***2,500***	***2,500***	***2,500***	***2,500***	***2,500***	***2,500***
Mills	Brazos	1,430	1,430	1,430	1,254	1,254	1,028	1,028
Mills	Colorado	1,330	1,330	1,330	1,166	1,166	956	956
	County Total	***2,760***	***2,760***	***2,760***	***2,420***	***2,420***	***1,984***	***1,984***
Travis	Brazos	28	28	28	28	28	28	28
Travis	Colorado	3,839	3,839	3,839	3,839	3,839	3,839	3,839
Travis	Guadalupe	33	33	33	33	33	33	33
	County Total	***3,900***	***3,900***	***3,900***	***3,900***	***3,900***	***3,900***	***3,900***
Williamson	Brazos	58	58	58	58	58	58	58
Williamson	Colorado	2	2	2	2	2	2	2
	County Total	***60***	***60***	***60***	***60***	***60***	***60***	***60***
Region K	**Region Total**	**16,782**	**16,782**	**16,782**	**16,440**	**16,440**	**15,717**	**15,717**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.1.4 *Availability*.

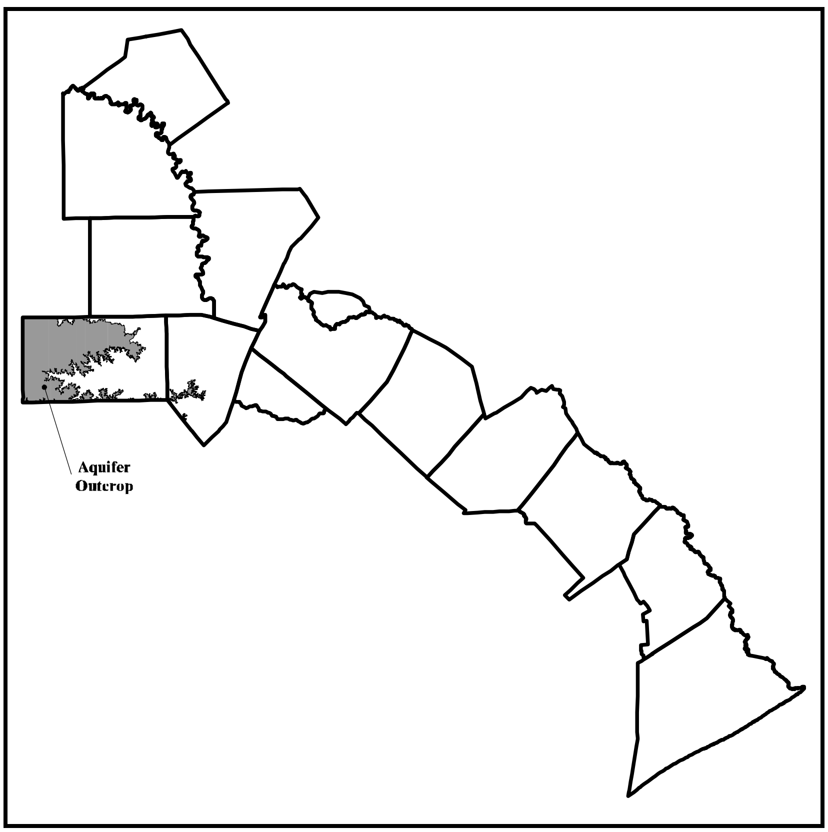
3.2.2.1.5 Edwards-Trinity (Plateau) Aquifer

Location and Use

The Edwards-Trinity (Plateau) aquifer underlies the Edwards Plateau east of the Pecos River and the Stockton Plateau west of the Pecos River, providing water to all or parts of 38 counties. The aquifer extends from the Hill Country of Central Texas to the Trans-Pecos region of West Texas.

Groundwater use from the Edwards-Trinity aquifer within the LCRWPA is limited to Gillespie County. TWDB records indicate that the total groundwater pumpage from the Edwards-Trinity (Plateau) in the study area for 2000 was 13 ac-ft, which was used exclusively for municipal purposes. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.6*.

Figure 3.6: Edwards Trinity Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The aquifer consists of saturated sediments of lower Cretaceous age Trinity Group formations and overlying limestones and dolomites of the Comanche Peak, Edwards, and Georgetown Formations. Springs issuing from the aquifer form the headwaters for the Pedernales, Llano, and San Saba Rivers.

The aquifer generally exists under water table conditions, however, where the Trinity is fully saturated and a zone of low permeability occurs near the base of the overlying Edwards, artesian conditions may exist. Reported well yields commonly range from less than 50 gal/min, where saturated thickness is thin, to more than 1,000 gal/min, in areas outside of Region K where large capacity wells are completed in jointed and cavernous limestone.

Water Quality

Natural chemical quality of Edwards-Trinity (Plateau) water ranges from fresh to slightly saline. The water is typically hard and may vary widely in concentrations of dissolved solids, composed mostly of calcium and bicarbonate. The salinity of the groundwater tends to increase toward the west. Water quality of springs issuing from the aquifer in the southern and eastern border areas is typically excellent.

Availability

There is little pumpage from the aquifer over most of its extent, and water levels have generally remained constant or have fluctuated only with seasonal precipitation. In some instances, water levels have declined as a result of increased pumpage. None of the areas supplied by groundwater from the Edwards-Trinity (Plateau) aquifer have experienced declines greater than 20 feet since 1980. The availability of the Edwards-Trinity aquifer in Gillespie County is based on the Hill Country Underground Water Conservation District Water Management Plan. The availability of the Edwards-Trinity aquifer in Blanco County is same as in the 2000 Region K Water Supply Plan which was based on the TWDB default number; the number has since been adopted by Blanco-Pedernales Groundwater Conservation District Water Management Plan. This information is presented in *Table 3.17*.

Table 3.17 Water Availability from the Edwards-Trinity Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Blanco	Colorado	107	107	107	107	107	108	108
Blanco	Guadalupe	50	50	50	50	50	51	51
	County Total	***157***	***157***	***157***	***157***	***157***	***159***	***159***
Gillespie	Colorado	1,410	1,410	1,410	1,410	1,410	1,410	1,410
Gillespie	Guadalupe	90	90	90	90	90	90	90
	County Total	***1,500***	***1,500***	***1,500***	***1,500***	***1,500***	***1,500***	***1,500***
Region K	**Region Total**	**1,657**	**1,657**	**1,657**	**1,657**	**1,657**	**1,659**	**1,659**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.1.5 *Availability*.

3.2.2.2 Minor Aquifers

The minor aquifers in the LCRWPA are the Hickory, Queen City, Sparta, Ellenburger-San Saba, and Marble Falls aquifers. These aquifers provide water supply to many of the cities and towns in the hill country of Central Texas, or in the case of the Sparta and Queen City aquifers, to farms, ranches, and small towns in Bastrop and Fayette Counties.

There are also WUGs in Region K that rely on alluvial aquifers for supply. These supplies are referred to as "Other Aquifer" since the actual aquifers have not been identified or named and the extent of the aquifer supply has not been determined.

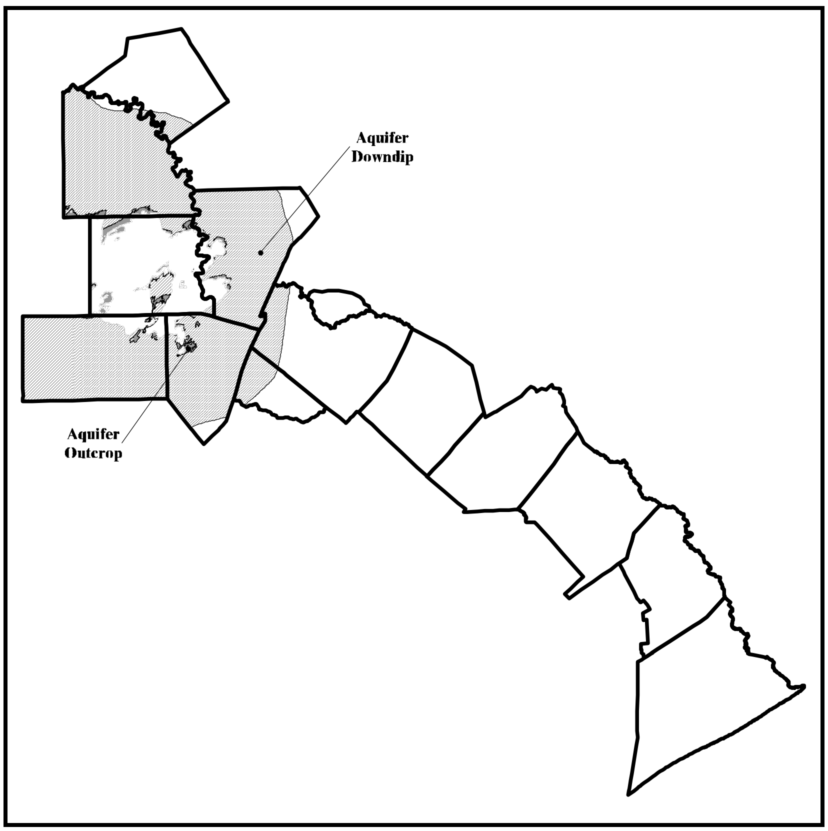
3.2.2.2.1 Hickory Aquifer

Location and Use

The Hickory aquifer underlies approximately 5,000 square miles in parts of 19 counties within the Llano Uplift region of Central Texas. Discontinuous outcrops of the Hickory sandstone overlie and flank the exposed Precambrian rocks that form the central core of the Uplift. The downdip artesian portion of the aquifer encircles the Uplift and extends to maximum depths approaching 4,500 feet.

Groundwater use from the Hickory aquifer within the LCRWPA occurs in Burnet, Gillespie, Llano, San Saba, and Blanco Counties. TWDB records indicate that the total groundwater pumpage from the Hickory aquifer in the study area for 2000 was 2,443 ac-ft. Municipal uses accounted for 13 percent of the total, mining accounted for 13 percent, irrigation accounted for 55 percent, and livestock accounted for 19 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.7*.

Figure 3.7: Hickory Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The Hickory aquifer, like the Marble Falls and Ellenburger-San Saba aquifers, was formed by the Llano Uplift, a distinct area of the state that includes portions of 19 counties. The Hickory Sandstone member of the Cambrian Riley Formation is composed of some of the oldest sedimentary rocks found in Texas. In most of the northern and western portions of the aquifer, the Hickory Sandstone Member can be differentiated into lower, middle, and upper units, which reach a maximum thickness of 480 feet in southwestern McCulloch County just northwest of the LCRWPA. In the southern and eastern extent of the aquifer, the Hickory Sandstone Member consists of only two units, which range in thickness from about 150 to 400 feet.

The Hickory aquifer has been compartmentalized by block faulting. The vertical displacement of faults ranges from a few feet to as much as 2,000 feet. Significant lateral displacement is also associated with these faults. Throughout its extent, the thickness of the aquifer is affected by the relief of the underlying Precambrian surface. Both of these elements have contributed to the significant variability that occurs in groundwater availability, movement, quality, and productivity.

Large wells used for irrigation and municipal supply may range from 200 to 500 gal/min. Some exceptional wells have been reported to have yields in excess of 1,000 gal/min. These would typically occur outside of the LCRWPA, northwest of the Llano Uplift.

Water Quality

In general, the quality of water from the Hickory aquifer could be described as moderate to low quality. The total dissolved solids concentrations vary from 300 to 500 mg/l. In some areas the groundwater may have dissolved solids concentrations as high as 3,000 mg/l. The water may contain alpha particle and total radium concentrations that may exceed the new safe drinking water levels soon to be issued by the EPA. Radon gas may also be entrained. Most of the radioactive groundwater is thought to be produced from the middle Hickory unit, while the upper Hickory unit produces water that exceeds safe drinking water concentrations for iron. High nitrate levels may be found in the shallower portions of the aquifer where there may be interaction with surface activities such as fertilizer applications and septic systems.

Availability

The amounts of water available from the Hickory aquifer in Blanco, Gillespie, and San Saba Counties are based on the Blanco-Pedernales Groundwater Conservation District, the Hill Country UWCD, and the Hickory Underground Water Conservation District (UWCD) No. 1 Water Management Plans, respectively. Groundwater availabilities in Burnet and Llano Counties are same as in the 2000 Region K Water Supply Plan which were based on information obtained from the TWDB. These projections of availability are shown in *Table 3.18* below.

Table 3.18 Water Availability from the Hickory Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Blanco	Colorado	747	747	747	747	747	747	747
Blanco	Guadalupe	165	165	165	165	165	165	165
	County Total	***912***	***912***	***912***	***912***	***912***	***912***	***912***
Burnet	Colorado	3,154	3,154	3,154	3,154	3,154	3,154	3,154
Burnet	Brazos	2,257	2,257	2,257	2,257	2,257	2,257	2,257
	County Total	***5,411***	***5,411***	***5,411***	***5,411***	***5,411***	***5,411***	***5,411***
Gillespie	Colorado	1,934	1,934	1,934	1,934	1,934	1,934	1,934
Gillespie	Guadalupe	66	66	66	66	66	66	66
	County Total	***2,000***	***2,000***	***2,000***	***2,000***	***2,000***	***2,000***	***2,000***
Llano	Colorado	12,517	12,517	12,517	12,517	12,517	12,517	12,517
San Saba	Colorado	6,540	6,540	6,540	6,540	6,540	6,540	6,540
Region K	**Region Total**	**27,380**	**27,380**	**27,380**	**27,380**	**27,380**	**27,380**	**27,380**

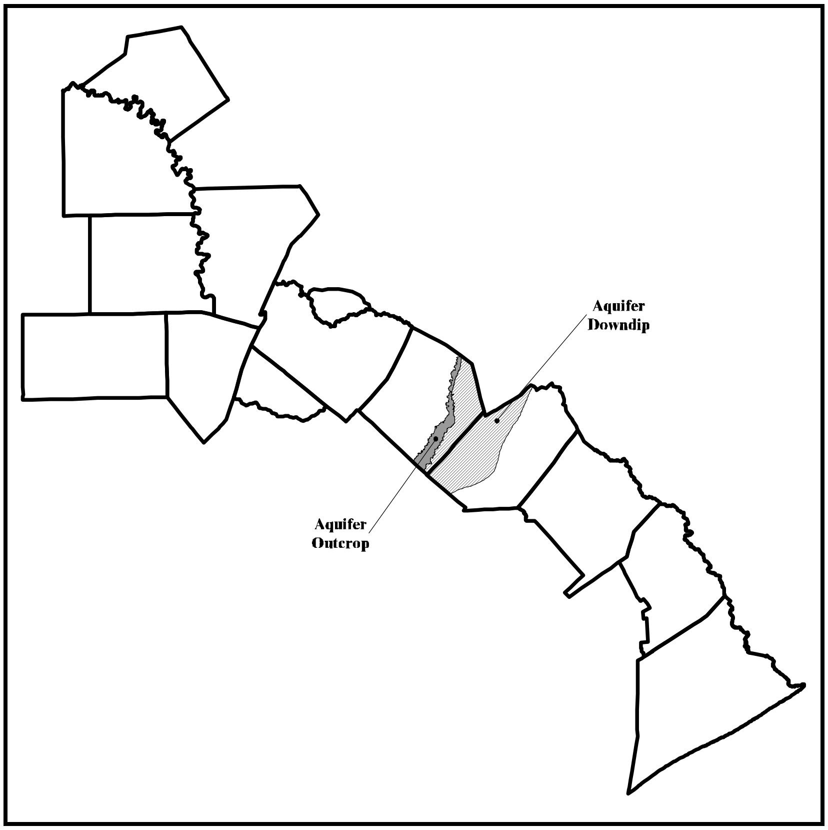
Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.2.1 *Availability*.

3.2.2.2.2 Queen City Aquifer

Location and Use

The Queen City aquifer extends in a band across most of the State from the Frio River in South Texas northeastward into Louisiana. The southwestern boundary is placed at the Frio River because of a facies change in the formation. This facies change results in reduced amounts of poorer quality water produced from this interval southwest of the Frio River. In 2000, Bastrop and Fayette Counties are listed as using Queen City water in the study area. The reported usage for 2000 was 126 ac-ft in the TWDB records. Municipal uses accounted for 29 percent of the total, irrigation accounted for 11 percent, and livestock accounted for 60 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.8*.

Figure 3.8: Queen City Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The Queen City aquifer is composed of sand, loosely cemented sandstone, and interbedded clay units of the Queen City Formation of the Tertiary Claiborne Group. These rocks slope downward or dip gently to the south and southeast toward the Gulf of Mexico. The total thickness of this aquifer is usually less than 500 feet in the LCRWPA. The Queen City aquifer generally parallels the Carrizo aquifer, and like the Carrizo, it has both a water table and artesian portion. Well yields are generally low with a few exceeding 400 gal/min.

Water Quality

Throughout most of the LCRWPA, the chemical quality of the Queen City aquifer water is excellent, but water quality may deteriorate fairly rapidly downdip. The water may be fairly acidic (low pH), have high iron concentrations, or contain hydrogen sulfide gas. All of these conditions are relatively easy to remedy with standard water treatment methods.

Availability

The water availability of the Queen City aquifer in Bastrop County is same as in the 2000 Region K Water Supply Plan which was based on aquifer-wide TWDB projections. The amount of water available from the Queen City aquifer in Fayette County is based on the Fayette County Groundwater Conservation

District Water Management Plan. The total supply available is distributed in proportion to the area occurring in each river basin. These projections are presented in *Table 3.19* below.

Table 3.19 Water Availability From the Queen City Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Bastrop	Brazos	227	227	227	227	227	227	227
Bastrop	Colorado	2,126	2,126	2,126	2,126	2,126	2,126	2,126
Bastrop	Guadalupe	403	403	403	403	403	403	403
	County Total	***2,756***	***2,756***	***2,756***	***2,756***	***2,756***	***2,756***	***2,756***
Fayette	Colorado	1,034	1,034	1,034	1,034	1,034	1,034	1,034
Fayette	Lavaca	26	26	26	26	26	26	26
Fayette	Guadalupe	175	175	175	175	175	175	175
	County Total	***1,235***	***1,235***	***1,235***	***1,235***	***1,235***	***1,235***	***1,235***
Region K	**Region Total**	**3,991**	**3,991**	**3,991**	**3,991**	**3,991**	**3,991**	**3,991**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.2.2 *Availability*.

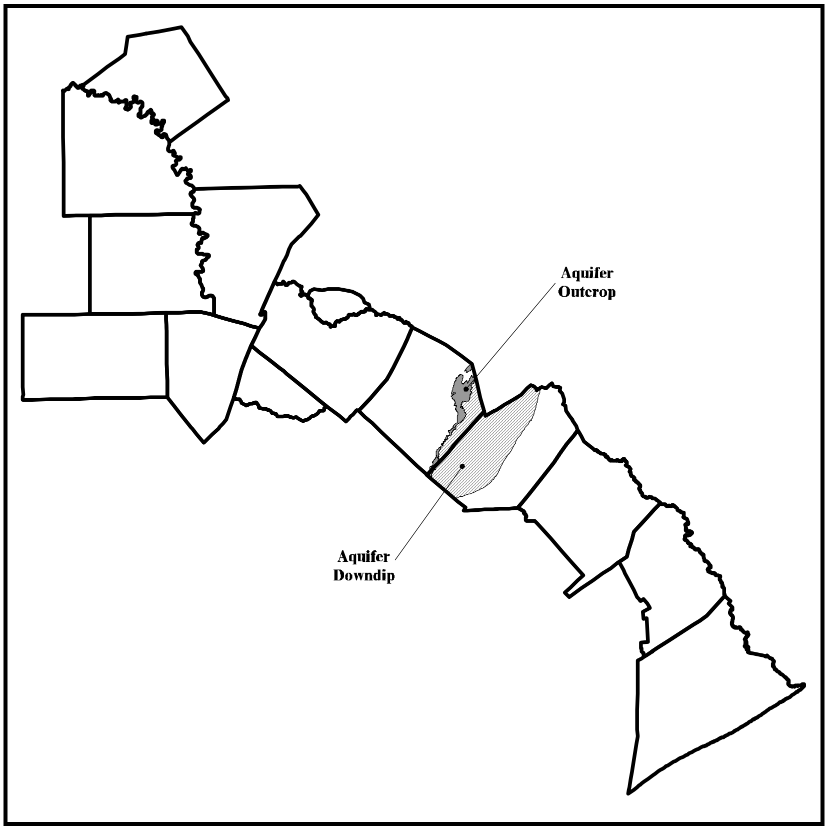
3.2.2.2.3 Sparta Aquifer

Location and Use

The Sparta aquifer extends in a narrow band across the state from the Frio River in South Texas northeastward to the Louisiana border in Sabine County. The southwestern boundary is placed at the Frio River because of a facies change in the formation, which makes it difficult to delineate the boundaries of the Sparta and contiguous formations southwestward. The facies change results in reduced amounts of water and poorer quality water produced from the interval.

Groundwater use from the Sparta aquifer within the LCRWPA occurs in Bastrop and Fayette Counties. TWDB records indicate that the total groundwater pumpage from the Sparta aquifer in the study area for 2000 was 181 ac-ft. Municipal uses accounted for 41 percent of the total, irrigation accounted for 37 percent, and livestock accounted for 22 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.9*.

Figure 3.9: Sparta Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The Sparta Formation, like the Queen City, is part of the Claiborne Group. The aquifer consists of sand and interbedded clay with more massive sand beds in the basal section. Rocks composing the Sparta Formation also dip gently to the south and southeast toward the Gulf Coast, with a total thickness that can reach up to 300 feet. Yields of individual wells are generally low to moderate, but high capacity wells, producing 400 to 500 gal/min, are possible. The water occurs under water table conditions near the outcrop but becomes confined and is under artesian conditions downdip. Usable quality water may be recovered from as much as 2,000 feet below the surface.

Water Quality

Usable quality water is commonly found within the outcrop and for a few miles downdip. The water quality in most of this aquifer is excellent, but the quality does decrease in the downdip direction. In some areas the water can contain iron concentrations exceeding the safe drinking water standards.

Availability

The amount of water available from the Sparta aquifer in Fayette County is based on the Fayette County Groundwater Conservation District Water Management Plan. The water availability from the Sparta aquifer in Bastrop County is same as in the 2000 Region K Water Supply Plan which was based on aquifer-wide TWDB projections. The total supply available was distributed in proportion to the area occurring in each basin. These projections are presented in *Table 3.20* below.

Table 3.20 Water Availability from the Sparta Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Fayette	Colorado	3,667	3,667	3,667	3,667	3,667	3,667	3,667
Fayette	Lavaca	235	235	235	235	235	235	235
Fayette	Guadalupe	598	598	598	598	598	598	598
	County Total	***4,500***	***4,500***	***4,500***	***4,500***	***4,500***	***4,500***	***4,500***
Bastrop	Brazos	49	49	49	49	49	49	49
Bastrop	Colorado	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Bastrop	Guadalupe	340	340	340	340	340	340	340
	County Total	***5,389***	***5,389***	***5,389***	***5,389***	***5,389***	***5,389***	***5,389***
Region K	**Region Total**	**9,889**	**9,889**	**9,889**	**9,889**	**9,889**	**9,889**	**9,889**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.2.3, *Availability*.

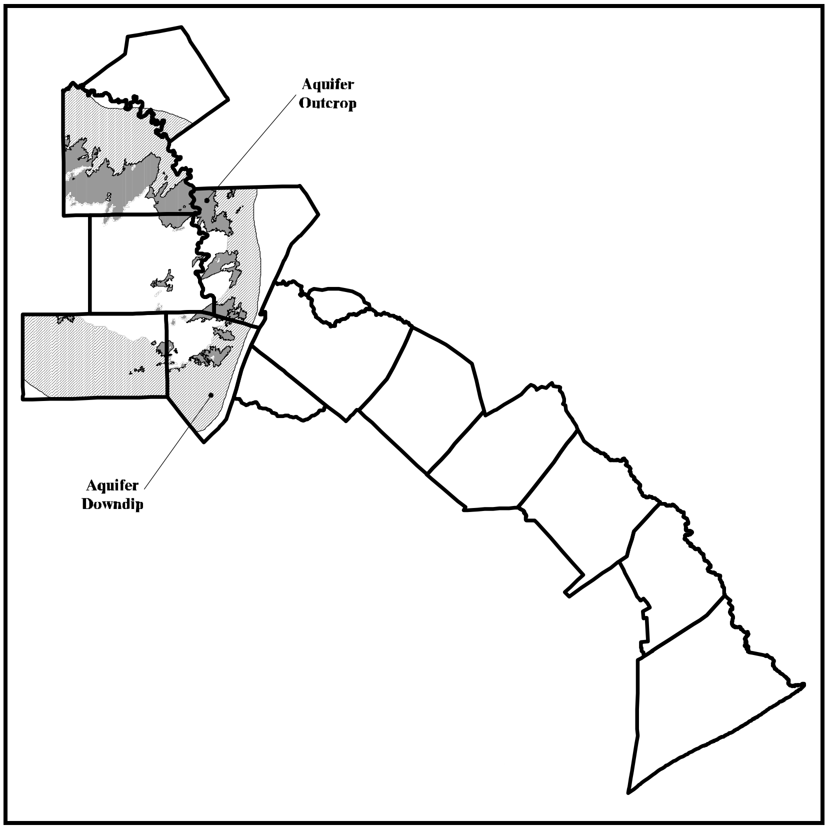
3.2.2.2.4 Ellenburger-San Saba Aquifer

Location and Use

The Ellenburger-San Saba aquifer underlies about 4,000 square miles in parts of 15 counties in the Llano Uplift area of Central Texas. Discontinuous outcrops of the aquifer generally encircle older rocks in the core of the uplift. The remaining downdip portion contains fresh to slightly saline water to depths of approximately 3,000 feet below land surface.

Groundwater use from the Ellenburger-San Saba aquifer within the LCRWPA occurs in Blanco, Burnet, Gillespie, Llano, and San Saba Counties. TWDB records indicate that the total groundwater pumpage from the Ellenburger-San Saba in the study area for 2000 was 4,972 ac-ft. Municipal uses accounted for 74 percent of the total, irrigation accounted for 10 percent, and livestock accounted for 15 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.10*.

Figure 3.10: Ellenburger-San Saba Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

The Ellenburger-San Saba aquifer occurs in limestone and dolomite facies of the San Saba Member of the Wilbern Formation of the Late Cambrian Age; and in the Honeycut, Gorman, and Tanyard Formations of the Ellenburger Group. In the southeastern portion of the aquifer, these units have a combined maximum thickness of about 2,700 feet while in the northeastern portion of the aquifer and a maximum combined thickness is about 1,100 feet. In some areas where the overlying confining beds are thin or nonexistent the aquifer may be hydrologically connected to the Marble Falls aquifer.

Most of the water is under artesian conditions, even in the outcrop areas where impermeable carbonate rocks in the upper portion of the Ellenburger-San Saba function as confining layers. The aquifer is compartmentalized by block faulting with the fractures forming various sized cavities, which are the major water-bearing features.

The maximum capacity of wells used for municipal and irrigation purposes generally range from 200 to 600 gal/min. Most other wells produce less than 100 gal/min. The variable flow properties of the aquifer make it difficult to consistently obtain higher yield wells in some areas. Locations in the LCRWPA that have experienced this difficulty include the cities of Fredericksburg and Bertram.

Water Quality

Water produced from the aquifer may have dissolved concentrations that range from 200 mg/l to as high as 3,000 mg/l, but in most cases is usually less than 1,000 mg/l. The quality of water declines rapidly in the downdip direction.

Availability

The water available from the Ellenburger-San Saba aquifer in Blanco, Gillespie and San Saba Counties is based on the Blanco-Pedernales Groundwater Conservation District, the Hill Country UWCD and the Hickory Underground Water Conservation District (UWCD) No. 1 Water Management Plans respectively. Groundwater availabilities in Burnet and Llano Counties are the same as in the 2000 Region K Water Supply Plan which were based on the TWDB projections. GIS was used to apportion areas, which were then applied to separate the quantity available in the different river basins. The total supply available was distributed in proportion to the area occurring in each basin. These projections are shown in *Table 3.21* below.

Table 3.21 Water Availability from the Ellenburger-San Saba Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Blanco	Colorado	2,849	2,849	2,849	2,849	2,849	2,849	2,849
Blanco	Guadalupe	1,025	1,025	1,025	1,025	1,025	1,025	1,025
	County Total	***3,874***	***3,874***	***3,874***	***3,874***	***3,874***	***3,874***	***3,874***
Burnet	Brazos	987	987	987	987	987	987	987
Burnet	Colorado	2,161	2,161	2,161	2,161	2,161	2,161	2,161
	County Total	***3,148***	***3,148***	***3,148***	***3,148***	***3,148***	***3,148***	***3,148***
Gillespie	Colorado	5,535	5,535	5,535	5,535	5,535	5,535	5,535
Gillespie	Guadalupe	65	65	65	65	65	65	65
	County Total	***5,600***	***5,600***	***5,600***	***5,600***	***5,600***	***5,600***	***5,600***
Llano	Colorado	758	758	758	758	758	758	758
San Saba	Colorado	10,194	10,194	10,194	10,194	10,194	10,194	10,194
Region K	**Region Total**	**23,574**	**23,574**	**23,574**	**23,574**	**23,574**	**23,574**	**23,574**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.2.4 *Availability*.

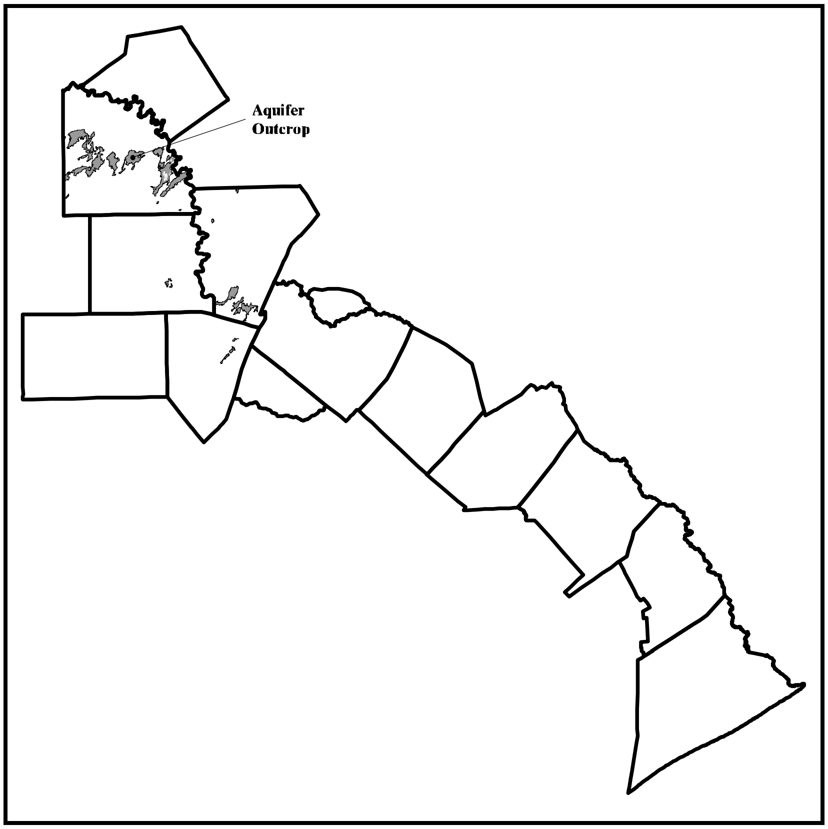
3.2.2.2.5 Marble Falls Aquifer

Location and Use

The Marble Falls aquifer occurs in several separated outcrops, primarily along the northern and eastern flanks of the Llano Uplift region of Central Texas. The downdip portion of the aquifer is of unknown extent.

Groundwater use from the Marble Falls aquifer within the LCRWPA occurs in Burnet and San Saba Counties. TWDB records indicate that the total groundwater pumpage from the Marble Falls in the study area for 2000 was 1,505 ac-ft. Municipal uses accounted for 76 percent of the total, manufacturing accounted for 2 percent, irrigation accounted for 6 percent, and livestock accounted for 16 percent. The location of the aquifer within the LCRWPA is illustrated in *Figure 3.11*.

Figure 3.11: Marble Falls Aquifer Within the Lower Colorado Regional Water Planning Area



Hydrogeology

This aquifer occurs in the fractures, solution cavities, and channels of the limestone rocks of the Marble Falls Formation of the Pennsylvanian Bend Group. The maximum thickness of the formation is 600 feet. Numerous large springs discharge from the aquifer and provide a significant portion of the baseflow of the San Saba River in McCulloch and San Saba Counties; and to the Colorado River in San Saba and Lampasas Counties. The aquifer contributes flow to the San Saba springs, which is the source of drinking water for the City of San Saba. In some areas where the confining layers are thin or nonexistent, the Marble Falls aquifer may be hydrologically connected to the San Saba-Ellenburger aquifer. Some wells have been known to produce as much as 2,000 gal/min; however, most wells produce at rates significantly less than this amount.

Water Quality

The water produced from this aquifer is suitable for most purposes, but some wells in Blanco County have produced water with high nitrate concentrations. The downdip portion of the aquifer is not extensive, but in these areas the water becomes highly mineralized. Because the limestone formation comprising this aquifer is relatively shallow, it is susceptible to pollution by surface uses and activities.

Availability

The water available from the Marble Falls aquifer in Blanco and San Saba Counties is based on the Blanco-Pedernales Groundwater Conservation District and the Hickory Underground Water Conservation District (UWCD) No. 1 Water Management Plans respectively. Groundwater availability in Burnet County is same as in the 2000 Region K Water Supply Plan which was based on former estimates of groundwater availability provided by the TWDB. These projections are shown in *Table 3.22* below.

Table 3.22 Water Availability from the Marble Falls Aquifer (ac-ft/yr)

County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Blanco	Colorado	300	300	300	300	300	300	300
Burnet	Brazos	291	291	291	291	291	291	291
Burnet	Colorado	5,334	5,334	5,334	5,334	5,334	5,334	5,334
	County Total	***5,625***	***5,625***	***5,625***	***5,625***	***5,625***	***5,625***	***5,625***
San Saba	Colorado	12,380	12,380	12,380	12,380	12,380	12,380	12,380
Region K	**Region Total**	**18,305**	**18,305**	**18,305**	**18,305**	**18,305**	**18,305**	**18,305**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.2.5 *Availability*.

3.2.2.2.6 Other Aquifer

Other Aquifer refers to alluvial aquifer water supplies that have not been identified, named, or studied. These alluvial aquifers are being used by a few WUGs in Region K as supply sources. The most likely source of these Other Aquifer supplies in Region K is the Colorado River Alluvium and related terrace deposits. Other Aquifer supplies were only considered for counties where WUGs specifically list alluvial aquifer type supplies as a source or where municipal or industrial WUGs could potentially utilize these alluvial supplies. Other Aquifer supplies were not considered for counties which had already established availability based on total groundwater usage and where there was not significant usage of Other Aquifer water occurring currently. The TCEQ Water Utility Database was used to determine the well capacities and productions for these Other Aquifer supplies when information was available.

The availability of Other Aquifer supplies was estimated based on annual recharge estimates for the county. The annual recharge estimate is based on a GIS (Geographically Information Systems) calculation of the area in each county of the Colorado River alluvium and related terrace deposits and an assumptive rate of recharge of 1.5 percent of average annual precipitation.

For Llano County, the Other Aquifer supplies are based on TCEQ production data. For Travis County, the Other Aquifer availability estimate was almost the same as the supply estimate based upon WUG data, therefore, the Other Aquifer availability is based on the WUG data. *Table 3.22* contains a summary of the Other Aquifer sources available to the LCRWPA.

Table 3.23 Water Availability from Other Aquifer (ac-ft/yr)

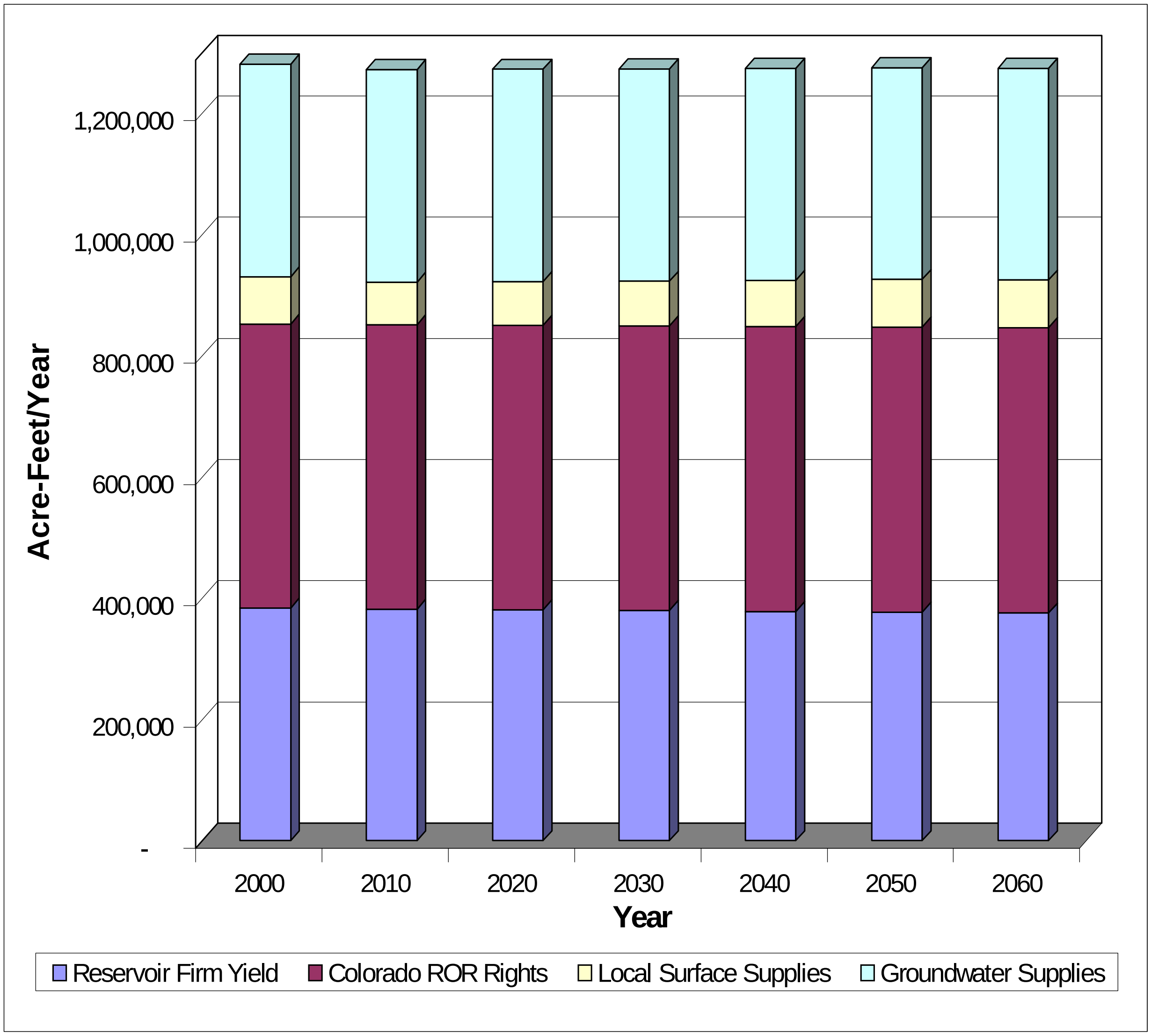
County	Basin	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Bastrop	Colorado	3,350	3,350	3,350	3,350	3,350	3,350	3,350
	County Total	***3,350***	***3,350***	***3,350***	***3,350***	***3,350***	***3,350***	***3,350***
Burnet	Colorado	305	305	305	305	305	305	305
	County Total	***305***	***305***	***305***	***305***	***305***	***305***	***305***
Colorado	Colorado	4,269	4,269	4,269	4,269	4,269	4,269	4,269
	County Total	***4,269***	***4,269***	***4,269***	***4,269***	***4,269***	***4,269***	***4,269***
Fayette	Colorado	3,696	3,696	3,696	3,696	3,696	3,696	3,696
	County Total	***3,696***	***3,696***	***3,696***	***3,696***	***3,696***	***3,696***	***3,696***
Llano	Colorado	109	109	109	109	109	109	109
	County Total	***109***	***109***	***109***	***109***	***109***	***109***	***109***
Travis	Colorado	1,808	1,818	1,835	1,848	1,853	1,856	1,860
Travis	Guadalupe	21	25	30	34	37	40	43
	County Total	***1,829***	***1,843***	***1,865***	***1,882***	***1,890***	***1,896***	***1,903***
Region K	**Region Total**	**13,558**	**13,572**	**13,594**	**13,611**	**13,619**	**13,625**	**13,632**

Note: An explanation of the numbers presented in this table is provided in Section 3.2.2.2.6.

3.2.3 Regional Water Availability Summary

The TWDB guidelines for regional water planning process require that a summary of the water sources available to the region be presented. The table, *Region K Current Water Availability Sources*, is presented in the *Appendix 3E*. This information is presented graphically in *Figure 3.12* and is summarized in *Table 3.24*. As indicated, under current conditions, a total of nearly 1.3 million ac-ft of water is available annually to the LCRWPA under DOR conditions. Of this amount, approximately 73 percent is from surface water sources and 27 percent is from groundwater sources.

Figure 3.12: Total Water Available to Region K During a Drought of Record



Appendix F contains a comparison of the total water available to Region K in the 2001 Plan and in the current Plan.

Table 3.24 Total Water Available to the Lower Colorado Regional Planning Area During a Drought of Record (ac-ft/yr)

Water Source	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
City of Austin - ROR Municipal [1]	181,053	181,657	182,261	182,865	183,469	184,073	184,677
City of Austin - ROR Steam Electric [1]	9,613	9,477	9,341	9,205	9,069	8,933	8,795
LCRA - Garwood ROR	111,740	111,740	111,740	111,740	111,740	111,740	111,740
LCRA - Gulf Coast ROR	74,137	74,124	74,111	74,098	74,085	74,072	74,056
LCRA - Lakeside #1 ROR	19,769	19,769	19,769	19,769	19,769	19,769	19,769
LCRA - Lakeside #2 ROR	10,769	10,769	10,769	10,769	10,769	10,769	10,769
LCRA - Pierce Ranch ROR	10,769	10,769	10,769	10,769	10,769	10,769	10,769
STP Nuclear Operating Co. et al. ROR	49,089	49,039	48,989	48,939	48,889	48,839	48,791
San Bernard ROR [3]	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Highland Lakes [4]	382,924	381,545	380,166	378,787	377,408	376,029	374,642
Goldthwaite Reservoir	144	144	144	145	145	145	145
Llano Reservoir	187	178	169	160	151	142	135
Blanco Reservoir	596	596	596	596	596	596	596
Irrigation Local Supply	40,663	40,663	40,663	40,663	40,663	40,663	40,663
Livestock Local Supply	8,458	8,458	8,458	8,458	8,458	8,458	8,458
Other Local Supply	29,297	20,978	22,636	24,510	26,727	29,370	29,370
Carrizo-Wilcox Aquifer	28,400	28,400	28,400	28,400	28,400	28,400	28,400
Edwards Aquifer BFZ	8,375	8,375	8,375	8,375	8,375	8,375	8,375
Edwards-Trinity Aquifer (Plateau)	1,657	1,657	1,657	1,657	1,657	1,659	1,659
Ellenburger-San Saba Aquifer	23,574	23,574	23,574	23,574	23,574	23,574	23,574
Gulf Coast Aquifer	198,425	198,425	198,425	198,425	198,425	198,425	198,425
Hickory Aquifer	27,380	27,380	27,380	27,380	27,380	27,380	27,380
Marble Falls Aquifer	18,305	18,305	18,305	18,305	18,305	18,305	18,305
Queen City Aquifer	3,991	3,991	3,991	3,991	3,991	3,991	3,991
Sparta Aquifer	9,889	9,889	9,889	9,889	9,889	9,889	9,889
Trinity Aquifer	16,782	16,782	16,782	16,440	16,440	15,717	15,717
Other Aquifer	13,558	13,572	13,594	13,611	13,619	13,625	13,632
Region K Totals	**1,281,144**	**1,271,856**	**1,272,553**	**1,273,120**	**1,274,362**	**1,275,307**	**1,274,322**

Notes: Downstream water availability does not include return flows.
The water availability numbers in this table reflect water that is physically present in the region. This does not necessarily mean that this water is available to WUGs for immediate use as defined in *Table 3.31*.

[1] Refer to *Table 3.3a* and *Table 3.27* for a breakdown of what is included in the COA ROR rights.
[2] The Colorado Basin run-of-river rights are presented in *Table 3.3a*.
[3] The San Bernard ROR value is based on TCEQ water rights database; Reliability of the WR has not been verified.
[4] Refer to *Table 3.1a* and Table *3.2a* for a detailed breakdown of the Highland Lakes.
[5] The reservoirs firm yields are presented in *Table 3.2a*.
[6] Local Supply Sources are presented in *Tables 3.4, 3.6, 3.7, 3.8, 3.9,* and *3.10*.
[7] Groundwater availabilities are discussed in Section 3.2.2.

3.3 WHOLESALE WATER PROVIDERS

The RWPGs are required to prepare estimates of the water available to the Wholesale Water Providers within each region. The LCRWPG has identified two Wholesale Water Providers, the LCRA, and the City of Austin. The water supplies available to these two entities are discussed in the following sections.

3.3.1 LCRA Water Availability

The LCRA has acquired the rights to significant quantities of water within the LCRWPA. The majority of water that is available to LCRA during a repeat of the drought of record is associated with the Highland Lakes System. However, the LCRA also has two smaller reservoirs that it operates in association with two power generating facilities. In addition, the LCRA has acquired many of the senior rights for irrigation water in the lower basin. *Table 3.25* contains a summary of the water that is available to the LCRA.

Table 3.25 Total Water Available to the Lower Colorado River Authority (ac-ft/yr)

Water Rights Holder	Water Availability During Drought of Record [1]						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
LCRA - Garwood	111,740	111,740	111,740	111,740	111,740	111,740	111,740
LCRA - Lakeside #1	19,769	19,769	19,769	19,769	19,769	19,769	19,769
LCRA - Gulf Coast	74,137	74,124	74,111	74,098	74,085	74,072	74,056
LCRA - Pierce Ranch	10,769	10,769	10,769	10,769	10,769	10,769	10,769
LCRA - Lakeside #2	10,769	10,769	10,769	10,769	10,769	10,769	10,769
LCRA - Highland Lakes	382,924	381,545	380,166	378,787	377,408	376,029	374,642
Totals	**610,108**	**608,716**	**607,324**	**605,932**	**604,540**	**603,148**	**601,745**

Data Source: Colorado WAM provided by TCEQ, November 2004, Run 3 Modified by FNI. WRAP modeling program provided by Dr. Ralph Wurbs, Texas A&M University, July 2004 version.
Note: Downstream water availability does not include return flows.
[1] The firm yield determinations for the irrigation ROR rights are discussed in Section 3.2.1.2.5 and are presented in *Table 3.3a*. The Highland Lakes firm yield determination is discussed in Section 3.2.1.2.3 and is presented in *Tables 3.1a* and *3.2a*.

The LCRA makes the majority of this water available to other entities for final consumption through water sales contracts. The majority of these water sales contracts are for stored water from the Highland Lakes System. In addition, the LCRA operates three irrigation districts in the lower basin. These districts provide irrigation water for rice production in Colorado, Wharton, and Matagorda Counties. *Table 3.26* contains a summary of current LCRA water supply commitments, including rice irrigation, by Water User Groups.

Table 3.26 LCRA Water Commitment Summary (ac-ft/yr)

County/WUG	Basin	2000	2010	2020	2030	2040	2050	2060
Bastrop County								
Aqua WSC	Colorado	5,000	5,000	5,000	5,000	5,000	0	0
County-Other	Colorado	2,092	2,050	700	700	700	700	700
Steam Electric	Colorado	16,720	16,720	16,720	16,720	13,970	10,750	10,750

Table 3.26 LCRA Water Commitment Summary (ac-ft/yr) (Continued)

County/WUG	Basin	2000	2010	2020	2030	2040	2050	2060
Burnet County								
Burnet	Colorado	4,100	4,100	4,100	4,100	0	0	0
Cottonwood Shores	Colorado	138	138	0	0	0	0	0
Granite Shoals	Colorado	830	830	830	0	0	0	0
Lake LBJ MUD	Colorado	1,789	1,789	1,789	1,789	1,789	0	0
Marble Falls	Colorado	3,000	3,000	3,000	1,000	1,000	0	0
County-Other	Colorado	901	556	330	280	250	250	250
Manufacturing	Colorado	500	500	500	500	500	500	500
Colorado County								
Irrigation [1]	Colorado	157,682	150,617	144,349	138,285	132,416	126,710	121,247
Fayette County								
County-Other	Colorado	97	12	0	0	0	0	0
Steam Electric (LCRA)	Colorado	38,101	38,101	38,101	38,101	38,101	38,101	38,101
Steam Electric (COA)	Colorado	3,500	3,500	3,500	0	0	0	0
Hays County								
Dripping Springs WSC	Colorado	560	560	560	560	560	0	0
County-Other	Colorado	1,915	1,915	1,915	1,915	1,915	0	0
Lampasas County (Region G)								
Lometa	Colorado	882	0	0	0	0	0	0
Llano County								
Kingsland WSC	Colorado	500	500	500	500	500	500	0
Llano	Colorado	87	87	87	87	0	0	0
Sunrise Beach Village [2]	Colorado	278	278	278	278	278	278	278
County-Other	Colorado	2,074	2,074	747	747	728	728	728
Steam Electric [3]	Colorado	15,700	15,700	15,700	15,700	15,700	15,700	15,700
Matagorda County								
Manufacturing	Brazos-Colorado	7,438	7,438	3,150	1,464	1,464		
Manufacturing	Colorado	6,784	6,784	2,872	1,336	1,336	0	0
County-Other	Colorado	15	15	0	0	0	0	0
Irrigation [4]	Colorado	179,211	167,952	161,883	156,037	150,437	145,048	139,853
Steam Electric [5]	Colorado	38,060	38,111	38,162	38,213	0	0	0
San Saba County								
County-Other	Colorado	20	0	0	0	0	0	0

[1] The Colorado Irrigation commitment represents 75 percent of the Colorado County Irrigation demand.
[2] The value for Sunrise Beach Village was estimated based upon TCEQ maximum production capacity for system.
[3] The Llano Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI amount instead of the 15,000 ac-ft/yr, which LCRA has in the 1999 WMP.
[4] The Matagorda Irrigation commitment represents 87 percent of the Matagorda County Irrigation demand.
[5] The Matagorda Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of the 5,680 ac-ft/yr LCRA contract value; Refer to *Table 3.1a*.

Table 3.26 LCRA Water Commitment Summary (ac-ft/yr) (Continued)

County/WUG	Basin	2000	2010	2020	2030	2040	2050	2060
Travis County								
Austin - Municipal [6]	Colorado	143,947	143,343	142,739	142,135	141,531	140,927	0
Austin - Steam Electric [7]	Colorado	30,860	30,994	31,128	31,262	31,396	31,530	0
Barton Creek West WSC	Colorado	348	348	348	348	348	348	348
Bee Cave Village	Colorado	241	241	241	241	241	241	241
Briar Cliff Village	Colorado	300	300	300	300	0	0	0
Cedar Park [8]	Colorado	594	670	290	384	443	0	0
The Hills	Colorado	1,600	1,600	1,600	0	0	0	0
Jonestown WSC	Colorado	360	360	360	360	0	0	0
Lago Vista	Colorado	6,770	6,770	6,500	0	0	0	0
Lakeway MUD	Colorado	2,455	2,455	2,455	0	0	0	0
Loop 360 WSC	Colorado	871	871	871	0	0	0	0
Pflugerville	Colorado	12,000	12,000	12,000	12,000	12,000	0	0
River Place on Lake Austin	Colorado	900	900	0	0	0	0	0
Travis County WCID #17	Colorado	9,354	9,354	8,800	8,800	8,800	8,800	0
Travis County WCID #18	Colorado	1,400	1,400	0	0	0	0	0
Travis County WCID #20	Colorado	1,135	1,135	1,135	0	0	0	0
West Travis County Regional WS [9]	Colorado	3,411	3,411	3,411	3,411	3,411	3,411	3,411
County-Other [10]	Colorado	14,717	14,196	11,846	6,171	5,051	1,470	1,470
Manufacturing	Colorado	910	0	0	0	0	0	0
Williamson County (Region G)								
Cedar Park [8]	Brazos	18,141	18,065	17,710	17,616	17,557	0	0
Leander	Brazos	6,400	6,400	6,400	0	0	0	0
County-Other	Brazos	25,000	25,000	25,000	25,000	25,000	25,000	15,000
Wharton County								
Irrigation [11]	Colorado	105,183	100,642	97,043	93,570	90,224	86,997	74,751
TOTAL		**874,871**	**848,782**	**814,950**	**764,910**	**702,646**	**637,989**	**423,328**

[6] The Austin-Municipal value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of 152,327 ac-ft/yr LCRA contract value.

[7] The Austin-Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of 35,197 ac-ft/yr LCRA contract value.

[8] Cedar Park is located in both Region K and Region G, and it serves Williamson-Travis Counties MUD #1 (WUG).

[9] West Travis County Regional WS is composed of multiple water user groups including the Village of Bee Cave, Barton Creek West WSC, and Hill Country WSC.

[10] Travis County-Other contains Travis County MUD District #4 who serves Travis County WCID #19 (WUG).

[11] The Wharton Irrigation commitment represents 55 percent of the total Wharton County Irrigation demand.

The LCRA has typically entered into 20-year contracts with its customers for the supply of water. Many of the commitments identified in *Table 3.26* expire before 2060. In accordance with the TWDB guidance, water provided under these commitments will be shown as not being available to the WUG once the contract has expired. However, the LCRA generally considers these contracts to be commitments to supply water in perpetuity. Renewal and extension of these contracts will be discussed in Chapter 4 of this plan.

In addition to these firm commitments for water, the LCRA also provides water to users on an interruptible supply basis. Based on the LCRA Water Management Plan, the LCRA will release water from storage on an interruptible basis when the levels in the Highland Lakes are above a prescribed level at the beginning of the year. During drought conditions, this water may not be available for users. Therefore, in accordance with the TWDB guidance, interruptible water supplied by LCRA is not being considered as a "currently available water supply." The actual availability of this water will be addressed in Chapter 4 discussing management strategies to meet identified water shortages.

3.3.2 City of Austin Water Availability

The City of Austin has run-of-river water rights to divert and use water from the Colorado River. Hydrologic conditions are such that Austin's full authorized diversion amount of water is not available to Austin under these water rights. As a result, the City of Austin has entered into a contract with LCRA to firm up these water rights with water stored in the Highland Lakes. *Table 3.27* contains a summary of the water available to the City of Austin.

Table 3.27 City of Austin Water Availability (ac-ft/yr)

Water Source (Water Right ID Numbers)	Water Rights Holder	Water Supply Source	Water Availability During Drought of Record						
			2000	2010	2020	2030	2040	2050	2060
61405471005SMRR	COA [1]	ROR-Municipal	119,468	119,734	120,000	120,266	120,532	120,798	121,062
61405471005SBU	COA [1]	ROR-Municipal	46,894	47,010	47,126	47,242	47,358	47,474	47,592
61405471005LMRR	COA [2]	ROR-Municipal	9,461	9,556	9,651	9,746	9,841	9,936	10,030
61405489003M	COA [3]	ROR-Municipal	5,230	5,357	5,484	5,611	5,738	5,865	5,993
Municipal ROR Subtotal			181,053	181,657	182,261	182,865	183,469	184,073	184,677
61405471005RMBU	COA backup (LCRA) [1]	Highland Lakes	83,638	83,256	82,874	82,492	82,110	81,728	0
61405471005LMBU	COA backup (LCRA) [2]	Highland Lakes	11,942	11,847	11,752	11,657	11,562	11,467	0
61405489003MBU	COA backup (LCRA) [3]	Highland Lakes	15,070	14,943	14,816	14,689	14,562	14,435	0
Remaining Contract	LCRA Contract	Highland Lakes	33,297	33,297	33,297	33,297	33,297	33,297	0
LCRA Subtotal			143,947	143,343	142,739	142,135	141,531	140,927	0
Municipal & Manufacturing Total			**325,000**	**325,000**	**325,000**	**325,000**	**325,000**	**325,000**	**184,677**

[1] These two City of Austin ROR Rights and the LCRA backup total 250,000 ac-ft/yr (the LCRA contract expires in 2051).
[2] The City of Austin ROR Right and the LCRA backup total 21,403 ac-ft/yr (the LCRA contract expires in 2051).
[3] The City of Austin ROR Right and the LCRA backup total 20,300 ac-ft/yr (the LCRA contract expires in 2051).

Table 3.27 City of Austin Water Availability (ac-ft/yr) (Continued)

Water Source (Water Right ID Numbers)	Water Rights Holder	Water Supply Source	Water Availability During Drought of Record						
			2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
61405471001P (Town Lake)	COA [5]	ROR-SE [4]	5,283	5,296	5,309	5,322	5,335	5,348	5,361
61405471002P (FPP)	COA [5]	ROR-SE	1,426	1,312	1,198	1,084	970	856	741
61405489003P (Decker)	COA	ROR-SE	317	315	313	311	309	307	304
61405489003PBU (Decker)	COA [6]	ROR-SE	2,587	2,554	2,521	2,488	2,455	2,422	2,389
Steam Electric ROR Subtotal			9,613	9,477	9,341	9,205	9,069	8,933	8,795
Town Lake Contract	LCRA Contract [5]	Highland Lakes	17,291	17,392	17,493	17,594	17,695	17,796	0
Decker Contract	LCRA Contract [6]	Highland Lakes	13,569	13,602	13,635	13,668	13,701	13,734	0
FPP & Sandhill Contract	LCRA Contract [7]	Highland Lakes	3,500	3,500	3,500	0	0	0	0
LCRA Steam Electric Subtotal			34,360	34,494	34,628	31,262	31,396	31,530	0
Steam Electric Total			**43,973**	**43,971**	**43,969**	**40,467**	**40,465**	**40,463**	**8,795**
TOTAL (Municipal & Manufacturing + Stream Electric)			**368,973**	**368,971**	**368,969**	**365,467**	**365,465**	**365,463**	**193,472**

[4] ROR–SE stands for Run-of-River Steam Electric right.
[5] These two City of Austin ROR rights combined with the LCRA-Town Lake contract, which expires in 2051, total 24,000 ac-ft/yr, but the contract amount is only available at Town Lake.
[6] The Decker ROR Right decreases to zero due to assumed sedimentation of the reservoirs. The Decker ROR right and the LCRA contract total 16,156 ac-ft/yr (the contract expires in 2051).
[7] This LCRA contract expires in 2025.

The City of Austin provides treated water to customers within its service area. In addition, the City has contracts to provide treated water on a wholesale basis to utility districts and cities in surrounding areas. *Table 3.28* contains a summary of the City of Austin water commitments.

Table 3.28 City of Austin Water Commitment Summary (ac-ft/yr)

Water User Groups (WUGs)	County	Basin	2000	2010	2020	2030	2040	2050	2060
Hill Country WSC [1]	Hays	Colorado	992						
Austin	Travis	Colorado	126,388	150,180	183,509	214,242	241,074	268,462	293,095
County-Other [1] (COA Retail portion)	Travis	Colorado	7,403	5,343	4,186	3,252	2,100	1,119	1,209
Manufacturing [1] (COA portion)	Travis	Colorado	15,102	21,925	27,217	37,431	49,406	56,626	63,575
Creedmoor-Maha WSC [1]	Travis	Colorado	818	818					
Creedmoor-Maha WSC [1]	Travis	Guadalupe	21	21					
Hill Country WSC [1]	Travis	Colorado	688						
Lost Creek MUD	Travis	Colorado	951						
Manor [1]	Travis	Colorado	1,680	1,680	1,680				
Manville WSC [1]	Travis	Colorado	2,240	2,240	2,240				
North Austin MUD#1	Travis	Colorado	112	109	107				
Pflugerville [1]	Travis	Colorado	11,201						
Rollingwood	Travis	Colorado	1,120	1,120	1,120	1,120			
Round Rock [1]	Travis	Colorado	108						
Shady Hollow MUD	Travis	Colorado	763	747	731				
Wells Branch MUD	Travis	Colorado	1,527	1,508	1,490				
West Lake Hills	Travis	Colorado	2,420	2,420	2,420				
Windermere Utility [1]	Travis	Colorado	2,240	2,240	2,240				
Austin	Williamson	Brazos	2,315	3,993	5,964	8,286	10,786	13,479	16,338
County-Other (All COA Retail)	Williamson	Brazos	2,123	2,401	2,729	3,118	3,536	3,989	4,469
Anderson Mill MUD	Williamson	Brazos	1,504						
North Austin MUD#1	Williamson	Brazos	1,007	983	968				
Round Rock [1] (Region G)	Williamson	Brazos	6053						
Total			**188,776**	**197,728**	**236,601**	**267,449**	**306,902**	**343,675**	**378,686**

Steam-Electric [2]	Fayette [3]	Colorado	7,102	14,222	14,302	17,602	25,739	25,739	31,649
Steam-Electric [2]	Travis	Colorado	7,494	17,500	18,500	22,500	23,500	27,500	28,500
Total			**14,596**	**31,722**	**32,802**	**40,102**	**49,239**	**53,239**	**60,149**

[1] These WUGs are also served by other entities.
[2] COA's portion of the STP demand is included in the STP total steam-electric demand in Matagorda County.
[3] COA portion - based on estimated current supply levels and approved projections.

3.4 WATER SUPPLIES AVAILABLE TO WATER USER GROUPS

Estimates of the total available supply of water within the LCRWPA during a repeat of the drought of record conditions are presented in Section 3.2. However, the availability of this water to each of the water user groups is dependent upon the WUG's location and the infrastructure capacity or permits/contracts that are in place to move the water where it is needed. The following sections discuss the currently available water supplies for each of the water user groups within the LCRWPA. The water supply amounts presented in this section are a total of permitted/contracted amount and/or infrastructure capacity for each WUG in LCRWPA. The amount presented in Section 3.2 (*Table 3.24*) is the total water available for LCRWPA established through modeling effort or regulatory limit.

The amount of total water supply available to the WUGs in Region K is less than the total available water to the region presented in *Table 3.24*, since the water supply for the WUGs is limited by current supplies owned or controlled by each WUG, location relative to the source, and infrastructure limitations. There is water available in Region K that is not currently being used by WUGs because they do not have the needs right now, or they do not have the means to utilize the source at this time. The following sections present the amount of water supply that is currently available to the WUGs (current permits/contracts and infrastructure capacities).

3.4.1 Surface Water Supplies Available to Water User Groups

As previously stated, there are three primary categories of surface water to be considered. The three categories include water stored in reservoirs, run-of-river water rights, and local surface water supplies. The surface water supplies are available to the water user groups in a variety of methods. Many users of water throughout the basin have contracts with one of the two designated Wholesale Water Providers within the Region. Other users of surface water generally obtain water from small reservoirs or from other local sources such as stock ponds. Surface water information was also obtained from the TCEQ Water Utility Database (plant production capacities). If better information was not available the values determined in the 2001 LCRWPG Region K Water Plan were utilized.

Information concerning the available surface water supply for each county within the LCRWPA is presented in *Table 3.29*. Detailed information concerning water supply availability for individual WUGs is presented in *Appendix 3E* in the table *Region K Water Supply Table (by WUG and water source)*.

Table 3.29 Summary of Surface Water Supply to WUGs by County (ac-ft/yr)

County	2000 Supply	2010 Supply	2020 Supply	2030 Supply	2040 Supply	2050 Supply	2060 Supply
Bastrop	24,431	24,255	22,715	22,555	19,696	13,112	13,112
Blanco	970	1,038	1,119	1,196	1,261	1,329	1,408
Burnet	13,360	13,171	13,026	10,369	6,448	5,333	5,310
Colorado	136,897	128,557	129,510	130,630	132,037	133,717	133,717
Fayette	46,085	45,911	45,810	42,216	42,117	41,853	41,738
Gillespie	1,566	1,566	1,566	1,566	1,566	1,566	1,566
Hays	3,700	3,148	3,410	3,688	3,957	1,815	2,077
Llano	21,175	21,135	19,757	19,709	19,557	18,110	17,674
Matagorda	184,869	184,857	176,630	173,396	135,120	132,257	132,193
Mills	4,524	4,524	4,524	2,837	2,837	2,837	2,837
San Saba	9,044	9,024	9,024	9,024	9,024	9,024	9,024
Travis	409,073	419,927	412,302	392,935	388,849	368,683	184,406
Wharton	57,534	57,575	57,625	57,672	57,723	57,779	57,779
Williamson	6,949	7,377	9,661	11,404	14,322	17,468	20,807
Regional Totals	**920,177**	**922,065**	**906,679**	**879,197**	**834,514**	**804,883**	**623,648**

Note: The supplies presented in this table are supplies currently available to the WUGs (current contracts and infrastructure capacities). Surface water availability excludes City of Austin return flows.

Existing water rights, contracts, and option agreements that were existing at the time of the development of the regional plan were protected to the extent feasible. However, as documented in the plan in Section 3.2.1.2, Regions F and K used a "No Call" modeling assumption in the surface water availability modeling effort for the Colorado River. No other adjustments to the model results were performed and individual entity amounts were determined through the modified model.

3.4.2 Groundwater Supplies Available to Water User Groups

Groundwater supplies were allocated to the various WUGs within the LCRWPA using data from various sources. Information provided by the water user group was entered when available. Permit information was entered for various groundwater conservation districts, and supplies were estimated based upon the TCEQ Water Utility Database information (well production capacities). If better information was not available the values determined in the 2001 LCRWPG Region K Water Plan were utilized.

Methodology for the 2001 LCRWPG Region K Water Plan:

The primary source of information is data from the 1997 State Water Plan provided by the TWDB, which shows projected user demands and projected user allocations for the LCRWPA. Most of the groundwater users are found in the TWDB allocation tables; however, additional users are included based on information provided in the TWDB demand tables and the demand projections provided in Chapter 2 of the 2001 LCRWPG Region K Water Plan. The TWDB allocation tables provided data in the form of an allocation percent or allocation limit for each user. To estimate the projected supply of water available to each user from the applicable water sources, the percent allocation value was applied to the amount of available water. The following are exceptions to that methodology:

- When the allocation table provided an estimate representing the limit in ac-ft/year of water available to a user, that number was used for the allocation;

- When a user was not included in the allocation tables but was listed in the demand projections, the values from the projected demand tables were used to represent the supply available to that user;

- When a user was not included in the allocation tables or in the demand projections, but listed in the TWDB demand tables, the values from the demand tables were used to represent the supply available to that user;

- When the TWDB allocation for a user was given as 100 percent of the water available from the associated water source, the resulting value (1.00 x available water from *Section 3.2.2* of the 2001 LCRWPG Region K Water Plan) was reduced by the sum of the supply values listed for other users also drawing from a particular groundwater supply. Example: User "C" is allocated 100 percent of the supply from a particular aquifer. User "A" is allocated an amount "N" from this aquifer and user "B" is allocated an amount "M" also from this aquifer. The total amount available from this aquifer is "Q." Therefore, the availability for the water user is C = Q – N – M.

- When available, results for municipalities were compared with information provided in the 1990 TWDB Facility Plan Summaries. Additionally, users were contacted individually to confirm their current maximum sustainable groundwater supply capacity and the supply estimates were adjusted where appropriate.

Information concerning the available groundwater supply for each county within the LCRWPA is presented in *Table 3.30*. Detailed information concerning water supply availability for individual WUGs is presented in *Appendix 3E* in the table *Region K Water Supply Table (by WUG and water source)*.

Table 3.30 Summary of Groundwater Supply to WUGs by County (ac-ft/yr)

County	2000 Supply	2010 Supply	2020 Supply	2030 Supply	2040 Supply	2050 Supply	2060 Supply
Bastrop	23,376	22,997	22,911	22,752	22,635	22,884	22,902
Blanco	4,317	4,255	4,232	4,232	4,232	3,989	3,989
Burnet	10,859	10,831	10,800	10,716	10,694	10,626	10,626
Colorado	42,582	42,458	42,458	42,458	42,458	42,458	42,458
Fayette	10,148	9,746	9,553	9,428	9,335	9,325	9,324
Gillespie	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Hays	4,677	4,755	4,755	4,755	4,755	4,747	4,747
Llano	12,090	12,090	12,090	12,090	12,090	12,090	12,090
Matagorda	35,844	35,842	35,839	35,838	35,838	35,839	35,839
Mills	2,003	2,003	2,003	1,818	1,818	1,584	1,584
San Saba	27,753	27,753	27,753	27,753	27,753	27,753	27,753
Travis	5,668	5,681	5,719	5,727	5,697	5,520	5,513
Wharton	78,867	78,867	78,867	78,867	78,867	78,867	78,867
Williamson	323	323	323	323	323	323	323
Regional Totals	**271,007**	**270,101**	**269,803**	**269,257**	**268,995**	**268,505**	**268,515**

Note: The supplies presented in this table are supplies currently available to the WUGs (current permits and infrastructure capacities).

3.4.3 WUG Water Supply Summary

Information concerning the available water supply to WUGs in each county within the LCRWPA is presented in *Table 3.31*. There is water available in Region K that is not currently being used by WUGs because they do not have the needs right now, or they do not have the means to utilize the source at this time. *Table 3.31* shows the amount of water supply that is currently available to the WUGs (current permits/contracts and infrastructure capacities). As the contracts and permits expire the amount of supply available to the WUGs decreases, which is why the total reduces from approximately 1.2 million ac-ft in the year 2000 to approximately 900,000 ac-ft in the year 2060. *Figure 3.13* presents a comparison of the total water supply available to WUGs during the years 2000 and 2060.

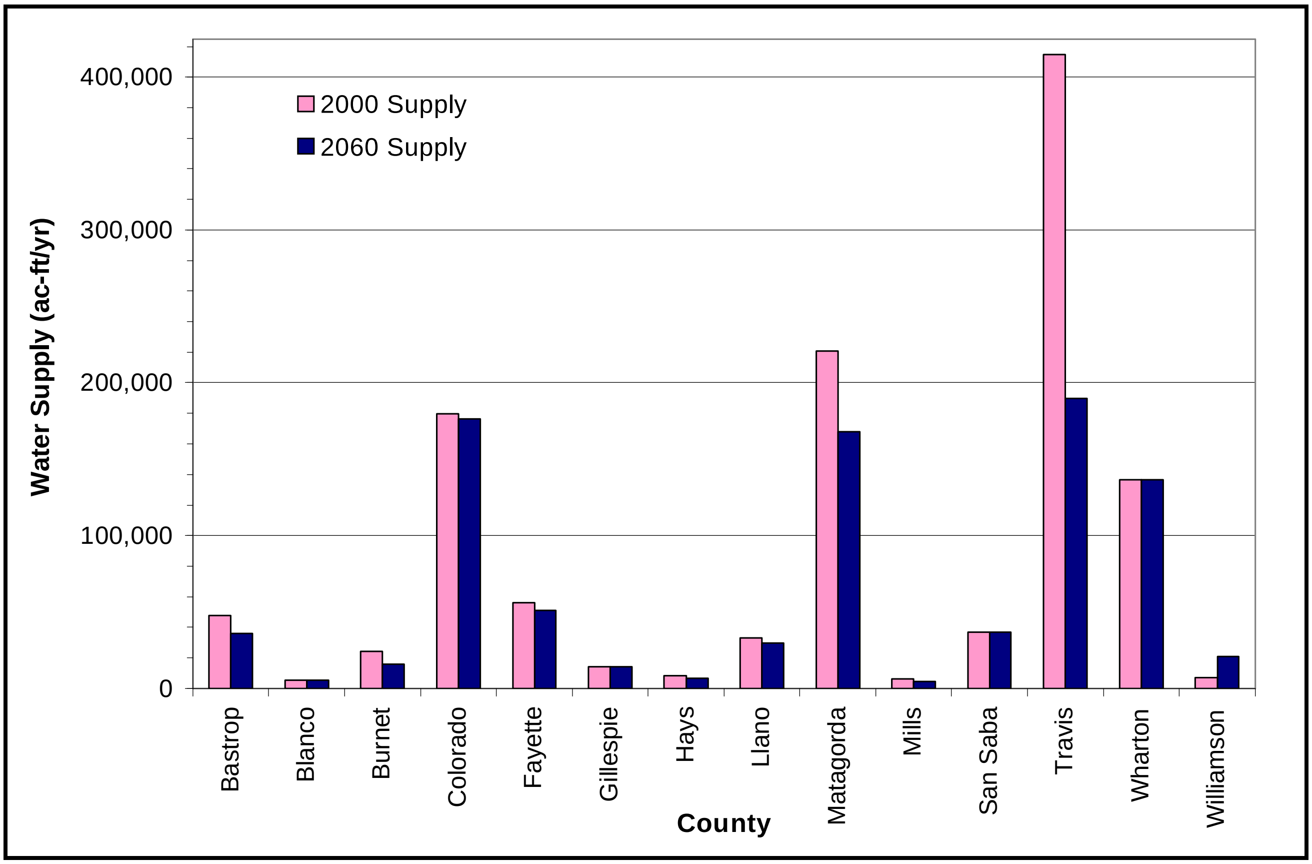
Detailed information concerning water supply available for every individual WUG in Region K is presented in *Appendix 3E* in the table *Region K Water Supply Table (by WUG and water source)*.

Table 3.31 Total Water Supply to WUGs by County (ac-ft/yr)

County	2000 Supply	2010 Supply	2020 Supply	2030 Supply	2040 Supply	2050 Supply	2060 Supply
Bastrop	47,807	47,252	45,626	45,307	42,331	35,996	36,014
Blanco	5,287	5,293	5,351	5,428	5,493	5,318	5,397
Burnet	24,219	24,002	23,826	21,085	17,142	15,959	15,936
Colorado	179,479	171,015	171,968	173,088	174,495	176,175	176,175
Fayette	56,233	55,657	55,363	51,644	51,452	51,178	51,062
Gillespie	14,066	14,066	14,066	14,066	14,066	14,066	14,066
Hays	8,377	7,903	8,165	8,443	8,712	6,562	6,824
Llano	33,265	33,225	31,847	31,799	31,647	30,200	29,764
Matagorda	220,713	220,699	212,469	209,234	170,958	168,096	168,032
Mills	6,527	6,527	6,527	4,655	4,655	4,421	4,421
San Saba	36,797	36,777	36,777	36,777	36,777	36,777	36,777
Travis	414,741	425,608	418,021	398,662	394,546	374,203	189,919
Wharton	136,401	136,442	136,492	136,539	136,590	136,646	136,646
Williamson	7,272	7,700	9,984	11,727	14,645	17,791	21,130
Regional Totals	**1,191,184**	**1,192,166**	**1,176,482**	**1,148,454**	**1,103,509**	**1,073,388**	**892,163**

Note: The supplies presented in this table are supplies currently available to the WUGs (current permits/contracts and infrastructure capacities).

Figure 3.13: Total Water Supply to WUGs by County



Note: The supplies presented in this figure are supplies currently available to the WUGs (current permits/contracts and infrastructure capacities).

APPENDIX 3A

WATER RIGHTS HELD IN THE LOWER COLORADO REGIONAL WATER PLANNING AREA

WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
3696	JOHN W WHITE	Bastrop	Colorado	Recreation		11/15/1976
3753	BLUEBONNET LANDOWNERS ASSN INC	Bastrop	Colorado	Recreation	83	3/14/1977
4428	LOWER COLORADO RIVER AUTHORITY	Bastrop	Colorado	Irrigation	10	1/17/1984
4429	LOWER COLORADO RIVER AUTHORITY	Bastrop	Colorado	Mining	5	1/17/1984
5084	SUN WEST INVESTMENTS INC	Bastrop	Colorado	Irrigation	4	8/14/1986
5084	SUN WEST INVESTMENTS INC	Bastrop	Colorado	Recreation		8/14/1986
5250	LOWER COLORADO RIVER AUTHORITY	Bastrop	Colorado	Irrigation	23	7/25/1989
5250	LOWER COLORADO RIVER AUTHORITY	Bastrop	Colorado	Industrial	3	7/25/1989
5398	JOHN COLEMAN HORTON III ET AL	Bastrop	Colorado	Irrigation	120	3/31/1954
5399	BELLE PENDLETON	Bastrop	Colorado	Irrigation	26	6/30/1955
5400	JERRY B. DONALDSON	Bastrop	Colorado	Irrigation	8	4/30/1955
5402	LLOYD KETHA	Bastrop	Colorado	Irrigation	348	12/31/1905
5403	MERLE A PROKOP JR	Bastrop	Colorado	Irrigation	5	7/31/1966
5404	TEXAS PARKS & WILDLIFE DEPT	Bastrop	Colorado	Recreation		5/19/1969
5405	EDWARD L HUGHES	Bastrop	Colorado	Irrigation	8	12/31/1960
5406	J B LOVEJOY	Bastrop	Colorado	Irrigation	2	12/31/1962
5407	A J ROD	Bastrop	Colorado	Irrigation	80	12/9/1974
5408	TEXAS PARKS & WILDLIFE DEPT	Bastrop	Colorado	Recreation		8/25/1969
5411	MILTON C PETZOLD	Bastrop	Colorado	Irrigation	15	2/23/1970
5412	HORSESHOE LAKES PROP OWNERS	Bastrop	Colorado	Recreation		4/8/1975
5413	CARL DROEMER	Bastrop	Colorado	Irrigation	61	9/16/1974
5414	LAKE THUNDERBIRD OWNERS ASSN	Bastrop	Colorado	Recreation		10/15/1973
5415	INDIAN LAKE OWNERS ASSN	Bastrop	Colorado	Recreation		10/1/1973
5473	LOWER COLORADO RIVER AUTHORITY	Bastrop	Colorado	Industrial	10,750	3/4/1963
5473	LOWER COLORADO RIVER AUTHORITY	Bastrop	Colorado	Recreation		3/4/1963
3849	DAN L DUNCAN	Bastrop	Guadalupe	Recreation		8/30/1976
1468	MARY O'BOYLE II ENGLISH	Blanco	Colorado	Irrigation	500	4/1/1963
1470	WERNER SCHUMANN	Blanco	Colorado	Irrigation	50	1/1/1967
1470	TEXAS PARKS & WILDLIFE DEPT	Blanco	Colorado	Irrigation		1/1/1967
1472	AL LOUIS LINDIG ET UX	Blanco	Colorado	Irrigation	7	1/1/1933
1473	JOHN W O'BOYLE JR	Blanco	Colorado	Irrigation	276	1/1/1964
1477	KELLER EQUIPMENT CO	Blanco	Colorado	Irrigation	4	12/31/1964
1478	JAMES J MOONEY	Blanco	Colorado	Irrigation	9	8/16/1965
1479	CITY OF JOHNSON CITY	Blanco	Colorado	Municipal	220	11/29/1966
1479	CITY OF JOHNSON CITY	Blanco	Colorado	Recreation		11/29/1966
1480	W T YETT	Blanco	Colorado	Recreation	30	4/1/1967
1481	TEXAS PARKS & WILDLIFE DEPT	Blanco	Colorado	Municipal	30	4/24/1972
1482	NANCY WARREN FRASHER	Blanco	Colorado	Irrigation	34	9/7/1962
4366	LUXURY TRAILS INCORPORATED	Blanco	Colorado	Recreation		5/23/1983
3871	W J HAAS	Blanco	Guadalupe	Irrigation	6	9/30/1957
3871	W J HAAS	Blanco	Guadalupe	Irrigation	6	9/30/1967
3872	BEN R HAMMOND JR	Blanco	Guadalupe	Irrigation	5	11/25/1974
3872	HALL STREET HAMMOND	Blanco	Guadalupe	Irrigation	20	11/25/1974
3872	HALL STREET HAMMOND	Blanco	Guadalupe	Irrigation		11/25/1974
3872	STETLER FAMILY LIVING TRUST	Blanco	Guadalupe	Irrigation	7	11/25/1974
3872	STETLER FAMILY LIVING TRUST	Blanco	Guadalupe	Irrigation		11/25/1974
3873	HENRY & ELSIE LEE MCCLAIN	Blanco	Guadalupe	Irrigation	48	6/30/1957
3874	JIMMY C PARKER ET AL	Blanco	Guadalupe	Irrigation	24	11/30/1963
3874	JIMMY C PARKER ET AL	Blanco	Guadalupe	Irrigation		11/30/1963
3875	B J & ALICE F BARNHART	Blanco	Guadalupe	Irrigation	45	5/31/1963
3876	WILLIAM W ATWELL	Blanco	Guadalupe	Recreation		5/28/1974
3876	WAYNE A ZERCHER	Blanco	Guadalupe	Recreation		5/28/1974
3876	NORVAL K HAILE ET UX	Blanco	Guadalupe	Recreation		5/28/1974
3877	CITY OF BLANCO	Blanco	Guadalupe	Municipal	600	8/29/1955
3878	TEXAS PARKS & WILDLIFE DEPT	Blanco	Guadalupe	Recreation		5/26/1969
3879	ARTHUR S VERA ET AL	Blanco	Guadalupe	Recreation		6/14/1976
3960	GARY & BRUCE GRANBERG	Blanco	Guadalupe	Irrigation	7	2/5/1979
4247	WAYMOND LIGHTFOOT, TRUSTEE	Blanco	Guadalupe	Recreation		9/20/1982
4302	A DEAN MABRY ET AL	Blanco	Guadalupe	Recreation		1/10/1983
5556	CHARLES JAMES TESAR	Blanco	Guadalupe	Irrigation	20	7/31/1996
3421	PHILLIPS PETROLEUM CO	Brazoria	Brazos-Colorado	Industrial	16,400	9/13/1928
3421	PHILLIPS PETROLEUM CO	Brazoria	Brazos-Colorado	Irrigation		9/13/1928
3421	PHILLIPS PETROLEUM CO	Brazoria	Brazos-Colorado	Irrigation		9/13/1928
3421	PHILLIPS PETROLEUM CO	Brazoria	Brazos-Colorado	Industrial		9/13/1928
1748	ZEPHYR LAND COMPANY	Brown	Colorado	Irrigation		1/1/1904
2989	CAROLYN SUE CAROTHERS	Burnet	Brazos	Irrigation	9	12/31/1923

Note: Water Rights 5478 and 5482 are storage and diversion rights.

WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
2989	GARY L REID ET AL	Burnet	Brazos	Irrigation	19	12/31/1923
2990	HERBERT A & BARBARA MAAS	Burnet	Brazos	Irrigation	63	4/30/1966
2991	SAWTOOTH ENTERPRISES LTD	Burnet	Brazos	Irrigation	145	12/31/1965
2991	SAWTOOTH ENTERPRISES LTD	Burnet	Brazos	Irrigation		4/29/2002
2992	FLORENCE ELIZABETH SMITH BROWN ET AL	Burnet	Brazos	Irrigation	68	3/14/1954
2993	HANSFORD B SMITH ET AL	Burnet	Brazos	Irrigation	44	12/31/1925
2994	THOMAS M & BETTY L R SPENCER	Burnet	Brazos	Irrigation	6	12/31/1925
2995	MORSE RANCH, A PARTNERSHIP	Burnet	Brazos	Irrigation	120	3/7/1966
2996	JOHN TAYLOR ET UX	Burnet	Brazos	Irrigation	56	4/1/1966
3735	HENRY GRADY RYLANDER	Burnet	Brazos	Irrigation	26	6/30/1963
5593	JERRY W GLAZE ET UX	Burnet	Brazos	Irrigation	270	7/1/1997
5593	JERRY W GLAZE ET UX	Burnet	Brazos	Irrigation	130	7/1/1997
132	SOUTHWESTERN GRAPHITE CO	Burnet	Colorado	Mining	400	6/14/1942
1120	UNITED STATES DEPT OF INTERIOR	Burnet	Colorado	Industrial	100	
1368	CITY OF GRANITE SHOALS	Burnet	Colorado	Municipal	830	7/1/1983
1409	TRAVIS CO MUD 1	Burnet	Colorado	Municipal	6,500	5/1/1983
1836	MARBLE FALLS, CITY OF	Burnet	Colorado	Municipal	2,000	4/2/1992
1930	HIGHLAND LAKES ATHLETIC CORP	Burnet	Colorado	Irrigation	6	3/18/1994
2085	CAMP LONGHORN	Burnet	Colorado	Municipal	40	6/16/1997
2085	CAMP LONGHORN	Burnet	Colorado	Irrigation		6/16/1997
2144	TEXAS BRINE CO LLC	Burnet	Colorado	Industrial	8,200	11/6/1997
2280	PECAN GROVE PLANTATION	Burnet	Colorado	Irrigation	75	
2386	BLUE LAKE GOLF CLUB INC	Burnet	Colorado	Irrigation	23	
2387	KINGSLAND WATER SUPPLY CORP	Burnet	Colorado	Municipal	710	
2607	GOODRICH RANCH	Burnet	Colorado	Irrigation	165	3/31/1955
2608	GOODRICH RANCH	Burnet	Colorado	Municipal		9/7/1950
2609	JAMES BARBER JOHANSON	Burnet	Colorado	Irrigation	33	12/31/1948
2614	FAMILY TRUST NO 1	Burnet	Colorado	Irrigation	46	12/31/1953
2615	C A BARNETT ESTATE	Burnet	Colorado	Irrigation	150	12/31/1959
2629	FRITZ & BERNICE BRUNS	Burnet	Colorado	Irrigation	8	12/31/1956
2630	AGNES ANDERSON HEFNER ET AL	Burnet	Colorado	Irrigation	438	7/4/1956
2631	TEXAS GRANITE CORPORATION	Burnet	Colorado	Industrial	33	5/23/1950
2631	TEXAS GRANITE CORPORATION	Burnet	Colorado	Irrigation	55	7/15/1965
2632	MEADOWLAKES CO AND MUD	Burnet	Colorado	Irrigation	78	4/4/1895
2632	MEADOWLAKES CO AND MUD	Burnet	Colorado	Irrigation	89	3/27/1905
2632	MEADOWLAKES CO AND MUD	Burnet	Colorado	Municipal	400	3/27/1905
2633	BILLY C SMITH	Burnet	Colorado	Irrigation	18	12/31/1934
2634	MOUSTAPHA ABOU-SAMRA ET UX	Burnet	Colorado	Irrigation	144	12/31/1953
2635	MARGERY RUTH FELPS TRUST	Burnet	Colorado	Irrigation	11	12/31/1953
2636	BILLIE J PRATT	Burnet	Colorado	Irrigation	2	3/31/1966
2637	BILLIE J PRATT	Burnet	Colorado	Irrigation	6	3/31/1966
2638	BILLIE J PRATT	Burnet	Colorado	Irrigation	6	3/31/1966
2639	P H SMITH ET UX	Burnet	Colorado	Irrigation	10	3/31/1966
2640	R G FUSSELL ET UX	Burnet	Colorado	Irrigation	10	3/31/1966
2641	G.S. ALLEN	Burnet	Colorado	Irrigation	253	2/28/1958
2642	D M DOYLE	Burnet	Colorado	Irrigation	89	12/31/1961
2643	COSTILLO C LEWIS	Burnet	Colorado	Irrigation	80	4/30/1967
3701	MEADOWLAKES CO	Burnet	Colorado	Irrigation	403	11/22/1976
3701	MEADOWLAKES CO	Burnet	Colorado	Municipal		11/22/1976
3701	MEADOWLAKES CO	Burnet	Colorado	Recreation		11/22/1976
5116	BUCKNER BAPTIST BENEVOLENCES	Burnet	Colorado	Recreation		12/30/1986
5193	SOUTHWESTERN GRAPHITE CO	Burnet	Colorado	Other		9/6/1988
5327	CITY OF BURNET	Burnet	Colorado	Recreation		10/26/1990
5452	BASKIN FAMILY CAMPS, INC	Burnet	Colorado	Recreation		2/23/1993
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Municipal	1,500,000	3/29/1926
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Industrial		3/29/1926
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Irrigation		3/29/1926
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Mining		3/29/1926
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Hydroelectric		3/29/1926
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Recreation		3/29/1926
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Recharge		3/29/1926
5478	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Municipal		3/29/1926
5479	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Hydroelectric		3/29/1926
5480	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Industrial	15,700	3/29/1926
5480	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Hydroelectric		3/29/1926
5481	LOWER COLORADO RIVER AUTHORITY	Burnet	Colorado	Hydroelectric		3/29/1926

Note: Water Rights 5478 and 5482 are storage and diversion rights.

WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
3415	JOHN & ORA MAE BATLA	Colorado	Brazos-Colorado	Irrigation	11	5/31/1964
3415	ORA LEE BATLA PLENGEMEYER	Colorado	Brazos-Colorado	Irrigation	14	5/31/1964
3416	JOHN W ADKINS	Colorado	Brazos-Colorado	Irrigation	150	7/14/1980
3417	ALICE M ADKINS ET AL	Colorado	Brazos-Colorado	Irrigation	150	7/14/1980
5156	UNITED STATES DEPT OF INTERIOR	Colorado	Brazos-Colorado	Irrigation		9/15/1987
5523	CLARK & VICKI POWERS	Colorado	Brazos-Colorado	Irrigation	300	3/1/1995
5429	C G JOHNSON	Colorado	Colorado	Irrigation	73	7/31/1949
5432	CHARLES T TREFNY	Colorado	Colorado	Irrigation	21	8/31/1951
5434	LOWER COLORADO RIVER AUTHORITY	Colorado	Colorado	Irrigation	133,000	11/1/1900
5434	LOWER COLORADO RIVER AUTHORITY	Colorado	Colorado	Municipal		11/1/1900
5434	LOWER COLORADO RIVER AUTHORITY	Colorado	Colorado	Industrial		11/1/1900
5434	CITY OF CORPUS CHRISTI	Colorado	Colorado	Municipal	35,000	11/2/1900
5434	CITY OF CORPUS CHRISTI	Colorado	Colorado	Industrial		11/2/1900
5434	CITY OF CORPUS CHRISTI	Colorado	Colorado	Irrigation		11/2/1900
5475	LOWER COLORADO RIVER AUTHORITY	Colorado	Colorado	Irrigation	131,250	1/4/1901
5475	LOWER COLORADO RIVER AUTHORITY	Colorado	Colorado	Irrigation	55,000	9/1/1907
5728	CITY OF WEIMAR	Colorado	Colorado	Irrigation		1/25/2001
2079	LAKE SHERIDAN ESTATES INC	Colorado	Lavaca	Recreation	455	10/7/1963
2080	ENGSTROM BROTHERS PARTNERSHIP	Colorado	Lavaca	Irrigation	248	12/31/1938
2081	TRUMAN ENGSTROM JR ET AL	Colorado	Lavaca	Irrigation	683	4/30/1955
2085	WILLIAM MARK WIED	Colorado	Lavaca	Irrigation	13	12/31/1962
2086	A J RICHTER ET AL	Colorado	Lavaca	Irrigation	282	4/30/1955
2087	LEO M KORENEK	Colorado	Lavaca	Irrigation	84	4/30/1946
2088	LEO M KORENEK	Colorado	Lavaca	Irrigation	45	4/30/1924
2089	LOUIS P HOFFMAN	Colorado	Lavaca	Irrigation	48	5/31/1966
4160	NOBERT WEID AND PAT WISHERT	Colorado	Lavaca	Irrigation	60	11/16/1981
4162	HERBERT J & JOSEPHINE POPP	Colorado	Lavaca	Irrigation	140	11/16/1981
4164	ELIZABETH B MILLER	Colorado	Lavaca	Irrigation	279	11/16/1981
1744	CITY OF SAN MARCOS	Comal	Guadalupe	Municipal	5,000	10/10/1989
1890	SOUTHWEST TX STATE UNIVERSITY	Comal	Guadalupe	Municipal	500	9/27/1993
3614	JEAN A PHARR	Fayette	Colorado	Recreation		6/14/1976
3775	JOHN WETH	Fayette	Colorado	Irrigation	35	6/20/1977
5410	FIVE H & ONE LTD	Fayette	Colorado	Recreation		2/17/1975
5416	CLEAR LAKE PINES MAINTENANCE	Fayette	Colorado	Recreation		9/16/1974
5417	G W OEDING	Fayette	Colorado	Recreation		9/17/1973
5418	EDMUND KAPPLER ET AL	Fayette	Colorado	Irrigation	128	2/10/1975
5420	WILLIAM GOLDAPP	Fayette	Colorado	Irrigation	32	6/10/1968
5421	WILLIE G LEHMANN	Fayette	Colorado	Irrigation	30	5/22/1972
5422	ROBERT LEHMANN	Fayette	Colorado	Irrigation	3	6/30/1967
5423	CLEAR LAKES PINES INC	Fayette	Colorado	Recreation		7/5/1976
5424	ERNEST G BARTEK ET UX	Fayette	Colorado	Irrigation	47	7/31/1967
5425	CHARLES T TREFNY	Fayette	Colorado	Irrigation	76	7/31/1956
5426	BETTY RUTH JACKSON ET AL	Fayette	Colorado	Irrigation	10	7/31/1956
5427	C A HENSEL	Fayette	Colorado	Irrigation	14	7/31/1956
5428	RALPH T JOHNSON ET UX	Fayette	Colorado	Irrigation	15	7/31/1956
5433	KELLY K REYNOLDS TRUSTEE	Fayette	Colorado	Irrigation	35	11/4/1974
5471	CITY OF AUSTIN	Fayette	Colorado	Industrial		6/27/1914
5474	LOWER COLORADO RIVER AUTHORITY	Fayette	Colorado	Industrial	2,450	2/3/1975
5474	LOWER COLORADO RIVER AUTHORITY	Fayette	Colorado	Industrial		2/3/1975
2075	O C TOWNSEND ET UX	Fayette	Lavaca	Irrigation	2	12/31/1954
2075	H D WRIGHT ET UX	Fayette	Lavaca	Irrigation	2	12/31/1954
1405	R J SECHRIST	Gillespie	Colorado	Irrigation	42	1/1/1959
1405	R J SECHRIST	Gillespie	Colorado	Irrigation	14	8/31/1964
1405	R J SECHRIST	Gillespie	Colorado	Irrigation	16	1/1/1965
1406	R J SECHRIST ET UX	Gillespie	Colorado	Irrigation	8	9/30/1957
1407	PENNY L GRONA CRENWELGE ET AL	Gillespie	Colorado	Irrigation	16	12/31/1940
1407	FALCON SEABOARD DIVERSIFIED INC	Gillespie	Colorado	Irrigation	33	12/31/1940
1407	CLETIS GRONA ET AL	Gillespie	Colorado	Irrigation	11	12/31/1940
1408	HERBERT REEH	Gillespie	Colorado	Irrigation	8	12/31/1955
1409	KEYSER BIERSCHWALE	Gillespie	Colorado	Irrigation	13	12/31/1958
1410	JAY D RUTLEDGE III ET AL	Gillespie	Colorado	Irrigation	25	12/31/1970
1411	PAUL D & BETTY MEEK	Gillespie	Colorado	Irrigation	50	12/31/1951
1412	C H BONN & SONS	Gillespie	Colorado	Irrigation	118	3/31/1955
1413	EDWIN & WERNER HENKE	Gillespie	Colorado	Irrigation	21	9/30/1954
1414	ERNEST W KOTT	Gillespie	Colorado	Irrigation	12	12/31/1955
1415	STEVE & HILMAR JUENKE	Gillespie	Colorado	Irrigation	13	7/1/1974

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
1416	MELVIN BONN ET UX	Gillespie	Colorado	Irrigation	22	4/30/1955
1417	ROY RICHARD HENKE	Gillespie	Colorado	Irrigation	113	5/1/1938
1417	ALLEN ROY HENKE ET AL	Gillespie	Colorado	Irrigation	7	5/1/1938
1417	E J COP	Gillespie	Colorado	Irrigation	120	5/1/1938
1418	NATHAN KOTT ET AL	Gillespie	Colorado	Irrigation	44	12/31/1955
1419	GEORGE HEIMANN	Gillespie	Colorado	Irrigation	3	4/1/1960
1420	LILLIAN WISSEMANN ET VIR	Gillespie	Colorado	Irrigation	10	1/10/1967
1420	YUCCA LILY LTD	Gillespie	Colorado	Irrigation	10	1/10/1967
1421	DONALD M PARRISH ET UX	Gillespie	Colorado	Irrigation	98	12/31/1935
1422	WEIRICH BROTHERS INC	Gillespie	Colorado	Mining	50	1/1/1959
1423	GREGORY KEITH HAGEL	Gillespie	Colorado	Irrigation	80	4/15/1967
1424	THOMAS G LOEFFLER ET UX	Gillespie	Colorado	Irrigation	33	6/30/1964
1425	RAY E & ANNETTE GILBERT	Gillespie	Colorado	Irrigation	2	12/31/1963
1426	F W BURGESS	Gillespie	Colorado	Irrigation	17	4/30/1963
1427	CITY OF FREDERICKSBURG	Gillespie	Colorado	Recreation		4/1/1968
1428	VAN C BROWN	Gillespie	Colorado	Irrigation	21	12/31/1952
1429	CONRAD ERNST	Gillespie	Colorado	Irrigation	6	12/31/1951
1430	MILTON C BOOS	Gillespie	Colorado	Irrigation	25	12/31/1950
1431	LILLIAN M WISSEMAN	Gillespie	Colorado	Irrigation	11	4/15/1967
1432	DAYTON SOLBRIG ET AL	Gillespie	Colorado	Irrigation	25	12/31/1947
1432	MARVIN G PIPKIN ET UX	Gillespie	Colorado	Irrigation	12	12/31/1947
1433	THEDORE J STEHLING	Gillespie	Colorado	Irrigation	30	1/11/1949
1434	DR J HARDIN PERRY	Gillespie	Colorado	Irrigation	6	12/31/1963
1435	CLEMENS IMMEL ESTATE	Gillespie	Colorado	Irrigation	4	12/31/1957
1436	GAY NELL MILLARD ET AL	Gillespie	Colorado	Irrigation	12	5/31/1965
1437	DOR W BROWN JR ET AL	Gillespie	Colorado	Irrigation	30	4/30/1964
1438	HENRY J FRANTZEN	Gillespie	Colorado	Irrigation	4	1/1/1952
1438	LESTER C FRANTZEN	Gillespie	Colorado	Irrigation	33	1/1/1952
1438	ALBERT G DWARSHUS JR	Gillespie	Colorado	Irrigation	3	1/1/1952
1439	HILMER WEINHEIMER	Gillespie	Colorado	Irrigation	221	5/31/1948
1440	ISSAM TX LAND CATTLE CO N V	Gillespie	Colorado	Irrigation	121	12/31/1943
1441	BOOT RANCH DEVELOPMENT LP	Gillespie	Colorado	Irrigation	34	1/1/1943
1442	LISTON MANER	Gillespie	Colorado	Irrigation	12	1/1/1940
1443	EUGENE PATTESON	Gillespie	Colorado	Irrigation	13	1/1/1966
1443	JANICE C PATTESON	Gillespie	Colorado	Irrigation	0	1/1/1966
1443	STEPHEN G REEH ET UX	Gillespie	Colorado	Irrigation	2	1/1/1966
1444	K & S SUPPLY CORPORATION	Gillespie	Colorado	Irrigation	100	1/1/1915
1445	WAYNE E MOHR	Gillespie	Colorado	Mining	30	1/1/1951
1446	MARTIN & ELVIRA BEYER	Gillespie	Colorado	Irrigation	45	12/31/1964
1447	KELLER EQUIPMENT CO	Gillespie	Colorado	Irrigation	31	8/1/1964
1448	VICTOR KLINKSIEK	Gillespie	Colorado	Irrigation	22	1/1/1923
1449	DANIEL HOHENBERGER	Gillespie	Colorado	Irrigation	26	1/1/1966
1450	CLAYTON KLINKSIEK ET AL	Gillespie	Colorado	Irrigation	35	1/1/1943
1452	SHEILA E GRAMS	Gillespie	Colorado	Irrigation	19	1/1/1952
1452	JEANINE M BELL	Gillespie	Colorado	Irrigation	19	1/1/1952
1453	WILLIE A WEHMEYER JR	Gillespie	Colorado	Irrigation	41	1/1/1964
1454	WILLIE A WEHMEYER JR	Gillespie	Colorado	Irrigation	68	1/1/1962
1456	ELGIN O BEHRENDS	Gillespie	Colorado	Irrigation	11	1/1/1967
1457	BERNARD STAUDT ESTATE	Gillespie	Colorado	Irrigation	14	1/1/1965
1458	HILMER O NEBGEN	Gillespie	Colorado	Irrigation	2	8/1/1966
1459	RUBEN RUEBSAHM	Gillespie	Colorado	Irrigation	25	1/1/1953
1460	CHARLES W KLEIN	Gillespie	Colorado	Irrigation	10	1/1/1948
1461	THE LBJ COMPANY	Gillespie	Colorado	Irrigation	3	1/1/1966
1461	JOE KIRK FULTON	Gillespie	Colorado	Irrigation	500	1/1/1966
1461	J MIKE HOWARD ET UX	Gillespie	Colorado	Irrigation	14	1/1/1966
1461	BYRON C HULETT ET UX	Gillespie	Colorado	Irrigation	13	1/1/1966
1462	TEXAS PARKS & WILDLIFE DEPT	Gillespie	Colorado	Recreation		5/8/1972
1463	ERNEST HODGES ESTATE ET AL	Gillespie	Colorado	Irrigation	39	1/1/1950
1464	THE LBJ COMPANY	Gillespie	Colorado	Irrigation	86	1/8/1952
1465	UNITED STATES DEPT OF INTERIOR	Gillespie	Colorado	Irrigation	114	1/8/1952
1466	THE LBJ COMPANY	Gillespie	Colorado	Irrigation	1,244	1/1/1952
1466	UNITED STATES DEPT OF INTERIOR	Gillespie	Colorado	Irrigation		1/1/1952
1466	JOE KIRK FULTON	Gillespie	Colorado	Irrigation	16	1/1/1952
1467	AUSTIN INVESTMENTS CO	Gillespie	Colorado	Irrigation	220	1/1/1953
1467	UNITED STATES DEPT OF INTERIOR	Gillespie	Colorado	Irrigation		1/1/1953
1469	TEXAS PARKS & WILDLIFE DEPT	Gillespie	Colorado	Irrigation	160	3/1/1964

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
1471	ESTATE OF J O TANNER	Gillespie	Colorado	Irrigation	22	1/1/1944
1471	GEORGE RICHARD TANNER	Gillespie	Colorado	Irrigation	1	1/1/1944
1471	KENNETH LINDIG	Gillespie	Colorado	Irrigation	33	1/1/1944
1474	KERMIT ECKHARDT	Gillespie	Colorado	Irrigation	26	1/1/1900
1475	CHARLES OTTMERS	Gillespie	Colorado	Irrigation	3	1/1/1942
1476	JOHNNIE W OTTMERS	Gillespie	Colorado	Irrigation	3	1/1/1966
1632	JAMES VANCE BAETHGE	Gillespie	Colorado	Irrigation	23	3/1/1954
1632	LENNAH JO HOOPER	Gillespie	Colorado	Irrigation		3/1/1954
2619	BILL TEAGUE	Gillespie	Colorado	Irrigation	114	9/30/1962
2620	LEVY ERSCH	Gillespie	Colorado	Irrigation	1	4/30/1966
2621	DANIEL J PETERSEN	Gillespie	Colorado	Irrigation	15	12/31/1935
2622	LEROY RABKE	Gillespie	Colorado	Industrial	1	9/30/1944
3690	DANIEL J PETERSEN	Gillespie	Colorado	Irrigation	55	11/8/1976
3697	J D HEXT ESTATE	Gillespie	Colorado	Irrigation	19	11/22/1976
5427	CITY OF FREDERICKSBURG	Gillespie	Colorado	Recreation		7/15/1992
5569	WEIRICH BROTHERS INC	Gillespie	Colorado	Mining	180	7/17/1997
4457	STEVEN R SPRINKEL ET UX	Hays	Colorado	Irrigation	25	6/5/1984
5086	STEPHEN P CARRIGAN	Hays	Colorado	Irrigation	88	8/15/1986
5273	COYOTE CREW RANCH LTD	Hays	Colorado	Irrigation	60	12/18/1989
5360	RIVER OAKS RANCH DEV CORP	Hays	Colorado	Recreation		5/15/1991
5387	JAMES H ARNOLD JR ET AL	Hays	Colorado	Irrigation	182	1/13/1965
5387	JAMES L ARNOLD JR	Hays	Colorado	Irrigation	60	1/13/1965
5387	WILLIAM H CUNNINGHAM ET UX	Hays	Colorado	Irrigation	61	1/13/1965
5388	TRAVIS ALLISON MATHIS	Hays	Colorado	Irrigation	16	7/31/1965
5389	ANNA MARIE WIDEN SPEIR ET AL	Hays	Colorado	Irrigation	5	12/31/1939
5389	HANCOCK/HANKS INVESTMENTS LTD	Hays	Colorado	Irrigation	0	12/31/1939
5390	SLAUGHTER FAMILY RANCH ET AL	Hays	Colorado	Irrigation	6	12/31/1954
5391	KATHRYN LAURA NAGEL ELLIOTT	Hays	Colorado	Irrigation	12	5/31/1955
5696	LA VENTANA RANCH OWNERS ASSOCIATION INC	Hays	Colorado	Recreation		8/15/2000
5696	LA VENTANA RANCH OWNERS ASSOCIATION INC	Hays	Colorado	Recreation		8/15/2000
5696	LA VENTANA RANCH OWNERS ASSOCIATION INC	Hays	Colorado	Recreation		8/15/2000
5768	FSP DEVELOPMENT OF TEXAS LLC	Hays	Colorado	Recreation		3/25/2002
1642	RANDOLPH C LEIFESTE	Llano	Colorado	Industrial	5	1/1/1956
1642	RANDOLPH C LEIFESTE	Llano	Colorado	Irrigation		1/1/1956
1643	CHARLES T PERKINS, JR, ET UX	Llano	Colorado	Industrial	1	1/1/1959
1644	NORMAN H GRENWELGE	Llano	Colorado	Industrial	30	1/1/1947
1644	NORMAN H GRENWELGE	Llano	Colorado	Irrigation		1/1/1947
1645	CLYDE C BUSH ET AL	Llano	Colorado	Recreation	68	1/1/1960
1646	MRS LUKE MOSS	Llano	Colorado	Recreation	40	1/1/1954
1647	MRS RACHEL E JONES TALKINGTON	Llano	Colorado	Irrigation	15	1/1/1900
1648	FLOYD KOTHMANN	Llano	Colorado	Irrigation	2	1/1/1930
1649	ODIS K JONES	Llano	Colorado	Irrigation	6	1/1/1964
1650	CITY OF LLANO	Llano	Colorado	Municipal	400	12/10/1956
1650	CITY OF LLANO	Llano	Colorado	Irrigation	100	6/1/1976
1651	LILA FAYE JOHNSON	Llano	Colorado	Irrigation	24	9/1/1964
1652	KENNETH D RHODES ET UX	Llano	Colorado	Irrigation	11	3/1/1966
1653	MRS LUKE MOSS	Llano	Colorado	Recreation	276	12/31/1945
1654	MAUD MOSS	Llano	Colorado	Recreation	251	1/1/1939
1655	CITY OF LLANO	Llano	Colorado	Municipal	1,200	6/13/1914
1655	CITY OF LLANO	Llano	Colorado	Irrigation	180	6/13/1914
1656	GUY L CLYMER	Llano	Colorado	Recreation	3	11/29/1946
1657	LEONARD TURBIVILLE	Llano	Colorado	Irrigation	1	1/1/1964
1658	SHERMAN L LONG	Llano	Colorado	Irrigation	60	1/1/1904
1659	ROY B SILER	Llano	Colorado	Irrigation	24	9/18/1918
1950	HORSESHOE BAY P O ASSOCIATION	Llano	Colorado	Irrigation	27	4/29/1994
1954	LAKE LBJ INVESTMENT CORP	Llano	Colorado	Irrigation	900	6/3/1994
1956	HORSESHOE BAY APPLEHEAD POA	Llano	Colorado	Irrigation	27	6/7/1994
2400	BILL SMYRL	Llano	Colorado	Irrigation	5	
2407	TRAVIS COUNTY MUD NO 4	Llano	Colorado	Irrigation	804	
2610	THOMAS D BARROW	Llano	Colorado	Irrigation	99	8/31/1957
2611	DRACE WILLIAMS ET AL	Llano	Colorado	Irrigation	52	12/31/1910
2612	T M CASH	Llano	Colorado	Irrigation	12	5/31/1955
2613	SOUTHERN PACIFIC LINES	Llano	Colorado	Other	1	1/19/1915
2616	ANN ETTA HALL	Llano	Colorado	Recreation		12/31/1935
2617	J A RATLIFF ET AL	Llano	Colorado	Recreation		12/31/1950
2618	JAMES M INKS & M I DALRYMPLE	Llano	Colorado	Recreation		12/31/1939

Note: Water Rights 5478 and 5482 are storage and diversion rights.

WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
2623	SAMUEL OEHLER	Llano	Colorado	Irrigation	3	12/31/1964
2623	CAROLINE OEHLER JOHNSON	Llano	Colorado	Irrigation	3	12/31/1964
2623	MARY OEHLER GOFF	Llano	Colorado	Irrigation	1	12/31/1964
2624	HAROLD DONOVAN HOHMANN ET UX	Llano	Colorado	Irrigation	7	3/31/1966
2625	HAROLD DONOVAN HOHMANN ET AL	Llano	Colorado	Irrigation	6	3/31/1966
2626	OTTO DOYLE HOHMANN ET UX	Llano	Colorado	Irrigation	10	3/31/1966
2627	E J MOSS	Llano	Colorado	Irrigation	1	12/31/1966
2628	ETHEL MAE MOSS ESTATE	Llano	Colorado	Industrial	4	12/31/1955
4189	LAKE LBJ IMPROVEMENT CORP	Llano	Colorado	Irrigation	750	2/17/1982
4346	LAKE LBJ INVESTMENT CORP	Llano	Colorado	Recreation		4/25/1983
4464	LAKE LBJ INVESTMENT CORP	Llano	Colorado	Recreation		7/10/1984
5033	DEBORAH SLATOR GILLAN ET AL	Llano	Colorado	Municipal		12/12/1985
3426	JOHN S RUNNELLS III	Matagorda	Brazos-Colorado	Irrigation	17	3/1/1971
3426	TIMOTHY R BLAYLOCK ET UX	Matagorda	Brazos-Colorado	Irrigation	26	3/1/1971
3427	BEN H TOWLER JR	Matagorda	Brazos-Colorado	Irrigation	6	11/7/1977
3427	JOSEPH F BECK	Matagorda	Brazos-Colorado	Irrigation	24	11/7/1977
3428	ESTATE OF P J REEVES JR	Matagorda	Brazos-Colorado	Irrigation	20	11/6/1978
3429	D R ALFORD	Matagorda	Brazos-Colorado	Irrigation	40	6/27/1977
3430	HUDGINS DIVISION OF HD HUDGINS	Matagorda	Brazos-Colorado	Irrigation	800	11/1/1954
3431	MICHAEL J PRUETT	Matagorda	Brazos-Colorado	Irrigation	44	8/25/1964
3431	KOONCE-CULLERS DIVISION	Matagorda	Brazos-Colorado	Irrigation	41	8/25/1964
3432	JOHNNY WAYNE & VICKI L JONES	Matagorda	Brazos-Colorado	Irrigation	2	12/12/1977
3432	JOHNNY WAYNE & VICKI L JONES	Matagorda	Brazos-Colorado	Irrigation	78	4/18/1983
3434	DONALD R & JANICE M KOPNICKY	Matagorda	Brazos-Colorado	Irrigation	30	10/29/1979
3435	JOHN A. HUEBNER, JR., ET AL	Matagorda	Brazos-Colorado	Irrigation	550	4/2/1969
3435	JOHN A. HUEBNER, JR., ET AL	Matagorda	Brazos-Colorado	Irrigation	250	4/26/1982
3436	RUSSELL & JUANITA MATTHES	Matagorda	Brazos-Colorado	Irrigation	880	12/16/1974
3437	FRANCIS I SAVAGE	Matagorda	Brazos-Colorado	Irrigation	411	9/11/1967
3437	O B STANLEY	Matagorda	Brazos-Colorado	Irrigation	2,339	9/11/1967
3438	E CROSS CATTLE CO INC	Matagorda	Brazos-Colorado	Irrigation	668	6/25/1914
3438	E CROSS CATTLE CO INC	Matagorda	Brazos-Colorado	Irrigation	600	6/21/1990
3439	E CROSS CATTLE CO INC	Matagorda	Brazos-Colorado	Irrigation	592	6/25/1914
4092	LILLIAN G. ZERNICEK	Matagorda	Brazos-Colorado	Irrigation	80	12/22/1980
4157	CLEYONE E CHAPMAN	Matagorda	Brazos-Colorado	Irrigation	90	11/9/1981
4217	THE MINZE LAND INVESTMENTS LP	Matagorda	Brazos-Colorado	Irrigation	1,000	5/17/1982
4288	BETTY GENE MCAFERTY ET AL	Matagorda	Brazos-Colorado	Irrigation	35	12/20/1982
4301	FUTURO FARMS INC	Matagorda	Brazos-Colorado	Irrigation	450	1/10/1983
4301	G P HARDY III	Matagorda	Brazos-Colorado	Irrigation		1/10/1983
4336	RUNNELS PASTURE COMPANY LTD	Matagorda	Brazos-Colorado	Irrigation	219	2/28/1983
4414	JULIA HOLUB ET AL	Matagorda	Brazos-Colorado	Irrigation	25	11/28/1983
5438	MATAGORDA CO DRAINAGE DIST #1	Matagorda	Brazos-Colorado	Other	260	11/17/1992
5682	HERFF CORNELIUS	Matagorda	Brazos-Colorado	Irrigation	2,400	3/27/2000
5682	HERFF CORNELIUS	Matagorda	Brazos-Colorado	Industrial		3/27/2000
1690	CELANESE LTD	Matagorda	Colorado	Industrial	3,222	1/1/1988
5436	CROUCH FAMILY LIMITED PARTNERSHIP LLP	Matagorda	Colorado	Irrigation	728	6/27/1914
5437	STP NUCLEAR OPERATING COMPANY AGENT	Matagorda	Colorado	Industrial	102,000	6/10/1974
5437	STP NUCLEAR OPERATING COMPANY AGENT ETAL	Matagorda	Colorado	Industrial		6/10/1974
5476	LOWER COLORADO RIVER AUTHORITY	Matagorda	Colorado	Irrigation	262,500	12/1/1900
5476	LOWER COLORADO RIVER AUTHORITY	Matagorda	Colorado	Hydroelectric	2,142,180	
5609	TEXAS BRINE CO LLC	Matagorda	Colorado	Industrial	5,000	5/28/1998
4315	JOHN SCHMERMUND	Matagorda	Colorado-Lavaca	Irrigation	1,500	1/31/1983
4530	DON A CULWELL ET AL	Matagorda	Colorado-Lavaca	Industrial	750	1/3/1985
4530	DON A CULWELL ET AL	Matagorda	Colorado-Lavaca	Industrial	1,500	1/3/1985
4530	DON A CULWELL ET AL	Matagorda	Colorado-Lavaca	Recreation		1/3/1985
4780	MAX CORNELIUS JOHNSON ET AL	Matagorda	Colorado-Lavaca	Irrigation	400	11/24/1969
4781	LAWRENCE J PETERSON & WIFE	Matagorda	Colorado-Lavaca	Irrigation	400	1/24/1916
4782	FARMERS CANAL COMPANY	Matagorda	Colorado-Lavaca	Irrigation	120	1/24/1916
4783	LOUIS F HARPER	Matagorda	Colorado-Lavaca	Irrigation	301	12/31/1961
4786	WILLIAM J NAISER	Matagorda	Colorado-Lavaca	Irrigation	93	12/31/1945
4787	FARMERS CANAL COMPANY	Matagorda	Colorado-Lavaca	Irrigation	20,615	5/31/1909
4788	MRS GLEN HUTSON ET AL	Matagorda	Colorado-Lavaca	Irrigation	7	12/31/1956
4790	SOUTH TEXAS LAND LTD PARTNER	Matagorda	Colorado-Lavaca	Irrigation	1,500	1/12/1976
5099	MATAGORDA BAY AQUACULTURE INC	Matagorda	Colorado-Lavaca	Industrial	316	9/25/1986
5609	TEXAS BRINE CO LLC	Matagorda	Colorado-Lavaca	Industrial		5/28/1998
2916	LEE ROY SCHWARTZ	Mills	Brazos	Irrigation	53	5/31/1959
2917	WILFORD & RUTH WITZSCHE	Mills	Brazos	Irrigation	25	3/31/1963

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
2918	PAMELA ANN MARWITZ POPE ET AL	Mills	Brazos	Irrigation	20	4/30/1949
2919	FRITZ HOPPER	Mills	Brazos	Irrigation	27	4/30/1958
2920	DOUG HOPPER	Mills	Brazos	Irrigation	12	5/31/1965
2954	HOMER MCCASLAND	Mills	Brazos	Municipal		7/11/1977
2955	MARTIN P SHELTON ET AL	Mills	Brazos	Irrigation	150	7/1/1968
2957	HOWARD K MOORE	Mills	Brazos	Irrigation	65	8/31/1940
1744	L L GILGER	Mills	Colorado	Irrigation	95	1/1/1963
1745	JOHN JUDSON GRAVES ET AL	Mills	Colorado	Irrigation	80	7/14/1969
1745	JOHN JUDSON GRAVES ET AL	Mills	Colorado	Irrigation	20	10/15/1974
1746	JOHN JUDSON GRAVES ET AL	Mills	Colorado	Irrigation	160	1/1/1906
1746	JOHN JUDSON GRAVES ET AL	Mills	Colorado	Irrigation	118	10/15/1974
1748	ZEPHYR LAND COMPANY	Mills	Colorado	Irrigation	78	1/1/1904
1748	SLEDGE CATTLE CO INC	Mills	Colorado	Irrigation	47	1/1/1904
1749	GENE SLEDGE / SLEDGE CATTLE CO	Mills	Colorado	Irrigation	20	11/2/1964
1750	J DON WYLIE	Mills	Colorado	Irrigation	32	11/12/1969
1751	MARY ALICE STALCUP	Mills	Colorado	Irrigation	200	4/27/1970
1751	PEGGY JEAN ROSS	Mills	Colorado	Irrigation		4/27/1970
1752	P V KING	Mills	Colorado	Irrigation	127	3/1/1973
1753	CHARLES & CATHERINE MANGHAM	Mills	Colorado	Irrigation	52	6/9/1969
1754	HUBERT MEYER	Mills	Colorado	Irrigation	60	7/22/1968
1755	JOHN C SMITH ET AL	Mills	Colorado	Irrigation	60	2/2/1970
1756	JERRY L DAY ET UX	Mills	Colorado	Irrigation	16	1/1/1964
1757	MILLS CO HUNT & FISH CLUB INC	Mills	Colorado	Recreation		7/6/1916
1758	HARVEY C TUBB	Mills	Colorado	Irrigation	3	8/1/1965
1758	JAMES R FARMER ET UX	Mills	Colorado	Irrigation	3	8/1/1965
1759	W M STANSBERRY	Mills	Colorado	Irrigation	69	3/1/1965
1760	DUREN TRUST	Mills	Colorado	Irrigation	60	2/7/1972
1761	JERRY L. SPRINKLE, ET UX	Mills	Colorado	Irrigation	4	1/1/1957
1762	TOMMY STERLING ET UX	Mills	Colorado	Irrigation	23	1/1/1955
1762	TOMMY STERLING ET UX	Mills	Colorado	Irrigation	18	1/1/1955
1920	WALLACE MADDOX ET AL	Mills	Colorado	Industrial	14	6/3/1914
1920	WALLACE MADDOX ET AL	Mills	Colorado	Industrial	15	1/1/1915
2472	O P LEONARD JR ET UX	Mills	Colorado	Irrigation	1,460	12/31/1961
2524	ROBERT D GILES ET UX	Mills	Colorado	Irrigation	120	12/31/1923
2526	W H HICKS	Mills	Colorado	Irrigation	14	5/15/1963
2527	CHARLES A HICKS	Mills	Colorado	Irrigation	14	5/15/1963
2528	TRUMAN LONG	Mills	Colorado	Irrigation	203	3/4/1916
2532	A J BECK ESTATE	Mills	Colorado	Irrigation	90	5/7/1973
2535	THOMSON REVOCABLE LIVING TRUST	Mills	Colorado	Irrigation	313	6/22/1914
2537	L. I. TANNER	Mills	Colorado	Irrigation	125	12/31/1913
2538	GRENETTA BELL BERRY	Mills	Colorado	Irrigation	17	5/31/1913
2538	BILLY W BORHO ET UX	Mills	Colorado	Irrigation	66	5/31/1913
2539	GRENETTE BELL BERRY	Mills	Colorado	Irrigation	102	6/30/1906
2541	RUTH FEAZLE RAINBOLT	Mills	Colorado	Irrigation	57	12/31/1905
2542	MILDRED HALE CHANEY ET AL	Mills	Colorado	Irrigation	13	8/15/1967
2543	BILLY B. HALE	Mills	Colorado	Irrigation	100	12/31/1956
2544	J WAYNE WILCOX	Mills	Colorado	Irrigation	16	12/31/1957
2545	BILL WILLIAMS ET UX	Mills	Colorado	Irrigation	16	12/31/1957
2547	STEVE AMMONS ET UX	Mills	Colorado	Irrigation	171	9/30/1965
2549	O P LEONARD JR ET UX	Mills	Colorado	Irrigation	249	12/31/1905
2550	O P LEONARD JR ET AL	Mills	Colorado	Irrigation	3,680	12/31/1903
2551	H H COCKRELL	Mills	Colorado	Irrigation	81	12/31/1926
2552	MARTIN HUGHES DVM ET UX	Mills	Colorado	Irrigation	37	12/31/1950
2552	ROBERT LEE LONG JR ET UX	Mills	Colorado	Irrigation	73	12/31/1950
2553	CITY OF GOLDTHWAITE	Mills	Colorado	Municipal	800	5/6/1960
2553	CITY OF GOLDTHWAITE	Mills	Colorado	Industrial	700	5/6/1960
2553	CITY OF GOLDTHWAITE	Mills	Colorado	Irrigation	250	5/6/1960
2554	LEE P SHELLBERG TRUSTEE	Mills	Colorado	Irrigation	24	9/27/1949
2555	FRED E HARTLEY ET UX	Mills	Colorado	Irrigation	34	2/26/1968
2556	JOE N WEATHERBY	Mills	Colorado	Irrigation	75	12/31/1952
2563	O P LEONARD JR ET AL	Mills	Colorado	Irrigation	70	12/31/1937
2565	THE ESTATE OF OTHEL OTTO SMITH	Mills	Colorado	Irrigation	100	6/30/1964
2566	DORTHEY DUCKETT	Mills	Colorado	Irrigation	159	12/31/1952
2568	SHANNON LEA BURDETTE, ET AL	Mills	Colorado	Irrigation	168	12/31/1963
2569	R C JOHNSON ET AL	Mills	Colorado	Irrigation	106	12/31/1905
2569	MILLS COUNTY STATE BANK	Mills	Colorado	Irrigation	2	12/31/1905

Note: Water Rights 5478 and 5482 are storage and diversion rights.

WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
2570	DANIEL M WATSON & JUDITH C WATSON TRUST	Mills	Colorado	Irrigation	189	12/31/1904
2570	MILLS COUNTY STATE BANK	Mills	Colorado	Irrigation	277	12/31/1904
2570	R C JOHNSON	Mills	Colorado	Irrigation	5	12/31/1904
2576	DONALD D. BURNHAM	Mills	Colorado	Irrigation	84	12/31/1941
5111	NEW HORIZONS RANCH & CENTER IN	Mills	Colorado	Municipal	15	11/24/1986
5111	NEW HORIZONS RANCH & CENTER IN	Mills	Colorado	Recreation		11/24/1986
1847	WILLIAM R GODDARD JR	San Saba	Colorado	Irrigation	200	1/1/1951
1856	KATHLEEN HAWKINS	San Saba	Colorado	Irrigation	9	6/24/1914
1856	FLORENCE BAGLEY	San Saba	Colorado	Irrigation	9	6/26/1914
1856	JUDY DUNNEGAN	San Saba	Colorado	Irrigation	16	6/26/1914
1857	MABEL FLEMING	San Saba	Colorado	Irrigation	6	6/24/1914
1858	E L BYRD	San Saba	Colorado	Irrigation	19	6/24/1914
1859	CHRISTINE DIANE POOL BESSENT ET AL	San Saba	Colorado	Irrigation	171	6/27/1914
1860	LARRY BAKER ET UX	San Saba	Colorado	Irrigation	96	6/27/1914
1861	WILLARD KEITH BESSENT ET UX	San Saba	Colorado	Irrigation	20	6/27/1914
1862	CHRISTINE DIANE POOL BESSENT ET AL	San Saba	Colorado	Irrigation	28	6/27/1914
1863	FRANK CHURCHILL ET UX	San Saba	Colorado	Irrigation	15	6/27/1914
1863	JIMMY SHOOK ET AL	San Saba	Colorado	Irrigation	35	6/27/1914
1864	SLOAN ECKERT ELLIS	San Saba	Colorado	Irrigation	33	4/25/1914
1864	BRYANT KENT ELLIS	San Saba	Colorado	Irrigation		4/25/1914
1865	SLOAN ECKERT ELLIS	San Saba	Colorado	Irrigation	15	4/25/1914
1866	SEIDERS SAN SABA RANCH LTD	San Saba	Colorado	Irrigation	93	1/1/1947
1867	JERRY W JOHNSON ET AL	San Saba	Colorado	Irrigation	54	1/1/1935
1868	ELEANOR OWEN JOHNSON ET AL	San Saba	Colorado	Irrigation	190	1/1/1918
1869	HOMER R OWENS ET UX	San Saba	Colorado	Irrigation	26	1/1/1925
1869	CRAIG STENCIL ET UX	San Saba	Colorado	Irrigation	41	1/1/1925
1870	HOMER R OWENS ET UX	San Saba	Colorado	Irrigation	88	5/2/1914
1871	LARRY GENE CONNER	San Saba	Colorado	Irrigation	120	1/1/1955
1872	TRIPLE M CATTLE CO	San Saba	Colorado	Irrigation	225	6/24/1914
1873	EUGENE CONNER	San Saba	Colorado	Irrigation	104	1/1/1952
1874	DENNIS HARDMAN ET UX	San Saba	Colorado	Irrigation	34	1/1/1922
1874	BEN F AMONETT ET AL	San Saba	Colorado	Irrigation	1	1/1/1922
1875	CHARLES B MARTIN JR ET UX	San Saba	Colorado	Irrigation	114	6/22/1914
1876	THE ESTATE OF RILEY C HARKEY ET AL	San Saba	Colorado	Irrigation	142	1/1/1922
1877	BONNIE HARKEY	San Saba	Colorado	Irrigation	146	11/14/1914
1878	THE ESTATE OF RILEY C HARKEY	San Saba	Colorado	Irrigation	120	1/1/1910
1879	RANDY KIRK HARKEY ET AL	San Saba	Colorado	Irrigation	25	1/1/1913
1880	CHRISTINE BAGLEY EDMONDSON	San Saba	Colorado	Irrigation	29	1/1/1956
1881	DEAN BAGLEY JR	San Saba	Colorado	Irrigation	161	1/1/1910
1882	BILLY JOE GUNTER ET AL	San Saba	Colorado	Irrigation	150	1/1/1919
1883	BYRON E & GEORGIA L LEWIS	San Saba	Colorado	Irrigation	31	1/1/1933
1884	JAMES B. BONHAM CORPORATION	San Saba	Colorado	Irrigation	72	1/1/1963
1885	T N WOOD	San Saba	Colorado	Irrigation	64	9/4/1962
1886	RICKY LAMBERT ET UX	San Saba	Colorado	Irrigation	31	1/1/1911
1886	MAXINE MIFFLETON	San Saba	Colorado	Irrigation	4	1/1/1911
1886	RONNIE MCBRIDE ET UX	San Saba	Colorado	Irrigation	4	1/1/1911
1887	ROGER RICKY LAMBERT ET UX	San Saba	Colorado	Irrigation	329	1/1/1911
1888	SLOAN LIVESTOCK, LTD	San Saba	Colorado	Irrigation	88	1/1/1956
1889	MRS HOPE CRUTSINGER	San Saba	Colorado	Irrigation	41	1/1/1925
1890	THE GREAT SAN SABA RIVER PECAN	San Saba	Colorado	Irrigation	434	1/1/1911
1891	ESTATE OF SARA JEAN CAMERON	San Saba	Colorado	Irrigation	25	1/1/1921
1891	JOE ROGAN MILLER	San Saba	Colorado	Irrigation	118	1/1/1921
1892	ESTATE OF JOHN P MCCONNELL JR	San Saba	Colorado	Irrigation	53	1/1/1953
1892	JOHNETTE MCCONNELL EARLY ET AL	San Saba	Colorado	Irrigation	180	1/1/1953
1893	DEAN BAGLEY JR	San Saba	Colorado	Irrigation	52	1/1/1959
1894	GAILIAN DEAN BAGLEY JR	San Saba	Colorado	Irrigation	272	1/1/1913
1895	THE GREAT SAN SABA RIVER PECAN	San Saba	Colorado	Irrigation	48	1/1/1955
1896	GAILIAN DEAN BAGLEY JR	San Saba	Colorado	Irrigation	64	1/1/1950
1897	WILTON & BETTY MARTIN	San Saba	Colorado	Irrigation	80	5/16/1914
1898	DAVID GILGER	San Saba	Colorado	Irrigation	40	3/30/1914
1898	DAVID GILGER	San Saba	Colorado	Irrigation	20	4/24/1914
1899	ANITA OWEN	San Saba	Colorado	Irrigation	340	1/1/1929
1900	CHRISTINE BAGLEY EDMONDSON	San Saba	Colorado	Irrigation	54	1/1/1954
1901	ROY BAGLEY	San Saba	Colorado	Irrigation	49	1/1/1940
1902	JOHN T & GLENNETTA SANDERSON	San Saba	Colorado	Irrigation	2	1/1/1963
1903	CITY OF SAN SABA	San Saba	Colorado	Municipal	550	6/29/1914

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
1904	ELSIE MILLICAN	San Saba	Colorado	Irrigation	5	1/1/1966
1905	L F & MARY B TOWNSEND	San Saba	Colorado	Irrigation	38	1/1/1912
1906	CITY OF SAN SABA	San Saba	Colorado	Irrigation	54	1/1/1920
1907	PATSY RAYE McCONNELL	San Saba	Colorado	Irrigation	198	1/1/1933
1908	W L OWEN JR	San Saba	Colorado	Irrigation	40	10/8/1914
1908	W L OWEN JR	San Saba	Colorado	Irrigation	10	12/31/1930
1909	JOE C SMITH	San Saba	Colorado	Irrigation	84	1/1/1963
1910	EDGAR HUBBERT JR ET UX	San Saba	Colorado	Irrigation	14	6/26/1914
1911	JIMMY N SHOOK ET AL	San Saba	Colorado	Irrigation	95	1/1/1883
1912	J M GAGE JR	San Saba	Colorado	Irrigation	112	1/1/1915
1913	ROXIE GRUMBLES	San Saba	Colorado	Irrigation	270	1/1/1932
1914	MARTHA OWEN BURNHAM ET AL	San Saba	Colorado	Irrigation	207	1/1/1931
1915	MAX MAHAN	San Saba	Colorado	Irrigation	220	1/1/1918
1916	ANN BERNICE JOYCE ET AL	San Saba	Colorado	Irrigation	103	1/1/1908
1917	MARTHA OWEN BURNHAM ET AL	San Saba	Colorado	Irrigation	188	1/1/1918
1918	HELEN MIKKELSON ET AL	San Saba	Colorado	Irrigation	40	4/25/1914
1919	JIMMIE D SHAHAN	San Saba	Colorado	Irrigation	15	6/3/1914
1921	SAN SABA IRREVOCABLE TR AG	San Saba	Colorado	Irrigation	20	1/1/1904
1922	WILLIE MAY SHAHAN	San Saba	Colorado	Irrigation	40	6/3/1914
1924	RAYMOND A OLIVER	San Saba	Colorado	Irrigation	49	1/1/1905
1925	WILLIE MAY SHAHAN	San Saba	Colorado	Irrigation	37	5/30/1914
1926	R L OLIVER ET AL	San Saba	Colorado	Irrigation	6	1/1/1905
1927	M A O'BANNON ALTIZER ET AL	San Saba	Colorado	Irrigation	54	1/1/1905
1928	ELSIE MILLICAN	San Saba	Colorado	Irrigation	118	1/1/1905
1929	WINNIFRED LIPTAK	San Saba	Colorado	Irrigation	53	1/1/1907
2452	O P LEONARD JR ET AL	San Saba	Colorado	Irrigation	1,302	12/31/1964
2516	J. PHILLIP KEETER	San Saba	Colorado	Irrigation	12	12/31/1966
2518	OSCAR L GRANT	San Saba	Colorado	Irrigation	6	12/31/1966
2519	JEAN IRBY	San Saba	Colorado	Irrigation	8	12/31/1966
2523	TOM LAFFERTY	San Saba	Colorado	Irrigation	90	7/20/1970
2525	C BARTON DRAPER ET UX	San Saba	Colorado	Irrigation	620	12/31/1903
2529	T. WARD LOCKLEAR	San Saba	Colorado	Irrigation	239	12/31/1924
2530	RIVER CREEK LTD	San Saba	Colorado	Irrigation	41	12/31/1904
2531	RICHARD M BARNEY	San Saba	Colorado	Irrigation	28	12/31/1960
2531	RUTH A CANTU	San Saba	Colorado	Irrigation	35	12/31/1960
2531	DON TAPP ET UX	San Saba	Colorado	Irrigation	73	12/31/1960
2531	ELMER LEON WAECHTER	San Saba	Colorado	Irrigation	8	12/31/1960
2531	PAT REAGAN ET UX	San Saba	Colorado	Irrigation	55	12/31/1960
2533	ROGER D BUSH ET UX	San Saba	Colorado	Irrigation	44	12/31/1912
2533	NANCY C BUSH	San Saba	Colorado	Irrigation	44	12/31/1912
2533	KITTY JO SIMPSON CUMMINGS	San Saba	Colorado	Irrigation	44	12/31/1912
2534	NETTLESHIP FAMILY TRUST PTA MAR 31 1997	San Saba	Colorado	Irrigation	156	12/31/1955
2536	JOAN PEET MCMULLAN TRUST NO 1	San Saba	Colorado	Irrigation	140	12/31/1912
2536	NATHAN CAROTHERS ET UX	San Saba	Colorado	Irrigation	96	12/31/1912
2540	J C EDMONDSON	San Saba	Colorado	Irrigation	67	12/31/1937
2546	KENNETH O O'REAR ET UX	San Saba	Colorado	Irrigation	1,600	12/31/1956
2557	JOHN BARFIELD	San Saba	Colorado	Irrigation	16	8/31/1928
2558	CECIL CAMPBELL	San Saba	Colorado	Irrigation	71	8/31/1928
2559	J C OSWALD ET UX	San Saba	Colorado	Irrigation	27	8/31/1928
2560	ROBERT E MILLICAN ET UX	San Saba	Colorado	Irrigation	27	8/31/1928
2561	CECIL CAMPBELL	San Saba	Colorado	Irrigation	39	8/31/1928
2562	MELBA LOU WHITT ET AL	San Saba	Colorado	Irrigation	49	7/31/1913
2562	JOHN H BANNISTER ET UX	San Saba	Colorado	Irrigation	47	7/31/1913
2563	O P LEONARD JR ET AL	San Saba	Colorado	Irrigation	173	12/31/1937
2564	HASKEL G HUDSON ET UX	San Saba	Colorado	Irrigation	606	12/31/1929
2564	LUTHER W SIMPSON ET UX	San Saba	Colorado	Irrigation	474	12/31/1929
2564	KENDALL C MONTGOMERY ET UX	San Saba	Colorado	Irrigation	20	12/31/1929
2567	RICHARD TURNER MILLER	San Saba	Colorado	Irrigation	70	6/29/1914
2571	JAMES R CROMER	San Saba	Colorado	Irrigation	113	7/31/1965
2572	ALTA FERN EDMONDSON FREEMAN ET	San Saba	Colorado	Irrigation	232	6/30/1910
2573	DON E KRANZ ET UX	San Saba	Colorado	Irrigation	11	12/31/1952
2574	JOHN J OLIVER	San Saba	Colorado	Irrigation	45	12/31/1911
2575	TOMMIE WORTH WOOD ET AL	San Saba	Colorado	Irrigation	93	12/31/1911
2577	CECIL M. JOHNSON	San Saba	Colorado	Irrigation	88	12/31/1911
2578	SUE BETH O'BANON GRIMES ET AL	San Saba	Colorado	Irrigation	30	12/31/1940
2582	DICK GLOVER COMPANY INC	San Saba	Colorado	Irrigation	71	12/31/1905

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
2583	MICHAEL H ROCKAFELLOW ET UX	San Saba	Colorado	Irrigation	259	12/31/1912
2584	MYLES D MCDOWELL ET AL	San Saba	Colorado	Irrigation	96	6/23/1914
2591	KENNETH R MCCOY ET UX	San Saba	Colorado	Irrigation	73	1/31/1911
2593	KENNETH R MCCOY ET UX	San Saba	Colorado	Irrigation	57	9/30/1963
2595	WILLIAM G BURGESS ET UX	San Saba	Colorado	Irrigation	205	12/31/1914
2598	W B CLARK AND W N CLARK	San Saba	Colorado	Irrigation	180	12/31/1911
2601	BOBBIE JOHN FOSTER	San Saba	Colorado	Irrigation	105	12/31/1957
2602	W D PORCH	San Saba	Colorado	Irrigation	30	6/30/1964
2603	JACKIE BRISTER	San Saba	Colorado	Irrigation	187	5/31/1907
2604	W N CLARK	San Saba	Colorado	Irrigation	60	5/31/1907
2606	ELSIE MILLICAN ET AL	San Saba	Colorado	Irrigation	18	12/31/1961
3867	LOU ERA BATES	San Saba	Colorado	Municipal		2/27/1978
3867	H D SOFGE	San Saba	Colorado	Municipal		2/27/1978
5288	TOMMY LEE JONES ET UX	San Saba	Colorado	Irrigation	20	3/20/1990
327	STP NUCLEAR OPERATING COMPANY AGENT	Travis	Colorado	Industrial	102,000	1/1/1976
1166	HURST CREEK MUD	Travis	Colorado	Municipal	1,600	3/1/1980
1166	HURST CREEK MUD	Travis	Colorado	Industrial		3/1/1980
1229	DAVENPORT RANCH MUD 1	Travis	Colorado	Municipal	1,700	5/1/1981
1242	TRAVIS CO WCID 20	Travis	Colorado	Municipal	1,100	7/1/1981
1394	GARY L. BRADLEY	Travis	Colorado	Municipal	101	7/1/1983
1448	JOCELYN LEVI STRAUS	Travis	Colorado	Municipal	630	6/1/1984
1472	BALDWIN INTEREST	Travis	Colorado	Municipal	199	6/1/1983
1481	TRAVIS CO WCID 18	Travis	Colorado	Municipal	1,400	10/1/1984
1490	RESORT RANCH OF LAKE TRAVIS	Travis	Colorado	Municipal	50	9/1/1984
1490	RESORT RANCH OF LAKE TRAVIS	Travis	Colorado	Irrigation	100	9/1/1984
1505	CITY OF BURNET	Travis	Colorado	Municipal	4,100	1/1/1985
1522	EANES ISD	Travis	Colorado	Municipal	37	4/1/1985
1556	LOOP 360 WATER SUPPLY CORP	Travis	Colorado	Municipal	879	8/1/1985
1582	TRAVIS COUNTY WCID 20	Travis	Colorado	Municipal	35	1/1/1986
1627	TRAVIS CO WCID-POINT VENTURE	Travis	Colorado	Municipal	110	3/1/1987
1628	LAKE LBJ MUD	Travis	Colorado	Municipal	1,120	3/1/1987
1657	THE ISLAND ON LAKE TRAVIS LTD	Travis	Colorado	Irrigation	11	11/1/1987
1658	THE ISLAND ON LAKE TRAVIS LTD	Travis	Colorado	Industrial	1,714	11/1/1987
1738	GARWOOD IRRIGATION COMPANY	Travis	Colorado	Irrigation		4/20/1989
1772	CITY OF AUSTIN	Travis	Colorado	Municipal	250,000	12/10/1987
1787	CITY OF COTTONWOOD SHORES	Travis	Colorado	Municipal	138	1/1/1991
1825	RIVER PLACE MUD	Travis	Colorado	Municipal	900	9/28/1991
1833	LAKESIDE UTILITIES INC	Travis	Colorado	Municipal	25	
1835	RIVERCREST WATER SYSTEMS INC	Travis	Colorado	Municipal	185	4/2/1992
1851	TOMMY LEE JONES ET UX	Travis	Colorado	Irrigation	20	10/1/1990
1877	LEANDER, CITY OF	Travis	Colorado	Irrigation	64	7/28/1993
1879	BALCONES COUNTRY CLUB ASSN INC	Travis	Colorado	Irrigation	60	7/30/1993
1882	SENNA HILLS MUD #1	Travis	Colorado	Municipal	170	8/25/1993
1924	CHARLES T. TREFNY	Travis	Colorado	Irrigation	400	3/2/1994
1925	MORRIS F. ZAPALAC	Travis	Colorado	Irrigation	300	3/4/1994
1926	VOLENTE BEACH, INC	Travis	Colorado	Recreation	1	3/11/1994
1951	HIGHLAND LAKES GOLF CLUB INC	Travis	Colorado	Irrigation	40	5/13/1994
1952	LA GRANGE ISD	Travis	Colorado	Irrigation	12	6/1/1994
1953	POINT VENTURE PROPERTY OWNERS ASSN	Travis	Colorado	Irrigation	75	6/1/1994
1955	BARTON CREEK RESORT & CLUBS	Travis	Colorado	Irrigation	500	6/6/1994
1957	HYATT CORPORATION	Travis	Colorado	Industrial	15	6/8/1994
1958	LAGO VISTA INC	Travis	Colorado	Irrigation	270	1/25/1994
1959	COUNTRY CLUB AT RIVER PLACE IN	Travis	Colorado	Irrigation	150	6/14/1994
1960	PEDERNALES GOLF CLUB INC	Travis	Colorado	Irrigation	52	6/15/1994
1961	HYATT CORPORATION	Travis	Colorado	Irrigation	15	6/17/1994
1962	DON M BRYANT & KATHIE A BRYANT	Travis	Colorado	Municipal	21	6/21/1994
1963	CRENSHAW & DOGUET TURFGRASS	Travis	Colorado	Irrigation	850	6/22/1994
1964	USAA STRATUM REAL ESTATE CO	Travis	Colorado	Municipal	19	7/14/1994
1969	AUSTIN AMERICAN STATESMAN	Travis	Colorado	Irrigation	30	9/1/1994
1975	HERMOSA OP PUD OWNERS ASSN INC	Travis	Colorado	Irrigation	15	11/4/1994
2036	JONESTOWN WSC	Travis	Colorado	Municipal	360	
2045	LAKEWAY GOLF CLUBS INC	Travis	Colorado	Irrigation	310	
2079	HIDDEN VALLEY SUBDIVISION COOP	Travis	Colorado	Municipal	10	
2080	TRAVIS COUNTY MUD NO 4	Travis	Colorado	Municipal	2,104	
2083	SPICEWOOD BEACH POA	Travis	Colorado	Irrigation	11	12/27/1996
2176	COLOVISTA ESTATES INC	Travis	Colorado	Irrigation	42	7/1/1997

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
2190	FRISCH AUF! VALLEY COUNTRY CLB	Travis	Colorado	Irrigation	25	
2191	LAKE LBJ MUD	Travis	Colorado	Municipal	1,430	
2202	LEN D JORDAN	Travis	Colorado	Municipal	7	
2209	AUSTIN GOLF CLUB INC	Travis	Colorado	Irrigation	200	10/1/1999
2237	BARTON CREEK LAKESIDE INC	Travis	Colorado	Irrigation	229	1/12/2000
2238	CITY OF AUSTIN	Travis	Colorado	Industrial	3,500	
2249	VILLAGE OF BRIARCLIFF	Travis	Colorado	Municipal	300	2/20/2000
2255	BRAD MCCLAIN	Travis	Colorado	Irrigation	29	4/7/2000
2261	TRAVIS COUNTY UTILITY DISTRICT NO 10	Travis	Colorado	Municipal	55	5/17/2000
2262	PECAN UTILITIES CO INC	Travis	Colorado	Municipal	30	6/1/2000
2281	LAKEWAY MUD	Travis	Colorado	Municipal	2,445	
2282	SHUMAKER ENTERPRISES INC	Travis	Colorado	Mining	300	
2288	LLANO COUNTY MUD NO 1	Travis	Colorado	Municipal	87	
2292	BLUEBONNET HILL GOLF COURSE	Travis	Colorado	Irrigation	199	
2299	INVERNESS UTILITY CO	Travis	Colorado	Municipal	50	
2314	CITY OF CEDAR PARK	Travis	Colorado	Irrigation	735	
2330	TESTAMENTARY TRUSTS ESTS OF LW ARMOUR	Travis	Colorado	Irrigation	55,000	
2330	AM & RESTATED 1989 TRUST BR DELLA LONGA	Travis	Colorado	Irrigation		
2333	LAKECLIFF ON LAKE TRAVIS LP	Travis	Colorado	Irrigation	994	
2342	BASTROP ENERGY PARTNERS LP	Travis	Colorado	Industrial	3,220	
2342	EL PASO MERCHANT ENERGY	Travis	Colorado	Industrial		
2358	BRAZOS RIVER AUTHORITY	Travis	Colorado	Industrial	25,000	
2380	EQUISTAR CHEMICALS LP	Travis	Colorado	Industrial	2,800	
2381	CITY OF CEDAR PARK	Travis	Colorado	Municipal	18,000	
2399	RAINBOW MATERIALS LP	Travis	Colorado	Industrial	46	
2403	LEGENDS ON LAKE LBJ LTD	Travis	Colorado	Irrigation	125	
2405	DRIPPING SPRINGS WATER SUPPLY CORP	Travis	Colorado	Municipal	560	
2406	ANGELISLE LP	Travis	Colorado	Irrigation	5	
2414	CITY OF PFLUGERVILLE	Travis	Colorado	Municipal	12,000	
2431	TEXIA PRODUCTIONS INC	Travis	Colorado	Recreation	64	
2434	HAYS COUNTY WCID NO 1	Travis	Colorado	Municipal	118	
2435	CITY OF MARBLE FALLS	Travis	Colorado	Municipal	1,000	
2439	TRAVIS CO WCID 17	Travis	Colorado	Recreation	554	
2440	AQUA WSC	Travis	Colorado	Municipal	6,500	
2444	TRAVIS CO WCID 17	Travis	Colorado	Municipal	8,800	
2449	LSM RANCH LTD	Travis	Colorado	Municipal	490	
2450	SGL DEVELOPMENT LTD	Travis	Colorado	Municipal	160	
2451	CYPRESS-HAYS LP	Travis	Colorado	Municipal	625	
2452	KINDER MORGAN TEXAS PIPELINE LP	Travis	Colorado	Industrial	48	
2644	UNITED STATES FISH & WILDLIFE SERVICE	Travis	Colorado	Irrigation	28	12/31/1954
2644	UNITED STATES FISH & WILDLIFE SERVICE	Travis	Colorado	Recreation		12/31/1954
2645	LAGO VISTA INC	Travis	Colorado	Irrigation	9	1/28/1974
2646	JAMES L ANDERSON	Travis	Colorado	Irrigation	0	4/30/1964
2647	TEXAS CONFERENCE ASSOCIATION	Travis	Colorado	Irrigation	6	4/30/1964
2648	WALTER L MOORE ET UX	Travis	Colorado	Irrigation		4/30/1964
2649	JAMES L ANDERSON	Travis	Colorado	Irrigation	10	7/31/1963
2650	MARVIN T TALBOTT ET UX	Travis	Colorado	Irrigation	1	7/31/1963
2651	UNITED STATES FISH & WILDLIFE SERVICE	Travis	Colorado	Irrigation	14	12/31/1954
2651	UNITED STATES FISH & WILDLIFE SERVICE	Travis	Colorado	Recreation		12/31/1954
3638	ONION CREEK CLUB INC	Travis	Colorado	Irrigation	12	8/2/1976
3657	HYDE PARK BAPTIST CHURCH	Travis	Colorado	Recreation	64	9/13/1976
3668	CARROL & JAMES SANSOM & R COE	Travis	Colorado	Irrigation	200	9/27/1976
4109	APACHE SHORES INC	Travis	Colorado	Recreation	128	3/30/1981
4150	BALCONES COUNTRY CLUB ASSN INC	Travis	Colorado	Irrigation	76	9/21/1981
4150	BALCONES COUNTRY CLUB ASSN INC	Travis	Colorado	Recreation		9/21/1981
4254	HURST CREEK MUD OF TRAVIS CO	Travis	Colorado	Irrigation	700	11/1/1982
4254	HURST CREEK MUD OF TRAVIS CO	Travis	Colorado	Recreation	1,000	11/1/1982
4347	THE LAKEWAY COMPANY	Travis	Colorado	Irrigation		4/18/1983
4348	CITY OF AUSTIN DRAINAGE UTIL	Travis	Colorado	Recreation		4/18/1983
4385	CITY OF CEDAR PARK	Travis	Colorado	Municipal		7/18/1983
4385	CITY OF CEDAR PARK	Travis	Colorado	Municipal	5,600	7/18/1983
4385	CITY OF CEDAR PARK	Travis	Colorado	Industrial		7/18/1983
4385	CITY OF CEDAR PARK	Travis	Colorado	Irrigation		7/18/1983
5042	TEXAS CONFERENCE ASSOCIATION	Travis	Colorado	Recreation		1/29/1986
5058	HHCC PROPERTIES INC	Travis	Colorado	Recreation		5/16/1986
5070	THI AUSTIN LP	Travis	Colorado	Recreation		6/27/1986

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
5095	NORWOOD/UNITED PARK	Travis	Colorado	Recreation		9/8/1986
5102	AQUAPLEX INC	Travis	Colorado	Recreation		10/8/1986
5179	WINDERMERE A JOINT VENTURE	Travis	Colorado	Other		5/4/1988
5268	APPLIED MATERIALS INC	Travis	Colorado	Recreation		12/6/1989
5269	MARKBOROUGH DEVELOPMENT CO LTD	Travis	Colorado	Recreation		12/6/1989
5368	TAYLOR WOODROW COMM/STEINER RANCH LTD	Travis	Colorado	Irrigation	123	6/30/1954
5368	239 RIO VISTA LTD	Travis	Colorado	Irrigation	14	6/30/1954
5368	LAKE AUSTIN LAND & CATTLE LTD	Travis	Colorado	Irrigation	1	6/30/1954
5368	MINI ME MANAGEMENT LTD	Travis	Colorado	Irrigation	12	6/30/1954
5368	THL RANCH LTD	Travis	Colorado	Irrigation	8	6/30/1954
5368	LA/WCD FAMILY WATERWORKS LTD	Travis	Colorado	Irrigation	2	6/30/1954
5368	MICHAEL G MCCARTHY	Travis	Colorado	Irrigation	1	6/30/1954
5368	ROBERT L STEINER TRUSTEE	Travis	Colorado	Irrigation	0	6/30/1954
5368	RONALD LEE FINN	Travis	Colorado	Irrigation	0	6/30/1954
5368	DORIS WILKERSON	Travis	Colorado	Irrigation	0	6/30/1954
5368	JAY C CHOWNING ET AL	Travis	Colorado	Irrigation	0	6/30/1954
5369	BOHLS CATTLE RANCH & INVEST	Travis	Colorado	Irrigation	22	12/31/1939
5371	MARION FOWLER	Travis	Colorado	Irrigation	8	12/12/1956
5372	GEORGE S NALLE JR & WIFE	Travis	Colorado	Irrigation	25	12/31/1948
5373	RANDOLPH G MUELLER ET AL	Travis	Colorado	Irrigation	11	12/31/1966
5374	GREAT HILL LTD	Travis	Colorado	Irrigation	13	1/20/1976
5374	GREAT HILL LTD	Travis	Colorado	Recreation		1/20/1976
5375	ROBERT J JOHNSON TR NO 1 ET AL	Travis	Colorado	Irrigation	40	8/16/1965
5376	HILL COUNTRY GOLF INC	Travis	Colorado	Recreation		3/13/1972
5377	CITY OF AUSTIN	Travis	Colorado	Recreation		3/24/1975
5378	BALCONES COUNTRY CLUB	Travis	Colorado	Irrigation	60	8/27/1991
5379	THELMA BOLM YEATES ET AL	Travis	Colorado	Irrigation	1,323	6/10/1914
5379	ARLENE BOLM FITZPATRICK ET AL	Travis	Colorado	Irrigation		6/10/1914
5380	CAPITOL AGGREGATES LTD	Travis	Colorado	Mining	2,540	9/11/1972
5380	CAPITOL AGGREGATES LTD	Travis	Colorado	Mining	242	11/17/1964
5380	CAPITOL AGGREGATES LTD	Travis	Colorado	Mining	22	11/17/1964
5380	CAPITOL AGGREGATES LTD	Travis	Colorado	Irrigation	5	11/17/1964
5382	WILLIAM D MCMORRIS ET AL	Travis	Colorado	Irrigation	50	6/29/1914
5384	SHAPARD FARM	Travis	Colorado	Irrigation	74	6/29/1914
5385	WILLIAM D MCMORRIS ET AL	Travis	Colorado	Irrigation	67	3/4/1916
5386	TEXAS INDUSTRIES INC	Travis	Colorado	Mining	110	5/25/1970
5392	O V GRUBERT	Travis	Colorado	Irrigation	2	1/15/1973
5392	O V GRUBERT	Travis	Colorado	Recreation		1/15/1973
5393	TRAVIS COUNTY LANDFILL CO LLC	Travis	Colorado	Industrial	17	6/30/1963
5393	TRAVIS COUNTY LANDFILL CO LLC	Travis	Colorado	Irrigation	3	6/30/1963
5393	SCHWERTNER FARMS INC	Travis	Colorado	Industrial	70	6/30/1963
5393	SCHWERTNER FARMS INC	Travis	Colorado	Irrigation	25	6/30/1963
5394	DAVID & KATHERINE MELLENBRUCH	Travis	Colorado	Irrigation	150	4/25/1899
5394	PEARCE JOHNSON	Travis	Colorado	Irrigation		4/25/1899
5396	BASTROP ENERGY PARTNERS LP	Travis	Colorado	Irrigation	180	11/12/1913
5396	BASTROP ENERGY PARTNERS LP	Travis	Colorado	Industrial		11/12/1913
5397	CLARENCE WASHINGTON	Travis	Colorado	Industrial	17	11/20/1967
5397	CLARENCE WASHINGTON	Travis	Colorado	Recreation		11/20/1967
5401	J. W. SIMECEK	Travis	Colorado	Irrigation	30	4/30/1963
5471	CITY OF AUSTIN	Travis	Colorado	Municipal	270,403	6/30/1913
5471	CITY OF AUSTIN	Travis	Colorado	Irrigation	1,150	6/30/1913
5471	CITY OF AUSTIN	Travis	Colorado	Hydroelectric		6/30/1913
5471	CITY OF AUSTIN	Travis	Colorado	Industrial	24,000	6/27/1914
5471	CITY OF AUSTIN	Travis	Colorado	Industrial		6/27/1914
5471	CITY OF AUSTIN	Travis	Colorado	Recreation		3/5/1959
5471	CITY OF AUSTIN	Travis	Colorado	Recreation		12/31/1928
5482	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Municipal		3/29/1926
5482	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Industrial	1,470	3/29/1926
5482	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Irrigation		3/29/1926
5482	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Mining		3/29/1926
5482	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Hydroelectric		3/29/1926
5482	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Recreation		3/29/1926
5482	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Other		3/29/1926
5483	NIX O BODDEN ET UX	Travis	Colorado	Irrigation	1	12/31/1961
5489	CITY OF AUSTIN	Travis	Colorado	Municipal	20,300	8/20/1945
5489	CITY OF AUSTIN	Travis	Colorado	Industrial	16,156	8/20/1945

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WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
5489	CITY OF AUSTIN	Travis	Colorado	Industrial		8/20/1945
5489	CITY OF AUSTIN	Travis	Colorado	Recreation		8/20/1945
5491	ROBERT D HEJL	Travis	Colorado	Irrigation	22	12/31/1952
5542	WELLS BRANCH MUD	Travis	Colorado	Recreation		11/20/1995
5564	NATIONAL INSTRUMENTS CORP	Travis	Colorado	Recreation		12/9/1996
5677	LOWER COLORADO RIVER AUTHORITY	Travis	Colorado	Municipal	6,400	2/2/2000
5790	CITY OF PFLUGERVILLE	Travis	Colorado	Municipal	12,000	12/20/2002
5790	CITY OF PFLUGERVILLE	Travis	Colorado	Recreation		12/20/2002
3418	HARRY H & NANCY B ANDERSON	Wharton	Brazos-Colorado	Irrigation	110	12/31/1910
3418	HARRY H & NANCY B ANDERSON	Wharton	Brazos-Colorado	Irrigation	1,010	5/7/1979
3418	GLEN D & BETTY J LAAS	Wharton	Brazos-Colorado	Irrigation	480	5/7/1979
3419	HARRY H & NANCY B ANDERSON	Wharton	Brazos-Colorado	Irrigation	800	5/7/1979
3420	PEMM PARTNERS LTD	Wharton	Brazos-Colorado	Irrigation	300	9/10/1979
3421	LEONARD WITTIG GRASS FARMS INC	Wharton	Brazos-Colorado	Mining	1,000	9/13/1928
3421	LEONARD WITTIG GRASS FARMS INC	Wharton	Brazos-Colorado	Municipal		9/13/1928
3421	LEONARD WITTIG GRASS FARMS INC	Wharton	Brazos-Colorado	Industrial		9/13/1928
3421	LEONARD WITTIG GRASS FARMS INC	Wharton	Brazos-Colorado	Irrigation		9/13/1928
3421	LEONARD WITTIG GRASS FARMS INC	Wharton	Brazos-Colorado	Irrigation		9/13/1928
3421	LEONARD WITTIG GRASS FARMS INC	Wharton	Brazos-Colorado	Irrigation		9/13/1928
3421	LEONARD WITTIG GRASS FARMS INC	Wharton	Brazos-Colorado	Irrigation		9/13/1928
3421	WHARTON COUNTY POWER PARTNERS LP	Wharton	Brazos-Colorado	Municipal	1,600	9/13/1928
3421	WHARTON COUNTY POWER PARTNERS LP	Wharton	Brazos-Colorado	Industrial		9/13/1928
3421	WHARTON COUNTY POWER PARTNERS LP	Wharton	Brazos-Colorado	Mining		9/13/1928
3421	WHARTON COUNTY POWER PARTNERS LP	Wharton	Brazos-Colorado	Irrigation		9/13/1928
3421	WHARTON COUNTY POWER PARTNERS LP	Wharton	Brazos-Colorado	Irrigation		9/13/1928
3421	PHILLIPS PETROLEUM CO	Wharton	Brazos-Colorado	Municipal	1,000	9/13/1928
3421	PHILLIPS PETROLEUM CO	Wharton	Brazos-Colorado	Mining		9/13/1928
4108	CHARLIE F JOCHETZ ET AL	Wharton	Brazos-Colorado	Irrigation	400	5/30/1981
4112	JAMES L FORGASON ET UX	Wharton	Brazos-Colorado	Irrigation	912	3/24/1981
4171	S W K LAND COMPANY ET AL	Wharton	Brazos-Colorado	Irrigation	1,011	11/30/1981
4203	RAYMOND A & JO MARIE RABIUS	Wharton	Brazos-Colorado	Irrigation	275	4/19/1982
4239	WAYNE LEE CORMAN ET AL	Wharton	Brazos-Colorado	Irrigation	300	9/7/1982
4330	RONALD & JOHNNIE M CLOUGH	Wharton	Brazos-Colorado	Irrigation	130	2/22/1983
4494	WAYNE ALLEN GUESS ET AL	Wharton	Brazos-Colorado	Irrigation	164	9/25/1984
4548	MARCIAL SORREL III TRUSTEE	Wharton	Brazos-Colorado	Irrigation	297	3/19/1985
4593	GARY W ROBERTS ET AL	Wharton	Brazos-Colorado	Irrigation	450	7/30/1985
4611	LEROY MACHA ET AL	Wharton	Brazos-Colorado	Irrigation	1,151	9/3/1985
5067	ELIZABETH ANN ULLMAN	Wharton	Brazos-Colorado	Irrigation	325	6/4/1986
5067	OMAR ARLT TRUST	Wharton	Brazos-Colorado	Irrigation	325	6/4/1986
5067	ROBERT STRUNK TRUST	Wharton	Brazos-Colorado	Irrigation	325	6/4/1986
5324	RABIUS CHILDREN TRUST	Wharton	Brazos-Colorado	Irrigation	87	10/25/1990
5338	BERNARD O STONE JR	Wharton	Brazos-Colorado	Irrigation	420	12/19/1990
5459	S & S FARMS, A JOINT VENTURE	Wharton	Brazos-Colorado	Irrigation	1,000	4/21/1993
5477	LOWER COLORADO RIVER AUTHORITY	Wharton	Brazos-Colorado	Irrigation		9/1/1907
5568	MORRISON TRUST	Wharton	Brazos-Colorado	Irrigation	1,120	1/15/1997
5573	ANNIE LEE ANSLEY	Wharton	Brazos-Colorado	Irrigation	1,289	1/21/1997
5623	STEVEN C CALLAWAY ET AL	Wharton	Brazos-Colorado	Irrigation	185	4/6/1999
5674	F JOE PREISLER JR ET AL	Wharton	Brazos-Colorado	Irrigation	152	2/4/2000
5684	WILLIAM A ANSLEY ET AL	Wharton	Brazos-Colorado	Irrigation	184	5/5/2000
5685	MARIE E SIKORA	Wharton	Brazos-Colorado	Irrigation	33	5/5/2000
5702	LESLIE W HUDGINS	Wharton	Brazos-Colorado	Irrigation	217	11/1/2000
5721	RONALD HUDGINS CALDWELL	Wharton	Brazos-Colorado	Irrigation	72	11/16/2000
4120	OEHMIG LAND & CATTLE COMPANY LLC	Wharton	Colorado	Irrigation	450	4/27/1981
5435	TRI-GEN LAND CORPORATION	Wharton	Colorado	Irrigation	2,200	12/31/1955
5436	CROUCH FAMILY LIMITED PARTNERSHIP LLP	Wharton	Colorado	Irrigation	715	6/26/1914
5475	LOWER COLORADO RIVER AUTHORITY	Wharton	Colorado	Irrigation		9/1/1907
5477	LOWER COLORADO RIVER AUTHORITY	Wharton	Colorado	Irrigation	55,000	9/1/1907
5477	LOWER COLORADO RIVER AUTHORITY	Wharton	Colorado	Municipal		9/1/1907
5477	LOWER COLORADO RIVER AUTHORITY	Wharton	Colorado	Industrial		9/1/1907
5477	LOWER COLORADO RIVER AUTHORITY	Wharton	Colorado	Recreation		9/1/1907
4562	MERLE T CARLSON ET AL	Wharton	Colorado-Lavaca	Recreation		5/7/1985
4562	MERLE T CARLSON ET AL	Wharton	Colorado-Lavaca	Municipal		5/7/1985
4562	MERLE T CARLSON ET AL	Wharton	Colorado-Lavaca	Other	111	5/7/1985
4773	EDMUND HOLUB	Wharton	Colorado-Lavaca	Irrigation	160	12/31/1951
4774	JOHN T GANN JR	Wharton	Colorado-Lavaca	Irrigation	63	6/30/1948
4775	KATHRYN & LEIGH ANN ALLEN	Wharton	Colorado-Lavaca	Irrigation	640	12/31/1941

Note: Water Rights 5478 and 5482 are storage and diversion rights.

WATER RIGHTS
LOWER COLORADO REGIONAL WATER PLANNING AREA (REGION K)

Water Right Number	Owner	County	Basin	Use	Max. Permitted Diversion (ac-ft/yr)	Priority Date
4776	JOHN T GANN JR	Wharton	Colorado-Lavaca	Irrigation	228	12/31/1941
4777	PATSY RUTH COX CARLQUIST	Wharton	Colorado-Lavaca	Irrigation	640	4/30/1944
4778	JAMES R HLAVINKA	Wharton	Colorado-Lavaca	Irrigation	1,093	3/31/1953
4779	SOUTH TEXAS RICE INC	Wharton	Colorado-Lavaca	Irrigation	247	4/30/1923
4779	ELIAS RICHARD CALLAHAN	Wharton	Colorado-Lavaca	Irrigation	133	4/30/1923
4779	ELIAS R CALLAHAN ET UX	Wharton	Colorado-Lavaca	Irrigation	82	4/30/1923
4784	SOUTH TEXAS LAND LTD PARTNER	Wharton	Colorado-Lavaca	Irrigation	324	4/30/1944
4785	MAREK FARMS ET AL	Wharton	Colorado-Lavaca	Irrigation	26	4/30/1944
5477	LOWER COLORADO RIVER AUTHORITY	Wharton	Colorado-Lavaca	Irrigation		9/1/1907
5595	E G GOFF ET AL	Wharton	Lavaca	Irrigation	1,550	9/27/2000
5706	ANTON BRANDL JR ET UX	Wharton	Lavaca	Irrigation	104	10/1/2000
5667	NNP-TERAVISTA LP	Williamson	Brazos	Recreation		12/13/1999

Note: Water Rights 5478 and 5482 are storage and diversion rights.

APPENDIX 3B

TCEQ WAM VERSUS LCRA RESPONSE MODEL

TCEQ WAM versus LCRA Response Model

Feature	TCEQ WAM	LCRA Response
a. Computational Issues		
i. Data Units	User defined. Typically acre-feet per month.	Data cards/files have associated units, stream flow and diversion rates are CFS, volumes are Acre-Feet, and areas are in acres. Depths are either feet or inches, depending on the data.
ii. Time Step	Monthly.	Daily time step for the river downstream of Mansfield Dam. Monthly time step for the operations of the five Highland Lakes.
b. Physical System		
i. Hydrology	Long-term time series of naturalized monthly flows required for all primary control point locations (gauged locations). These data can be prorated based on numerous techniques to an unlimited number of secondary control points (ungauged locations).	Daily stream flow for 1941-1965 from TDWR report LP-60 “Present and Future Surface-Water Availability in the Colorado River Basin, Texas” published in 1978. Combined inflow at Mansfield Dam is reach 1, and 3 downstream reaches have incremental lateral inflows which accumulate downstream.
ii. Evaporation	Historical monthly evaporation required in feet per month at site-specific locations, i.e., major reservoirs. Can be either simple net evaporation or more complex adjusted net evaporation.	Monthly net lake evaporation data from TWDB for Highland Lakes (units=Feet). Monthly gross lake evaporation and precipitation data from TWDB for irrigation districts during growing season (units=Inches)
iii. Physical Component Descriptions	All major physical features of basin represented at control points (reservoirs, diversions, return flows, spring discharges, channel losses for downstream reach, etc). Each item described and related within code-specific WRAP data input file.	Five Highland Lakes (Buchanan, Inks, LBJ, Marble Falls, Travis) are included, with only Buchanan and Travis usually allowed to vary from normal operation level. No flood control storage and no hydro-electric generation considerations.
iv. Major Water Rights	All represented at their actual locations in accordance with authorizations and limitations in their paper water right documents.	Four irrigation districts and the City of Austin are allowed to divert run-of-river water under their water rights. Shortages are backed-up with release of stored water from the Lakes Buchanan/Travis. LCRA thermal-electric generation demands assumed to be met directly from Lakes Buchanan/Travis. STP routines not integral to model.
v. Minor Water Rights	All represented at their actual locations in accordance with authorizations and limitations in their paper water right documents.	Generally considered insignificant, but may be represented as one composite diversion for irrigation demand.
vi. Cooling Reservoirs		Not directly modeled. Demands for Ferguson, Sim Gideon & Lost Pines (Lake Bastrop), and FPP are met as monthly demand diverted directly out of Lakes Buchanan/Travis.
1. FPP	Both Fayette and Baylor Creek Reservoirs are simulated pursuant to the language in their authorizing water rights and both receive firm stored water released from LCRA System storage (which is diverted from the Colorado River to each reservoir). Per WMP, a maximum of 38,101 acre-feet per year of stored water is provided for this demand. If the entire contract amount is not required in some years, the remaining unused balance is discarded from the model to assure full utilization of the 38,101 acre-feet per year.	n/a
2. Bastrop	Generally the same as Fayette and Baylor representation, except a different quantity of firm stored water (10,750 acre-feet per year) is released from LCRA System storage for this demand and diverted from the Colorado River to the reservoir. If the entire contract amount is not required in some years, the remaining unused balance is discarded from the model to assure full utilization of the 10,750 acre-feet per year.	n/a

Feature	TCEQ WAM	LCRA Response
3. Decker	Modeled consistent with specification in the authorizing water right with no LCRA System water provided as backup, but with Colorado River water available for diversion into reservoir at Decker's priority date.	n/a
4. STP	Modeled consistent with specifications in the authorizing water right (including complex flow conditions) and backed up with System stored water up to STP's authorized diversion amount, if required.	A separate model is used as a post-processor to RESPONSE.
vii. Return Flows	Specified by user as percentages of demands by various diverters.	Specified by user as percentages of demands by various diverters.
1. Municipal	No return flows are considered in baseline run. However, data input file incorporates provisions for municipal return flows (including Austin) and thus can be activated as necessary. User has flexibility of modeling return flow discharges during same month in priority order of associated water right or next month at beginning of time step.	No City of Austin return flows were used in the baseline run. City of Austin return flows were used as a Water Management Strategy (WMS) for meeting rice irrigation demands (WMS R1A - Utilization of City of Austin Return Flows). Return flows can be set as a percentage of diversion. For example, City of Austin return flow is typically set between 50% and 55% of municipal demand and enters the river just below the Austin gage. No time lag between diversion and return flow.
2. Agricultural	No return flows are considered in baseline run. However, data input file incorporates provisions for agriculture return flows for the large lower basin diverters (Garwood, Gulf Coast, Pierce Ranch, and Lakeside) and thus can be activated as necessary. User has flexibility of modeling return flow discharges during same month in priority order of associated water right or next month at beginning of time step.	For each irrigation district, percentage of area which drains back to river and percentage of demand that is returned are user specified and the return flows enter the river just above the Bay City gage, which is below all diverters.
viii. Configuration - Objects	Control points similar to Objects.	Not an object oriented model.
ix. Configuration - links	Reaches similar to Links.	Data files are constructed to represent the order and connections in the model.
1. Lags and travel times	No provision for time lags or travel time since it is a monthly model. However return flows may carry forward for the next month's simulation to allow return flows to be used in priority order.	Stream flow below Mansfield Dam is routed with fixed integer day time lags to all gages and diversion points. For each day, all demands and stream flow and lagged to equivalent day at Mansfield Dam.
2. Losses and routing methods	Simplified channel loss capability applied only to changes in flow. Site-specific channel losses can be defined at every control point for the reach immediately downstream, but the loss calculation is based on a constant loss rate independent of flow magnitude). Note that there are no channel losses in Colorado Basin WAM from Lake Travis to the Gulf. WAM does not rout stream flow hydrographs. Only changes to the total hydrograph at each point are passed downstream.	Losses are represented as negative incremental lateral inflow within a reach. Losses are met from upstream lateral inflows and reservoir releases.
c. Water Rights Modeling		
i. Adjudicated Water Rights Permit & Priorities	Individual water rights are simulated in priority date order in accordance with their paper right authorizations and limitations. Other priority and authorized amount considerations are available either in other model runs (diversion amounts based on maximum use in last 10 years) or different priority specifications in job control parameter (river order priority).	Starting at the downstream end, daily demands by water rights are satisfied, in the order of priority date, to extent possible, first with run-of-river flow. Calculations then work upstream, utilizing the incremental lateral inflow of each reach. If necessary, inflows at Mansfield Dam are passed thru in order to meet downstream senior rights. Inflow at Mansfield Dam that is not passed thru to senior rights is the amount of storable inflow for that day. Daily demands are never short due to release rule limitations and adjustments made to input conditions through iterations.

TCEQ WAM versus LCRA Response Model

Feature	TCEQ WAM	LCRA Response
ii. Subordination Solution Methodology	Model allows switching of priority between entities that are party to a subordination agreement with additional quantity limitations based on terms of agreement.	Subordination options exist, but since Pierce Ranch water right was purchased by LCRA, it treats the CoA Lake Austin portion to be senior to Gulf Coast, Lakeside and Pierce Ranch irrigation operations.
iii. Downstream Releases	Reservoir releases are triggered when a water right with contracted access to reservoir storage experiences a run of river diversion shortage. Water rights may contract for reservoir releases from any number of reservoirs, and releases can be limited by the state of hydrology at other locations in the model.	Shortages are summed each day for all diversions which have backup from storage. A release from Lake Buchanan/Travis will be made out of storage to meet that shortage.
1. Forecast and advance knowledge issues	Model does not have knowledge of future conditions (before time step is encountered). Instead, model reacts to whatever flows/shortages are encountered at the instant in the priority loop during a time step when a particular water use activity is simulated.	All demands and incremental lateral inflows are known ahead and lagged back in time to Mansfield Dam. Then release decisions are made based on this knowledge.
2. Routing	No routing. All simulated flows are monthly values representative of individual monthly time steps.	Integer day routing of releases made to all gages and diversion points.
d. System Operating Modeling Methodology	All system topology and operating logic are specified in the DAT input file.	The relative location and priorities of all diverters are specified in the input files “alter” and “system”.
i. Interruptible Delivery	Interruptible water is simulated as stored water available for use as back up for run-of-river water use activities. The back up amount is subject to curtailment based on beginning-of-year LCRA System storage. Note that there is no separate pool of stored water for “interruptible uses”. For all “interruptible uses”, back up water is released from System storage at the 1987 priority date. The priorities for releasing stored System water among the various “interruptible uses” is the same as that of the interruptible water use activities.	The designation of access to interruptible storage causes a particular calculation to be done to determine the annual water demand for each year of simulation for that irrigation district. At the beginning of each simulation year, the amount of water stored in Lakes Buchanan/Travis determines an interruptible supply amount for that year. This supply value is then used to set acreages to be planted that year in each irrigation district that has interruptible storage. The interruptible supply amount needs to be adjusted for the conditions of simulation. The acreage, along with historical meteorological data are used to calculate the water demand for that year. There is no separation of the water in storage between firm and interruptible amounts.
ii. Instream Flow Criteria	Critical Instream Flow criteria are satisfied (reserved), to the extent possible, from System inflows at a 1926 priority date. Any remaining shortages are made up with stored water from LCRA system storage and are not subject to curtailment. Target Instream Flow criteria are satisfied (reserved), to the extent possible, from System inflows at a 1926). Target Instream Flow criteria are not supported with stored water to the system from LCRA System storage beyond inflows.	At the beginning of each simulation year, the amount of water stored in Lakes Buchanan/Travis determines the appropriate level of instream flow goal for the year. Each day, release and subsequent diversion for downstream demands is added to the stream flow at all locations. These resulting flows are compared to the instream flow goal and additional release may be called. If the goal is target level, the release is limited to no more the storable inflow for that day. However, according to the current WMP policies release to meet the critical level goal is not restricted by the storable inflow amount.
iii. Bay and Estuary Criteria	Critical Bay and Estuary Inflow criteria are satisfied (reserved), to the extent possible, from System inflows at a 1926 priority date. Critical Bay and Estuary Inflow criteria are not supported with stored water from LCRA system storage. Target Instream Flow criteria are satisfied (reserved), to the extent possible, from System inflows at a 1926 priority date. Target Instream Flow criteria are not supported with stored water from LCRA System storage beyond inflows to the system.	At the beginning of each simulation year, the amount of water stored in Lakes Buchanan/Travis determines the appropriate level of freshwater inflow goal for the estuary. This is a monthly criteria measured by the stream flow passing the Bay City gage. During each month, the sum of daily Bay City gage stream flow after other releases and spills is compared to the freshwater inflow goal and additional release may be called. For all levels of freshwater inflow goal, this additional monthly release is limited to no more than the storable inflow for that month that was not already released for instream flow purpose.

TCEQ WAM versus LCRA Response Model

Feature	TCEQ WAM	LCRA Response
iv. Firm Contracts	For Firm Water Contracts, the specific diversion amounts that are specified in the WMP are represented. Basically, the maximum quantity specified in the contract is used (or deducted) from the LCRA System storage each year. For Interruptible Water Contracts, the quantity computed within the WAM, with the curtailment scheme as specified in the WMP, is released from System storage to supplement these entities' water use requirements up to their authorized diversion amounts.	Demands for contracts are met as monthly demand diverted directly out of Lakes Buchanan/Travis.

APPENDIX 3C

FREESE AND NICHOLS, INC. SUBORDINATION METHODOLOGY

Region F
Water Planning Group

Freese and Nichols, Inc.
LBG-Guyton Associates, Inc.
MH_3 Consultants, Inc.
Alan Plummer Associates, Inc.

DRAFT TECHNICAL MEMORANDUM

To: Region F Water Planning Group
Lower Colorado Water Planning Group

From: Jon S. Albright – Freese and Nichols, Inc.
Andres Salazar, Ph.D. P.E. - Freese and Nichols, Inc.

Re: Subordination Analysis for Major Colorado Basin Water Rights

Date: May 18, 2005

Introduction

This memorandum describes the results of modeling of subordination of selected major water rights in the Colorado Basin performed by Freese and Nichols, Inc. (FNI) in March and April of 2005. The approach was developed by FNI in consultation with representatives of the Lower Colorado Region (Region K) and major water rights holders in the Colorado Basin. Oversight for the modeling process was provided by the Region K Modeling Committee. The results of this modeling have been presented to both the Region F and Lower Colorado (Region K) Regional Water Planning Groups. The sole purpose of this analysis is to provide information to the regional water planning groups. No water right holder will be obligated to abide by the results of this analysis.

Table 1 summarizes the yields of reservoirs in Region F. For use in the Region F water plan, Region F may reduce some of these yields to account for the impact of recent drought. Table 2 summarizes preliminary results developed by FNI for water rights in Region F. Region K is in the process of refining these results for use in the Region K water plan.

The subordination modeling consists of four different scenarios:

- Year 2000 conditions with no return flows

Table 1
Comparison of Supplies for Upper Basin Reservoirs from the 2001 Region F/Brazos G Regional Water Plans to Supplies from the Colorado WAM With and Without Subordination

(Values in Acre-Feet per Year)

Water Right Number	Water Right Name	Permitted Amounts	Supplies without Subordination[1]	Current Supplies [2]			End of Planning Period Supplies [3]		
				2001 Region F/G Plans	Subordination with No Return Flows	Subordination with Austin Return Flows	2001 Region F/G Plans[4]	Subordination with No Return Flows	Subordination with Austin Return Flows
CA 1002	Lake Thomas	23,000	0	8,150	10,550	10,650	8,042	10,700	10,650
CA 1009	Lake Champion	6,750	10	3,473	2,630	2,530	3,285	2,390	2,350
CA 1009	Lake Colorado City	5,500	0	3,384	3,140	3,160	2,665	2,150	1,900
CA 1008	Spence Reservoir	41,573	100	34,450	41,573	41,573	34,134	41,573	41,573
CA 1031	Oak Creek Reservoir	10,000	5	4,273	2,400	2,540	3,645	2,110	2,140
CA 1072	Lake Ballinger	1,685	30	1,685	950	1,040	1,405	890	980
CA 1095	Lake Winters	1,360	0	997	730	780	931	720	760
CA 1318/1319	Twin Buttes - Nasworthy	54,000	10	13,500	13,630	13,620	12,550	12,440	12,310
CA 1190	Fisher Reservoir	80,400	0	2,257	5,750	5,510	1,462	4,590	4,400
A 3866/P 3676	Ivie Reservoir	113,000	113,000	85,890	78,400	78,080	77,370	66,250	65,370
CA 1705	Hords Creek Lake	2,240	0	1,176	1,420	1,360	1,118	1,240	1,260
CA 1702	Lake Coleman	9,000	5	7,022	8,610	8,140	6,412	7,990	7,830
CA 1660	Lake Clyde [4]	1,200	0	500	810	750	500	720	690
CA 2454	Lake Brownwood	29,712	29,712	29,000	29,712	29,712	26,200	28,570	28,140
CA 1849	Brady Creek Lake	3,500	0	1,802	2,310	2,000	1,604	2,220	1,970
CA 1570	Junction Run-of-River [5]	1,000	0	873	1,000	1,000	873	1,000	1,000
	Total	*383,830*	*142,872*	*198,432*	*203,615*	*202,445*	*182,196*	*185,553*	*183,323*

1 Firm yields from the R.J. Brandes Co. report *Water Availability Modeling for the Colorado /Brazos Colorado Basin*, December 2001.
2 Year 2000 conditions safe yields
3 The supplies from the 2001 plans are for 2050 conditions, which was the end of the planning period for the 2001 regional plans. Supplies with subordination are for 2060 conditions, which is the end of the planning period in the current round of planning.
4 Lake Clyde is in Region G. All other sources are in Region F.
5 Supply for the City of Junction is equal to the minimum annual diversion.

Table 2
Comparison of Base Run to Preliminary Region K Impact Run
(Values in Acre-Feet per Year)

Year 2000 Conditions with No Return Flows

Water Right Number	Water Right Name	Base Run					Subordination					Increase (Decrease) due to Subordination			
		Target	Mean annual diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Target	Mean annual Diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Mean Annual Diversion	Minimum Annual Diversion	Average diversion 1950-1957	Volume Reliability
CA 5434	Corpus Christi	35,000	34,876	99.64	31,483	34,083	35,000	34,494	98.55	25,021	32,005	(381)	(6,462)	(2,078)	(1.09)
CA 5434	LCRA Garwood	133,000	133,000	100.00	133,000	133,000	133,000	132,357	99.52	130,592	132,200	(643)	(2,409)	(800)	(0.48)
CA 5476	LCRA Gulf Coast	262,500	251,989	96.00	120,795	216,559	262,500	248,275	94.58	82,230	177,703	(3,713)	(38,565)	(38,856)	(1.42)
CA 5475	Lakeside 1	131,250	124,251	94.67	25,960	96,944	131,250	122,360	93.23	23,655	74,538	(1,891)	(2,305)	(22,405)	(1.44)
CA 5475	Lakeside 2	55,000	53,343	96.99	23,571	47,186	55,000	52,922	96.22	19,102	39,936	(421)	(4,469)	(7,250)	(0.77)
CA 5477	Pierce Ranch	55,000	53,335	96.97	22,238	47,129	55,000	52,508	95.47	19,102	39,648	(827)	(3,136)	(7,481)	(1.50)
CA 5471	City of Austin Town Lake	24,000	22,476	93.65	15,400	21,298	24,000	16,781	69.92	6,000	16,977	(5,695)	(9,400)	(4,321)	(23.73)
CA 5471	City of Austin	250,000	250,000	100.00	250,000	250,000	250,000	249,513	99.81	228,041	246,405	(488)	(21,959)	(3,595)	(0.19)
CA 5471	City of Austin Lake Austin	21,403	21,403	100.00	21,403	21,403	21,403	21,314	99.58	18,675	20,747	(89)	(2,728)	(656)	(0.42)
CA 5480	LCRA LBJ	15,700	15,700	100.00	15,700	15,700	15,700	15,700	100.00	15,700	15,700	0	0	0	0.00
CA 5482/5478	LCRA remaining yield *	239,800	239,800	100.00	239,800	239,800	0	0	0.00	0	0	(239,800)	(239,800)	(239,800)	(100.00)

Year 2000 Conditions with Austin Return Flows

Water Right Number	Water Right Name	Base Run					Subordination					Increase (Decrease) due to Subordination			
		Target	Mean annual diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Target	Mean annual Diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Mean Annual Diversion	Minimum Annual Diversion	Average diversion 1950-1957	Volume Reliability
CA 5434	Corpus Christi	35,000	35,000	100.00	35,000	35,000	35,000	34,904	99.73	31,911	34,999	(96)	(3,089)	(1)	(0.27)
CA 5434	LCRA Garwood	133,000	133,000	100.00	133,000	133,000	133,000	132,639	99.73	132,999	132,999	(361)	(1)	(1)	(0.27)
CA 5476	LCRA Gulf Coast	262,500	252,519	96.20	132,258	217,889	262,500	250,623	95.48	88,694	187,950	(1,896)	(43,564)	(29,939)	(0.72)
CA 5475	Lakeside 1	131,250	124,559	94.90	37,839	98,089	131,250	123,487	94.09	28,740	79,403	(1,073)	(9,099)	(18,686)	(0.81)
CA 5475	Lakeside 2	55,000	53,394	97.08	23,571	47,245	55,000	53,097	96.54	20,378	41,513	(297)	(3,193)	(5,732)	(0.54)
CA 5477	Pierce Ranch	55,000	53,786	97.79	23,511	48,380	55,000	53,093	96.53	20,378	42,303	(693)	(3,134)	(6,077)	(1.26)
CA 5471	City of Austin Town Lake	24,000	22,691	94.55	15,400	21,448	24,000	17,431	72.63	9,575	16,761	(5,260)	(5,825)	(4,687)	(21.92)
CA 5471	City of Austin	250,000	250,000	100.00	250,000	250,000	250,000	250,000	100.00	250,000	250,000	0	0	0	0.00
CA 5471	City of Austin Lake Austin	21,403	21,403	100.00	21,403	21,403	21,403	21,403	100.00	21,403	21,403	0	0	0	0.00
CA 5480	LCRA LBJ	15,700	15,700	100.00	15,700	15,700	15,700	15,700	100.00	15,700	15,700	0	0	0	0.00
CA 5482/5478	LCRA remaining yield *	297,300	297,300	100.00	297,300	297,300	25,500	25,500	100.00	25,500	25,500	(271,800)	(271,800)	(271,800)	0.00

* Yield from the Highland Lakes system after meeting all other commitments. In the original TCEQ Colorado WAM, which included subordination of the Highland Lakes to Ivie Reservoir, the LCRA remaining yield was 178,300 acre-feet per year. Removal of Ivie subordination and other changes required adjustment of this target amount for each scenario. Region K consultants may adjust interruptible triggers to increase the supply from this category. The reliability of other water rights may change as a result.

CA 5479 has no permitted supply and is not reported in Table 2.

Table 2 (continued)
Comparison of Base Run to Preliminary Region K Impact Run

Year 2060 Conditions with No Return Flows

Water Right Number	Water Right Name	Base Run					Subordination					Increase (Decrease) due to Subordination			
		Target	Mean annual diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Target	Mean annual Diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Mean Annual Diversion	Minimum Annual Diversion	Average diversion 1950-1957	Volume Reliability
CA 5434	Corpus Christi	35,000	34,876	99.64	31,483	34,083	35,000	34,494	98.55	25,021	32,005	(381)	(6,462)	(2,078)	(1.09)
CA 5434	LCRA Garwood	133,000	133,000	100.00	133,000	133,000	133,000	132,357	99.52	111,740	132,200	(643)	(21,260)	(800)	(0.48)
CA 5476	LCRA Gulf Coast	262,500	194,672	74.16	72,925	149,043	262,500	193,822	73.84	74,055	145,797	(850)	1,130	(3,246)	(0.32)
CA 5475	Lakeside 1	131,250	79,764	60.77	19,528	54,877	131,250	80,983	61.70	19,768	53,324	1,218	240	(1,553)	0.93
CA 5475	Lakeside 2	55,000	45,320	82.40	10,769	34,389	55,000	43,737	79.52	10,769	32,225	(1,583)	0	(2,164)	(2.88)
CA 5477	Pierce Ranch	55,000	46,263	84.11	10,769	34,854	55,000	46,345	84.26	10,769	35,952	82	0	1,099	0.15
CA 5471	City of Austin Town Lake	24,000	22,476	93.65	15,400	21,298	24,000	17,161	71.50	6,101	17,405	(5,315)	(9,299)	(3,893)	(22.15)
CA 5471	City of Austin	250,000	250,000	100.00	250,000	250,000	250,000	250,000	100.00	250,000	250,000	0	0	0	0.00
CA 5471	City of Austin Lake Austin	21,403	21,403	100.00	21,403	21,403	21,403	21,403	100.00	21,403	21,403	0	0	0	0.00
CA 5480	LCRA LBJ	15,700	15,700	100.00	15,700	15,700	15,700	15,700	100.00	15,700	15,700	0	0	0	0.00
CA 5482/5478	LCRA remaining yield *	402,000	402,000	100.00	402,000	402,000	84,400	84,400	100.00	84,400	84,400	(317,600)	(317,600)	(317,600)	0.00

Year 2060 Conditions with Austin Return Flows

Water Right Number	Water Right Name	Base Run					Subordination					Increase (Decrease) due to Subordination			
		Target	Mean annual diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Target	Mean annual Diversion	Volume Reliability	Minimum annual diversion	Average diversion 1950-1957	Mean Annual Diversion	Minimum Annual Diversion	Average diversion 1950-1957	Volume Reliability
CA 5434	Corpus Christi	35,000	35,000	100.00	35,000	35,000	35,000	34,900	99.71	31,911	34,999	(100)	(3,089)	(1)	(0.29)
CA 5434	LCRA Garwood	133,000	133,000	100.00	133,000	133,000	133,000	132,609	99.71	111,740	132,999	(391)	(21,260)	(1)	(0.29)
CA 5476	LCRA Gulf Coast	262,500	203,584	77.56	72,962	159,235	262,500	202,700	77.22	74,289	156,692	(885)	1,327	(2,543)	(0.34)
CA 5475	Lakeside 1	131,250	82,877	63.14	21,329	59,477	131,250	83,857	63.89	22,184	56,957	979	855	(2,520)	0.75
CA 5475	Lakeside 2	55,000	46,858	85.20	10,894	36,780	55,000	45,526	82.77	10,894	35,373	(1,332)	0	(1,407)	(2.43)
CA 5477	Pierce Ranch	55,000	48,274	87.77	12,902	37,715	55,000	48,560	88.29	12,902	38,559	286	0	844	0.52
CA 5471	City of Austin Town Lake	24,000	22,717	94.65	15,400	21,448	24,000	17,264	71.93	7,322	16,781	(5,453)	(8,078)	(4,667)	(22.72)
CA 5471	City of Austin	250,000	250,000	100.00	250,000	250,000	250,000	250,000	100.00	250,000	250,000	0	0	0	0.00
CA 5471	City of Austin Lake Austin	21,403	21,403	100.00	21,403	21,403	21,403	21,403	100.00	21,403	21,403	0	0	0	0.00
CA 5480	LCRA LBJ	15,700	15,700	100.00	15,700	15,700	15,700	15,700	100.00	15,700	15,700	0	0	0	0.00
CA 5482/5478	LCRA remaining yield *	433,000	433,000	100.00	433,000	433,000	125,700	125,700	100.00	125,700	125,700	(307,300)	(307,300)	(307,300)	0.00

* Yield from the Highland Lakes system after meeting all other commitments. In the original TCEQ Colorado WAM, which included subordination of the Highland Lakes to Ivie Reservoir, the LCRA remaining yield was 178,300 acre-feet per year. Removal of Ivie subordination and other changes required adjustment of this target amount for each scenario. Region K consultants may adjust interruptible triggers to increase the supply from this category. The reliability of other water rights may change as a result.

CA 5479 has no permitted supply and is not reported in Table 2.

- Year 2000 conditions with current City of Austin return flows
- Year 2060 conditions with no return flows
- Year 2060 conditions with projected 2060 City of Austin return flows

The remainder of this memorandum describes the background and need for the subordination modeling, the approach used for the modeling, and the results of the modeling.

Background and Need for Subordination Modeling

The TWDB requires the use of the Colorado WAM for regional water planning. Table 3 compares the supplies for the Region F water rights using the Colorado WAM to those used in previous state water plans. As Table 3 shows, the Colorado WAM gives a very different assessment of water availability for many reservoirs in Region F than assumed in previous plans. The primary difference between the supply analysis used in previous plans and the Colorado WAM is that previous plans did not assume that senior lower basin water rights would continuously make priority calls on upper basin water rights. Other differences with less impact include a shorter period of hydrologic analysis, assumptions about channel losses, and the use of return flows.

In many cases the supplies in Table 3 are the sole source of water for the owners of the reservoirs and there are no cost-effective alternative supplies. For example, Lake Ballinger, Lake Winters, Lake Coleman and Hords Creek Reservoir are the only source of water for the communities of Ballinger, Winters and Coleman but have little or no yield in the WAM. The reservoirs in Table 3 are not operated according to the way that they are modeled in the WAM. For example, CRMWD does not pass water from its own reservoirs downstream to Lake Ivie. Also, other reservoirs do not routinely pass inflows to downstream senior water rights; flows are only passed downstream if there is a priority call. Many of the water rights throughout the basin do not function at their full permitted diversion and storage. There are many other examples of how the WAM model differs from the way that the Colorado Basin has historically been operated. Therefore the WAM may not be an accurate assessment of actual water supplies as used in the basin.

Table 3
Comparison of Supplies from Major Region F Water Rights from the 1997 State Water Plan, the 2001 Region F Plan, and the Colorado Water Availability Model
(Values in Acre-Feet per Year)

Reservoir Name	Yield from 1997 State Water Plan [a]	Firm Yield from 2001 Region F Plan [a]	Firm Yield from WAM Run 3 [b]
Lake J. B. Thomas	151,800 [c]	9,900	780 [d]
E. V. Spence Reservoir		38,776	
O. H. Ivie Reservoir		96,169	86,110 [e]
Lake Colorado City	5,500	4,550	0
Champion Creek Reservoir	5,000	4,081	0
Oak Creek Reservoir	4,800	5,684	0
Lake Coleman	7,090	8,822	30
Lake Winters/ New Lake Winters	1,160	1,407	0
Lake Brownwood	31,400	41,800	40,612 [e]
Hords Creek Lake	1,200	1,425	0
Lake Ballinger / Lake Moonen	1,600	3,566	40
O. C. Fisher Lake	13,200	2,973	0
Twin Buttes Reservoir	31,400	8,900	50 [d]
Lake Nasworthy	500	7,900	
Brady Creek Reservoir	3,100	2,252	10
Junction Run-of-River	814	873	0
Total	*258,564*	*239,078*	*127,632*

a 1997 and 2001 Water Plan yields are for year 2000 sediment conditions
b WAM supplies are for original sediment conditions except where noted
c Individual yields not reported for Thomas, Spence or Ivie in the 1997 State Water Plan
d Individual yields not computed in the Colorado WAM report
e WAM yield using year 2000 sediment conditions at reservoir

Although the Colorado WAM does not give an accurate assessment of water supplies based on the way the basin has historically been operated, TWDB requires use of the WAM in regional water planning. Therefore these sources in Region F have no supply by definition, even though in practice their supply may be greater than indicated by the WAM. One way to reserve some supplies for these water rights in the planning process is to assume that downstream senior water rights do not make priority calls on major upper basin municipal water rights. This assumption is similar to the methodology used in previous water plans.

Table 4 is shows the major water rights in the Colorado Basin considered in the subordination analysis. Figure 1 shows the location of theses water rights. The LCRA/Corpus Christi water rights with a 1900 priority date are the most senior major water rights. Lake Brownwood has a 1925 priority date, making it the most senior reservoir. The Highland Lakes Rights (Lake Buchanan, Inks Lake, Lake LBJ, Lake Marble Falls and Lake Travis) are the next most senior rights, with a storage priority of 1926 and a diversion priority of 1938. Ivie Reservoir is the most junior reservoir with a 1978 priority date. However, as modeled in the Colorado WAM, Ivie Reservoir can impound water at the same 1926 priority date as Lake Buchanan. (TCEQ elected to model Ivie Reservoir in this fashion to address the impact of the reservoir on the yield of the Highland Lakes system as specified in the LCRA Water Management Plan.)

The instream flow and bay and estuary requirements associated with the LCRA Water Management Plan essentially function as water rights in the WRAP model and affect water availability for all water rights with priority dates after 1926. Therefore the instream flow and bay and estuary requirements are also subject to subordination in this analysis.

In Region F there are fifteen major reservoirs (reservoirs with more than 5,000 acre-feet of storage). Lake Ballinger, Brady Creek Reservoir, Lake Brownwood, Lake Coleman, O.C. Fisher Reservoir, Hords Creek Lake, Ivie Reservoir, Lake Nasworthy, Oak Creek Lake, Spence Reservoir, Lake Thomas, Twin Buttes Reservoir, and Lake Winters are primarily used for municipal supplies. Champion Creek Reservoir and Lake Colorado City are used solely for steam-electric power generation. Oak Creek Lake and Lake Nasworthy also provide some water for steam-electric power generation. Twin Buttes Reservoir and Lake Brownwood supply water for irrigation. In addition to the reservoir water rights, the City of Junction relies on a run-of-the-river right with a small amount of storage as its sole source of water. This right has no reliable supply in the WAM. Therefore, the Junction water right was included in the subordination analysis.

Table 4
Water Rights Considered in the Subordination Analysis

Water Right	Owner	Type of Use	Authorized Diversion (Acre-Feet)	Priority Date	Authorized Storage (Acre-Feet)	Reservoir Name	Remarks
CA 5434	LCRA	Irr	133,000	11/1/1900	86		Garwood
	City of Corpus Christi	Mun	35,000	11/2/1900			
		Total	*168,000*		*86*		
CA 5476	LCRA	Irr	228,570	12/1/1900			Gulf Coast. Subordinate to Lake Austin rights.
		Irr	33,930	11/1/1987			
				11/8/1939	78	Bay City Dam	
				10/24/1983	305	Lane City Dam	
		Hydro		None			2,142,180 ac-ft/yr maximum diversion on a non-priority basis.
		Total	*262,500*		*78*		
CA 5475	LCRA	Irr	52,500	1/4/1901	9,600	Eagle Lake	Lakeside. Subordinate to Lake Austin rights.
		Irr	78,750	11/1/1987			
		Irr	55,000	9/1/1907			Modeled with a 9/2/1907 priority date in Colorado WAM
		Total	*186,250*		*9,600*		
CA 5477	LCRA	Mun, Irr, Ind, Rec	55,000	9/1/1907			Pierce Ranch. Senior to 55,000 ac-ft/yr with same priority date in CA 5475
CA 5471	City of Austin	Mun	250,000	6/30/1913	21,000	Lake Austin	Diversion from Lake Austin & Town Lake
		Irr	150	6/30/1913			Diversion from Lake Austin & Town Lake
		Mun	21,403	6/27/1914			
		Rec		12/31/1928	10.7	Barton Springs Pool	
		Ind	24,000	6/27/1914			Diversion from Lake Austin & Town Lake
				6/27/1914	3,520	Town Lake	
		Hydro		None			Hydro junior to all existing & future water rights
		Total	*295,553*		*24,531*		

Table 4: Water Rights Considered in the Subordination Analysis (continued)

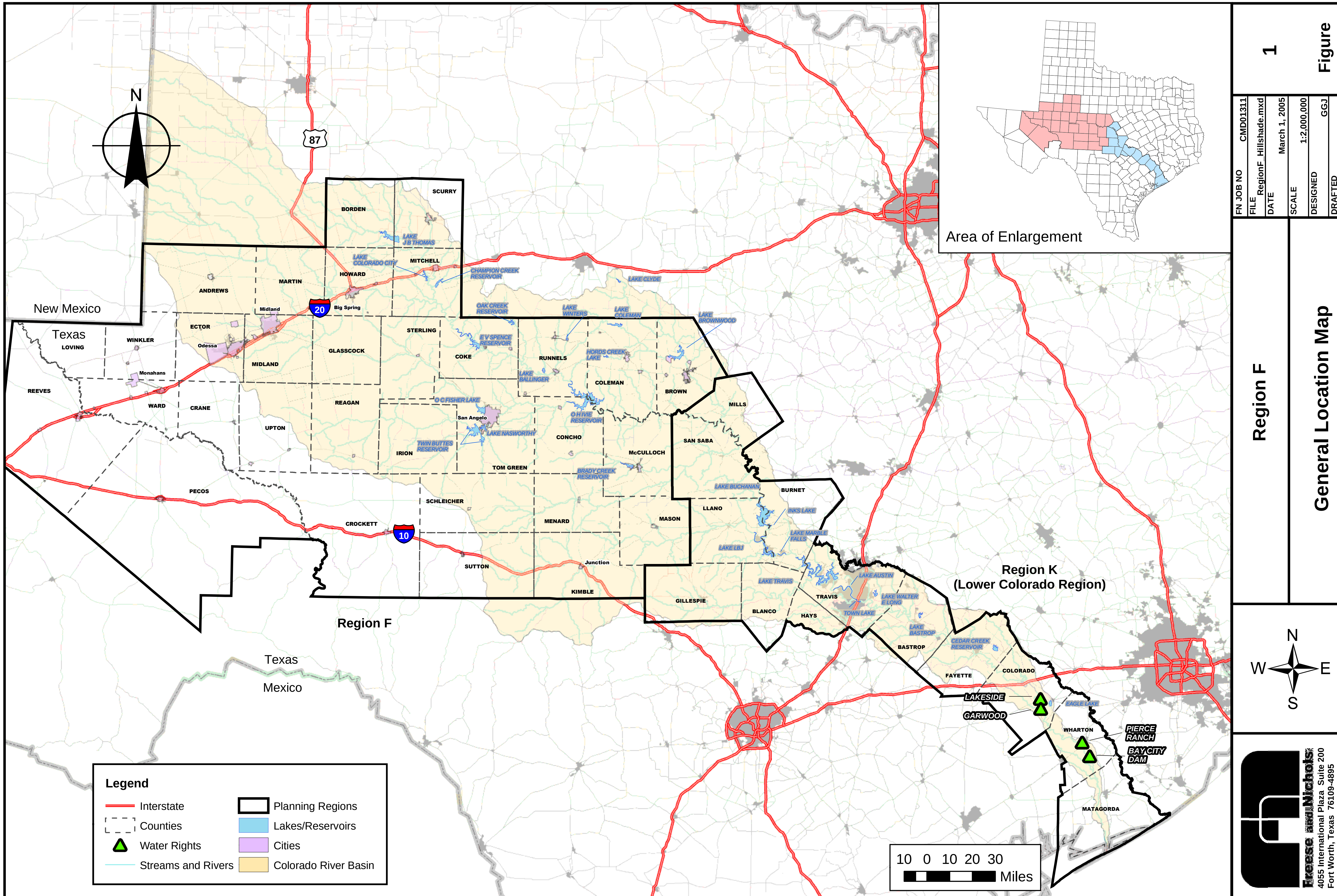
Water Right	Owner	Type of Use	Authorized Diversion (Acre-Feet)	Priority Date	Authorized Storage (Acre-Feet)	Reservoir Name	Remarks
CA 2454	Brown County Water Improvement District No. 1	Mun	15,996	9/29/1925	114,000	Lake Brownwood	12,797 ac-ft/yr authorized use
		Ind	5,004	9/29/1925			4,003 ac-ft/yr authorized use
		Irr	8,712	9/29/1925			6,970 ac-ft/yr authorized use
		Total	*29,712*		*114,000*		23,770 ac-ft/yr total
CA 5478	LCRA			3/29/1926	992,475	Lake Buchanan	
			532	12/31/1929			
		Mun, Irr, Ind, Rec, others	1,500,000	3/7/1938			Diversion also from Lake Travis. No priority calls above firm yield for water rights up to 11/1/1987 priority
		Hydro		None			Non-priority
		Total	*1,500,532*		*992,475*		
CA 5480	LCRA	Rec	0	3/29/1926	138,500	Lake LBJ	
		Ind	15,700	8/24/1970			
		Hydro		None			Non-priority
		Total	*15,700*		*138,500*		
CA 5479	LCRA	Rec	0	3/29/1926	17,545	Inks Lake	
		Hydro		None			Non-priority
		Total	*0*		*17,545*		
CA 5482	LCRA			3/29/1926	1,170,752	Lake Travis	Diversion also from Lake Buchanan
		Hydro		None			Non-priority
		Total	*0*		*1,170,752*		
CA 1570	Kimble County WCID	Mun	1,000	3/17/1931			For some reason changed to 910 ac-ft diversion in WAM
				11/23/1964	300	Lake Junction	
		Total	*1,000*		*300*		
CA 1319	City of San Angelo	Mun	17,000	3/11/1929	12,500	Lake Nasworthy	
		Ind	7,000	3/11/1929			
		Irr	1,000	3/11/1929			
		Total	*25,000*		*12,500*		
CA 1095	City of Winters	Mun	560	12/18/1944	2,447		
		Mun	600	6/5/1957			
				1/3/1979	5,900		
		Mun	200	2/7/1983			Plus 395 ac-ft/yr reuse
		Total	*1,360*		*8,347*		

Table 4: Water Rights Considered in the Subordination Analysis (continued)

Water Right	Owner	Water Right	Authorized Diversion (Acre-Feet)	Owner	Authorized Diversion (Acre-Feet)	Reservoir Name	Owner
CA 1705	City of Coleman	Mun	2,220	3/23/1946	7,959	Hords Creek Lake	
		D&L	20	3/23/1946			
		Total	*2,240*		*7,959*		
CA 1002	CRMWD	Mun, Ind, Min	30,000	8/5/1946	204,000	Lake J.B. Thomas	
CA 1072	City of Ballinger	Mun	1,000	10/4/1946	4,000	Lake Ballinger	
				Non-priority	800		Non-priority sediment storage
				4/7/1980	2,050	Lake Moonen	
		Total	*1,000*		*6,850*		
CA 1009	Texas Utilities Electric Company	Mun, Ind	5,500	11/22/1948	29,934	Lake Colorado City	
		Mun	2,700	4/8/1957	40,170	Champion Creek Reservoir	
		Ind	4,050	4/8/1957			
		Total	*12,250*		*70,104*		
CA 1031	City of Sweetwater	Ind	4,000	4/27/1949	30,000	Oak Creek Reservoir	
		Mun	6,000	4/27/1949			
		Total	*10,000*		*30,000*		
CA 1190	Upper Colorado River Authority	Mun, Ind, Min	80,400	5/27/1949	80,400	O.C. Fisher Reservoir	
CA 1702	City of Coleman	Mun	4,500	8/25/1958	40,000	Lake Coleman	
		Ind	4,500				
		Total	*9,000*		*40,000*		
CA 1318	San Angelo Water Supply Corporation	Irr	25,000	5/6/1959	170,000	Twin Buttes Reservoir	
		Mun	4,000	5/6/1959			Plus 25,000 AF authorized in CA 1319
		Total	*29,000*		*170,000*		
CA-1849	City of Brady	Mun	3,000	9/2/1959	30,000	Brady Creek Lake	
		Ind	500	9/2/1959			
		Total	*3,500*		*30,000*		
CA 1008	CRMWD	Mun	38,537	8/17/1964	488,760	Lake E.V. Spence	
		Ind	2,000	8/17/1964			
		Min	1,000	8/17/1964			
		Other	14,692	3/6/1984	2,500	Barber Reservoir	Water quality enhancement
		Total	*56,229*		*491,260*		

Table 4: Water Rights Considered in the Subordination Analysis (continued)

Water Right	**Owner**	**Water Right**	**Authorized Diversion** (Acre-Feet)	**Owner**	**Authorized Diversion** (Acre-Feet)	**Reservoir Name**	**Owner**
CA 1660	City of Clyde	Mun	1,000	2/2/1965	5,748	Lake Clyde	200 ac-ft/yr to Brazos Basin with a priority of 9/6/1985
A 3866 P 3676	CRMWD	Ind	10,000	2/21/1978	554,340	Ivie Reservoir	
		Mun	103,000	2/21/1978			
		Total	*113,000*		*554,340*		
	Grand Total		***2,888,226***		***4,179,375***		



Area of Enlargement
New Mexico
Texas
Mexico
Region F
Region K
(Lower Colorado Region)
BORDEN
SCURRY
MITCHELL
HOWARD
MARTIN
ANDREWS
ECTOR
WINKLER
LOVING
REEVES
WARD
CRANE
UPTON
MIDLAND
GLASSCOCK
STERLING
COKE
RUNNELS
COLEMAN
BROWN
MILLS
REAGAN
IRION
TOM GREEN
CONCHO
McCULLOCH
SAN SABA
PECOS
CROCKETT
SCHLEICHER
MENARD
MASON
LLANO
BURNET
SUTTON
KIMBLE
GILLESPIE
BLANCO
TRAVIS
HAYS
BASTROP
FAYETTE
COLORADO
WHARTON
MATAGORDA
Midland
Odessa
Big Spring
Monahans
San Angelo
Junction
LAKE J B THOMAS
LAKE COLORADO CITY
CHAMPION CREEK RESERVOIR
OAK CREEK RESERVOIR
E V SPENCE RESERVOIR
LAKE CLYDE
LAKE WINTERS
LAKE COLEMAN
LAKE BROWNWOOD
HORDS CREEK LAKE
LAKE BALLINGER
O C FISHER LAKE
O H IVIE RESERVOIR
LAKE NASWORTHY
TWIN BUTTES RESERVOIR
BRADY CREEK RESERVOIR
LAKE BUCHANAN
INKS LAKE
LAKE MARBLE FALLS
LAKE LBJ
LAKE TRAVIS
LAKE AUSTIN
TOWN LAKE
LAKE WALTER E LONG
LAKE BASTROP
CEDAR CREEK RESERVOIR
EAGLE LAKE
LAKESIDE
GARWOOD
PIERCE RANCH
BAY CITY DAM
20
10
87
N
W
E
S
Legend
Interstate
Counties
Water Rights
Streams and Rivers
Planning Regions
Lakes/Reservoirs
Cities
Colorado River Basin
10 0 10 20 30
Miles
Figure
1
FN JOB NO CMD01311
FILE RegionF_Hillshade.mxd
DATE March 1, 2005
SCALE 1:2,000,000
DESIGNED GGJ
DRAFTED GGJ
Region F
General Location Map
Freese and Nichols
4055 International Plaza Suite 200
Fort Worth, Texas 76109-4895
817-735-7300

Major water rights in Region K considered for the subordination analysis include senior rights owned by LCRA, the City of Austin and the City of Corpus Christi. These include the rights for the Highland Lakes, which are used for municipal, manufacturing, irrigation, steam-electric power and hydropower generation. The Highland Lakes also provide an important source of recreation for central Texas. The City of Austin rights are associated with Lake Austin, Town Lake and Lake Walter E. Long. These sources are used for municipal, manufacturing, irrigation, steam-electric power and hydropower generation. Lower basin rights owned by LCRA are currently used primarily for irrigation. The rights owned by the City of Corpus Christi will be used for municipal supplies once facilities to deliver the water have been constructed.

Two reservoirs providing water to the Brazos G planning region were included in the analysis. Lake Clyde is in Callahan County and provides water to the City of Clyde. Oak Creek Reservoir is located in Region F and supplies a small amount of water to water user groups within the region. However the reservoir is owned and operated by the City of Sweetwater, which is in the Brazos G Region. Both of these cities have other sources of water in addition to the supplies in the Colorado Basin.

Modeling Approach

At the time of this analysis the Water Rights Analysis Package (WRAP) did not have a method to directly model subordination of water rights. The model does not track water passed downstream by individual water rights to other senior water rights, only the total amount of water passed downstream. (WRAP is the model used for the Colorado WAM. A beta version of WRAP that includes some subordination options was made available at the time of completion of this analysis. This version of the model has not been evaluated at this time.) Because the model does not track the needed data, much of the calculation involved with the strategy was done outside of the model.

The modeling approach used a three-step process, with each step using a different model setup, referred to as a 'run'. These runs are:

- A Base Run of the basin operating in perfect priority order (similar to the Colorado WAM);
- A 'MiniWAM' of the upper basin water rights; and
- An Impact Run to assess the changes in water availability in Region K due to subordination.

Each step of the process is described in detail below.

These models were used to evaluate four different scenarios:

1. Year 2000 conditions with no return flows
2. Year 2000 conditions with current City of Austin return flows
3. Year 2060 conditions with no return flows
4. Year 2060 conditions with expected 2060 return flows from the City of Austin

City of Austin return flows were provided by Region K. Region F return flows were not included in the analysis because very little of the wastewater in the region is currently discharged into streams. The existing wastewater discharges will most likely be targeted for direct reuse at some point in the planning process.

Base Runs of the Full Colorado WAM

Different base runs were developed for each scenario. The base runs are modified versions of the TCEQ Colorado WAM Run 3 (November 12, 2004 version). The modifications include:

1. Original area-capacity relationships were replaced with either year 2000 conditions or 2060 conditions. Reservoirs in Region F used sedimentation rates developed by Freese and Nichols for the 2001 Region F Plan. Region K provided their own year 2000 and 2060 sediment conditions for the reservoirs in their region. Other reservoirs were based on WAM Run 8 data (the TCEQ current conditions run).

2. The subordination modeling of the Highland Lakes to Ivie Reservoir was removed. This prevented upstream reservoirs from passing water to satisfy Ivie Reservoir depletions.

3. The yield of the Highland Lakes system was increased to account for the removal of the subordination to Ivie Reservoir.

4. Pairs of dummy water rights with zero diversion were added to track the water passed by the junior water rights in the upper basin to the downstream senior water rights included in this subordination strategy. Table 5 includes a list of the junior water rights and Table 6 is a list of the senior water rights that were tracked with the dummy water rights. The first set of dummy water rights had a priority date one day senior and the second set of water rights had a priority date one day junior to the downstream senior water rights as specified in Tables 5 and 6, respectively. The difference in available water for these water rights represents the flow passed downstream.

Table 5
Junior Upstream Water Rights Used to Track Releases for Downstream Senior Water Rights

Junior Upstream Rights	Priority Date (mm/dd/yyyy)	Subordinated Senior Right Group*
Lake Thomas	5/08/1946	LCRA, Corpus and Austin Rights
Champion Creek Reservoir	4/08/1957	LCRA, Corpus and Austin Rights
Lake Colorado City	11/22/1948	LCRA, Corpus and Austin Rights
Spence Reservoir	8/17/1964	LCRA, Corpus and Austin Rights
Oak Creek Reservoir	4/27/1949	LCRA, Corpus and Austin Rights
Ballinger	10/04/1946	LCRA, Corpus and Austin Rights
Lake Winters	12/18/1944	LCRA, Corpus and Austin Rights
Fisher Reservoir	5/27/1949	LCRA, Corpus and Austin Rights
Twin Buttes Reservoir	5/06/1959	LCRA, Corpus and Austin Rights
Lake Nasworthy	3/11/1929	LCRA, Corpus and Austin Rights
Ivie Reservoir	2/21/1978	LCRA, Corpus and Austin Rights
Hords Creek Lake	3/23/1946	LCRA, Corpus and Austin Rights, and BCWID
Lake Coleman	8/25/1958	LCRA, Corpus and Austin Rights, and BCWID
Lake Clyde	2/02/1965	LCRA, Corpus and Austin Rights, and BCWID
Lake Brownwood	9/29/1925	LCRA irrigation, Corpus and Austin rights
Brady Creek Reservoir	9/02/1959	LCRA, Corpus and Austin Rights
Run-of-the river right City of Junction	11/23/1964	LCRA, Corpus and Austin Rights

* Subordination of Ivie Reservoir is described in step 2 above. Subordination of Lake Nasworthy is described in step 5 of the section *Hydrology for the MiniWAM.*

Table 6
Senior Water Rights Tracked for Releases by Junior Water Rights*

Senior Water Right Group	**Water Right Number**	**Priority Date** (mm/dd/yyyy)	**Total Diversion** (Ac-Ft/Yr)
LCRA	5434	11/1/1900	168,000
	5476	12/1/1900	228,570
	5475	1/4/1901	52,500
		9/2/1907	55,000
	5477	9/1/1907	55,000
		3/27/1926	Target & critical flows
	5478	3/29/1926	Refill Lake Buchanan
		12/31/1929	532
		3/7/1938	560,000
	5480	3/29/1926	Refill LBJ
	5479	3/29/1926	Refill Inks Lake
	5482	03/07/1938	178,300
City of Austin	5471	6/30/1913	250,000
		6/30/1913	150
		6/27/1914	21,403
		6/27/1914	24,000
		12/31/1928	Refill Barton Springs
BCWID	2454	9/29/1925	15,996
		9/29/1925	5,004
		9/29/1925	8,712

* Subordination of Ivie Reservoir is described in step 2 above. Subordination of Lake Nasworthy is described under Hydrology for the MiniWAM step 5.

5. Several of the senior water rights have multiple priority dates. Only the portions of water rights with priority dates of 1938 or earlier will be considered for subordination.

6. For the return flow scenarios, City of Austin wastewater return flows were added at the appropriate locations as constant monthly inflows (CI cards).

MiniWAM Runs of the Upper Basin Water Rights

The upper basin water rights (water rights in Region F and Brazos G) in Table 4 are assumed not to make calls on each other. To facilitate the modeling of this situation, a simplified 'MiniWAM' was developed which contains only the upper basin water rights. The MiniWAM uses artificial hydrology based on depletions by the water rights, flows passed downstream and unappropriated flow. The results of the MiniWAM became the basis for the Impact Model.

Figure 2 shows the primary control points in the MiniWAM. These control points are associated with the upstream water rights in Table 5. The hydrology for each primary control point is the sum of the water passed to the downstream senior water rights in Table 6, the depletions made by the junior water rights in the respective base run, and the unappropriated flow at each junior water right location. Flows at the secondary control points were calculated as the sum of flows from upstream control points. Equivalent channel losses were incorporated in the MiniWAMs as needed.

Each scenario has its own version of the MiniWAM with hydrology based on the corresponding base run. Hydrology for the MiniWAMs was developed as follows:

1. Using the output of the base runs, the water passed by a reservoir to a senior right was computed as the difference in the available flow at the junior water right's control point before and after allocating for the senior water rights. For example, the following formulas was applied for subordination of the Highland Lakes:

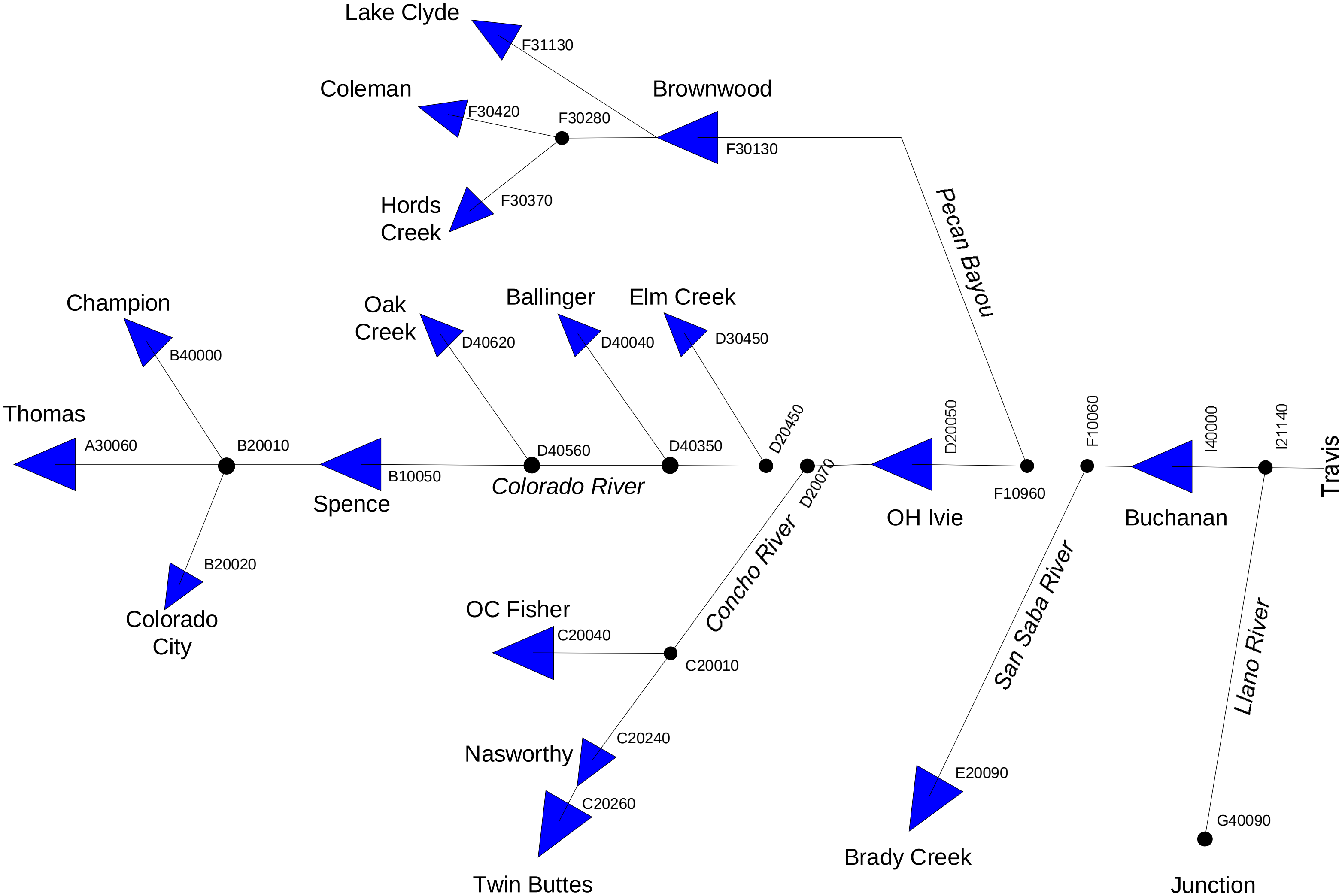
   Water passed to Highland Lakes for first refill (Priority 3/29/1926) =
   available at 3/28/1926 - available at 3/30/1926

   Water passed to Highland Lakes for second refill (Priority 3/08/1938) =
   available at 3/07/1938 - available at 3/09/1938

   The total water passed for senior water rights is the sum of the amounts passed for each individual senior water right.

2. Unappropriated flows at each junior water right control point were extracted from the WRAP output file for each base run. These unappropriated flows were added to the water passed by senior water rights from step 1 to develop flows for the MiniWAMs. These flows were input using IN cards, taking the place of the naturalized flows in the full Colorado WAM.

Figure 2
Schematic of MiniWAM



3. Depletions made by each junior water right under each base run were entered into the MiniWAM as flow adjustments (FA cards). Using FA cards eliminates the need to manually add the depletions at each downstream control point. The WRAP model adds these flows to the flows entered on the IN cards at each downstream control point, calculating the total flow at each control point adjusted for channel losses.

4. Lake Nasworthy was assumed to be subordinate to Twin Buttes Reservoir. Because of the relatively senior priority date of Lake Nasworthy, these two water rights were treated somewhat differently than other water rights in Table 5. In the base runs, the water passed by Twin Buttes was included in the depletions by Lake Nasworthy. To implement subordination, the flows passed by Twin Buttes to Lake Nasworthy were added to the Twin Buttes unappropriated flows. Equal amounts were subtracted at Lake Nasworthy, after adjusting for channel losses if needed.

5. Evaporation and area capacity relationships in the MiniWAM were identical to those used in the equivalent base run of the full Colorado WAM.

The MiniWAMs were used to calculate the safe yield of the upper basin reservoirs in natural order. Natural order makes depletions for water rights in upstream to downstream order, ignoring the priority of the water right. This is identical to assuming that all major upper basin water rights will not make priority calls on each other. Yields of the reservoirs were limited to the permitted diversion of the reservoir.

Most reservoirs in Region F are operated on a safe yield basis, which is a more conservative definition of yield than firm yield. Firm yield fully uses the storage in the reservoir, leaving no reserve content at the lowest point in the simulation period. Safe yield reserves one year of supply in the reservoir at the lowest point in the simulation period. Safe yield allows for the occurrence of more severe droughts than have occurred in the simulation period. Because most of Region F experienced critical drought conditions since 1998 which are not included in the Colorado WAM (the Colorado WAM ends in 1998), it is prudent to use safe yield rather than firm yield as the basis for water availability in the Region.

Using safe yield as the definition of reliable supply also has less impact on water rights in Region K than if firm yields were used. Because safe yields are less than firm yields, not as much water is depleted to meet demands and there is less empty storage in the reservoirs to fill when water is available.

Water availability for the City of Junction is defined by the minimum annual diversion from the river.

The specific steps in determining yields of the reservoirs using the MiniWAM were as follows:

Safe yields were calculated in natural order, starting with Lake Thomas. The computations for a reservoir assume that upstream reservoirs operate at their safe yield. Safe yield was limited to the permitted diversion.

Impact Runs

The Impact Runs replace the water rights in the MiniWAM with depletions made by the water rights in the MiniWAM. The depletions of the MiniWAM represent the water that is available for the reservoirs in Region F after subordination. Monthly depletions are entered for each MiniWAM water right using the WRAP model's TS records. Each month has a unique value. Each region may then use this output to determine the impact of subordination on the water availability within their region.

The proposed approach was developed to have minimal impact on water rights not included in the subordination analysis. However, the interaction of water rights in the WAMs is complex, and some differences between the Base Runs and the Impact Runs is to be expected. The approach used in this analysis has reduced the impacts on other water rights not included in the subordination analysis. However, future modeling efforts with an improved version of WRAP with subordination options may develop approaches with fewer impacts on other water rights.

The water rights that have access to water released from storage in the Highland Lakes as defined in the LCRA Water Management Plan may experience some impacts from subordination even if the water right is not directly included in the subordination analysis. Water rights that depend on interruptible supplies may be impacted significantly. These impacts will be determined by Region K.

The specific steps used to develop the Impact Runs were as follows:

1. The total available flow in the upstream basin after subordination was computed from the MiniWAM. This computation is performed for each reservoir in Region F.
2. The additional flow obtained as a direct result of subordination was calculated as the difference between the depletions of the MiniWAM and the depletions under the Base Run. This computation was performed for each reservoir in Region F.
3. The total additional flow in Region F obtained as a result of subordination was calculated as the sum of the gains at each reservoir, adjusting for channel losses between each reservoir and Lake Buchanan. The total additional flow in Region F was equal to the reduction of flow coming into Region K, and represents the flow that would have been passed for Region K in the absence of subordination.
4. The total water available for senior rights in Region K after subordination was computed as the total depletion from the base run minus the reduction of flow calculated in step 3.
5. The approximate physical regulated flow at diversion points in Region K was computed as the naturalized flow at each point minus the reduction of flow computed in step 3.
6. The total amount available for Region K was distributed among the water rights in priority order. The allocation started with the most senior water right. The allocation was limited to the physical regulated flow computed in step 5. If the total available for Region K was not used by the first right, the next water right in priority was allocated. The allocation stops once the total amount available for Region K was reached. Water rights to be allocated after the limit was reached did not get any water.
7. The allocation of water rights of step 6 produced the water available for each senior water right. These amounts were written in TS Cards for each right.

8. The impact run replaced Region F Reservoirs with TS Cards from step 1 with the most senior water right. It also limited the depletions of Region K water rights to the allocation of step 6.

Modeling Results

Table 1 compares the results for upper basin water rights to water supplies used in the 2001 Region F and Brazos G water plans. The total supplies available in the upper basin with the subordination analysis are similar to those used in the 2001 Region F and Brazos G plans. The presence of Austin return flows has a minimal impact on water availability in Region F. Region F may conduct additional water availability analyses of the impact of recent drought on these supplies, which may reduce the available supply from some sources.

Table 2 compares supplies for the subordinated Region K water rights before and after subordination. These results are preliminary and may be adjusted by Region K for planning purposes. For example, Region K may adjust triggers used to determine interruptible supplies as well as other parameters necessary to distribute water within the region. Because many of the water supplies in Region K are supplemented by water stored in the Highland Lakes, the reliability of other water rights may change as Region K adjusts these triggers.

Table 7 compares the preliminary results from the analyses by the Region K to those used in the 2001 Region K plan[1]. Although the subordination analysis results in less water than WAM Run 3 run in strict priority order, overall there are more supplies for the region than assumed in the previous water plan.

Table 7
Comparison of Supplies for Region K from the 2001 Lower Colorado Regional Water Plan, Colorado WAM Run 3, and Draft Supplies including Subordination*

	Year 2000			Year 2060		
	2001 Plan	WAM Run 3	Subordination Analysis	2001 Plan	WAM Run 3	Subordination Analysis
Austin Mun	172,673	225,972	170,063	172,673	226,111	173,121
Austin SE	7,159	18,141	9,691	7,159	16,795	8,967

[1] Turner, Collie & Braden April 21, 2005.

Garwood	50,000	133,000	111,740	50,000	133,000	111,740
Gulf Coast		122,520	74,136	0	122,520	74,055
Lakeside #1		25,960	19,763	0	25,960	19,763
Lakeside #2	4,232	23,571	10,769	4,232	23,571	10,769
Pierce Ranch		22,237	10,769	0	22,237	10,769
STP	41,320	42,291	42,337	41,320	43,736	41,803
Highland Lakes	445,766	435,737	405,821	445,766	401,608	397,072
Lake Bastrop	1,000			1,000		
Lake Fayette	1,400			1,400		
Walter E Long	1,000			1,000		
Total	*724,550*	*1,049,429*	*855,089*	*724,550*	*1,015,538*	*848,059*

* Turner, Collie and Braden, Draft results provided April 21, 2005.

Conclusions

- The subordination analysis results in water supplies which are similar to those used in the 2001 Region F and Region G water plans.
- The subordination analysis results in less water for Region K than without the subordination assumption. However, the overall results give more water supply than assumed in the 2001 Lower Colorado Regional Water Plan.
- This analysis was performed strictly for planning purposes and is presented for information only. Implementation of this strategy will require a more definitive analysis and the willing participation of the affected parties.

APPENDIX 3D

LAKES BUCHANAN/TRAVIS WAM TRIGGERS

Appendix 3D: Lakes Buchanan/Travis WAM Triggers

As discussed in Section 3.2.1.1.1, the triggers for curtailing the availability of water from Lakes Buchanan and Travis for interruptible supplies, largely used for agricultural irrigation and to meet some of the environmental needs, must be adjusted as firm demands increase over time. Imposition of the "No Call" assumption has a similar effect by reducing the overall water availability under these and other major senior water rights in the lower basin. Therefore, to preserve the availability of water to meet firm commitments in the No Call scenario, with continued assumption of full utilization of water rights and zero return flow, new curtailment triggers had to be developed to determine water availability and allocation of water from the LCRA's rights for Lakes Buchanan and Travis. These new triggers, which were used in computing availability reported in *Table 3.1a*, are set forth in the attached table.

BUCHANAN/TRAVIS CONSERVATION STORAGE AND LCRA SYSTEM DROUGHT TRIGGERS

RJBCO / 04-19-05

RESERVOIR	CONS. WATER WATER SURFACE ELEV, FEET MSL	CONSERVATION STORAGE CAPACITY, ACRE-FEET		
		WAM RUN 3 CONDITION	2000 CONDITION	2060 CONDITION
BUCHANAN	1020.35	992,475	883,000	734,000
TRAVIS	681.1	1,170,752	1,133,000	1,098,000
SYSTEM	n/a	2,163,227	2,016,000	1,832,000

RJBCO / 04-19-05 — TCB

WAM DROUGHT INDEX NO.	WAM TRIGGER DESCRIPTION	LOGIC STATED IN 1999 WMP (With Respect to System Cons. Storage)	TRIGGERS USED FOR SUBORDINATION RUNS		TRIGGERS USED FOR WAM RUNS (pre-SUBORD)	
			2000 WITHOUT RETURN FLOWS (Future WMP) [2]	2060 (Future WMP) [2]	2000	2060
1	INTERRUPTIBLE TRIGGER NO. 1					
	Lower Basin Irrigation Water Rights					
	1 No Curtailment of Supply	> 52%	> 2,016,000	> 1,832,000	> 2,163,227	> 2,163,227
	2 Supply Curtailment Begins	52%	2,016,000	1,832,000	1,124,878	1,124,878
	3 Supply Totally Cutoff	≤ 325,000 ac-ft	≤ 2,016,000	≤ 1,832,000	≤ 325,000	≤ 325,000
2	INTERRUPTIBLE TRIGGER NO. 2					
	Short-Term Contracts: Jan - Jun					
	1 Supply Curtailment Begins	100%	2,016,000	1,832,000	2,163,227	2,163,227
	2 Supply Totally Cutoff	≤ 94%	≤ 2,016,000	≤ 1,832,000	≤ 2,163,227	≤ 2,163,227
3	INTERRUPTIBLE TRIGGER NO. 3					
	Short-Term Contracts: Jul - Dec					
	1 Supply Curtailment Begins	100%	2,016,000	1,832,000	2,163,227	2,163,227
	2 Supply Totally Cutoff	≤ 94%	≤ 2,016,000	≤ 1,832,000	≤ 2,163,227	≤ 2,163,227
4	TARGET INSTREAM FLOW TRIGGERS [1]					
	1 System Supports TARGET Criteria	> 52%	> 2,016,000	> 1,832,000	> 1,124,877	> 1,124,877
	2 System Does Not Support TARGET Criteria	≤ 52%	≤ 2,016,000	≤ 1,832,000	≤ 1,124,877	≤ 1,124,877
5	CRITICAL INSTREAM FLOW TRIGGER [1]	None	None	None	None	None
6	TARGET B&E INFLOW TRIGGERS [1]					
	1 System Supports B&E Criteria	> 1,660,000 ac-ft	> 1,700,000	> 1,700,000	> 1,660,000	> 1,660,000
	2 System Does Not Support B&E Criteria	≤ 1,660,000 ac-ft	≤ 1,700,000	≤ 1,700,000	≤ 1,660,000	≤ 1,660,000
7	CRITICAL B&E INFLOW TRIGGERS [1]	None	None	None	None	None

[1] All environmental flow requirements (for both Target and Critical criteria) are subject to the complex limitations stated in the 1999 WMP. These limitations are implemented in WAM with the Environmental Limitation Routine located at the beginning of the WR section of the input file. Note that the logic for this routine must be changed in each model that represents an LCRA System storage smaller than the amount specified for RUN3 so that the Environmental Limitation Routine can properly determine when the LCRA System spills.

[2] In general, to the extent possible, these triggers have been set based on several iterations of simulations for each run to provide interruptible water while also preserving sufficient firm water to supply LCRA's existing contractual commitments. These triggers are based on assumed conditions and are not intended to represent operations for future Water Management Plans for the LCRA System.

APPENDIX 3E

CURRENTLY AVAILABLE WATER SUPPLY TABLES
(by Water Source and WUG)

Region K Current Water Availability Sources

Source Name	Source Type	Source RWPG	Source County	Source Basin	Source Identifier	Water Availability (ac-ft/yr) Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060	Comments
City of Austin - ROR (Municipal)	0	K		Colorado	3461405471A	175,823	176,300	176,777	177,254	177,731	178,208	178,684	TCEQ WAM
City of Austin - ROR (Municipal)	0	K		Colorado	3461405489A	5,230	5,357	5,484	5,611	5,738	5,865	5,993	TCEQ WAM
City of Austin - ROR (Steam Elec.)	0	K		Colorado	3461405471A-SE	6,709	6,608	6,507	6,406	6,305	6,204	6,102	TCEQ WAM
City of Austin - ROR (Steam Elec.)	0	K		Colorado	3461405489A-SE	2,904	2,869	2,834	2,799	2,764	2,729	2,693	TCEQ WAM
LCRA - Garwood ROR	0	K		Colorado	3461405434A	111,740	111,740	111,740	111,740	111,740	111,740	111,740	TCEQ WAM
LCRA - Gulf Coast ROR	0	K		Colorado	3461405476A	74,137	74,124	74,111	74,098	74,085	74,072	74,056	TCEQ WAM
LCRA - Lakeside ROR	0	K		Colorado	3461405475	30,538	30,538	30,538	30,538	30,538	30,538	30,538	TCEQ WAM
LCRA - Pierce Ranch ROR	0	K		Colorado	3461405477	10,769	10,769	10,769	10,769	10,769	10,769	10,769	TCEQ WAM
STP Nuclear Operating Co. - ROR	0	K		Colorado	3461405437	49,089	49,039	48,989	48,939	48,889	48,839	48,791	TCEQ WAM
San Bernard ROR	0	K		Brazos-Colorado	3461303421	1,600	1,600	1,600	1,600	1,600	1,600	1,600	Based on TCEQ water rights database; Reliability of WR has not been verified.
Goldthwaite Reservoir	0	K		Colorado	14350	144	144	144	145	145	145	145	TCEQ WAM
Highland Lakes	0	K		Colorado	140B0	382,924	381,545	380,166	378,787	377,408	376,029	374,642	TCEQ WAM
Llano Reservoir	0	K		Colorado	14520	187	178	169	160	151	142	135	TCEQ WAM
Blanco Reservoir	0	K		Guadalupe	18120	596	596	596	596	596	596	596	TCEQ WAM
Irrigation Local Supply	0	K	Bastrop	Brazos	011996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Bastrop	Colorado	011996	786	786	786	786	786	786	786	TWDB IRLS table
Irrigation Local Supply	0	K	Bastrop	Guadalupe	011996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Blanco	Colorado	016996	67	67	67	67	67	67	67	TWDB IRLS table
Irrigation Local Supply	0	K	Blanco	Guadalupe	016996	9	9	9	9	9	9	9	TWDB IRLS table
Irrigation Local Supply	0	K	Burnet	Brazos	027996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Burnet	Colorado	027996	276	276	276	276	276	276	276	TWDB IRLS table
Irrigation Local Supply	0	K	Colorado	Brazos-Colorado	045996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Colorado	Colorado	045996	3,000	3,000	3,000	3,000	3,000	3,000	3,000	TWDB IRLS table
Irrigation Local Supply	0	K	Colorado	Lavaca	045996	4,002	4,002	4,002	4,002	4,002	4,002	4,002	TWDB IRLS table
Irrigation Local Supply	0	K	Fayette	Brazos	075996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Fayette	Colorado	075996	534	534	534	534	534	534	534	TWDB IRLS table
Irrigation Local Supply	0	K	Fayette	Guadalupe	075996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Fayette	Lavaca	075996	20	20	20	20	20	20	20	TWDB IRLS table
Irrigation Local Supply	0	K	Gillespie	Colorado	086996	880	880	880	880	880	880	880	TWDB IRLS table
Irrigation Local Supply	0	K	Gillespie	Guadalupe	086996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Hays	Colorado	105996	41	41	41	41	41	41	41	TWDB IRLS table
Irrigation Local Supply	0	K	Llano	Colorado	150996	440	440	440	440	440	440	440	TWDB IRLS table
Irrigation Local Supply	0	K	Matagorda	Brazos-Colorado	161996	4,000	4,000	4,000	4,000	4,000	4,000	4,000	TWDB IRLS table
Irrigation Local Supply	0	K	Matagorda	Colorado	161996	900	900	900	900	900	900	900	TWDB IRLS table
Irrigation Local Supply	0	K	Matagorda	Colorado-Lavaca	161996	4,000	4,000	4,000	4,000	4,000	4,000	4,000	TWDB IRLS table
Irrigation Local Supply	0	K	Mills	Brazos	167996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Mills	Colorado	167996	2,378	2,378	2,378	2,378	2,378	2,378	2,378	TWDB IRLS table
Irrigation Local Supply	0	K	San Saba	Colorado	206996	8,800	8,800	8,800	8,800	8,800	8,800	8,800	TWDB IRLS table
Irrigation Local Supply	0	K	Travis	Brazos	227996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Travis	Colorado	227996	880	880	880	880	880	880	880	TWDB IRLS table
Irrigation Local Supply	0	K	Travis	Guadalupe	227996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Wharton	Brazos-Colorado	241996	2,000	2,000	2,000	2,000	2,000	2,000	2,000	TWDB IRLS table
Irrigation Local Supply	0	K	Wharton	Colorado	241996	7,650	7,650	7,650	7,650	7,650	7,650	7,650	TWDB IRLS table
Irrigation Local Supply	0	K	Wharton	Colorado-Lavaca	241996	0	0	0	0	0	0	0	TWDB IRLS table
Irrigation Local Supply	0	K	Williamson	Colorado	246996	0	0	0	0	0	0	0	TWDB IRLS table
Livestock Local Supply	0	K		Brazos	12997	566	566	566	566	566	566	566	2001 Plan: Sum of Demands
Livestock Local Supply	0	K		Brazos-Colorado	13997	394	394	394	394	394	394	394	2001 Plan: Sum of Demands
Livestock Local Supply	0	K		Colorado	14997	6,262	6,262	6,262	6,262	6,262	6,262	6,262	2001 Plan: Sum of Demands
Livestock Local Supply	0	K		Colorado-Lavaca	15997	289	289	289	289	289	289	289	2001 Plan: Sum of Demands
Livestock Local Supply	0	K		Guadalupe	18997	298	298	298	298	298	298	298	2001 Plan: Sum of Demands
Livestock Local Supply	0	K		Lavaca	16997	649	649	649	649	649	649	649	2001 Plan: Sum of Demands
Other Local Supply	0	K		Brazos-Colorado	13999	1,655	1,696	1,746	1,793	1,844	1,900	1,900	TWDB
Other Local Supply	0	K		Colorado	14999	27,642	19,282	20,890	22,717	24,883	27,470	27,470	TWDB
Carrizo-Wilcox	1	K	Bastrop	Brazos	01110	1,744	1,744	1,744	1,744	1,744	1,744	1,744	Lost Pines GCD

Region K Current Water Availability Sources

Source Name	Source Type	Source RWPG	Source County	Source Basin	Source Identifier	Water Availability (ac-ft/yr) Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060	Comments
Carrizo-Wilcox	1	K	Bastrop	Colorado	01110	24,916	24,916	24,916	24,916	24,916	24,916	24,916	Lost Pines GCD
Carrizo-Wilcox	1	K	Bastrop	Guadalupe	01110	1,340	1,340	1,340	1,340	1,340	1,340	1,340	Lost Pines GCD
Carrizo-Wilcox	1	K	Fayette	Colorado	07510	290	290	290	290	290	290	290	based on % of area
Carrizo-Wilcox	1	K	Fayette	Guadalupe	07510	66	66	66	66	66	66	66	based on % of area
Carrizo-Wilcox	1	K	Fayette	Lavaca	07510	44	44	44	44	44	44	44	based on % of area
Edwards-BFZ	1	K	Hays	Colorado	10511	5,140	5,140	5,140	5,140	5,140	5,140	5,140	BSEACD
Edwards-BFZ	1	K	Travis	Brazos	22711	22	22	22	22	22	22	22	BSEACD, GAM
Edwards-BFZ	1	K	Travis	Colorado	22711	2,913	2,913	2,913	2,913	2,913	2,913	2,913	BSEACD, GAM
Edwards-BFZ	1	K	Travis	Guadalupe	22711	25	25	25	25	25	25	25	BSEACD, GAM
Edwards-BFZ	1	K	Williamson	Brazos	24611	265	265	265	265	265	265	265	GAM
Edwards-BFZ	1	K	Williamson	Colorado	24611	10	10	10	10	10	10	10	GAM
Edwards-Trinity (Plateau)	1	K	Blanco	Colorado	01613	107	107	107	107	107	108	108	based on % of area
Edwards-Trinity (Plateau)	1	K	Blanco	Guadalupe	01613	50	50	50	50	50	51	51	based on % of area
Edwards-Trinity (Plateau)	1	K	Gillespie	Colorado	08613	1,410	1,410	1,410	1,410	1,410	1,410	1,410	based on % of area
Edwards-Trinity (Plateau)	1	K	Gillespie	Guadalupe	08613	90	90	90	90	90	90	90	based on % of area
Ellenburger-San Saba	1	K	Blanco	Colorado	01614	2,849	2,849	2,849	2,849	2,849	2,849	2,849	based on % of area
Ellenburger-San Saba	1	K	Blanco	Guadalupe	01614	1,025	1,025	1,025	1,025	1,025	1,025	1,025	based on % of area
Ellenburger-San Saba	1	K	Burnet	Brazos	02714	987	987	987	987	987	987	987	based on % of area
Ellenburger-San Saba	1	K	Burnet	Colorado	02714	2,161	2,161	2,161	2,161	2,161	2,161	2,161	based on % of area
Ellenburger-San Saba	1	K	Gillespie	Colorado	08614	5,535	5,535	5,535	5,535	5,535	5,535	5,535	based on % of area
Ellenburger-San Saba	1	K	Gillespie	Guadalupe	08614	65	65	65	65	65	65	65	based on % of area
Ellenburger-San Saba	1	K	Llano	Colorado	15014	758	758	758	758	758	758	758	TWDB GW-U table
Ellenburger-San Saba	1	K	San Saba	Colorado	20614	10,194	10,194	10,194	10,194	10,194	10,194	10,194	TWDB GW-U table
Gulf Coast	1	K	Colorado	Brazos-Colorado	04515	11,506	11,506	11,506	11,506	11,506	11,506	11,506	based on % of area
Gulf Coast	1	K	Colorado	Colorado	04515	17,436	17,436	17,436	17,436	17,436	17,436	17,436	based on % of area
Gulf Coast	1	K	Colorado	Lavaca	04515	18,915	18,915	18,915	18,915	18,915	18,915	18,915	based on % of area
Gulf Coast	1	K	Fayette	Brazos	07515	65	65	65	65	65	65	65	based on % of area
Gulf Coast	1	K	Fayette	Colorado	07515	3,300	3,300	3,300	3,300	3,300	3,300	3,300	based on % of area
Gulf Coast	1	K	Fayette	Guadalupe	07515	144	144	144	144	144	144	144	based on % of area
Gulf Coast	1	K	Fayette	Lavaca	07515	5,188	5,188	5,188	5,188	5,188	5,188	5,188	based on % of area
Gulf Coast	1	K	Matagorda	Brazos-Colorado	16115	22,423	22,423	22,423	22,423	22,423	22,423	22,423	based on % of area
Gulf Coast	1	K	Matagorda	Colorado	16115	3,218	3,218	3,218	3,218	3,218	3,218	3,218	based on % of area
Gulf Coast	1	K	Matagorda	Colorado-Lavaca	16115	23,580	23,580	23,580	23,580	23,580	23,580	23,580	based on % of area
Gulf Coast	1	K	Wharton	Brazos-Colorado	24115	42,295	42,295	42,295	42,295	42,295	42,295	42,295	based on % of area
Gulf Coast	1	K	Wharton	Colorado	24115	41,812	41,812	41,812	41,812	41,812	41,812	41,812	based on % of area
Gulf Coast	1	K	Wharton	Colorado-Lavaca	24115	8,543	8,543	8,543	8,543	8,543	8,543	8,543	based on % of area
Hickory	1	K	Blanco	Colorado	01616	747	747	747	747	747	747	747	based on % of area
Hickory	1	K	Blanco	Guadalupe	01616	165	165	165	165	165	165	165	based on % of area
Hickory	1	K	Burnet	Brazos	02716	2,257	2,257	2,257	2,257	2,257	2,257	2,257	based on % of area
Hickory	1	K	Burnet	Colorado	02716	3,154	3,154	3,154	3,154	3,154	3,154	3,154	based on % of area
Hickory	1	K	Gillespie	Colorado	08616	1,934	1,934	1,934	1,934	1,934	1,934	1,934	based on % of area
Hickory	1	K	Gillespie	Guadalupe	08616	66	66	66	66	66	66	66	based on % of area
Hickory	1	K	Llano	Colorado	15016	12,517	12,517	12,517	12,517	12,517	12,517	12,517	TWDB GW-U table
Hickory	1	K	San Saba	Colorado	20616	6,540	6,540	6,540	6,540	6,540	6,540	6,540	TWDB GW-U table
Marble Falls	1	K	Blanco	Colorado	01619	300	300	300	300	300	300	300	GWbyBasin file 9/24/99
Marble Falls	1	K	Burnet	Brazos	02719	291	291	291	291	291	291	291	based on % of area
Marble Falls	1	K	Burnet	Colorado	02719	5,334	5,334	5,334	5,334	5,334	5,334	5,334	based on % of area
Marble Falls	1	K	San Saba	Colorado	20619	12,380	12,380	12,380	12,380	12,380	12,380	12,380	TWDB GW-U table
Queen City	1	K	Bastrop	Brazos	01124	227	227	227	227	227	227	227	based on % of area
Queen City	1	K	Bastrop	Colorado	01124	2,126	2,126	2,126	2,126	2,126	2,126	2,126	based on % of area
Queen City	1	K	Bastrop	Guadalupe	01124	403	403	403	403	403	403	403	based on % of area
Queen City	1	K	Fayette	Colorado	07524	1,034	1,034	1,034	1,034	1,034	1,034	1,034	based on % of area
Queen City	1	K	Fayette	Guadalupe	07524	175	175	175	175	175	175	175	based on % of area
Queen City	1	K	Fayette	Lavaca	07524	26	26	26	26	26	26	26	based on % of area
Sparta	1	K	Bastrop	Brazos	01127	49	49	49	49	49	49	49	based on % of area

Region K Current Water Availability Sources

Source Name	Source Type	Source RWPG	Source County	Source Basin	Source Identifier	Water Availability (ac-ft/yr) Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060	Comments
Sparta	1	K	Bastrop	Colorado	01127	5,000	5,000	5,000	5,000	5,000	5,000	5,000	based on % of area
Sparta	1	K	Bastrop	Guadalupe	01127	340	340	340	340	340	340	340	based on % of area
Sparta	1	K	Fayette	Colorado	07527	3,667	3,667	3,667	3,667	3,667	3,667	3,667	based on % of area
Sparta	1	K	Fayette	Guadalupe	07527	598	598	598	598	598	598	598	based on % of area
Sparta	1	K	Fayette	Lavaca	07527	235	235	235	235	235	235	235	based on % of area
Trinity	1	K	Bastrop	Colorado	01128	12	12	12	10	10	8	8	GWbyBasin file 9/24/99
Trinity	1	K	Blanco	Colorado	01628	1,149	1,149	1,149	1,149	1,149	942	942	based on % of area
Trinity	1	K	Blanco	Guadalupe	01628	451	451	451	451	451	373	373	based on % of area
Trinity	1	K	Burnet	Brazos	02728	1,221	1,221	1,221	1,221	1,221	1,221	1,221	GAM
Trinity	1	K	Burnet	Colorado	02728	1,329	1,329	1,329	1,329	1,329	1,329	1,329	GAM
Trinity	1	K	Gillespie	Colorado	08628	3,354	3,354	3,354	3,354	3,354	3,354	3,354	Based on HCUWCD Data
Trinity	1	K	Gillespie	Guadalupe	08628	46	46	46	46	46	46	46	Based on HCUWCD Data
Trinity	1	K	Hays	Colorado	10528	2,500	2,500	2,500	2,500	2,500	2,500	2,500	GAM
Trinity	1	K	Mills	Brazos	16728	1,430	1,430	1,430	1,254	1,254	1,028	1,028	based on % of area
Trinity	1	K	Mills	Colorado	16728	1,330	1,330	1,330	1,166	1,166	956	956	based on % of area
Trinity	1	K	Travis	Brazos	22728	28	28	28	28	28	28	28	GAM
Trinity	1	K	Travis	Colorado	22728	3,839	3,839	3,839	3,839	3,839	3,839	3,839	GAM
Trinity	1	K	Travis	Guadalupe	22728	33	33	33	33	33	33	33	GAM
Trinity	1	K	Williamson	Brazos	24628	58	58	58	58	58	58	58	GAM
Trinity	1	K	Williamson	Colorado	24628	2	2	2	2	2	2	2	GAM
Other Aquifer	1	K	Bastrop	Brazos	01122	0	0	0	0	0	0	0	
Other Aquifer	1	K	Bastrop	Colorado	01122	3,350	3,350	3,350	3,350	3,350	3,350	3,350	Alluvial supplies
Other Aquifer	1	K	Bastrop	Guadalupe	01122	0	0	0	0	0	0	0	
Other Aquifer	1	K	Blanco	Colorado	01622	0	0	0	0	0	0	0	
Other Aquifer	1	K	Burnet	Colorado	02722	305	305	305	305	305	305	305	Alluvial supplies
Other Aquifer	1	K	Colorado	Colorado	04522	4,269	4,269	4,269	4,269	4,269	4,269	4,269	Alluvial supplies
Other Aquifer	1	K	Fayette	Brazos	07522	0	0	0	0	0	0	0	
Other Aquifer	1	K	Fayette	Colorado	07522	3,696	3,696	3,696	3,696	3,696	3,696	3,696	Alluvial supplies
Other Aquifer	1	K	Fayette	Guadalupe	07522	0	0	0	0	0	0	0	
Other Aquifer	1	K	Fayette	Lavaca	07522	0	0	0	0	0	0	0	
Other Aquifer	1	K	Gillespie	Colorado	08622	0	0	0	0	0	0	0	
Other Aquifer	1	K	Hays	Colorado	10522	0	0	0	0	0	0	0	
Other Aquifer	1	K	Llano	Colorado	15022	109	109	109	109	109	109	109	Alluvial supplies
Other Aquifer	1	K	Mills	Brazos	16722	0	0	0	0	0	0	0	
Other Aquifer	1	K	Mills	Colorado	16722	0	0	0	0	0	0	0	
Other Aquifer	1	K	San Saba	Colorado	20622	0	0	0	0	0	0	0	
Other Aquifer	1	K	Travis	Brazos	22722	0	0	0	0	0	0	0	
Other Aquifer	1	K	Travis	Colorado	22722	1,808	1,818	1,835	1,848	1,853	1,856	1,860	Alluvial supplies
Other Aquifer	1	K	Travis	Guadalupe	22722	21	25	30	34	37	40	43	Alluvial supplies
Other Aquifer	1	K	Williamson	Brazos	24622	0	0	0	0	0	0	0	
Other Aquifer	1	K	Williamson	Colorado	24622	0	0	0	0	0	0	0	
					Region K Subtotal	1,281,144	1,271,856	1,272,553	1,273,120	1,274,362	1,275,307	1,274,322	
Lake Brownwood	0	F		Colorado	14140	1,688	1,688	1,688	0	0	0	0	Based on Brookesmith SUD
Brazos River Authority System	0	G		Brazos	120B0	301	316	342	370	401	440	488	Estimate based on TCEQ maximum production capacity at treatment plant (Stillhouse Reservoir) multiplied by the percent of Kempner demand in Region K.
Edwards-BFZ	1	G	Williamson	Brazos	24611G	12	10	9	9	8	8	8	Based on Chisholm Trail SUD
Canyon Lake	0	L		Guadalupe	18020	126	188	263	334	397	466	545	Estimate based on CLWSC Water Availability Report and demand.
					Subtotal	2,127	2,202	2,302	713	806	914	1,041	
					TOTAL	**1,283,271**	**1,274,058**	**1,274,855**	**1,273,833**	**1,275,168**	**1,276,221**	**1,275,363**	

Note: Downstream water availability does not include return flows.

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
AQUA WSC	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	5,952	5,952	5,952	5,952	5,952	5,952	5,952	New WUG: Supply Estimate based on Aqua WSC 3/29/04
AQUA WSC	BASTROP	COLORADO	K		Colorado	140B0	Highland Lakes	3,954	3,822	3,634	3,475	3,366	0	0	New WUG: Supply Estimate based on LCRA 02/02/05
BASTROP	BASTROP	COLORADO	K	Bastrop	Colorado	01122	Other Aquifer	1,927	1,927	1,927	1,927	1,927	1,927	1,927	Supply estimate based on TCEQ total production. 2/8/05
BASTROP COUNTY WCID #2	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	1,721	1,171	1,171	1,171	1,171	1,171	1,171	New WUG: Supply based on Bastrop County WCID #2 9/20/04
COUNTY-OTHER	BASTROP	BRAZOS	K	Bastrop	Brazos	01110	Carrizo-Wilcox	304	363	422	486	524	536	536	2001 Plan: Demand
COUNTY-OTHER	BASTROP	COLORADO	K		Colorado	140B0	Highland Lakes	2,092	2,050	700	700	700	700	700	Supply based on LCRA revised data 2/7/05
COUNTY-OTHER	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	446	446	446	446	446	446	446	Aqua WSC email 3/29/04
COUNTY-OTHER	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	735	805	561	222	0	0	0	2001 Plan: Demand - other supplies
COUNTY-OTHER	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01124	Queen City	196	196	196	196	196	196	196	2001 Plan: A-ALL, % & Tbl 4
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	6	6	6	6	6	6	6	New WUG: Supply Estimate based on Aqua WSC email 3/29/04
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	13	14	14	15	17	18	18	New WUG: Supply Estimate based on BSEACD
ELGIN	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	1,683	1,679	1,674	1,671	1,670	1,670	1,671	Based on TCEQ maximum production capacity and proportioned by total demand. 1/14/05
LEE COUNTY WSC	BASTROP	BRAZOS	K	Bastrop	Brazos	01110	Carrizo-Wilcox	725	725	725	725	725	725	725	New WUG: Supply based on Lee County WSC 9/20/04
LEE COUNTY WSC	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	1,123	1,123	1,123	1,123	1,123	1,123	1,123	New WUG: Supply based on Lee County WSC 9/20/04
MANVILLE WSC	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	124	127	131	133	136	140	146	New WUG: Supply estimated from TCEQ well production capacities and proportioned by total population. 1/11/05
MANVILLE WSC	BASTROP	COLORADO	K	Bastrop	Colorado	01122	Other Aquifer	38	41	42	46	52	60	68	New WUG: Supply estimated from TCEQ well production capacities and proportioned by total population. 1/11/05
POLONIA WSC	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	29	25	24	25	25	27	30	New WUG: Supply estimated from TCEQ well production capacities and proportioned by total population. 1/20/05
SMITHVILLE	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	794	830	922	1,025	1,072	1,283	1,283	2001 Plan: Demand
IRRIGATION	BASTROP	BRAZOS	K	Bastrop	Brazos	01124	Queen City	23	23	23	23	23	23	23	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BASTROP	BRAZOS	K	Bastrop	Brazos	01127	Sparta	5	5	5	5	5	5	5	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BASTROP	COLORADO	K	Bastrop	Colorado	011996	Irrigation Local Supply	750	750	750	750	750	750	750	2001 Plan: TWDB
IRRIGATION	BASTROP	COLORADO	K	Bastrop	Colorado	01127	Sparta	500	500	500	500	500	500	500	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BASTROP	COLORADO	K	Bastrop	Colorado	01124	Queen City	213	213	213	213	213	213	213	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01124	Queen City	40	40	40	40	40	40	40	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01127	Sparta	34	34	34	34	34	34	34	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	BASTROP	BRAZOS	K	Bastrop	Brazos	01127	Sparta	39	39	39	39	39	39	39	2001 Plan: AllocFile10 90% reduced
LIVESTOCK	BASTROP	BRAZOS	K		Brazos	12997	Livestock Local Supply	154	154	154	154	154	154	154	2001 Plan: LCRA Provided data
LIVESTOCK	BASTROP	BRAZOS	K	Bastrop	Brazos	01124	Queen City	141	141	141	141	141	141	141	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	BASTROP	COLORADO	K	Bastrop	Colorado	01124	Queen City	1,322	1,322	1,322	1,322	1,322	1,322	1,322	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	BASTROP	COLORADO	K	Bastrop	Colorado	01127	Sparta	4,000	4,000	4,000	4,000	4,000	4,000	4,000	2001 Plan: AllocFile10 90% reduced
LIVESTOCK	BASTROP	COLORADO	K		Colorado	14997	Livestock Local Supply	696	696	696	696	696	696	696	2001 Plan: LCRA Provided data
LIVESTOCK	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01124	Queen City	125	125	125	125	125	125	125	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	BASTROP	GUADALUPE	K		Guadalupe	18997	Livestock Local Supply	5	5	5	5	5	5	5	2001 Plan: LCRA Provided data
LIVESTOCK	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01127	Sparta	272	272	272	272	272	272	272	2001 Plan: AllocFile10 90% reduced
MANUFACTURING	BASTROP	BRAZOS	K	Bastrop	Brazos	01110	Carrizo-Wilcox	0	0	0	0	0	0	0	2001 Plan: Demand - other supplies
MANUFACTURING	BASTROP	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	31	38	46	54	64	75	75	2001 Plan: Demand - other supplies
MANUFACTURING	BASTROP	COLORADO	K		Colorado	14999	Other Local Supply	48	48	48	48	48	48	48	2001 Plan: LCRA Provided data
MANUFACTURING	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01110	Carrizo-Wilcox	0	0	0	0	0	0	0	2001 Plan: Demand
MINING	BASTROP	BRAZOS	K	Bastrop	Brazos	01124	Queen City	23	23	23	23	23	23	23	2001 Plan: AllocFile10 9/24/99
MINING	BASTROP	BRAZOS	K	Bastrop	Brazos	01127	Sparta	5	5	5	5	5	5	5	2001 Plan: AllocFile10 9/24/99
MINING	BASTROP	COLORADO	K	Bastrop	Colorado	01124	Queen City	213	213	213	213	213	213	213	2001 Plan: AllocFile10 9/24/99
MINING	BASTROP	COLORADO	K	Bastrop	Colorado	01127	Sparta	500	500	500	500	500	500	500	2001 Plan: AllocFile10 9/24/99
MINING	BASTROP	COLORADO	K		Colorado	14999	Other Local Supply	12	10	8	7	7	9	9	2001 Plan: LCRA Provided data
MINING	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01124	Queen City	40	40	40	40	40	40	40	2001 Plan: AllocFile10 9/24/99
MINING	BASTROP	GUADALUPE	K	Bastrop	Guadalupe	01127	Sparta	34	34	34	34	34	34	34	2001 Plan: AllocFile10 9/24/99
STEAM ELECTRIC POWER	BASTROP	BRAZOS						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	BASTROP	COLORADO	K		Colorado	140B0	Highland Lakes	5,970	5,970	5,970	5,970	3,220	0	0	Supply based on LCRA revised data 2/7/05
STEAM ELECTRIC POWER	BASTROP	COLORADO	K		Colorado	140B0	Highland Lakes	10,750	10,750	10,750	10,750	10,750	10,750	10,750	TCEQ WAM 5/6/05; LCRA Cooling Water
STEAM ELECTRIC POWER	BASTROP	GUADALUPE						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
BLANCO	BLANCO	GUADALUPE		Blanco	Guadalupe	18120	Blanco Reservoir	596	596	596	596	596	596	596	TCEQ WAM 2/21/05
BLANCO	BLANCO	GUADALUPE	K	Blanco	Guadalupe	01628	Trinity	25	25	25	25	25	25	25	2001 Plan: A-ALL, LIMIT
CANYON LAKE WSC	BLANCO	GUADALUPE	L		Guadalupe	18020	Canyon Lake	126	188	263	334	397	466	545	New WUG: Supply Estimate based on CLWSC Water Availability Report and demand 2/4/05
COUNTY-OTHER	BLANCO	COLORADO	K	Blanco	Colorado	01614	Ellenburger-San Saba	150	150	150	150	150	150	150	2001 Plan: A-ALL, LIMIT

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
COUNTY-OTHER	BLANCO	COLORADO	K	Blanco	Colorado	01616	Hickory	60	60	60	60	60	60	60	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	BLANCO	COLORADO	K		Colorado	14999	Other Local Supply	37	43	49	55	57	56	56	2001 Plan: LCRA Provided data
COUNTY-OTHER	BLANCO	COLORADO	K	Blanco	Colorado	01628	Trinity	1,149	1,149	1,149	1,149	1,149	942	942	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	BLANCO	GUADALUPE	K	Blanco	Guadalupe	01613	Edwards-Trinity (Plateau)	50	50	50	50	50	50	50	2001 Plan: A-ALL, LIMIT 157 reduced
COUNTY-OTHER	BLANCO	GUADALUPE	K	Blanco	Guadalupe	01628	Trinity	85	23	0	0	0	0	0	2001 Plan: A-ALL, % & Tbl 4
JOHNSON CITY	BLANCO	COLORADO	K	Blanco	Colorado	01614	Ellenburger-San Saba	887	887	887	887	887	887	887	2001 Plan: A-ALL, LIMIT
IRRIGATION	BLANCO	COLORADO	K	Blanco	Colorado	01614	Ellenburger-San Saba	667	667	667	667	667	667	667	2001 Plan: A-ALL, % & Tbl 4
IRRIGATION	BLANCO	GUADALUPE	K	Blanco	Guadalupe	016996	Irrigation Local Supply	9	9	9	9	9	9	9	2001 Plan: LCRA Provided data
IRRIGATION	BLANCO	GUADALUPE	K	Blanco	Guadalupe	01628	Trinity	89	89	89	89	89	76	76	2001 Plan: A-ALL, 100% reduced
LIVESTOCK	BLANCO	COLORADO	K		Colorado	14997	Livestock Local Supply	101	101	101	101	101	101	101	2001 Plan: Demand, LCRA provided data
LIVESTOCK	BLANCO	COLORADO	K	Blanco	Colorado	01614	Ellenburger-San Saba	749	749	749	749	749	749	749	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	BLANCO	GUADALUPE	K	Blanco	Guadalupe	01628	Trinity	69	69	69	69	69	56	56	2001 Plan: A-ALL, 42.6% reduced
LIVESTOCK	BLANCO	GUADALUPE	K		Guadalupe	18997	Livestock Local Supply	101	101	101	101	101	101	101	2001 Plan: Demand, LCRA provided data
MANUFACTURING	BLANCO	COLORADO						0	0	0	0	0	0	0	New WUG: Minimal Demand, therefore 0 Supply
MANUFACTURING	BLANCO	GUADALUPE	K	Blanco	Guadalupe	01628	Trinity	9	9	9	9	9	7	7	2001 Plan: AllocFile10 100% reduced
MINING	BLANCO	COLORADO	K	Blanco	Colorado	01614	Ellenburger-San Saba	285	285	285	285	285	285	285	2001 Plan: A-ALL, % & Tbl 4
MINING	BLANCO	GUADALUPE	K	Blanco	Guadalupe	01628	Trinity	43	43	43	43	43	35	35	2001 Plan: AllocFile10 9/24/99
STEAM ELECTRIC POWER	BLANCO	COLORADO						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	BLANCO	GUADALUPE						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
BERTRAM	BURNET	BRAZOS	K	Burnet	Brazos	02714	Ellenburger-San Saba	207	200	190	184	185	191	191	2001 Plan: Demand
BURNET	BURNET	COLORADO	K	Burnet	Colorado	02714	Ellenburger-San Saba	1,862	1,862	1,862	1,862	1,862	1,862	1,862	2001 Plan: A-ALL, LIMIT
BURNET	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	4,100	4,100	4,100	4,100	0	0	0	Supply Estimate based on LCRA 4/9/04
CHISHOLM TRAIL SUD	BURNET	BRAZOS	G	Williamson	Brazos	24611G	Edwards-BFZ	12	10	9	9	8	8	8	New WUG: less than 1% of population in Region K. All currently served by groundwater but contracts in place for Colorado River and Brazos River water. 1/11/05
COTTONWOOD SHORES	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	138	138	0	0	0	0	0	Supply Estimate based on LCRA 4/9/04
COUNTY-OTHER	BURNET	BRAZOS	K	Burnet	Brazos	02714	Ellenburger-San Saba	400	400	400	400	400	400	400	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	BURNET	BRAZOS	K	Burnet	Brazos	02728	Trinity	985	972	960	947	934	921	921	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	BURNET	COLORADO	K	Burnet	Colorado	02714	Ellenburger-San Saba	16	10	2	0	0	0	0	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	BURNET	COLORADO	K	Burnet	Colorado	02716	Hickory	54	54	54	54	54	54	54	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	901	556	330	280	250	250	250	Supply based on LCRA revised data 2/7/05
COUNTY-OTHER	BURNET	COLORADO	K	Burnet	Colorado	02719	Marble Falls	21	21	21	21	21	21	21	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	BURNET	COLORADO	K	Burnet	Colorado	02728	Trinity	227	227	227	192	192	157	157	2001 Plan: A-ALL, % & Tbl 4
GRANITE SHOALS	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	830	830	830	0	0	0	0	Supply Estimate based on LCRA 4/9/04
KEMPNER WSC	BURNET	BRAZOS	G		Brazos	120B0	Brazos River Authority System	301	316	342	370	401	440	488	New WUG: Supply Estimate based on TCEQ maximum production capacity at treatment plant (Stillhouse Reservoir) times percent of total Kempner demand in Region K. Need Region G coordination. 1/13/05
KINGSLAND WSC	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	40	45	52	58	64	71	0	Supply Estimate based on revised LCRA data and proportioned by county. 2/8/05
LAKE LBJ MUD	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	233	259	294	327	358	0	0	New WUG: Supply Estimate based on revised LCRA data. 2/2/05
MARBLE FALLS	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	2,000	2,000	2,000	0	0	0	0	Supply Estimate based on LCRA 4/9/04
MARBLE FALLS	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	1,000	1,000	1,000	1,000	1,000	0	0	Supply Estimate based on LCRA 4/9/04
MEADOWLAKES	BURNET	COLORADO	K		Colorado	14999	Other Local Supply	486	486	486	486	486	486	486	2001 Plan: TCB & LCRA provided data
IRRIGATION	BURNET	BRAZOS	K	Burnet	Brazos	02728	Trinity	0	0	0	0	0	0	0	2001 Plan: AllocFile10 18.4% reduced
IRRIGATION	BURNET	COLORADO	K	Burnet	Colorado	02716	Hickory	2,397	2,397	2,397	2,397	2,397	2,397	2,397	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BURNET	COLORADO	K	Burnet	Colorado	02719	Marble Falls	533	533	533	533	533	533	533	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BURNET	COLORADO	K	Burnet	Colorado	02728	Trinity	104	104	104	88	88	72	72	2001 Plan: AllocFile10 9/24/99
IRRIGATION	BURNET	COLORADO	K	Burnet	Colorado	027996	Irrigation Local Supply	276	276	276	276	276	276	276	2001 Plan: TWDB
IRRIGATION	BURNET	COLORADO	K	Burnet	Colorado	02714	Ellenburger-San Saba	25	25	25	25	25	25	25	2001 Plan: ALLOC-F10 9/24/99
LIVESTOCK	BURNET	BRAZOS	K	Burnet	Brazos	02728	Trinity	45	45	45	45	45	45	45	2001 Plan: A-ALL, 12.6% reduced
LIVESTOCK	BURNET	BRAZOS	K		Brazos	12997	Livestock Local Supply	341	341	341	341	341	341	341	2001 Plan: Demand
LIVESTOCK	BURNET	COLORADO	K	Burnet	Colorado	02716	Hickory	189	189	189	189	189	189	189	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	BURNET	COLORADO	K		Colorado	14997	Livestock Local Supply	210	210	210	210	210	210	210	2001 Plan: Demand
LIVESTOCK	BURNET	COLORADO	K	Burnet	Colorado	02728	Trinity	71	71	71	60	60	50	50	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	BURNET	COLORADO	K	Burnet	Colorado	02719	Marble Falls	3,115	3,115	3,115	3,115	3,115	3,115	3,115	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	BURNET	COLORADO	K	Burnet	Colorado	02714	Ellenburger-San Saba	25	25	25	25	25	25	25	2001 Plan: A-ALL, LIMIT
MANUFACTURING	BURNET	BRAZOS						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
MANUFACTURING	BURNET	COLORADO	K	Burnet	Colorado	02714	Ellenburger-San Saba	25	25	25	25	25	25	25	2001 Plan: ALLOC-F10 9/24/99
MANUFACTURING	BURNET	COLORADO	K		Colorado	14999	Other Local Supply	1,237	1,367	1,503	1,643	1,761	1,933	1,933	2001 Plan: LCRA Provided data
MANUFACTURING	BURNET	COLORADO	K		Colorado	140B0	Highland Lakes	500	500	500	500	500	500	500	Supply Estimate based on LCRA 4/9/04
MINING	BURNET	BRAZOS	K	Burnet	Brazos	02728	Trinity	54	54	54	54	45	45	45	2001 Plan: A-ALL, 5% reduced
MINING	BURNET	COLORADO	K		Colorado	14999	Other Local Supply	767	747	762	778	801	826	826	2001 Plan: LCRA Provided data
MINING	BURNET	COLORADO	K	Burnet	Colorado	02719	Marble Falls	123	123	123	123	123	123	123	2001 Plan: A-ALL, % & Tbl 4
MINING	BURNET	COLORADO	K	Burnet	Colorado	02716	Hickory	315	315	315	315	315	315	315	2001 Plan: A-ALL, % & Tbl 4

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
MINING	BURNET	COLORADO	K	Burnet	Colorado	02728	Trinity	4	4	4	3	3	3	3	2001 Plan: AllocFile10 9/24/99
MINING	BURNET	COLORADO	K	Burnet	Colorado	02714	Ellenburger-San Saba	25	25	25	25	25	25	25	2001 Plan: A-ALL, LIMIT
STEAM ELECTRIC POWER	BURNET	BRAZOS						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	BURNET	COLORADO	K	Burnet	Colorado	02714	Ellenburger-San Saba	25	25	25	25	25	25	25	2001 Plan: AllFile10 9/24 Limit
COLUMBUS	COLORADO	COLORADO	K	Colorado	Colorado	04515	Gulf Coast	1,350	1,350	1,350	1,350	1,350	1,350	1,350	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	COLORADO	BRAZOS-COLORADO	K	Colorado	Brazos-Colorado	04515	Gulf Coast	122	122	122	122	122	122	122	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	COLORADO	COLORADO	K	Colorado	Colorado	04515	Gulf Coast	800	800	800	800	800	800	800	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	COLORADO	LAVACA	K	Colorado	Lavaca	04515	Gulf Coast	254	250	250	250	250	250	250	2001 Plan: A-ALL, % & Tbl 4
EAGLE LAKE	COLORADO	BRAZOS-COLORADO	K	Colorado	Brazos-Colorado	04515	Gulf Coast	440	440	440	440	440	440	440	2001 Plan: A-ALL, LIMIT
EAGLE LAKE	COLORADO	COLORADO	K	Colorado	Colorado	04515	Gulf Coast	430	430	430	430	430	430	430	2001 Plan: A-ALL, LIMIT
WEIMAR	COLORADO	COLORADO	K	Fayette	Colorado	07515	Gulf Coast	1,804	1,804	1,804	1,804	1,804	1,804	1,804	2001 Plan: A-ALL, LIMIT
WEIMAR	COLORADO	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	2,119	2,119	2,119	2,119	2,119	2,119	2,119	2001 Plan: A-ALL, LIMIT 2218 reduced
IRRIGATION	COLORADO	BRAZOS-COLORADO	K		Colorado	3461405475	LCRA - Lakeside ROR	8,429	8,429	8,429	8,429	8,429	8,429	8,429	TCEQ WAM 5/6/05; Lakeside ROR split between 3 basins.
IRRIGATION	COLORADO	BRAZOS-COLORADO	K		Colorado	3461405434A	LCRA - Garwood ROR	21,588	21,588	21,588	21,588	21,588	21,588	21,588	TCEQ WAM 5/6/05; 70% of Garwood ROR water in a minimum year (LCRA) split between 3 basins.
IRRIGATION	COLORADO	BRAZOS-COLORADO	K	Colorado	Brazos-Colorado	04515	Gulf Coast	7,775	7,775	7,775	7,775	7,775	7,775	7,775	2001 Plan: Demand
IRRIGATION	COLORADO	COLORADO	K		Colorado	3461405475	LCRA - Lakeside ROR	4,092	4,092	4,092	4,092	4,092	4,092	4,092	TCEQ WAM 5/6/05; Lakeside ROR split between 3 basins.
IRRIGATION	COLORADO	COLORADO	K	Colorado	Colorado	04515	Gulf Coast	11,191	11,191	11,191	11,191	11,191	11,191	11,191	2001 Plan: Demand
IRRIGATION	COLORADO	COLORADO	K	Colorado	Colorado	045996	Irrigation Local Supply	3,000	3,000	3,000	3,000	3,000	3,000	3,000	2001 Plan: LCRA Provided data
IRRIGATION	COLORADO	COLORADO	K		Colorado	3461405434A	LCRA - Garwood ROR	10,481	10,481	10,481	10,481	10,481	10,481	10,481	TCEQ WAM 5/6/05; 70% of Garwood ROR water in a minimum year (LCRA) split between 3 basins.
IRRIGATION	COLORADO	LAVACA	K		Colorado	3461405475	LCRA - Lakeside ROR	18,017	18,017	18,017	18,017	18,017	18,017	18,017	TCEQ WAM 5/6/05; Lakeside ROR split between 3 basins.
IRRIGATION	COLORADO	LAVACA	K	Colorado	Lavaca	04515	Gulf Coast	14,050	14,050	14,050	14,050	14,050	14,050	14,050	2001 Plan: Demand
IRRIGATION	COLORADO	LAVACA	K	Colorado	Lavaca	045996	Irrigation Local Supply	4,002	4,002	4,002	4,002	4,002	4,002	4,002	2001 Plan: LCRA Provided data
IRRIGATION	COLORADO	LAVACA	K		Colorado	3461405434A	LCRA - Garwood ROR	46,149	46,149	46,149	46,149	46,149	46,149	46,149	TCEQ WAM 5/6/05; 70% of Garwood ROR water in a minimum year (LCRA) split between 3 basins.
LIVESTOCK	COLORADO	BRAZOS-COLORADO	K	Colorado	Brazos-Colorado	04515	Gulf Coast	65	65	65	65	65	65	65	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	COLORADO	BRAZOS-COLORADO	K		Brazos-Colorado	13997	Livestock Local Supply	39	39	39	39	39	39	39	2001 Plan: LCRA Provided data
LIVESTOCK	COLORADO	COLORADO	K		Colorado	14997	Livestock Local Supply	860	860	860	860	860	860	860	2001 Plan: LCRA Provided data
LIVESTOCK	COLORADO	COLORADO	K	Colorado	Colorado	04515	Gulf Coast	25	25	25	25	25	25	25	2001 Plan: A-ALL, LIMIT
LIVESTOCK	COLORADO	LAVACA	K		Lavaca	16997	Livestock Local Supply	177	177	177	177	177	177	177	2001 Plan: LCRA Provided data
LIVESTOCK	COLORADO	LAVACA	K	Colorado	Lavaca	04515	Gulf Coast	283	283	283	283	283	283	283	2001 Plan: A-ALL, % & Tbl 4
MANUFACTURING	COLORADO	BRAZOS-COLORADO	K	Colorado	Brazos-Colorado	04515	Gulf Coast	27	27	27	27	27	27	27	2001 Plan: A-ALL, % & Tbl 4
MANUFACTURING	COLORADO	COLORADO	K		Colorado	14999	Other Local Supply	1,143	1,215	1,285	1,353	1,418	1,481	1,481	2001 Plan: A-ALL, TCB
MANUFACTURING	COLORADO	LAVACA						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
MINING	COLORADO	BRAZOS-COLORADO	K	Colorado	Brazos-Colorado	04515	Gulf Coast	120	100	100	100	100	100	100	2001 Plan: A-ALL, % & Tbl 4
MINING	COLORADO	COLORADO	K		Colorado	14999	Other Local Supply	18,920	10,508	11,391	12,443	13,785	15,402	15,402	2001 Plan: A-ALL and LCRA provided data
MINING	COLORADO	LAVACA	K	Colorado	Lavaca	04515	Gulf Coast	1,727	1,627	1,627	1,627	1,627	1,627	1,627	2001 Plan: A-ALL, 100% reduced
STEAM ELECTRIC POWER	COLORADO	BRAZOS-COLORADO						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	COLORADO	COLORADO	K	Colorado	Colorado	04515	Gulf Coast	0	0	0	0	0	0	0	2001 Plan: AllFile10 9/24 Limit
STEAM ELECTRIC POWER	COLORADO	LAVACA						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
AQUA WSC	FAYETTE	COLORADO	K		Colorado	140B0	Highland Lakes	65	90	115	135	150	0	0	New WUG: Supply Estimate based on LCRA 02/02/05
COUNTY-OTHER	FAYETTE	BRAZOS	K	Fayette	Brazos	07515	Gulf Coast	0	0	0	0	0	0	0	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	FAYETTE	COLORADO	K	Fayette	Colorado	07515	Gulf Coast	428	154	0	0	0	0	0	2001 Plan: A-ALL, LIMIT; adjusted year 2000 value based on reduced total available Gulf Coast supplies 2/7/05
COUNTY-OTHER	FAYETTE	COLORADO	K	Fayette	Colorado	07524	Queen City	90	90	90	90	90	90	90	2001 Plan: AllFile10 limit
COUNTY-OTHER	FAYETTE	COLORADO	K	Fayette	Colorado	07527	Sparta	53	0	0	0	0	0	0	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	FAYETTE	COLORADO	K		Colorado	140B0	Highland Lakes	97	12	0	0	0	0	0	Supply Estimate based on LCRA 4/9/04
COUNTY-OTHER	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07515	Gulf Coast	76	76	76	76	76	76	76	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07527	Sparta	90	90	90	90	90	90	90	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	279	226	204	96	9	0	0	2001 Plan: A-ALL, % & Tbl 4
FAYETTE WSC	FAYETTE	COLORADO	K	Fayette	Colorado	07524	Queen City	282	282	282	282	282	282	282	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/13/05
FAYETTE WSC	FAYETTE	COLORADO	K	Fayette	Colorado	07515	Gulf Coast	675	675	675	675	675	675	675	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/13/05
FAYETTE WSC	FAYETTE	LAVACA	K	Fayette	Lavaca	07524	Queen City	25	25	25	25	25	25	25	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/13/05
FAYETTE WSC	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	59	59	59	59	59	59	59	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/13/05

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
FLATONIA	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07515	Gulf Coast	53	53	52	53	53	53	53	Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/20/05
FLATONIA	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07510	Carrizo-Wilcox	66	66	66	66	66	66	66	Supply Estimate based on TCEQ maximum production capacity for listed wells (168). 1/20/05 Total supply was reduced due to limited Carrizo supplies in Fayette County.
FLATONIA	FAYETTE	LAVACA	K	Fayette	Lavaca	07510	Carrizo-Wilcox	44	44	44	44	44	44	44	Supply Estimate based on TCEQ maximum production capacity for listed wells (168). 1/20/05; Reduced to supply available to Carrizo-Wilcox aquifer in Fayette County, Lavaca basin
FLATONIA	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	183	182	183	183	183	183	182	Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/20/05
LA GRANGE	FAYETTE	COLORADO	K	Fayette	Colorado	07524	Queen City	662	662	662	662	662	662	662	Supply available to Queen City aquifer in Fayette County, Colorado basin minus supply to Fayette WSC and County Other.
LA GRANGE	FAYETTE	COLORADO	K	Fayette	Colorado	07527	Sparta	1,850	1,850	1,850	1,850	1,850	1,850	1,850	2001 Plan: A-ALL, 100% reduced
LEE COUNTY WSC	FAYETTE	COLORADO		Fayette	Colorado	07510	Carrizo-Wilcox	290	290	290	290	290	290	290	Supply available to Carrizo-Wilcox aquifer in Fayette County, Colorado basin
SCHULENBURG	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	2,119	2,119	2,119	2,119	2,119	2,119	2,119	2001 Plan: A-ALL, LIMIT 2580 reduced
IRRIGATION	FAYETTE	BRAZOS	K	Fayette	Brazos	07515	Gulf Coast	1	1	1	1	1	1	1	2001 Plan: AllocFile10 9/24/99
IRRIGATION	FAYETTE	COLORADO	K	Fayette	Colorado	07515	Gulf Coast	150	150	150	150	150	150	150	2001 Plan: AllocFile10 9/24/99
IRRIGATION	FAYETTE	COLORADO	K	Fayette	Colorado	075996	Irrigation Local Supply	534	534	534	534	534	534	534	2001 Plan: LCRA provided data and Demand
IRRIGATION	FAYETTE	COLORADO	K	Fayette	Colorado	07510	Carrizo-Wilcox	0	0	0	0	0	0	0	Reduced supply due to over allocation of Carrizo-Wilcox in Fayette County Colorado basin 2/7/05
IRRIGATION	FAYETTE	COLORADO	K	Fayette	Colorado	07527	Sparta	484	484	484	484	484	484	484	2001 Plan: AllocFile10 9/24/99
IRRIGATION	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07515	Gulf Coast	2	2	2	2	2	2	2	2001 Plan: AllocFile10 10% reduced
IRRIGATION	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07527	Sparta	60	60	60	60	60	60	60	2001 Plan: AllocFile10 9/24/99
IRRIGATION	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	14	14	14	14	14	14	14	2001 Plan: AllocFile10 9/24/99
IRRIGATION	FAYETTE	LAVACA	K	Fayette	Lavaca	07527	Sparta	3	3	3	3	3	3	3	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	FAYETTE	BRAZOS	K		Brazos	12997	Livestock Local Supply	2	2	2	2	2	2	2	2001 Plan: Demand
LIVESTOCK	FAYETTE	COLORADO	K	Fayette	Colorado	07515	Gulf Coast	140	140	140	140	140	140	140	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	FAYETTE	COLORADO	K	Fayette	Colorado	07527	Sparta	733	733	733	733	733	733	733	2001 Plan: A-ALL, 30% reduced
LIVESTOCK	FAYETTE	COLORADO	K		Colorado	14997	Livestock Local Supply	1,746	1,746	1,746	1,746	1,746	1,746	1,746	2001 Plan: LCRA Provided data
LIVESTOCK	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07527	Sparta	179	179	179	179	179	179	179	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	FAYETTE	GUADALUPE	K		Guadalupe	18997	Livestock Local Supply	142	142	142	142	142	142	142	2001 Plan: LCRA Provided data
LIVESTOCK	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07515	Gulf Coast	2	2	2	2	2	2	2	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	176	176	176	176	176	176	176	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	FAYETTE	LAVACA	K	Fayette	Lavaca	07527	Sparta	71	71	71	71	71	71	71	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	FAYETTE	LAVACA	K		Lavaca	16997	Livestock Local Supply	472	472	472	472	472	472	472	2001 Plan: LCRA Provided data
MANUFACTURING	FAYETTE	BRAZOS						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
MANUFACTURING	FAYETTE	COLORADO	K	Fayette	Colorado	07515	Gulf Coast	0	0	0	0	0	0	0	2001 Plan: AllocFile10 9/24/99
MANUFACTURING	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07527	Sparta	22	22	22	22	22	22	22	2001 Plan: AllocFile10 9/24/99
MANUFACTURING	FAYETTE	LAVACA	K	Fayette	Lavaca	07527	Sparta	8	8	8	8	8	8	8	2001 Plan: AllocFile10 9/24/99
MANUFACTURING	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	152	152	152	152	152	152	152	2001 Plan: A-ALL, % & Tbl 4
MINING	FAYETTE	BRAZOS	K	Fayette	Brazos	07515	Gulf Coast	63	42	25	7	1	0	0	2001 Plan: A-ALL, 100% reduced
MINING	FAYETTE	COLORADO	K	Fayette	Colorado	07527	Sparta	367	367	367	367	367	367	367	2001 Plan: AllocFile10 9/24/99
MINING	FAYETTE	COLORADO	K	Fayette	Colorado	07515	Gulf Coast	103	103	103	103	103	103	103	2001 Plan: A-ALL, % & Tbl 4
MINING	FAYETTE	GUADALUPE	K	Fayette	Guadalupe	07527	Sparta	60	60	60	60	60	60	60	2001 Plan: AllocFile10 9/24/99
MINING	FAYETTE	LAVACA	K	Fayette	Lavaca	07515	Gulf Coast	10	10	10	10	10	10	10	2001 Plan: A-ALL, % & Tbl 4
MINING	FAYETTE	LAVACA	K	Fayette	Lavaca	07527	Sparta	24	24	24	24	24	24	24	2001 Plan: AllocFile10 9/24/99
STEAM ELECTRIC POWER	FAYETTE	BRAZOS						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	FAYETTE	COLORADO	K		Colorado	3461405471A-SE	City of Austin - ROR (Steam Elec.)	1,426	1,312	1,198	1,084	970	856	741	TCEQ WAM 5/6/05; FPP
STEAM ELECTRIC POWER	FAYETTE	COLORADO	K		Colorado	140B0	Highland Lakes	38,101	38,101	38,101	38,101	38,101	38,101	38,101	TCEQ WAM 5/6/05; LCRA Cooling Water
STEAM ELECTRIC POWER	FAYETTE	COLORADO	K		Colorado	140B0	Highland Lakes	3,500	3,500	3,500	0	0	0	0	Supply Estimate based on LCRA 4/9/04
STEAM ELECTRIC POWER	FAYETTE	GUADALUPE						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	FAYETTE	LAVACA						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
COUNTY-OTHER	GILLESPIE	COLORADO	K	Gillespie	Colorado	08613	Edwards-Trinity (Plateau)	968	968	968	968	968	968	968	Hill Country UWCD 5/14/04
COUNTY-OTHER	GILLESPIE	COLORADO	K	Gillespie	Colorado	08614	Ellenburger-San Saba	436	436	436	436	436	436	436	Hill Country UWCD 5/14/04
COUNTY-OTHER	GILLESPIE	COLORADO	K	Gillespie	Colorado	08616	Hickory	596	596	596	596	596	596	596	Hill Country UWCD 5/14/04
COUNTY-OTHER	GILLESPIE	GUADALUPE	K	Gillespie	Colorado	08628	Trinity	1,123	1,123	1,123	1,123	1,123	1,123	1,123	Hill Country UWCD 5/14/04
COUNTY-OTHER	GILLESPIE	GUADALUPE	K	Gillespie	Guadalupe	08613	Edwards-Trinity (Plateau)	90	90	90	90	90	90	90	Hill Country UWCD 5/14/04
COUNTY-OTHER	GILLESPIE	GUADALUPE	K	Gillespie	Guadalupe	08614	Ellenburger-San Saba	65	65	65	65	65	65	65	Hill Country UWCD 5/14/04
COUNTY-OTHER	GILLESPIE	COLORADO	K	Gillespie	Guadalupe	08616	Hickory	66	66	66	66	66	66	66	Hill Country UWCD 5/14/04
COUNTY-OTHER	GILLESPIE	GUADALUPE	K	Gillespie	Guadalupe	08628	Trinity	26	26	26	26	26	26	26	Hill Country UWCD 5/14/04
FREDERICKSBURG	GILLESPIE	COLORADO	K	Gillespie	Colorado	08614	Ellenburger-San Saba	3,174	3,174	3,174	3,174	3,174	3,174	3,174	Hill Country UWCD 5/14/04
FREDERICKSBURG	GILLESPIE	COLORADO	K	Gillespie	Colorado	08616	Hickory	662	662	662	662	662	662	662	Hill Country UWCD 5/14/04

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
IRRIGATION	GILLESPIE	COLORADO	K	Gillespie	Colorado	08613	Edwards-Trinity (Plateau)	71	71	71	71	71	71	71	2001 Plan: A-ALL, LIMIT reduced
IRRIGATION	GILLESPIE	COLORADO	K	Gillespie	Colorado	086996	Irrigation Local Supply	880	880	880	880	880	880	880	2001 Plan: LCRA provided data?
IRRIGATION	GILLESPIE	COLORADO	K	Gillespie	Colorado	08628	Trinity	1,149	1,149	1,149	1,149	1,149	1,149	1,149	Hill Country UWCD 5/14/04
IRRIGATION	GILLESPIE	COLORADO	K	Gillespie	Colorado	08616	Hickory	210	210	210	210	210	210	210	Hill Country UWCD 5/14/04
IRRIGATION	GILLESPIE	COLORADO	K	Gillespie	Colorado	08614	Ellenburger-San Saba	1,239	1,239	1,239	1,239	1,239	1,239	1,239	Hill Country UWCD 5/14/04
IRRIGATION	GILLESPIE	GUADALUPE	K	Gillespie	Guadalupe	08628	Trinity	0	0	0	0	0	0	0	2001 Plan: AllocFile10 10% reduced
LIVESTOCK	GILLESPIE	COLORADO	K		Colorado	14997	Livestock Local Supply	515	515	515	515	515	515	515	2001 Plan: Demand
LIVESTOCK	GILLESPIE	COLORADO	K	Gillespie	Colorado	08613	Edwards-Trinity (Plateau)	266	266	266	266	266	266	266	Hill Country UWCD 5/14/04
LIVESTOCK	GILLESPIE	COLORADO	K	Gillespie	Colorado	08614	Ellenburger-San Saba	266	266	266	266	266	266	266	Hill Country UWCD 5/14/04
LIVESTOCK	GILLESPIE	COLORADO	K	Gillespie	Colorado	08616	Hickory	266	266	266	266	266	266	266	Hill Country UWCD 5/14/04
LIVESTOCK	GILLESPIE	COLORADO	K	Gillespie	Colorado	08628	Trinity	932	932	932	932	932	932	932	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	GILLESPIE	GUADALUPE	K	Gillespie	Guadalupe	08628	Trinity	20	20	20	20	20	20	20	2001 Plan: A-ALL, 17.6% reduced
LIVESTOCK	GILLESPIE	GUADALUPE	K		Guadalupe	18997	Livestock Local Supply	13	13	13	13	13	13	13	2001 Plan: Demand
MANUFACTURING	GILLESPIE	COLORADO	K	Gillespie	Colorado	08613	Edwards-Trinity (Plateau)	34	34	34	34	34	34	34	Hill Country UWCD 5/14/04
MANUFACTURING	GILLESPIE	COLORADO	K	Gillespie	Colorado	08614	Ellenburger-San Saba	398	398	398	398	398	398	398	Hill Country UWCD 5/14/04
MANUFACTURING	GILLESPIE	COLORADO	K	Gillespie	Colorado	08616	Hickory	150	150	150	150	150	150	150	Hill Country UWCD 5/14/04
MANUFACTURING	GILLESPIE	COLORADO	K		Colorado	14999	Other Local Supply	158	158	158	158	158	158	158	2001 Plan: Demand
MANUFACTURING	GILLESPIE	GUADALUPE						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
MINING	GILLESPIE	COLORADO	K	Gillespie	Colorado	08616	Hickory	50	50	50	50	50	50	50	Hill Country UWCD 5/14/04
MINING	GILLESPIE	COLORADO	K	Gillespie	Colorado	08628	Trinity	150	150	150	150	150	150	150	Hill Country UWCD 5/14/04
MINING	GILLESPIE	COLORADO	K	Gillespie	Colorado	08613	Edwards-Trinity (Plateau)	71	71	71	71	71	71	71	2001 Plan: AllFile10 9/24 Limit reduced
MINING	GILLESPIE	COLORADO	K	Gillespie	Colorado	08614	Ellenburger-San Saba	22	22	22	22	22	22	22	2001 Plan: AllocFile10 9/24/99
MINING	GILLESPIE	GUADALUPE	K	Gillespie	Guadalupe	08628	Trinity	0	0	0	0	0	0	0	2001 Plan: AllocFile10 10% reduced
STEAM ELECTRIC POWER	GILLESPIE	COLORADO	K	Gillespie	Colorado	08613	Edwards-Trinity (Plateau)	0	0	0	0	0	0	0	Hill Country UWCD 5/14/04
STEAM ELECTRIC POWER	GILLESPIE	GUADALUPE						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
BUDA	HAYS	COLORADO	K	Hays	Colorado	10511	Edwards-BFZ	614	614	614	614	614	614	614	BSEACD 3/9/04
CIMARRON PARK WATER COMPANY	HAYS	COLORADO		Hays	Colorado	10511	Edwards-BFZ	327	362	362	362	362	362	362	New WUG: BSEACD 3/9/04
COUNTY-OTHER	HAYS	COLORADO	K		Colorado	140B0	Highland Lakes	1,915	1,915	1,915	1,915	1,915	0	0	Supply based on LCRA revised data 2/7/05
COUNTY-OTHER	HAYS	COLORADO	K	Hays	Colorado	10511	Edwards-BFZ	877	877	877	877	877	877	877	BSEACD 3/9/04
DRIPPING SPRINGS	HAYS	COLORADO	K		Colorado	140B0	Highland Lakes	560	560	560	560	560	0	0	New WUG: Supply Estimate based on LCRA 4/9/04 (from Dripping Springs WSC)
DRIPPING SPRINGS WSC	HAYS	COLORADO	K	Hays	Colorado	10528	Trinity	240	240	240	240	240	240	240	New WUG: Supply based on Dripping Springs WSC 9/20/04
HILL COUNTRY WSC	HAYS	COLORADO	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	992	0	0	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04
HILL COUNTRY WSC	HAYS	COLORADO	K		Colorado	140B0	Highland Lakes	0	440	702	980	1,249	1,582	1,844	New WUG: Retail customer of West Travis RWS. Subtracted demand from West Travis Contract. 2/10/05
MOUNTAIN CITY	HAYS	COLORADO		Hays	Colorado	10511	Edwards-BFZ	89	132	132	132	132	132	132	New WUG: BSEACD 3/9/04
IRRIGATION	HAYS	COLORADO	K	Hays	Colorado	10511	Edwards-BFZ	931	931	931	931	931	931	931	2001 Plan: AllocFile10 9/24/99
IRRIGATION	HAYS	COLORADO	K	Hays	Colorado	10528	Trinity	2	2	2	2	2	1	1	2001 Plan: AllocFile10 9/24/99
IRRIGATION	HAYS	COLORADO	K	Hays	Colorado	105996	Irrigation Local Supply	41	41	41	41	41	41	41	2001 Plan: LCRA Provided data
LIVESTOCK	HAYS	COLORADO	K		Colorado	14997	Livestock Local Supply	192	192	192	192	192	192	192	2001 Plan: LCRA Provided data
LIVESTOCK	HAYS	COLORADO	K	Hays	Colorado	10528	Trinity	30	30	30	30	30	25	25	2001 Plan: A-ALL, 17.6% reduced
LIVESTOCK	HAYS	COLORADO	K	Hays	Colorado	10511	Edwards-BFZ	624	624	624	624	624	624	624	2001 Plan: ALLOC-F10 9/24/99
MANUFACTURING	HAYS	COLORADO	K	Hays	Colorado	10511	Edwards-BFZ	922	922	922	922	922	922	922	BSEACD 3/9/04 855 ac-ft/yr; rest Plan2001
MINING	HAYS	COLORADO	K	Hays	Colorado	10511	Edwards-BFZ	9	9	9	9	9	9	9	2001 Plan: A-ALL, % & Tbl 4
MINING	HAYS	COLORADO	K	Hays	Colorado	10528	Trinity	12	12	12	12	12	10	10	2001 Plan: A-ALL, 3.5% reduced
STEAM ELECTRIC POWER	HAYS	COLORADO						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
COUNTY-OTHER	LLANO	COLORADO	K	Llano	Colorado	15014	Ellenburger-San Saba	120	120	120	120	120	120	120	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	LLANO	COLORADO	K	Llano	Colorado	15016	Hickory	45	45	45	45	45	45	45	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	LLANO	COLORADO	K		Colorado	140B0	Highland Lakes	2,074	2,074	747	747	728	728	728	Supply based on LCRA revised data 2/7/05
KINGSLAND WSC	LLANO	COLORADO	K		Colorado	140B0	Highland Lakes	460	455	448	442	436	429	0	New WUG: Supply Estimate based on revised LCRA data and proportioned by county. 2/8/05
KINGSLAND WSC	LLANO	COLORADO	K	Llano	Colorado	15022	Other Aquifer	109	109	109	109	109	109	109	New WUG: Supply Estimate based on TCEQ capacity for listed wells. Assumes all GW is supplied within Llano County. 1/14/05
LAKE LBJ MUD	LLANO	COLORADO	K		Colorado	140B0	Highland Lakes	1,556	1,530	1,495	1,462	1,431	0	0	New WUG: Supply Estimate based on revised LCRA data. 2/2/05
LLANO	LLANO	COLORADO	K		Colorado	140B0	Highland Lakes	87	87	87	87	0	0	0	Supply Estimate based on LCRA 4/9/04
LLANO	LLANO	COLORADO	K		Colorado	14520	Llano Reservoir	187	178	169	160	151	142	135	TCEQ WAM 5/6/05
SUNRISE BEACH VILLAGE	LLANO	COLORADO	K		Colorado	140B0	Highland Lakes	278	278	278	278	278	278	278	New WUG: Supply Estimate based on TCEQ maximum production capacity for system. 1/14/05
SUNRISE BEACH VILLAGE	LLANO	COLORADO	K	Llano	Colorado	15016	Hickory	65	65	65	65	65	65	65	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells. 1/14/05
IRRIGATION	LLANO	COLORADO	K	Llano	Colorado	150996	Irrigation Local Supply	440	440	440	440	440	440	440	2001 Plan: LCRA Provided data

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
IRRIGATION	LLANO	COLORADO	K	Llano	Colorado	15016	Hickory	10,051	10,051	10,051	10,051	10,051	10,051	10,051	2001 Plan: A-ALL, % & Tbl 4
IRRIGATION	LLANO	COLORADO	K	Llano	Colorado	15014	Ellenburger-San Saba	76	76	76	76	76	76	76	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	LLANO	COLORADO	K		Colorado	14997	Livestock Local Supply	393	393	393	393	393	393	393	2001 Plan: LCRA Provided data
LIVESTOCK	LLANO	COLORADO	K	Llano	Colorado	15016	Hickory	288	288	288	288	288	288	288	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	LLANO	COLORADO	K	Llano	Colorado	15014	Ellenburger-San Saba	8	8	8	8	8	8	8	2001 Plan: A-ALL, % & Tbl 4
MANUFACTURING	LLANO	COLORADO						0	0	0	0	0	0	0	New WUG: Minimal Demand, therefore 0 Supply
MINING	LLANO	COLORADO	K	Llano	Colorado	15016	Hickory	1,252	1,252	1,252	1,252	1,252	1,252	1,252	2001 Plan: A-ALL, % & Tbl 4
MINING	LLANO	COLORADO	K	Llano	Colorado	15014	Ellenburger-San Saba	76	76	76	76	76	76	76	2001 Plan: A-ALL, % & Tbl 4
STEAM ELECTRIC POWER	LLANO	COLORADO	K		Colorado	140B0	Highland Lakes	15,700	15,700	15,700	15,700	15,700	15,700	15,700	TCEQ WAM 5/6/05; LCRA Cooling Water
BAY CITY	MATAGORDA	BRAZOS-COLORADO	K	Matagorda	Brazos-Colorado	16115	Gulf Coast	6,255	6,255	6,255	6,255	6,255	6,255	6,255	2001 Plan: A-ALL, LIMIT 9725 reduced
COUNTY-OTHER	MATAGORDA	COLORADO			Colorado	140B0	Highland Lakes	15	15	0	0	0	0	0	Supply based on LCRA revised data 2/7/05
COUNTY-OTHER	MATAGORDA	BRAZOS-COLORADO	K	Matagorda	Brazos-Colorado	16115	Gulf Coast	1,938	1,936	1,933	1,932	1,932	1,933	1,933	2001 Plan: ALLOC-F10 9/24/99
COUNTY-OTHER	MATAGORDA	COLORADO	K	Matagorda	Colorado	16115	Gulf Coast	250	250	250	250	250	250	250	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	MATAGORDA	COLORADO		Matagorda	Brazos-Colorado	16115	Gulf Coast	789	789	789	789	789	789	789	
COUNTY-OTHER	MATAGORDA	COLORADO-LAVACA	K	Matagorda	Colorado-Lavaca	16115	Gulf Coast	3,902	3,902	3,902	3,902	3,902	3,902	3,902	2001 Plan: A-ALL, % & Tbl 4
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA		Matagorda	Colorado-Lavaca	16115	Gulf Coast	0	0	0	0	0	0	0	New WUG: TCEQ database shows only supply to Matagorda County as dissolved; No well data. 1/14/05
PALACIOS	MATAGORDA	COLORADO-LAVACA	K	Matagorda	Colorado-Lavaca	16115	Gulf Coast	2,152	2,152	2,152	2,152	2,152	2,152	2,152	2001 Plan: A-ALL, LIMIT
SOUTHWEST UTILITIES	MATAGORDA	BRAZOS-COLORADO		Matagorda	Colorado-Lavaca	16115	Gulf Coast	140	140	140	140	140	140	140	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells. 1/13/05
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	K		Colorado	3461405476A	LCRA - Gulf Coast ROR	34,844	34,838	34,832	34,826	34,820	34,814	34,806	TCEQ WAM 5/6/05; Gulf Coast ROR split by basin.
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	K	Matagorda	Brazos-Colorado	161996	Irrigation Local Supply	4,000	4,000	4,000	4,000	4,000	4,000	4,000	2001 Plan: TWDB
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	K	Matagorda	Brazos-Colorado	16115	Gulf Coast	4,082	4,082	4,082	4,082	4,082	4,082	4,082	2001 Plan: Demand
IRRIGATION	MATAGORDA	COLORADO	K		Colorado	3461405476A	LCRA - Gulf Coast ROR	4,449	4,448	4,447	4,446	4,445	4,444	4,444	TCEQ WAM 5/6/05; Gulf Coast ROR split by basin.
IRRIGATION	MATAGORDA	COLORADO	K	Matagorda	Colorado	16115	Gulf Coast	1,389	1,389	1,389	1,389	1,389	1,389	1,389	2001 Plan: Demand
IRRIGATION	MATAGORDA	COLORADO	K	Matagorda	Colorado	161996	Irrigation Local Supply	900	900	900	900	900	900	900	2001 Plan: TWDB
IRRIGATION	MATAGORDA	COLORADO-LAVACA	K		Colorado	3461405476A	LCRA - Gulf Coast ROR	34,844	34,838	34,832	34,826	34,820	34,814	34,806	TCEQ WAM 5/6/05; Gulf Coast ROR split by basin.
IRRIGATION	MATAGORDA	COLORADO-LAVACA	K	Matagorda	Colorado-Lavaca	16115	Gulf Coast	7,108	7,108	7,108	7,108	7,108	7,108	7,108	2001 Plan: Demand
IRRIGATION	MATAGORDA	COLORADO-LAVACA	K	Matagorda	Colorado-Lavaca	161996	Irrigation Local Supply	4,000	4,000	4,000	4,000	4,000	4,000	4,000	2001 Plan: TWDB
LIVESTOCK	MATAGORDA	BRAZOS-COLORADO	K		Brazos-Colorado	13997	Livestock Local Supply	206	206	206	206	206	206	206	2001 Plan: Demand
LIVESTOCK	MATAGORDA	BRAZOS-COLORADO	K	Matagorda	Brazos-Colorado	16115	Gulf Coast	875	875	875	875	875	875	875	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	MATAGORDA	COLORADO	K		Colorado	14997	Livestock Local Supply	25	25	25	25	25	25	25	2001 Plan: LCRA Provided data
LIVESTOCK	MATAGORDA	COLORADO	K	Matagorda	Colorado	16115	Gulf Coast	171	171	171	171	171	171	171	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	MATAGORDA	COLORADO-LAVACA	K		Colorado-Lavaca	15997	Livestock Local Supply	215	215	215	215	215	215	215	2001 Plan: LCRA Provided data
LIVESTOCK	MATAGORDA	COLORADO-LAVACA	K	Matagorda	Colorado-Lavaca	16115	Gulf Coast	215	215	215	215	215	215	215	2001 Plan: A-ALL, LIMIT
MANUFACTURING	MATAGORDA	BRAZOS-COLORADO	K	Matagorda	Brazos-Colorado	16115	Gulf Coast	1,823	1,823	1,823	1,823	1,823	1,823	1,823	2001 Plan: ALLOC-F10 8% reduced
MANUFACTURING	MATAGORDA	BRAZOS-COLORADO	K		Colorado	140B0	Highland Lakes	7,438	7,438	3,150	1,464	1,464	0	0	Supply Estimate based on revised LCRA data (split by basin). 2/2/05
MANUFACTURING	MATAGORDA	COLORADO	K	Matagorda	Colorado	16115	Gulf Coast	929	929	929	929	929	929	929	2001 Plan: A-ALL, % & Tbl 4
MANUFACTURING	MATAGORDA	COLORADO	K		Colorado	140B0	Highland Lakes	6,784	6,784	2,872	1,336	1,336	0	0	Supply Estimate based on revised LCRA data (split by basin). 2/2/05
MANUFACTURING	MATAGORDA	COLORADO-LAVACA	K	Matagorda	Colorado-Lavaca	16115	Gulf Coast	2,537	2,537	2,537	2,537	2,537	2,537	2,537	2001 Plan: A-ALL, % & Tbl 4
MINING	MATAGORDA	BRAZOS-COLORADO	K	Matagorda	Brazos-Colorado	16115	Gulf Coast	182	182	182	182	182	182	182	2001 Plan: A-ALL, % & Tbl 4
MINING	MATAGORDA	COLORADO	K	Matagorda	Colorado	16115	Gulf Coast	0	0	0	0	0	0	0	2001 Plan: AllocFile10 9/24/99
MINING	MATAGORDA	COLORADO-LAVACA	K	Matagorda	Colorado-Lavaca	16115	Gulf Coast	664	664	664	664	664	664	664	2001 Plan: A-ALL, % & Tbl 4
STEAM ELECTRIC POWER	MATAGORDA	BRAZOS-COLORADO						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	K	Matagorda	Colorado	16115	Gulf Coast	443	443	443	443	443	443	443	2001 Plan: A-ALL, % & Tbl 4
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	K		Colorado	3461405437	STP Nuclear Operating Co. - ROR	49,089	49,039	48,989	48,939	48,889	48,839	48,791	TCEQ WAM 5/10/05
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	K		Colorado	140B0	Highland Lakes	38,060	38,111	38,162	38,213	0	0	0	TCEQ WAM 5/6/05; LCRA contract: Back-up of STP WR (was 5680 now 38,060)
STEAM ELECTRIC POWER	MATAGORDA	COLORADO-LAVACA						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
BROOKSMITH SUD	MILLS	COLORADO	F		Colorado	14140	Lake Brownwood	1,688	1,688	1,688	0	0	0	0	New WUG: Supply based on Brookesmith SUD 9/20/04
COUNTY-OTHER	MILLS	BRAZOS	K	Mills	Brazos	16728	Trinity	259	259	259	227	227	186	186	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	MILLS	COLORADO	K	Mills	Colorado	16728	Trinity	336	336	336	295	295	242	242	2001 Plan: A-ALL, % & Tbl 4
GOLDTHWAITE	MILLS	BRAZOS	K	Mills	Brazos	16728	Trinity	1	1	1	1	1	1	1	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/20/05
GOLDTHWAITE	MILLS	BRAZOS	K		Colorado	14350	Goldthwaite Reservoir	2	2	2	2	2	2	2	New WUG: TCEQ WAM 5/6/05
GOLDTHWAITE	MILLS	COLORADO	K		Colorado	14350	Goldthwaite Reservoir	142	142	142	143	143	143	143	New WUG: TCEQ WAM 5/6/05
GOLDTHWAITE	MILLS	COLORADO	K	Mills	Colorado	16728	Trinity	67	67	67	67	67	68	68	Supply Estimate based on TCEQ maximum production capacity for listed wells and proportioned based on demand per basin. 1/20/05

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
IRRIGATION	MILLS	BRAZOS	K	Mills	Brazos	16728	Trinity	143	143	143	125	125	103	103	2001 Plan: AllocFile10 9/24/99
IRRIGATION	MILLS	COLORADO	K	Mills	Colorado	16728	Trinity	76	76	76	66	66	54	54	2001 Plan: AllocFile10 9/24/99
IRRIGATION	MILLS	COLORADO	K	Mills	Colorado	167996	Irrigation Local Supply	2,378	2,378	2,378	2,378	2,378	2,378	2,378	2001 Plan: TWDB
LIVESTOCK	MILLS	BRAZOS	K	Mills	Brazos	16728	Trinity	438	438	438	438	438	438	438	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	MILLS	COLORADO	K	Mills	Colorado	16728	Trinity	407	407	407	357	357	293	293	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	MILLS	COLORADO	K		Colorado	14997	Livestock Local Supply	314	314	314	314	314	314	314	2001 Plan: LCRA Provided data
MANUFACTURING	MILLS	BRAZOS						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
MANUFACTURING	MILLS	COLORADO						0	0	0	0	0	0	0	New WUG: Minimal Demand, therefore 0 Supply
MINING	MILLS	BRAZOS	K	Mills	Brazos	16728	Trinity	143	143	143	125	125	103	103	2001 Plan: AllocFile10 9/24/99
MINING	MILLS	COLORADO	K	Mills	Colorado	16728	Trinity	133	133	133	117	117	96	96	2001 Plan: AllocFile10 9/24/99
STEAM ELECTRIC POWER	MILLS	BRAZOS						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	MILLS	COLORADO						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
COUNTY-OTHER	SAN SABA	COLORADO	K	San Saba	Colorado	20614	Ellenburger-San Saba	7,744	7,744	7,744	7,744	7,744	7,744	7,744	Supply available to Ellenburger-San Saba aquifer in San Saba County, Colorado basin minus supply to Richland and San Saba WUG.
COUNTY-OTHER	SAN SABA	COLORADO	K	San Saba	Colorado	20616	Hickory	50	50	50	50	50	50	50	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	SAN SABA	COLORADO	K	San Saba	Colorado	20619	Marble Falls	250	250	250	250	250	250	250	2001 Plan: A-ALL, LIMIT
COUNTY-OTHER	SAN SABA	COLORADO	K		Colorado	140B0	Highland Lakes	20	0	0	0	0	0	0	Supply based on LCRA revised data 2/7/05
RICHLAND SUD	SAN SABA	COLORADO	K	San Saba	Colorado	20614	Ellenburger-San Saba	210	210	210	210	210	210	210	New WUG: Supply Estimate based on TCEQ maximum production capacity for listed wells. 1/14/05
SAN SABA	SAN SABA	COLORADO	K	San Saba	Colorado	20614	Ellenburger-San Saba	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2001 Plan: Plant verbal confirmation
IRRIGATION	SAN SABA	COLORADO	K	San Saba	Colorado	20616	Hickory	4,715	4,715	4,715	4,715	4,715	4,715	4,715	2001 Plan: AllocFile10 9/24/99
IRRIGATION	SAN SABA	COLORADO	K	San Saba	Colorado	20619	Marble Falls	4,643	4,643	4,643	4,643	4,643	4,643	4,643	2001 Plan: AllocFile10 9/24/99
IRRIGATION	SAN SABA	COLORADO	K	San Saba	Colorado	206996	Irrigation Local Supply	8,800	8,800	8,800	8,800	8,800	8,800	8,800	2001 Plan: TWDB
LIVESTOCK	SAN SABA	COLORADO	K	San Saba	Colorado	20619	Marble Falls	2,612	2,612	2,612	2,612	2,612	2,612	2,612	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	SAN SABA	COLORADO	K		Colorado	14997	Livestock Local Supply	224	224	224	224	224	224	224	2001 Plan: Demand
LIVESTOCK	SAN SABA	COLORADO	K	San Saba	Colorado	20616	Hickory	994	994	994	994	994	994	994	2001 Plan: A-ALL, % & Tbl 4
MANUFACTURING	SAN SABA	COLORADO	K	San Saba	Colorado	20616	Hickory	144	144	144	144	144	144	144	2001 Plan: AllocFile10 9/24/99
MANUFACTURING	SAN SABA	COLORADO	K	San Saba	Colorado	20619	Marble Falls	2,612	2,612	2,612	2,612	2,612	2,612	2,612	2001 Plan: AllocFile10 9/24/99
MINING	SAN SABA	COLORADO	K	San Saba	Colorado	20619	Marble Falls	1,238	1,238	1,238	1,238	1,238	1,238	1,238	2001 Plan: AllocFile10 9/24/99
MINING	SAN SABA	COLORADO	K	San Saba	Colorado	20616	Hickory	301	301	301	301	301	301	301	2001 Plan: A-ALL, % & Tbl 4
STEAM ELECTRIC POWER	SAN SABA	COLORADO						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
ANDERSON MILL MUD	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	0	0	0	0	0	0	0	New WUG Name: Supply Estimate based on OLD name & COA meeting 3/16/04
AQUA WSC	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	981	1,088	1,251	1,390	1,484	0	0	New WUG: Supply Estimate based on LCRA 02/02/05
AUSTIN	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	126,161	134,914	129,779	130,094	117,629	109,453	100,196	TCEQ WAM 5/6/05; remaining supply after wholesale commitment allocation
AUSTIN	TRAVIS	COLORADO	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	716	2,542	3,526	4,491	5,738	5,865	5,993	TCEQ WAM 5/10/05; remaining supply after wholesale commitment allocation
AUSTIN	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	143,947	143,343	142,739	142,135	141,531	140,927	0	TCEQ WAM 5/6/05; COA contract with LCRA (this supply makes the COA municipal and manufacturing supply total 325,000 ac-ft/yr)
BARTON CREEK WEST WSC	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	348	348	348	348	348	348	348	New WUG: Supply Estimate based on LCRA 4/9/04
BEE CAVE VILLAGE	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	241	241	241	241	241	241	241	New WUG: Supply Estimate based on LCRA 4/9/04
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	300	300	300	300	0	0	0	New WUG: Supply Estimate based on LCRA 4/9/04
CEDAR PARK	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	112	188	290	384	443	0	0	New WUG: Supply Estimate based on LCRA 4/9/04 (split by region); Contract to Williamson-Travis MUD #1 has been taken from 2000 and 2010 planning periods.
COUNTY-OTHER	TRAVIS	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	64	64	64	64	64	64	64	Aqua WSC email 3/29/04
COUNTY-OTHER	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	7,403	5,343	4,186	3,252	2,100	1,119	1,209	Based on COA meeting 1/28/05 (portion of demand)
COUNTY-OTHER	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	1,443	1,443	1,443	1,443	1,443	1,443	1,443	BSEACD 3/9/04
COUNTY-OTHER	TRAVIS	GUADALUPE	K	Travis	Colorado	22711	Edwards-BFZ	1	1	1	1	1	1	1	BSEACD 3/9/04
COUNTY-OTHER	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	14,424	13,820	11,472	6,171	5,051	1,470	1,470	Supply based on LCRA revised data 2/7/05 (Travis County WCID #19 supply taken out)
COUNTY-OTHER	TRAVIS	COLORADO	K	Travis	Colorado	22728	Trinity	592	592	592	592	592	485	485	2001 Plan: A-ALL, 100% reduced
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	818	818	0	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04 (Proportioned by basin demand)
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	477	450	437	430	417	407	407	New WUG: Supply Estimate based on BSEACD 3/9/04 (Proportioned by basin demand)
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	21	21	0	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04 (Proportioned by basin demand)
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	K	Travis	Guadalupe	22711	Edwards-BFZ	13	12	12	11	11	11	11	New WUG: Supply Estimate based on BSEACD 3/9/04 (Proportioned by basin demand)

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
ELGIN	TRAVIS	COLORADO	K	Bastrop	Colorado	01110	Carrizo-Wilcox	10	14	20	22	23	23	22	New WUG: Supply Estimate based on TCEQ maximum production capacity for groundwater treatment facility and proportioned by total demand. 1/14/05
GOFORTH WSC	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	32	27	25	24	22	20	20	New WUG: Supply Estimate based on BSEACD 3/9/04 (Proportioned by region demand)
HILL COUNTRY WSC	TRAVIS	COLORADO	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	688	0	0	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04
HILL COUNTRY WSC	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	0	238	364	484	555	633	714	New WUG: Retail customer of West Travis RWS. Subtracted demand from West Travis Contract. 2/10/05
JONESTOWN	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	251	251	250	250	0	0	0	Jonestown WSC split between Jonestown and Jonestown WSC WUGs.
JONESTOWN WSC	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	109	109	110	110	0	0	0	New WUG: Supply Estimate based on LCRA 4/9/04; supply split between Jonestown and Jonestown WSC
LAGO VISTA	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	6,770	6,770	6,500	0	0	0	0	Supply Estimate based on revised LCRA data 2/2/05. Multiple contracts with different expiration dates.
LAKEWAY	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	2,455	2,455	2,455	0	0	0	0	Lakeway MUD supply from LCRA was allocated to Lakeway.
LAKEWAY MUD	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	0	0	0	0	0	0	0	New WUG: Supply Estimate based on revised LCRA data. 2/2/05
LOOP 360 WSC	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	871	871	871	0	0	0	0	New WUG: Supply Estimate based on LCRA 4/9/04
LOST CREEK MUD	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	951	0	0	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04
MANOR	TRAVIS	COLORADO	K	Travis	Colorado	22722	Other Aquifer	661	661	661	661	661	661	661	Supply estimate based on TCEQ total production. 2/8/05
MANOR	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	1,680	1,680	1,680	0	0	0	0	COA email 2/18/04
MANVILLE WSC	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	2,240	2,240	2,240	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04
MANVILLE WSC	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	0	0	0	0	0	0	0	New WUG: Supply reduced from estimated from TCEQ well production capacities due to other supplies and reduction of Edwards-BFZ in Travis County Colorado Basin 2/7/05
MANVILLE WSC	TRAVIS	COLORADO	K	Travis	Colorado	22722	Other Aquifer	1,067	1,064	1,063	1,059	1,053	1,045	1,037	New WUG: Supply estimated from TCEQ well production capacities and proportioned for percent total population. 1/14/05
MUSTANG RIDGE	TRAVIS	COLORADO	K	Travis	Colorado	22722	Other Aquifer	80	93	111	128	139	150	162	New WUG: No Data; Assumed alluvial supplies (no major or minor aquifers in the area)
MUSTANG RIDGE	TRAVIS	GUADALUPE	K	Travis	Guadalupe	22722	Other Aquifer	21	25	30	34	37	40	43	New WUG: No Data; Assumed alluvial supplies (no major or minor aquifers in the area)
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	112	109	107	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	0	514	792	1,045	1,196	0	0	TCEQ database shows MUD as annexed by Pflugerville 2/8/05 (Met Demand from Pflugerville supplies)
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	314	0	0	0	0	0	0	TCEQ database shows MUD as annexed by Pflugerville 2/8/05 (Met Demand from Pflugerville supplies)
PFLUGERVILLE	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	0	11,486	11,208	10,955	10,804	0	0	Supply Estimate based on LCRA 4/9/04 (12000 reduced by North Travis County MUD 5)
PFLUGERVILLE	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	10,887	0	0	0	0	0	0	COA email 2/18/04; COA contract expires 12/31/07 and is replaced with LCRA contract (11201 reduced by North Travis County MUD 5)
PFLUGERVILLE	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	0	0	0	0	0	0	0	Supply reduced from estimated from City of Pflugerville Update due to other supplies and reduction of Edwards-BFZ in Travis County Colorado Basin 2/7/05
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	900	900	0	0	0	0	0	New WUG: Supply Estimate based on LCRA 4/9/04
ROLLINGWOOD	TRAVIS	COLORADO	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	1,120	1,120	1,120	1,120	0	0	0	Supply Estimate based on COA email 2/18/04
ROUND ROCK	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	108	0	0	0	0	0	0	New WUG: COA email 2/18/04. Proportioned by Region
ROUND ROCK	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	213	241	266	264	240	223	210	New WUG: Supply estimated from TCEQ well production capacities and proportioned for percent total demand. 1/14/05
SHADY HOLLOW MUD	TRAVIS	COLORADO	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	763	747	731	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
THE HILLS	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	1,600	1,600	1,600	0	0	0	0	New WUG: Supply Estimate based on LCRA 4/9/04
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	9,354	9,354	8,800	8,800	8,800	8,800	0	New WUG: Supply Estimate based on LCRA revised data. 2/2/05
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	1,400	1,400	0	0	0	0	0	New WUG: Supply Estimate based on LCRA 4/9/04
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	293	376	374	0	0	0	0	New WUG: Supply based on demand and Travis County WCID No. 19 9/20/04 (supplied by Travis County MUD #4 which is contained in Travis County Other)
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	1,135	1,135	1,135	0	0	0	0	New WUG: Supply Estimate based on LCRA revised data. 2/2/05
WELLS BRANCH MUD	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	1,527	1,508	1,490	0	0	0	0	New WUG Name: Supply Estimate based on COA email 2/18/04
WEST LAKE HILLS	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	2,420	2,420	2,420	0	0	0	0	2001 Plan; Supplied by Travis County Water District #10, which is included in County-Other
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	3,411	2,733	2,345	1,947	1,607	1,196	853	New WUG: Supply Estimate based on LCRA. Retail supplies to various WUGs have been subtracted out. 2/10/05
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	482	482	0	0	0	0	0	New WUG: Supply based on Williamson-Travis Counties MUD No. 1 (supplied by Cedar Park)
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	2,240	2,240	2,240	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	0	0	0	0	0	0	0	New WUG: Supply reduced from estimated from Windermere Utility Co. numbers due to other supplies and reduction of Edwards-BFZ in Travis County Colorado Basin 2/7/05
IRRIGATION	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	187	187	187	187	187	187	187	Reduced 2001 Plan value to account for reduction in available Edwards-BFZ supply to Travis County Colorado Basin 2/7/05
IRRIGATION	TRAVIS	COLORADO	K	Travis	Colorado	227996	Irrigation Local Supply	880	880	880	880	880	880	880	2001 Plan: TWDB
IRRIGATION	TRAVIS	COLORADO	K	Travis	Brazos	22711	Edwards-BFZ	5	5	5	5	5	5	5	New WUG Basin: AllocFile10 9/24/99
IRRIGATION	TRAVIS	COLORADO	K	Travis	Colorado	22728	Trinity	85	85	85	85	85	70	70	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	TRAVIS	COLORADO	K	Travis	Brazos	22711	Edwards-BFZ	1	1	1	1	1	1	1	New WUG Basin: AllocFile10 9/24/99
LIVESTOCK	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	186	186	186	186	186	186	186	Reduced 2001 Plan value to account for reduction in available Edwards-BFZ supply to Travis County Colorado Basin 2/7/05
LIVESTOCK	TRAVIS	COLORADO	K		Colorado	14997	Livestock Local Supply	870	870	870	870	870	870	870	2001 Plan: LCRA provided data and Demand
LIVESTOCK	TRAVIS	COLORADO	K	Travis	Colorado	22728	Trinity	2	2	2	2	2	1	1	2001 Plan: AllocFile10 9/24/99
LIVESTOCK	TRAVIS	GUADALUPE	K		Guadalupe	18997	Livestock Local Supply	36	36	36	36	36	36	36	2001 Plan: A-ALL, Demand
MANUFACTURING	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	167	167	167	167	167	167	167	2001 Plan: AllocFile10 9/24/99
MANUFACTURING	TRAVIS	COLORADO	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	12,943	18,578	23,081	32,504	43,680	50,168	56,472	Based on COA meeting 1/28/05 (portion of demand)
MANUFACTURING	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	910	0	0	0	0	0	0	Supply Estimate based on revised LCRA data. 2/2/05
MINING	TRAVIS	COLORADO	K		Colorado	14999	Other Local Supply	4,834	4,700	5,200	5,745	6,361	7,070	7,070	Revised 2001 number by 46 ac-ft/yr since supply was over allocated 2/7/05
MINING	TRAVIS	COLORADO	K	Travis	Colorado	22711	Edwards-BFZ	187	187	187	187	187	187	187	Reduced 2001 Plan value to account for reduction in available Edwards-BFZ supply to Travis County Colorado Basin 2/7/05
MINING	TRAVIS	COLORADO	K	Travis	Colorado	22728	Trinity	171	171	171	171	171	140	140	2001 Plan: AllocFile10 9/24/99
STEAM ELECTRIC POWER	TRAVIS	COLORADO	K		Colorado	140B0	Highland Lakes	30,860	30,994	31,128	31,262	31,396	31,530	0	TCEQ WAM 5/6/05 (firms up Town Lake and Decker supply)
STEAM ELECTRIC POWER	TRAVIS	COLORADO	K		Colorado	3461405471A-SE	City of Austin - ROR (Steam Elec.)	5,283	5,296	5,309	5,322	5,335	5,348	5,361	TCEQ WAM 5/6/05; Town Lake
STEAM ELECTRIC POWER	TRAVIS	COLORADO	K		Colorado	3461405489A-SE	City of Austin - ROR (Steam Elec.)	2,904	2,869	2,834	2,799	2,764	2,729	2,693	TCEQ WAM 5/6/05; Decker
STEAM ELECTRIC POWER	TRAVIS	COLORADO	K	Travis	Colorado	22728	Trinity	3	3	3	3	3	3	3	2001 Plan: AllocFile10 9/24/99
STEAM ELECTRIC POWER	TRAVIS	GUADALUPE						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
COUNTY-OTHER	WHARTON	BRAZOS-COLORADO	K	Wharton	Brazos-Colorado	24115	Gulf Coast	5,869	5,869	5,869	5,869	5,869	5,869	5,869	2001 Plan: A-ALL, 100% reduced
COUNTY-OTHER	WHARTON	COLORADO	K	Wharton	Colorado	24115	Gulf Coast	1,106	1,106	1,106	1,106	1,106	1,106	1,106	2001 Plan: A-ALL, % & Tbl 4
COUNTY-OTHER	WHARTON	COLORADO-LAVACA	K	Wharton	Colorado-Lavaca	24115	Gulf Coast	299	299	299	299	299	299	299	2001 Plan: A-ALL, % & Tbl 4
WHARTON	WHARTON	BRAZOS-COLORADO	K	Wharton	Brazos-Colorado	24115	Gulf Coast	5,636	5,636	5,636	5,636	5,636	5,636	5,636	2001 Plan: 2/3 OF DEMAND
WHARTON	WHARTON	COLORADO	K	Wharton	Colorado	24115	Gulf Coast	540	540	540	540	540	540	540	2001 Plan: 1/3 OF DEMAND
IRRIGATION	WHARTON	BRAZOS-COLORADO	K		Colorado	3461405434A	LCRA - Garwood ROR	18,267	18,267	18,267	18,267	18,267	18,267	18,267	TCEQ WAM 5/6/05; 30% of Garwood ROR water in a minimum year (LCRA) split between 3 basins.
IRRIGATION	WHARTON	BRAZOS-COLORADO	K	Wharton	Brazos-Colorado	24115	Gulf Coast	25,816	25,816	25,816	25,816	25,816	25,816	25,816	2001 Plan: Demand
IRRIGATION	WHARTON	BRAZOS-COLORADO	K	Wharton	Brazos-Colorado	241996	Irrigation Local Supply	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2001 Plan: TWDB
IRRIGATION	WHARTON	BRAZOS-COLORADO	K		Colorado	3461405477	LCRA - Pierce Ranch ROR	5,868	5,868	5,868	5,868	5,868	5,868	5,868	TCEQ WAM 5/6/05; Pierce Ranch ROR split by basin.
IRRIGATION	WHARTON	COLORADO	K		Colorado	3461405434A	LCRA - Garwood ROR	9,483	9,483	9,483	9,483	9,483	9,483	9,483	TCEQ WAM 5/6/05; 30% of Garwood ROR water in a minimum year (LCRA) split between 3 basins.
IRRIGATION	WHARTON	COLORADO	K	Wharton	Colorado	24115	Gulf Coast	29,567	29,567	29,567	29,567	29,567	29,567	29,567	2001 Plan: Demand
IRRIGATION	WHARTON	COLORADO	K	Wharton	Colorado	241996	Irrigation Local Supply	7,650	7,650	7,650	7,650	7,650	7,650	7,650	2001 Plan: TWDB

Region K Water Supply Table (by WUG and water source)

WUG Name	WUG County	WUG Basin	RWPG Water Source	Water Source County Name	Water Source Basin Name	Specific Source Identifier	Specific Source Name	Year 2000 SUPPLY (ac-ft/yr)	Year 2010 SUPPLY (ac-ft/yr)	Year 2020 SUPPLY (ac-ft/yr)	Year 2030 SUPPLY (ac-ft/yr)	Year 2040 SUPPLY (ac-ft/yr)	Year 2050 SUPPLY (ac-ft/yr)	Year 2060 SUPPLY (ac-ft/yr)	Source of Data*
IRRIGATION	WHARTON	COLORADO	K		Colorado	3461405477	LCRA - Pierce Ranch ROR	3,047	3,047	3,047	3,047	3,047	3,047	3,047	TCEQ WAM 5/6/05; Pierce Ranch ROR split by basin.
IRRIGATION	WHARTON	COLORADO-LAVACA	K		Colorado	3461405434A	LCRA - Garwood ROR	5,772	5,772	5,772	5,772	5,772	5,772	5,772	TCEQ WAM 5/6/05; 30% of Garwood ROR water in a minimum year (LCRA) split between 3 basins.
IRRIGATION	WHARTON	COLORADO-LAVACA	K	Wharton	Colorado-Lavaca	24115	Gulf Coast	7,060	7,060	7,060	7,060	7,060	7,060	7,060	2001 Plan: Demand
IRRIGATION	WHARTON	COLORADO-LAVACA	K		Colorado	3461405477	LCRA - Pierce Ranch ROR	1,854	1,854	1,854	1,854	1,854	1,854	1,854	TCEQ WAM 5/6/05; Pierce Ranch ROR split by basin.
LIVESTOCK	WHARTON	BRAZOS-COLORADO	K	Wharton	Brazos-Colorado	24115	Gulf Coast	222	222	222	222	222	222	222	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	WHARTON	BRAZOS-COLORADO	K		Brazos-Colorado	13997	Livestock Local Supply	149	149	149	149	149	149	149	2001 Plan: LCRA Provided data
LIVESTOCK	WHARTON	COLORADO	K		Colorado	14997	Livestock Local Supply	115	115	115	115	115	115	115	2001 Plan: LCRA Provided data
LIVESTOCK	WHARTON	COLORADO	K	Wharton	Colorado	24115	Gulf Coast	171	171	171	171	171	171	171	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	WHARTON	COLORADO-LAVACA	K	Wharton	Colorado-Lavaca	24115	Gulf Coast	113	113	113	113	113	113	113	2001 Plan: A-ALL, % & Tbl 4
LIVESTOCK	WHARTON	COLORADO-LAVACA	K		Colorado-Lavaca	15997	Livestock Local Supply	74	74	74	74	74	74	74	2001 Plan: LCRA Provided data
MANUFACTURING	WHARTON	BRAZOS-COLORADO	K	Wharton	Brazos-Colorado	24115	Gulf Coast	90	90	90	90	90	90	90	2001 Plan: A-ALL, % & Tbl 4
MANUFACTURING	WHARTON	COLORADO	K	Wharton	Colorado	24115	Gulf Coast	335	335	335	335	335	335	335	2001 Plan: A-ALL, % & Tbl 4
MANUFACTURING	WHARTON	COLORADO-LAVACA	K	Wharton	Colorado-Lavaca	24115	Gulf Coast	165	165	165	165	165	165	165	2001 Plan: A-ALL, % & Tbl 4
MINING	WHARTON	BRAZOS-COLORADO	K		Brazos-Colorado	13999	Other Local Supply	1,655	1,696	1,746	1,793	1,844	1,900	1,900	2001 Plan: LCRA Provided data
MINING	WHARTON	BRAZOS-COLORADO	K	Wharton	Brazos-Colorado	24115	Gulf Coast	850	850	850	850	850	850	850	2001 Plan: A-ALL, % & Tbl 4
MINING	WHARTON	COLORADO	K	Wharton	Colorado	24115	Gulf Coast	1,005	1,005	1,005	1,005	1,005	1,005	1,005	2001 Plan: A-ALL, % & Tbl 4
MINING	WHARTON	COLORADO-LAVACA	K	Wharton	Colorado-Lavaca	24115	Gulf Coast	23	23	23	23	23	23	23	2001 Plan: A-ALL, % & Tbl 4
STEAM ELECTRIC POWER	WHARTON	BRAZOS-COLORADO						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
STEAM ELECTRIC POWER	WHARTON	COLORADO	K		Brazos-Colorado	3461303421	San Bernard ROR	1,600	1,600	1,600	1,600	1,600	1,600	1,600	New WUG: Based on TCEQ water rights database; Reliability of WR has not been verified 2/8/05
STEAM ELECTRIC POWER	WHARTON	COLORADO-LAVACA						0	0	0	0	0	0	0	New WUG: 0 Demand, therefore 0 Supply
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	1,504	0	0	0	0	0	0	New WUG Name: Supply Estimate based on COA 1/28/05 (Demand)
AUSTIN	WILLIAMSON	BRAZOS	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	2,315	3,993	5,964	8,286	10,786	13,479	16,338	New WUG Basin: Supply Estimate based on OLD basin 2/21/04 (Met Demand)
AUSTIN	WILLIAMSON	BRAZOS	K		Colorado	3461405489A	City of Austin - ROR (Municipal)	0	0	0	0	0	0	0	New WUG Basin: Supply Estimate based on OLD basin 2/21/04
AUSTIN	WILLIAMSON	BRAZOS	K		Colorado	140B0	Highland Lakes	0	0	0	0	0	0	0	New WUG Basin: Supply Estimate based on OLD basin 2/21/04
COUNTY-OTHER	WILLIAMSON	BRAZOS	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	2,123	2,401	2,729	3,118	3,536	3,989	4,469	New WUG Basin: Supply Estimate based on COA meeting 1/28/05 (Met Demand)
COUNTY-OTHER	WILLIAMSON	BRAZOS	K	Williamson	Brazos	24628	Trinity	45	49	53	57	58	58	58	New WUG Basin: Supply available to Trinity aquifer in Williamson County, Brazos basin minus Mining Demand. 2/7/05
COUNTY-OTHER	WILLIAMSON	BRAZOS	K	Williamson	Brazos	24611	Edwards-BFZ	265	265	265	265	265	265	265	New WUG Basin: Supply available to Edwards-BFZ aquifer in Williamson County, Brazos basin. 2/7/05
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	K		Colorado	3461405471A	City of Austin - ROR (Municipal)	1,007	983	968	0	0	0	0	New WUG: Supply Estimate based on COA email 2/18/04
IRRIGATION	WILLIAMSON	BRAZOS						0	0	0	0	0	0	0	New WUG Basin: 0 Demand, therefore 0 Supply
LIVESTOCK	WILLIAMSON	BRAZOS						0	0	0	0	0	0	0	New WUG Basin: 0 Demand, therefore 0 Supply
MANUFACTURING	WILLIAMSON	BRAZOS						0	0	0	0	0	0	0	New WUG Basin: 0 Demand, therefore 0 Supply
MINING	WILLIAMSON	BRAZOS	K	Williamson	Brazos	24628	Trinity	13	9	5	1	0	0	0	New WUG Basin: Met Demand.
MINING	WILLIAMSON	BRAZOS	K	Williamson	Brazos	24611	Edwards-BFZ	0	0	0	0	0	0	0	New WUG Basin
STEAM ELECTRIC POWER	WILLIAMSON	BRAZOS						0	0	0	0	0	0	0	New WUG Basin: 0 Demand, therefore 0 Supply
								1,191,184	1,192,166	1,176,482	1,148,454	1,103,509	1,073,388	892,163	

BSEACD = Barton Springs Edwards Aquifer Conservation District
TWDB = Texas Water Development Board
A-ALL = TWDB allocation tables
LIMIT = Volume limitation based on TWDB allocation
% & Tbl 4 = Percent of available supply identified in 2001 Region K Table 4 based on TWDB allocation
LCRA = Lower Colorado River Authority (modeling results or contract amounts)
2001 Plan: Demand = Based on historic use
COA = City of Austin
Hill Country UWCD = Hill Country Underground Conservation District
TCEQ = Texas Commission on Environmental Quality
WUG = Water User Group

APPENDIX 3F

WATER AVAILABILITY COMPARISON
(2001 Plan versus 2006 Plan)

Water Availability Comparison (2001 Plan versus 2006 Plan)

2001 Availability Value: LCRA Response Model (December 2000 Chapter 3 Table 3.19)
2006 Availability Value: WAM before "No Call" (February 2005 Chapter 3 Table 3.23; No Return Flows)
2006 Availability Value: WAM with "No Call" Assumption (No Return Flows & No Interruptible)

	2000 (ac-ft/yr)				2010				2020				2030				2040				2050				2060		
2006 Water Source	2001 Plan	2006 WAM	2006 WAM "No Call"	***Difference (2006 "No Call"-2001)***	2001 Plan	2006 WAM	2006 WAM "No Call"	***Difference (2006 "No Call"-2001)***	2001 Plan	2006 WAM	2006 WAM "No Call"	***Difference (2006 "No Call"-2001)***	2001 Plan	2006 WAM	2006 WAM "No Call"	***Difference (2006 "No Call"-2001)***	2001 Plan	2006 WAM	2006 WAM "No Call"	***Difference (2006 "No Call"-2001)***	2001 Plan	2006 WAM	2006 WAM "No Call"	***Difference (2006 "No Call"-2001)***	2006 WAM	2006 WAM "No Call"	**Comment on Difference**
City of Austin - ROR Municipal	172,673	225,972	181,053	*8,380*	172,673	226,205	181,657	*8,984*	172,673	226,204	182,261	*9,588*	172,673	226,202	182,865	*10,192*	172,673	226,394	183,469	*10,796*	172,673	226,045	184,073	*11,400*	226,111	184,677	RESPONSE VS. WAM
City of Austin - ROR Steam Electric	7,159	18,141	9,613	*2,454*	7,159	18,141	9,477	*2,318*	7,159	18,141	9,341	*2,182*	7,159	18,141	9,205	*2,046*	7,159	18,141	9,069	*1,910*	7,159	16,795	8,933	*1,774*	16,795	8,795	RESPONSE VS. WAM
LCRA - Garwood ROR	50,000	133,000	111,740	*61,740*	50,000	133,000	111,740	*61,740*	50,000	133,000	111,740	*61,740*	50,000	133,000	111,740	*61,740*	50,000	133,000	111,740	*61,740*	50,000	133,000	111,740	*61,740*	133,000	111,740	RESPONSE VS. WAM
LCRA - Gulf Coast ROR	-	122,520	74,137	*74,137*	-	122,520	74,124	*74,124*	-	122,520	74,111	*74,111*	-	122,520	74,098	*74,098*	-	122,520	74,085	*74,085*	-	122,520	74,072	*74,072*	122,520	74,056	RESPONSE VS. WAM
LCRA - Lakeside #1 ROR	-	25,960	19,769	*19,769*	-	25,960	19,769	*19,769*	-	25,960	19,769	*19,769*	-	25,960	19,769	*19,769*	-	25,960	19,769	*19,769*	-	25,960	19,769	*19,769*	25,960	19,769	RESPONSE VS. WAM
LCRA - Lakeside #2 ROR	4,232	23,571	10,769	*6,537*	4,232	23,571	10,769	*6,537*	4,232	23,571	10,769	*6,537*	4,232	23,571	10,769	*6,537*	4,232	23,571	10,769	*6,537*	4,232	23,571	10,769	*6,537*	23,571	10,769	RESPONSE VS. WAM
LCRA - Pierce Ranch ROR	-	22,237	10,769	*10,769*	-	22,237	10,769	*10,769*	-	22,237	10,769	*10,769*	-	22,237	10,769	*10,769*	-	22,237	10,769	*10,769*	-	22,237	10,769	*10,769*	22,237	10,769	RESPONSE VS. WAM
San Bernard ROR	-	1,600	1,600	*1,600*	-	1,600	1,600	*1,600*	-	1,600	1,600	*1,600*	-	1,600	1,600	*1,600*	-	1,600	1,600	*1,600*	-	1,600	1,600	*1,600*	1,600	1,600	Based on TCEQ water rights database; Reliability of WR has not been verified.
STP Nuclear Operating Co. ROR	41,320	42,291	49,089	*7,769*	41,320	43,924	49,039	*7,719*	41,320	43,897	48,989	*7,669*	41,320	43,862	48,939	*7,619*	41,320	43,818	48,889	*7,569*	41,320	43,777	48,839	*7,519*	43,736	48,791	RESPONSE VS. WAM
Highland Lakes	445,766	435,737	382,924	*(62,842)*	445,766	419,307	381,545	*(64,221)*	445,766	415,800	380,166	*(65,600)*	445,766	411,380	378,787	*(66,979)*	445,766	410,040	377,408	*(68,358)*	445,766	406,898	376,029	*(69,737)*	401,608	374,642	RESPONSE VS. WAM
Goldthwaite Reservoir	400	125	144	*(256)*	400	125	144	*(256)*	400	125	144	*(256)*	400	125	145	*(255)*	400	125	145	*(255)*	400	125	145	*(255)*	125	145	Anecdotal Info. VS. WAM
Lake Bastrop	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	-	-	Included as part of Highland Lakes
Lake Fayette	1,400	-	-	*(1,400)*	1,400	-	-	*(1,400)*	1,400	-	-	*(1,400)*	1,400	-	-	*(1,400)*	1,400	-	-	*(1,400)*	1,400	-	-	*(1,400)*	-	-	Included as part of Highland Lakes
Llano Reservoir	400	99	187	*(213)*	400	99	178	*(222)*	400	99	169	*(231)*	400	99	160	*(240)*	400	99	151	*(249)*	400	99	142	*(258)*	99	135	RESPONSE VS. WAM
Walter E. Long (Decker Lake)	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	1,000	-	-	*(1,000)*	-	-	Included as part of Highland Lakes
Blanco Reservoir	300	596	596	*296*	300	596	596	*296*	300	596	596	*296*	300	596	596	*296*	300	596	596	*296*	300	596	596	*296*	596	596	RESPONSE VS. WAM
Irrigation Local Supply	40,663	40,663	40,663	-	40,663	40,663	40,663	-	40,663	40,663	40,663	-	40,663	40,663	40,663	-	40,663	40,663	40,663	-	40,663	40,663	40,663	-	40,663	40,663	This value shows as 40,704 in the 2001 Table 3.19, but only adds up to 40,663 in 2001 Table 4 (*Appendix 3E*).
Livestock Local Supply	8,458	8,458	8,458	-	8,458	8,458	8,458	-	8,458	8,458	8,458	-	8,458	8,458	8,458	-	8,458	8,458	8,458	-	8,458	8,458	8,458	-	8,458	8,458	
Other Local Supply	29,297	29,297	29,297	-	20,978	20,978	20,978	-	22,636	22,636	22,636	-	24,510	24,510	24,510	-	26,727	26,727	26,727	-	29,370	29,370	29,370	-	29,370	29,370	
Carrizo-Wilcox Aquifer	22,350	28,400	28,400	*6,050*	22,350	28,400	28,400	*6,050*	22,350	28,400	28,400	*6,050*	22,350	28,400	28,400	*6,050*	22,350	28,400	28,400	*6,050*	22,350	28,400	28,400	*6,050*	28,400	28,400	Lost Pine GCD availability number in Bastrop County.
Edwards Aquifer BFZ (Austin)	20,995	8,375	8,375	*(12,620)*	20,995	8,375	8,375	*(12,620)*	20,995	8,375	8,375	*(12,620)*	20,995	8,375	8,375	*(12,620)*	20,995	8,375	8,375	*(12,620)*	20,995	8,375	8,375	*(12,620)*	8,375	8,375	Northern Edwards (BFZ) GAM, BSEACD, refer to Ch. 3 Section 3.2.2.1.3.
Edwards-Trinity Aquifer (Plateau)	1,657	1,657	1,657	-	1,657	1,657	1,657	-	1,657	1,657	1,657	-	1,657	1,657	1,657	-	1,657	1,657	1,657	-	1,659	1,659	1,659	-	1,659	1,659	
Ellenburger-San Saba Aquifer	23,574	23,574	23,574	-	23,574	23,574	23,574	-	23,574	23,574	23,574	-	23,574	23,574	23,574	-	23,574	23,574	23,574	-	23,574	23,574	23,574	-	23,574	23,574	
Gulf Coast Aquifer	198,425	198,425	198,425	-	198,425	198,425	198,425	-	198,425	198,425	198,425	-	198,425	198,425	198,425	-	198,425	198,425	198,425	-	198,425	198,425	198,425	-	198,425	198,425	
Hickory Aquifer	27,380	27,380	27,380	-	27,380	27,380	27,380	-	27,380	27,380	27,380	-	27,380	27,380	27,380	-	27,380	27,380	27,380	-	27,380	27,380	27,380	-	27,380	27,380	
Marble Falls Aquifer	18,305	18,305	18,305	-	18,305	18,305	18,305	-	18,305	18,305	18,305	-	18,305	18,305	18,305	-	18,305	18,305	18,305	-	18,305	18,305	18,305	-	18,305	18,305	
Queen City Aquifer	3,991	3,991	3,991	-	3,991	3,991	3,991	-	3,991	3,991	3,991	-	3,991	3,991	3,991	-	3,991	3,991	3,991	-	3,991	3,991	3,991	-	3,991	3,991	
Sparta Aquifer	9,889	9,889	9,889	-	9,889	9,889	9,889	-	9,889	9,889	9,889	-	9,889	9,889	9,889	-	9,889	9,889	9,889	-	9,889	9,889	9,889	-	9,889	9,889	
Trinity Aquifer	11,841	16,782	16,782	*4,941*	11,841	16,782	16,782	*4,941*	11,841	16,782	16,782	*4,941*	11,077	16,440	16,440	*5,363*	11,077	16,440	16,440	*5,363*	9,698	15,717	15,717	*6,019*	15,717	15,717	Northern Trinity GAM, Edwards Trinity GAM (Trinity layer), refer to Ch. 3 Section 3.2.2.1.4.
Other Aquifer	120,000	13,558	13,558	*(106,442)*	120,000	13,572	13,572	*(106,428)*	120,000	13,594	13,594	*(106,406)*	120,000	13,611	13,611	*(106,389)*	120,000	13,619	13,619	*(106,381)*	120,000	13,625	13,625	*(106,375)*	13,632	13,632	Reduced Other Aquifer supplies to only represent areas that we know are supplied by alluvial sources.
Region K Totals	**1,262,475**	**1,480,603**	**1,281,144**	*18,669*	**1,254,156**	**1,457,734**	**1,271,856**	*17,700*	**1,255,814**	**1,455,879**	**1,272,553**	*16,739*	**1,256,924**	**1,452,971**	**1,273,120**	*16,196*	**1,259,141**	**1,454,004**	**1,274,362**	*15,221*	**1,260,407**	**1,451,054**	**1,275,307**	*14,900*	**1,445,796**	**1,274,322**	

Refer to Chapter 3 Section 3.2.1.1 and Tables 3.1, 3.1a, 3.2, 3.2a, 3.3 and 3.3a for an explanation of 2006 WAM assumptions and the WAM "no call" assumptions and values.

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CHAPTER 4.0: IDENTIFICATION, EVALUATION, AND SELECTION OF WATER MANAGEMENT STRATEGIES BASED ON NEED

4.1 IDENTIFICATION OF WATER NEEDS

The comparison of water demands for each water user group (WUG) to the water supplies available to each WUG within the Lower Colorado Regional Water Planning Area (LCRWPA) is a simple mathematical comparison of the estimates developed in Chapters 2 and 3 of this report. This comparison was completed and summarized in three different ways. First, a comparison of water demands and supplies was completed on a county-by-county basis. Second, the comparison was completed and summarized for each of the six river basins. Finally, a comparison of the water demands and supplies for the two designated wholesale water providers within the LCRWPA was also completed.

Regionwide, the comparison of available water supplies and water demands identified 99 separate WUGs that have projected water supply shortages, or "needs," by the year 2030, and an additional 19 WUGs with projected water supply shortages before the year 2060. **Note that throughout this chapter, the word "need" is consistently used to indicate a water supply shortage.** The estimated water need is approximately 281,000 acre-feet per year (ac-ft/yr) in 2030 and 557,000 ac-ft/yr in 2060. This identified shortage is based on conservative water availability estimates, which assume (1) only water is available during a repeat of the worst drought of record (DOR), (2) that all water rights are being fully and simultaneously utilized, and (3) excludes both water available from the Lower Colorado River Authority (LCRA) on an interruptible basis and water projected to be available as a result of municipal return flows to the Colorado River. In Region K, return flows discharged by the City of Austin (COA) constitute the vast majority of municipal return flows. The water availability calculations were also done using a model with many remaining technical issues. Water availability has also been impacted by the "No Call" planning assumption. These issues are discussed in Sections 3.2.1.2 and 8.5. Based upon these assumptions, water needs have been identified in all of the six water use categories. *Figure 4.1* contains an illustration of the distribution, by use category, of the number of WUGs with identified water needs in the years 2030 and 2060. *Figure 4.2* contains an illustration of the magnitude of the identified needs, by use category, for the years 2030 and 2060.

Figure 4.1: WUGs With Identified Water Needs in the LCRWPA

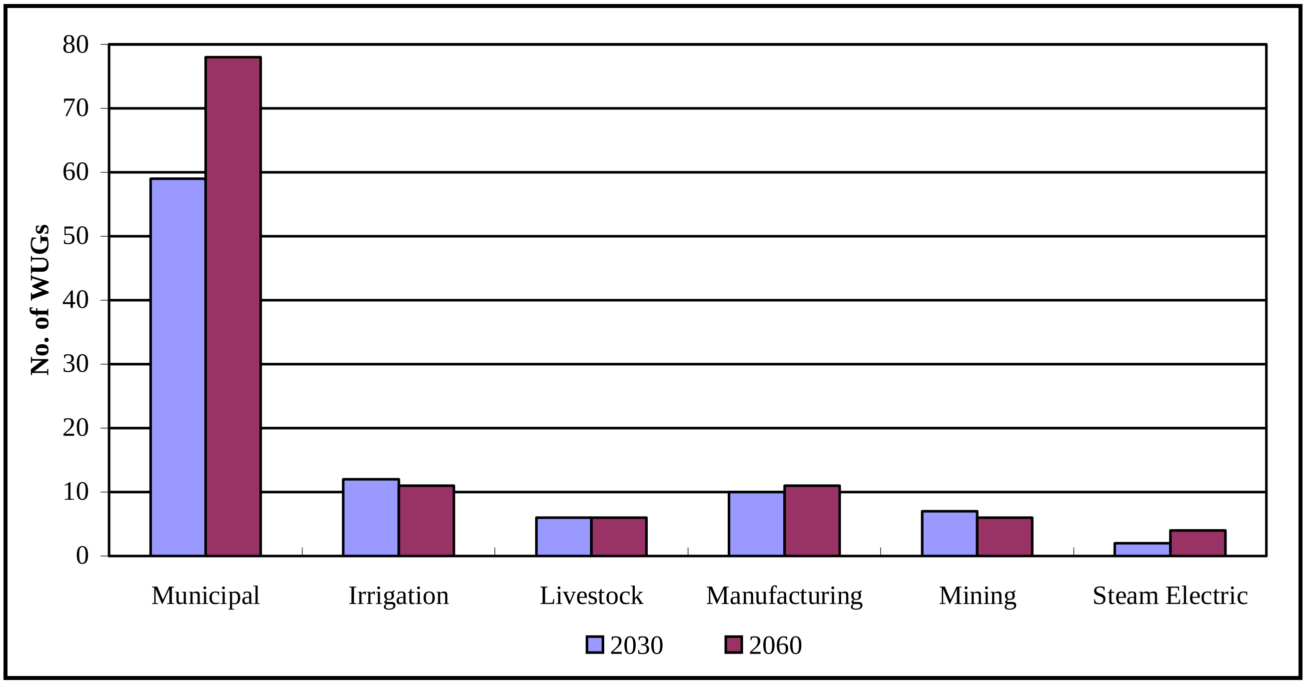
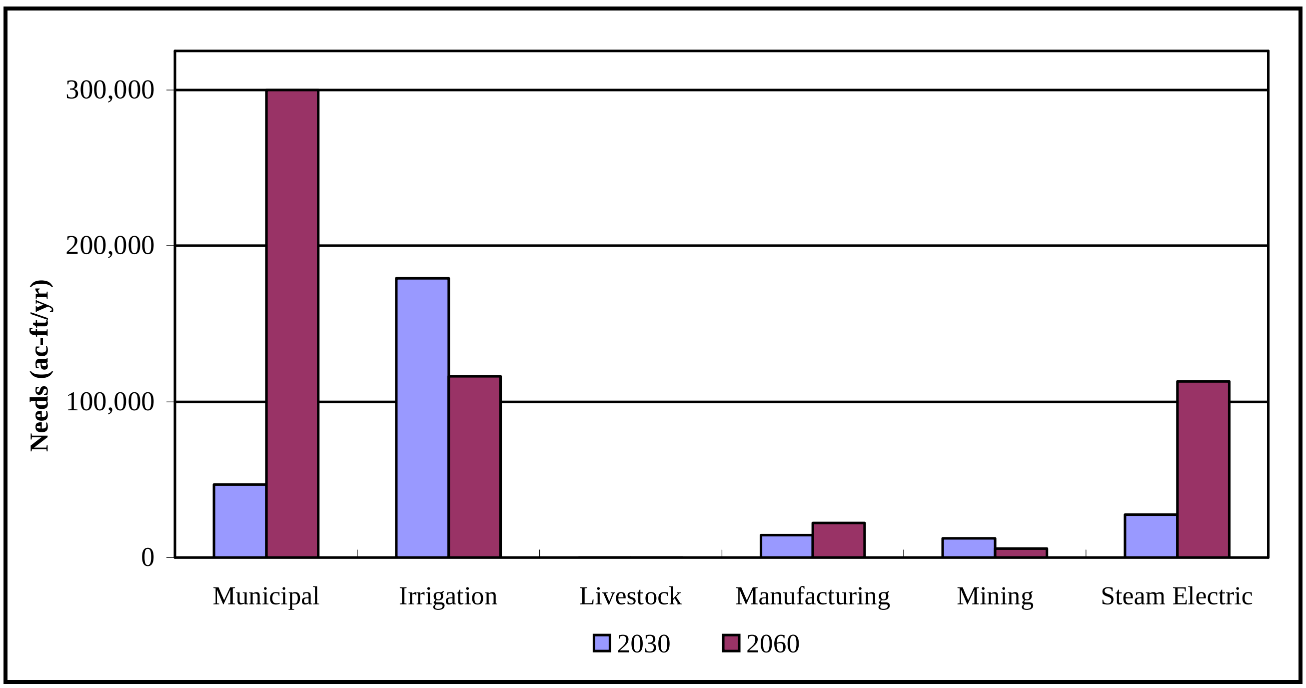


Figure 4.2: Identified Water Needs in the LCRWPA



The majority of the identified water supply shortages fall into two main categories. The first shortage is associated with rice irrigation demands in the lower three counties of Colorado, Matagorda and Wharton. It is estimated that irrigators in these three counties would experience a water supply shortage of approximately 247,000 ac-ft/yr under the existing demand conditions (year 2000 scenario), should a repeat of the driest year during the DOR occur. This shortage is estimated to decrease to 179,000 ac-ft/yr in 2030 (28 percent decrease) and to 116,000 ac-ft/yr in 2060 (53 percent decrease) due to projected declining rice irrigation acreage. These shortages would be reduced or eliminated through the implementation of water conservation and alternative water supply development measures under the LCRA-SAWS (San Antonio Water System) Water Project, the House Bill (HB) 1437 program, and the continued availability of interruptible water supplies and return flows over the planning period.

These estimated shortfalls are based on the available supply determined in Chapter 3. In accordance with Texas Water Development Board (TWDB) rules, the available supply of water for irrigation was estimated based on the available run-of-river (ROR) water rights and groundwater supplies in the area. The interruptible supply of water provided by the LCRA and municipal return flows were not considered in these calculations. As a result, the estimated shortages for rice irrigation in Colorado, Matagorda, and Wharton Counties are significantly overstated under typical conditions expected over the planning period. The continued use of interruptible water supplies to meet irrigation and other needs will be considered as one of the water management strategies.

The second category of identified shortages includes WUGs that purchase water from one of the two wholesale water providers within the LCRWPA - the COA and the LCRA. In accordance with TWDB rules, water available to WUGs under wholesale contracts is no longer considered available once the contract expires. Since the COA and the LCRA contracts generally extend for less than 50 years, most wholesale customers of these two major water providers will have an identified water shortage. The renewal and expansion of these wholesale water contracts will be considered as a water management strategy. However, the COA's current policy is that much of its water currently being supplied to wholesale customers may need to be provided by LCRA in the future. The COA will plan to continue to treat and transport this water.

LCRA is the major water supplier for the Lower Colorado Region. The COA also supplies a major portion of the municipal needs. LCRA holds water rights to over 2.1 million acre-feet (ac-ft) of water and provides water to 100 to 150 entities for municipal, industrial, irrigation, recreational, environmental, and other purposes. LCRA's strategy for meeting the region's changing and future water needs will be predicated on LCRA's ability to continue to use all of its water rights as a system. This includes not only the amendment of its water rights to meet changing and future water needs, but also an aggressive water conservation program and the development of alternative water supplies and conjunctive water management strategies.

Programs seeking to accomplish this include the LCRA-SAWS Water Project (LSWP), which was adopted in the last round of regional water planning, and HB 1437. Legislative conditions on the transfer of water to the San Antonio region include, but are not limited to, the protection of inbasin needs including adequate flows for environmental purposes, a limited contract term, and maintaining and enhancing average lake levels for recreational uses. Providing water to Williamson County under HB 1437 requires a "no net loss" of surface water to the Colorado River Basin through water replacement or offset strategies funded by a surcharge on the sale of water to users in Williamson County. Subject to potential litigation and competing applications, LCRA is also actively pursuing the acquisition of any remaining unappropriated water and the voluntary purchase and reallocation of any strategic, unused water rights to help meet LCRA's legislative mandate as a regional water supplier.

4.2 COUNTY SUMMARIES OF WATER NEEDS

The following sections provide summaries of the needs identified for each county within the LCRWPA. The tables presented in these sections provide a listing of individual WUGs with identified water supply needs (negative numbers in the tables indicate a water supply shortage). Named municipal WUGs with water supply needs resulting from the expiration of a wholesale contract appear shaded and italicized in the following tables. The shortages that would be solved through contract extension are also italicized. Following the information for the individual WUGs with water supply needs is a summation of the total needs identified within the county. This information is also included in the TWDB online database, DB07.

4.2.1 Bastrop County

The primary sources of water for Bastrop County are the Carrizo-Wilcox and Queen City aquifers. Surface water supplies are primarily associated with power generation and are supplied by firm water from the Highland Lakes. Local surface water supplies are available to irrigation and livestock users. Municipal water demands account for about one-half of the total demand in Bastrop County. Steam electric generation accounts for an additional one-third of the total demand. A summary of the estimated water shortages identified for Bastrop County is presented in *Table 4.1*.

Table 4.1 Bastrop County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Aqua WSC	0	0	0	0	(59)	(5,374)	(7,907)
Bastrop	0	0	0	(188)	(591)	(1,113)	(1,782)
Bastrop County WCID #2	0	0	0	0	0	0	(144)
County-Other	0	0	(1,722)	(3,379)	(5,130)	(7,088)	(9,576)
Creedmoor-Maha WSC	0	0	(3)	(8)	(12)	(19)	(30)
Elgin	0	0	0	0	0	(87)	(395)
Manville WSC	0	0	0	0	0	(7)	(52)
Polonia WSC	0	0	0	(4)	(10)	(17)	(25)
Smithville	0	0	0	0	(50)	(36)	(294)
Irrigation	(355)	(119)	(50)	(40)	(31)	(24)	(17)
Manufacturing	(6)	(8)	(17)	(28)	(38)	(46)	(60)
Mining	0	(4,293)	(4,297)	(4,298)	0	0	0
Steam Electric Power	0	0	0	0	(4,030)	(8,750)	(8,750)
Bastrop County Total Needs	**(361)**	**(4,420)**	**(6,089)**	**(7,945)**	**(9,951)**	**(22,561)**	**(29,032)**

4.2.2 Blanco County

Groundwater is available to users in Blanco County from the Ellenburger-San Saba, Trinity, Edwards-Trinity Plateau, and Hickory aquifers. Surface water supplies in the county are available from the City of Blanco's reservoirs and other local supplies. Municipal water demands account for well over one-half of the total water demands in Blanco County. The remainder of the demand consists primarily of irrigation and livestock needs. A summary of the estimated water shortages identified for Blanco County is presented in *Table 4.2*.

Table 4.2 Blanco County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
County-Other	(44)	(122)	(169)	(192)	(210)	(233)	(263)
Manufacturing	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Blanco County Total Needs	**(45)**	**(123)**	**(170)**	**(193)**	**(211)**	**(234)**	**(264)**

4.2.3 Burnet County

Groundwater is available to users in Burnet County from the Ellenburger-San Saba, Trinity, Marble Falls, and Hickory aquifers. Surface water supplies in the county are available from the Highland Lakes through contracts with the LCRA and other local supplies. Municipal water demands account for over one-half of the total water demands in Burnet County. One of the municipal shortages identified in Burnet County is due to wholesale contract expirations. A summary of the estimated water shortages identified for Burnet County is presented in *Table 4.3.*

Table 4.3 Burnet County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Bertram	(19)	(58)	(105)	(150)	(186)	(221)	(272)
Chisholm Trail SUD	(3)	(18)	(31)	(44)	(58)	(71)	(86)
Cottonwood Shores	0	(9)	(177)	(208)	(239)	(271)	(312)
County-Other	(18)	(611)	(1,152)	(1,536)	(1,861)	(2,211)	(2,615)
Granite Shoals	0	0	0	*(525)*	*(592)*	*(669)*	*(763)*
Kempner WSC	0	0	(39)	(96)	(147)	(196)	(253)
Kingsland WSC	(9)	(10)	(11)	(12)	(13)	(14)	(95)
Lake LBJ MUD	0	0	0	0	0	*(359)*	*(402)*
Marble Falls	0	0	0	*(1,238)*	*(1,452)*	*(2,693)*	*(2,984)*
Meadowlakes	(6)	(201)	(430)	(664)	(886)	(1,132)	(1,417)
Livestock	(23)	(23)	(23)	(23)	(23)	(23)	(23)
Mining	(437)	(688)	(766)	(800)	(833)	(853)	(898)
Burnet County Total Needs	**(515)**	**(1,618)**	**(2,734)**	**(5,296)**	**(6,290)**	**(8,713)**	**(10,120)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.2.4 Colorado County

The primary source of groundwater in Colorado County is the Gulf Coast aquifer. Surface water supplies are available through the irrigation district operated by LCRA and its ROR water rights, as well as other local supply sources. Irrigation demands in Colorado County represent 90 percent of the water demand in the county and are the primary water supply shortage identified. A summary of the estimated water shortages identified for Colorado County is presented in *Table 4.4*.

Table 4.4 Colorado County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
County-Other	(100)	(105)	(109)	(106)	(97)	(93)	(90)
Irrigation	(62,060)	(53,902)	(46,664)	(39,663)	(32,886)	(26,297)	(19,990)
Livestock	(25)	(25)	(25)	(25)	(25)	(25)	(25)
Mining	0	(8,569)	(8,079)	(7,246)	(6,111)	(4,692)	(4,867)
Colorado County Total Needs	**(62,185)**	**(62,601)**	**(54,877)**	**(47,040)**	**(39,119)**	**(31,107)**	**(24,972)**

4.2.5 Fayette County

Groundwater supplies in Fayette County are available from the Carrizo-Wilcox, Gulf Coast, Sparta, and Queen City aquifers. Surface water is available for steam electric generation through the LCRA and the COA. Steam electric generation represents more than three-fourths of the total water demand in the county with the remainder of the demand split primarily between municipal and livestock needs. Supplies from the LCRA Highland Lakes System also provide a considerable amount of water to municipal users. The estimated water shortages identified for Fayette are presented in *Table 4.5*.

Table 4.5 Fayette County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Aqua WSC	0	0	0	0	0	*(168)*	*(194)*
County-Other	(63)	(208)	(217)	(116)	(79)	(28)	(16)
Fayette WSC	0	0	(257)	(552)	(782)	(1,062)	(1,433)
Flatonia	(12)	(37)	(59)	(79)	(92)	(110)	(137)
Lee County WSC	0	0	(48)	(117)	(171)	(232)	(319)
Irrigation	(23)	(20)	(18)	(16)	(14)	(12)	(10)
Livestock	(22)	(22)	(22)	(22)	(22)	(22)	(22)
Manufacturing	(2)	(45)	(70)	(94)	(117)	(137)	(162)
Mining	0	0	(4)	(22)	(28)	(29)	(29)
Steam Electric Power	0	0	(401)	(13,315)	(24,769)	(24,883)	(30,908)
Fayette County Total Needs	**(122)**	**(332)**	**(1,096)**	**(14,333)**	**(26,074)**	**(26,683)**	**(33,230)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.2.6 Gillespie County

Groundwater supplies in Gillespie County are available from the Ellenburger-San Saba, Edwards-Trinity, Trinity, and Hickory aquifers. Surface water is available from local sources. Municipal water demands represent more than one-half of the total water demand in the county. Livestock and irrigation needs make up the majority of the remaining water demand. There are no water shortages expected for Gillespie County.

4.2.7 Hays County

Groundwater supplies in Hays County are available from the Edwards-Balcones Fault Zone (BFZ) and Trinity aquifers. Surface water is available from the Highland Lakes System and COA ROR rights. Municipal demand represents over 80 percent of the total demand in the county and represents the majority of supply shortages identified for Hays County, as presented in *Table 4.6*.

Table 4.6 Hays County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Buda	0	(638)	(1,514)	(1,989)	(2,474)	(3,052)	(3,526)
Cimarron Park Water Company	0	(41)	(127)	(220)	(314)	(427)	(520)
County-Other	0	(759)	(2,072)	(3,416)	(4,784)	(8,400)	(9,738)
Dripping Springs	0	(520)	(1,296)	(1,737)	(2,185)	(3,300)	(3,736)
Dripping Springs WSC	0	(108)	(261)	(420)	(577)	(773)	(926)
Manufacturing	0	0	0	(6)	(126)	(234)	(333)
Hays County Total Needs	**0**	**(2,066)**	**(5,270)**	**(7,788)**	**(10,460)**	**(16,186)**	**(18,779)**

4.2.8 Llano County

Groundwater supplies in Llano County are available from the Hickory and Ellenburger-San Saba aquifers. Surface water is available from the City of Llano Reservoir, the Highland Lakes, and local sources. Municipal demands represent approximately one-half of the total demand in the county and all of the identified water supply shortage. Two of the shortages identified would be eliminated by the extension of existing contracts. A summary of the estimated water shortages identified for Llano County is presented in *Table 4.7*.

Table 4.7 Llano County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
County-Other	0	0	(66)	(66)	(80)	(74)	(74)
Kingsland WSC	0	0	0	0	0	0	*(408)*
Lake LBJ MUD	0	0	0	0	0	*(1,290)*	*(1,290)*
Llano	(724)	(740)	(738)	(736)	(820)	(822)	(829)
Livestock	(62)	(62)	(62)	(62)	(62)	(62)	(62)
Manufacturing	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Llano County Total Needs	**(788)**	**(805)**	**(869)**	**(867)**	**(965)**	**(2,251)**	**(2,666)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.2.9 Matagorda County

The primary source of groundwater in Matagorda County is the Gulf Coast aquifer. Surface water supplies are available through the irrigation district operated by LCRA and STNPOC et al.'s ROR water right, its contract for Highland Lakes' water, as well as contracts for other industrial needs and other local supply sources. Irrigation demands in Matagorda County represent 70 percent of the water demand in the county with steam electric generation being the second largest demand. Significant water supply shortages have been identified for irrigation, manufacturing, and steam electric generation. A summary of the estimated water shortages identified for Matagorda County is presented in *Table 4.8*.

Table 4.8 Matagorda County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Orbit Systems Inc	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Irrigation	(110,374)	(97,445)	(90,482)	(83,776)	(77,352)	(71,171)	(65,215)
Livestock	(56)	(56)	(56)	(56)	(56)	(56)	(56)
Manufacturing	0	0	(4,479)	(8,439)	(9,134)	(12,507)	(13,515)
Steam Electric Power	0	0	0	(14,405)	(52,668)	(52,718)	(52,766)
Matagorda County Total Needs	**(110,432)**	**(97,503)**	**(95,019)**	**(106,678)**	**(139,212)**	**(136,454)**	**(131,554)**

4.2.10 Mills County

The primary source of groundwater in Mills County is the Trinity aquifer. Surface water supplies are available through the City of Goldthwaite Reservoir and other local supply sources. Irrigation demands in Mills County represent 60 percent of the water demand in the county with most of the remainder of the demand being livestock and municipal demand. A summary of the estimated water shortages identified for Mills County is presented in *Table 4.9*.

Table 4.9 Mills County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Brooksmith SUD	0	0	0	*(8)*	*(8)*	*(8)*	*(7)*
Goldthwaite	(366)	(357)	(370)	(368)	(366)	(357)	(350)
Irrigation	(404)	(339)	(275)	(241)	(180)	(193)	(186)
Manufacturing	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Mills County Total Needs	**(771)**	**(697)**	**(646)**	**(618)**	**(555)**	**(559)**	**(544)**

4.2.11 San Saba County

Groundwater supplies in San Saba County are available from the Ellenburger-San Saba, Marble Falls, and Hickory aquifers. Surface water availability is primarily limited to local sources. Irrigation demand represents over half of the total demand in the county with the remaining demand being livestock and municipal demands. The water needs for San Saba County are listed in Table *4.10*.

Table 4.10 San Saba County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Richland SUD	0	0	0	0	(3)	(3)	(5)
San Saba County Total Needs	**0**	**0**	**0**	**0**	**(3)**	**(3)**	**(5)**

4.2.12 Travis County

Groundwater supplies in Travis County are available from the Edwards-BFZ and Trinity aquifers. Surface water is available through the LCRA and COA ROR water rights. Municipal water demands represent approximately 85 percent of the total demand in the county. Manufacturing and steam electric generation account for most of the remaining demands. Many of the county's water shortages are associated with wholesale contract expirations. A summary of the estimated water shortages identified for Travis County is presented in *Table 4.11*.

Table 4.11 Travis County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Aqua WSC	0	0	0	0	0	*(1,582)*	*(1,695)*
Austin	0	0	0	0	0	(12,217)	(186,906)
Barton Creek West WSC	(55)	(53)	(50)	(47)	(45)	(43)	(43)
Bee Cave Village	(102)	(252)	(453)	(639)	(754)	(877)	(1,004)
Briarcliff Village	0	0	(50)	(139)	(494)	(552)	(614)
Cedar Park	0	0	0	0	0	*(506)*	*(570)*
Creedmoor-Maha WSC	0	0	*(287)*	*(400)*	*(479)*	*(558)*	*(639)*
Elgin	0	0	0	0	0	(1)	(5)
Goforth WSC	0	(3)	(14)	(23)	(30)	(38)	(43)
Jonestown	0	(29)	(79)	(122)	(400)	(429)	(463)
Jonestown WSC	0	(13)	(35)	(54)	(176)	(190)	(205)
Lago Vista	0	0	0	*(3,340)*	*(3,733)*	*(4,161)*	*(4,602)*
Lakeway	(198)	(1,074)	(2,261)	(5,796)	(6,467)	(7,199)	(7,953)
Loop 360 WSC	0	(357)	(354)	(1,221)	(1,218)	(1,218)	(1,218)
Lost Creek MUD	0	*(935)*	*(921)*	*(906)*	*(891)*	*(882)*	*(882)*
Manville WSC	0	0	0	*(1,839)*	*(2,184)*	*(2,577)*	*(2,982)*
North Austin MUD #1	0	0	0	*(106)*	*(103)*	*(102)*	*(102)*
North Travis County MUD #5	0	0	0	0	0	*(1,366)*	*(1,540)*
Pflugerville	0	0	0	0	0	*(10,143)*	*(11,342)*
River Place on Lake Austin	(19)	(570)	(1,723)	(1,723)	(1,717)	(1,717)	(1,717)
Rollingwood	0	0	0	0	*(372)*	*(371)*	*(373)*
Round Rock	0	(158)	(339)	(528)	(669)	(813)	(957)
Shady Hollow MUD	0	0	0	*(716)*	*(700)*	*(694)*	*(694)*

Table 4.11 Travis County Water Supply Needs (ac-ft/yr) (cont.)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
The Hills	0	0	0	*(733)*	*(729)*	*(729)*	*(729)*
Travis County WCID #17	0	0	0	0	0	0	*(6,979)*
Travis County WCID #18	0	0	*(1,075)*	*(1,278)*	(1,404)	(1,535)	(1,683)
Travis County WCID #19	0	0	0	*(372)*	*(371)*	*(371)*	*(371)*
Travis County WCID #20	0	0	0	*(457)*	*(456)*	*(455)*	*(455)*
Wells Branch MUD	0	0	0	*(1,472)*	*(1,444)*	*(1,435)*	*(1,435)*
West Lake Hills	0	0	0	*(2,049)*	*(2,178)*	*(2,320)*	(2,471)
West Travis County RWS	0	0	0	0	0	(615)	(1,170)
Williamson-Travis County MUD #1	0	0	*(274)*	*(344)*	*(385)*	*(433)*	*(482)*
Windermere Utility Company	0	0	0	*(2,201)*	*(2,180)*	*(2,180)*	*(2,180)*
Irrigation	(135)	(124)	(114)	(105)	(97)	(89)	(82)
Manufacturing	(2,159)	(4,257)	(5,046)	(5,837)	(6,636)	(7,368)	(8,013)
Steam Electric Power	0	0	0	0	0	0	(20,443)
Travis County Total Needs	**(2,668)**	**(7,825)**	**(13,075)**	**(32,447)**	**(36,312)**	**(65,766)**	**(273,042)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.2.13 Wharton County

The primary source of groundwater in Wharton County is the Gulf Coast aquifer. Surface water supplies are available through the irrigation districts operated by the LCRA and the Garwood and Pierce Ranch Irrigation Districts and the associated ROR water rights. In addition, surface water is available from other local supply sources. Irrigation demands in Wharton County represent over 95 percent of the water demand in the county with municipal demands being the second largest demand. A summary of the estimated water shortages identified for Wharton County is presented in *Table 4.12*.

Table 4.12 Wharton County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Wharton	0	0	0	(4)	(4)	0	0
Irrigation	(74,857)	(66,601)	(60,057)	(55,355)	(50,994)	(46,787)	(30,820)
Manufacturing	0	0	0	0	0	0	(8)
Wharton County Total Needs	**(74,857)**	**(66,601)**	**(60,057)**	**(55,359)**	**(50,998)**	**(46,787)**	**(30,828)**

4.2.14 Williamson County

Groundwater supplies in Williamson County are available from the Trinity and Edwards-BFZ aquifers. Surface water is available through the COA and LCRA. Municipal water demands represent 99 percent of the demand in the County. Both of the supply shortages identified for Williamson County are associated with municipal demands and wholesale contract expirations. A summary of the water shortages identified for Williamson County is presented in *Table 4.13*.

Table 4.13 Williamson County Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Anderson Mill MUD	0	*(1,464)*	*(1,434)*	*(1,405)*	*(1,375)*	*(1,355)*	*(1,355)*
North Austin MUD #1	0	0	0	*(952)*	*(928)*	*(920)*	*(920)*
Williamson County Total Needs	**0**	**(1,464)**	**(1,434)**	**(2,357)**	**(2,303)**	**(2,275)**	**(2,275)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.2.15 County-Wide Surpluses

As part of the 2006 regional water planning process, areas with water supply surpluses were identified as well as areas with water supply needs. This analysis was conducted by comparing the countywide estimated water supplies with the countywide estimated water demands. It is important to note that although a particular county may have a countywide water supply surplus, individual WUGs within that county may have water supply needs because they do not have access to the surplus water. *Table 4.14* contains a summary of the water supply condition within each county. It is also important to note that the regional totals shown in *Table 4.14* are less than the water supply needs identified in *Figure 4.2* due to surpluses in some counties. The fact that the regional totals show water supply needs despite considering the surpluses in some counties indicates that additional strategies must be developed to meet all of the needs in the LCRWPA. Simply moving surplus water from one area to another will not be sufficient to meet the needs of all WUGs in the LCRWPA. Additionally, movement of surplus water can be very costly, in some cases.

Table 4.14 County and Regional Water Supply Condition Summary (surplus/deficit, ac-ft/yr)

County[1]	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Bastrop	27,180	15,316	8,789	3,066	(955)	(13,985)	(20,654)
Blanco	3,558	3,405	3,255	3,133	3,034	2,661	2,496
Burnet	15,061	13,337	11,636	7,426	2,049	(666)	(2,547)
Colorado	(55,154)	(55,392)	(46,548)	(37,575)	(28,514)	(19,414)	(12,291)
Fayette	28,014	5,664	4,385	(9,076)	(20,954)	(21,717)	(28,477)
Gillespie	6,569	6,019	5,476	5,330	5,397	5,433	5,414
Hays	3,663	(223)	(3,537)	(6,164)	(8,833)	(14,567)	(17,160)
Llano	26,052	26,232	25,121	24,990	24,727	23,107	22,428
Matagorda	(68,350)	(71,447)	(74,009)	(93,336)	(125,845)	(123,016)	(118,061)
Mills	1,615	1,701	1,737	(65)	5	(153)	(80)
San Saba	30,774	30,856	30,941	31,029	31,115	31,218	31,303
Travis	227,704	192,143	137,912	67,524	20,505	(42,229)	(264,154)
Wharton	(60,147)	(52,336)	(46,024)	(39,801)	(33,757)	(27,932)	(5,784)
Williamson	310	(1,150)	(1,116)	(2,035)	(1,980)	(1,952)	(1,952)
Regional Totals[2]	**186,849**	**114,125**	**58,018**	**(45,554)**	**(134,006)**	**(203,212)**	**(409,519)**

[1] Overall County Surplus/Deficit = Countywide Water Supply – Countywide Water Demand
[2] Overall Regional Surplus/Deficit = Summation of County Surplus/Deficit

By comparison, *Table 4.15* shows all of the water supply needs by county in Region K if the surpluses are not taken into account. Region K is tasked with developing water management strategies to meet all of these needs. One potential strategy is to identify the WUGs with surpluses and determine if it is possible for this surplus water to meet the needs of WUGs with shortages.

Table 4.15 County and Regional Water Supply Condition Summary Excluding Surpluses (deficit, ac-ft/yr)

County[1]	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Bastrop	(361)	(4,420)	(6,089)	(7,945)	(9,951)	(22,561)	(29,032)
Blanco	(45)	(123)	(170)	(193)	(211)	(234)	(264)
Burnet	(515)	(1,618)	(2,734)	(5,296)	(6,290)	(8,713)	(10,120)
Colorado	(62,185)	(62,601)	(54,877)	(47,040)	(39,119)	(31,107)	(24,972)
Fayette	(122)	(332)	(1,096)	(14,333)	(26,074)	(26,683)	(33,230)
Gillespie	0	0	0	0	0	0	0
Hays	0	(2,066)	(5,270)	(7,788)	(10,460)	(16,186)	(18,779)
Llano	(788)	(805)	(869)	(867)	(965)	(2,251)	(2,666)
Matagorda	(110,432)	(97,503)	(95,019)	(106,678)	(139,212)	(136,454)	(131,554)
Mills	(771)	(697)	(646)	(618)	(555)	(559)	(544)
San Saba	0	0	0	0	(3)	(3)	(5)
Travis	(2,668)	(7,825)	(13,075)	(32,447)	(36,312)	(65,766)	(273,042)
Wharton	(74,857)	(66,601)	(60,057)	(55,359)	(50,998)	(46,787)	(30,828)
Williamson	0	(1,464)	(1,434)	(2,357)	(2,303)	(2,275)	(2,275)
Regional Totals[2]	**(252,744)**	**(246,055)**	**(241,336)**	**(280,921)**	**(322,453)**	**(359,579)**	**(557,311)**

[1] Overall County Deficit
[2] Overall Regional Deficit = Summation of County Deficit

4.3 BASIN SUMMARY OF WATER NEEDS

The following sections contain summaries of the water shortages identified in each of the six basins located wholly or in part within the LCRWPA.

4.3.1 Brazos River Basin

The majority of shortages identified in the Brazos River Basin were the result of expiring contracts to municipalities. Smaller shortages were associated with other communities, irrigation, livestock, and mining. *Table 4.16* contains the detailed information.

Table 4.16 Brazos River Basin Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Anderson Mill MUD	0	*(1,464)*	*(1,434)*	*(1,405)*	*(1,375)*	*(1,355)*	*(1,355)*
Bertram	(19)	(58)	(105)	(150)	(186)	(221)	(272)
Chisholm Trail MUD	(3)	(18)	(31)	(44)	(58)	(71)	(86)
Goldthwaite	(6)	(6)	(6)	(6)	(6)	(5)	(5)
Kempner WSC	0	0	(39)	(96)	(147)	(196)	(253)
North Austin MUD #1	0	0	0	*(952)*	*(928)*	*(920)*	*(920)*
Irrigation	(261)	(241)	(223)	(224)	(208)	(217)	(203)
Livestock	(45)	(45)	(45)	(45)	(45)	(45)	(45)
Mining	0	(7)	(14)	(34)	(50)	(53)	(54)
Brazos River Basin Total Needs	**(334)**	**(1,839)**	**(1,897)**	**(2,956)**	**(3,003)**	**(3,083)**	**(3,193)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.3.2 Brazos-Colorado Coastal River Basin

Surface water supply is available through the irrigation district operated by LCRA through its ROR water right and through Highland Lakes' water as interruptible supply. Water supply shortages in the Brazos-Colorado Coastal River Basin were identified for irrigation in Colorado, Matagorda, and Wharton Counties. In addition, various shortages in manufacturing and mining were identified. *Table 4.17* contains the detailed information.

Table 4.17 Brazos-Colorado Coastal River Basin Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Irrigation	(126,383)	(113,208)	(104,061)	(95,237)	(86,745)	(78,542)	(61,600)
Manufacturing	0	0	(1,957)	(4,029)	(4,393)	(6,156)	(6,684)
Mining	0	(19)	(22)	(23)	(24)	(25)	(26)
Brazos-Colorado River Basin Total Needs	**(126,383)**	**(113,227)**	**(106,040)**	**(99,289)**	**(91,162)**	**(84,723)**	**(68,310)**

4.3.3 Colorado River Basin

Water supply shortages were identified throughout the Colorado River Basin. Many of these shortages are associated with the expiration of wholesale water contracts. *Table 4.18* contains information detailing these shortages.

Table 4.18 Colorado River Basin Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Aqua WSC	0	0	0	0	(59)	(7,124)	(9,796)
Austin	0	0	0	0	0	(12,217)	(186,906)
Barton Creek West WSC	(55)	(53)	(50)	(47)	(45)	(43)	(43)
Bastrop	0	0	0	(188)	(591)	(1,113)	(1,782)
Bastrop County WCID #2	0	0	0	0	0	0	(144)
Bee Cave Village	(102)	(252)	(453)	(639)	(754)	(877)	(1,004)
Briarcliff Village	0	0	(50)	(139)	(494)	(552)	(614)
Brooksmith SUD	0	0	0	(8)	(8)	(8)	(7)
Buda	0	(638)	(1,514)	(1,989)	(2,474)	(3,052)	(3,526)
Cedar Park	0	0	0	0	0	*(506)*	*(570)*
Cimarron Park Water Company	0	(41)	(127)	(220)	(314)	(427)	(520)
Cottonwood Shores	0	(9)	(177)	(208)	(239)	(271)	(312)
County-Other	(52)	(1,578)	(5,229)	(8,513)	(11,902)	(17,753)	(21,915)
Creedmoor-Maha WSC	0	0	(283)	(398)	(479)	(563)	(653)
Dripping Springs	0	(520)	*(1,296)*	*(1,737)*	*(2,185)*	*(3,300)*	*(3,736)*
Dripping Springs WSC	0	(108)	(261)	(420)	(577)	(773)	(926)
Elgin	0	0	0	0	0	(88)	(400)
Fayette WSC	0	0	(236)	(507)	(719)	(976)	(1,317)
Goforth WSC	0	(3)	(14)	(23)	(30)	(38)	(43)
Goldthwaite	(360)	(351)	(364)	(362)	(360)	(352)	(345)
Granite Shoals	0	0	0	*(525)*	*(592)*	*(669)*	*(763)*
Jonestown	0	(29)	(79)	(122)	(400)	(429)	(463)
Jonestown WSC	0	(13)	(35)	(54)	(176)	(190)	(205)
Kingsland WSC	(9)	(10)	(11)	(12)	(13)	(14)	(503)
Lago Vista	0	0	0	*(3,340)*	*(3,733)*	*(4,161)*	*(4,602)*
Lake LBJ MUD	0	0	0	0	0	*(1,649)*	*(1,692)*
Lakeway	(198)	(1,074)	(2,261)	(5,796)	(6,467)	(7,199)	(7,953)
Lee County WSC	0	0	(48)	(117)	(171)	(232)	(319)
Llano	(724)	(740)	(738)	(736)	(820)	(822)	(829)
Loop 360 West	0	(357)	(354)	(1,221)	(1,218)	(1,218)	(1,218)
Lost Creek MUD	0	*(935)*	*(921)*	*(906)*	*(891)*	*(882)*	*(882)*
Manufacturing	0	0	0	(6)	(126)	(234)	(333)
Manville WSC	0	0	0	*(1,839)*	*(2,184)*	(2,584)	(3,034)
Marble Falls	0	0	0	*(1,238)*	*(1,452)*	*(2,693)*	*(2,984)*
Meadowlakes	(6)	(201)	(430)	(664)	(886)	(1,132)	(1,417)
North Austin MUD #1	0	0	0	*(106)*	*(103)*	*(102)*	*(102)*
North Travis County MUD #5	0	0	0	0	0	*(1,366)*	*(1,540)*
Pflugerville	0	0	0	0	0	*(10,143)*	(11,342)
Polonia WSC	0	0	0	(4)	(10)	(17)	(25)

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

Table 4.18 Colorado River Basin Water Supply Needs (ac-ft/yr) (continued)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Richland SUD	0	0	0	0	(3)	(3)	(5)
River Place on Lake Austin	(19)	(570)	(1,723)	(1,723)	(1,717)	(1,717)	(1,717)
Rollingwood	0	0	0	0	*(372)*	*(371)*	*(373)*
Round Rock	0	(158)	(339)	(528)	(669)	(813)	(957)
Sahdy Hollow MUD	0	0	0	*(716)*	*(700)*	*(694)*	*(694)*
Smithville	0	0	0	0	(50)	(36)	(294)
The Hills	0	0	0	*(733)*	*(729)*	*(729)*	*(729)*
Travis County WCID #17	0	0	0	0	0	0	*(6,979)*
Travis County WCID #18	0	0	*(1,075)*	*(1,278)*	(1,404)	(1,535)	(1,683)
Travis County WCID #19	0	0	0	*(372)*	*(371)*	*(371)*	*(371)*
Travis County WCID #20	0	0	0	*(457)*	*(456)*	*(455)*	*(455)*
Wells Branch MUD	0	0	0	*(1,472)*	*(1,444)*	*(1,435)*	*(1,435)*
West Lake Hills	0	0	0	*(2,049)*	*(2,178)*	*(2,320)*	(2,471)
West Travis County Regional WS	0	0	0	0	0	(615)	(1,170)
Wharton	0	0	0	(4)	(4)	0	0
Williamson-Travis County MUD #1	0	0	*(274)*	*(344)*	*(385)*	*(433)*	*(482)*
Windermere Utility Company	0	0	0	*(2,201)*	*(2,180)*	*(2,180)*	*(2,180)*
Irrigation	(10,480)	(7,088)	(4,704)	(4,083)	(3,644)	(3,270)	(2,912)
Livestock	(76)	(76)	(76)	(76)	(76)	(76)	(76)
Manufacturing	(2,163)	(4,262)	(7,580)	(10,269)	(11,407)	(13,756)	(14,893)
Mining	(437)	(13,424)	(12,978)	(12,158)	(6,730)	(5,312)	(5,515)
Steam Electric Power	0	0	(401)	(27,720)	(81,467)	(86,351)	(112,867)
Colorado River Basin Total Needs	**(14,681)**	**(32,490)**	**(44,081)**	**(98,267)**	**(156,458)**	**(208,241)**	**(433,023)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.3.4 Colorado-Lavaca Coastal River Basin

Surface water supply is available through the irrigation district operated by LCRA through its ROR water right and through Highland Lakes' water as interruptible supply. The greatest water needs identified in the Colorado-Lavaca River Basin were associated with irrigation usage in Matagorda County. *Table 4.19* contains the detailed information.

Table 4.19 Colorado-Lavaca Coastal River Basin Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Orbit Systems Inc	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Irrigation	(69,101)	(61,602)	(57,204)	(52,965)	(48,897)	(44,983)	(38,350)
Livestock	(56)	(56)	(56)	(56)	(56)	(56)	(56)
Manufacturing	0	0	0	0	0	0	(8)
Colorado-Lavaca River Basin Total Needs	**(69,159)**	**(61,660)**	**(57,262)**	**(53,023)**	**(48,955)**	**(45,041)**	**(38,416)**

4.3.5 Lavaca River Basin

Surface water supply is available through the irrigation district operated by LCRA through its ROR water right and through Highland Lakes' water as interruptible supply. The majority of shortages in the Lavaca River Basin were associated with irrigation in Colorado County. Several minor shortages were also recognized and are listed below in *Table 4.20*.

Table 4.20 Lavaca River Basin Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
County-Other	(129)	(105)	(109)	(106)	(129)	(118)	(106)
Fayette WSC	0	0	(21)	(45)	(63)	(86)	(116)
Flatonia	(12)	(37)	(59)	(79)	(92)	(110)	(137)
Irrigation	(41,848)	(36,287)	(31,354)	(26,582)	(21,963)	(17,472)	(13,173)
Livestock	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Manufacturing	(2)	(45)	(70)	(94)	(117)	(137)	(162)
Mining	0	(100)	(132)	(151)	(168)	(184)	(199)
Lavaca River Basin Total Needs	**(42,002)**	**(36,585)**	**(31,756)**	**(27,068)**	**(22,543)**	**(18,118)**	**(13,904)**

4.3.6 Guadalupe River Basin

Water supply shortages in the Guadalupe River Basin were identified for Bastrop, Blanco, and Travis Counties. *Table 4.21* contains the detailed information.

Table 4.21 Guadalupe River Basin Water Supply Needs (ac-ft/yr)

Water User Group Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
County-Other	(44)	(122)	(169)	(192)	(210)	(256)	(351)
Creedmoor-Maha WSC	0	0	*(7)*	*(10)*	*(12)*	*(14)*	*(16)*
Irrigation	(135)	(124)	(114)	(105)	(97)	(89)	(82)
Manufacturing	(6)	(8)	(10)	(11)	(13)	(14)	(16)
Guadalupe River Basin Total Needs	**(185)**	**(254)**	**(300)**	**(318)**	**(332)**	**(373)**	**(465)**

WUGs with water supply needs that can be met with the extension of a wholesale contract are shaded. The decades where the needs are met have been italicized.

4.4 WHOLESALE WATER PROVIDER NEEDS

As previously discussed, the LCRA and COA have been identified as wholesale water providers within the LCRWPA. The following sections present a comparison of the water supplies for these two entities and their water supply commitments.

4.4.1 Lower Colorado River Authority

The LCRA has two major sources for its water. These sources include the Highland Lakes System and ROR water rights in the lower portion of the basin. The LCRA has commitments to provide water to individual users and cities throughout the basin. In addition, the LCRA uses water at its electric generating facilities. Finally, LCRA provides water to meet requirements for environmental needs of the river and bay according to the LCRA Water Management Plan. *Table 4.22* contains a comparison of LCRA's Highland Lakes supplies and water commitments based on the "No Call" planning assumption. *Table 4.23* contains a comparison of LCRA's ROR water supplies and water commitments (mainly Irrigation Districts) based on the "No Call" assumption.

Table 4.22 LCRA Municipal, Manufacturing, and Steam Electric Water Supply/Commitment Comparison (ac-ft/yr)

LCRA Water Supply	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Highland Lakes Firm Water Supply	382,924	381,545	380,166	378,787	377,408	376,029	374,642
Firm Water Commitments	432,795	429,571	411,675	377,018	329,569	279,234	87,477
Contract Extensions	0	2,888	20,363	54,227	100,118	150,034	341,370
Water Surplus/Deficit	**(49,871)**	**(50,914)**	**(51,872)**	**(52,458)**	**(52,279)**	**(53,239)**	**(54,205)**

Note: The water supply is detailed in *Table 3.25*. The water commitments are detailed in *Tables 2.20* and *3.26*. The Firm Water Commitments presented in *Table 4.22* represent LCRA's Highland Lakes water commitments and their anticipated expiration dates. The contract extensions presented in this table represent the value of water required to extend LCRA's Highland Lakes contracts through 2060. Commitments include the out-of-basin 25,000 ac-ft/yr demand from Region G in Williamson County under the HB 1437 program and other current, separate out-of-region commitments (Leander, Cedar Park, and Lometa).

Table 4.23 LCRA Irrigation Water Supply/Commitment Comparison (ac-ft/yr)

LCRA Water Supply	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Irrigation Water Supply	227,184	227,171	227,158	227,145	227,132	227,119	227,103
Irrigation Water Commitments	442,076	419,211	403,275	387,892	373,077	358,755	335,851
Water Surplus/Deficit	**(214,892)**	**(192,040)**	**(176,117)**	**(160,747)**	**(145,945)**	**(131,636)**	**(108,748)**

Note: The water supply is detailed in *Table 3.25*. The water commitments are detailed in Tables *2.20* and *3.26*. The total water commitment presented in *Table 4.23* includes a portion of the rice irrigation demands for Region K (ratio for Colorado, Matagorda and Wharton Counties applied from last plan: 0.75, 0.87 and 0.55).

These tables indicate that the LCRA does not have enough water to meet all of its water commitments under the assumptions being used in this plan. How LCRA proposes to meet these additional needs is discussed in Section 4.6.1. It is also important to recognize that this analysis does not include interruptible water supplies projected to be available over the planning horizon through the implementation of the Water Management Plan (WMP) or projected municipal return flows. These supplies are discussed later in this chapter as water management strategies.

4.4.2 City of Austin

The COA has two major sources for its water. These sources include the ROR water rights and a contract with LCRA to receive firm water from any source under the LCRA water rights system. These rights are separated by the use of the water. The COA has separate rights for municipal and manufacturing uses and steam electric power generation. *Tables 4.24* and *4.25* contain comparisons of the COA's water supplies to its water commitments in these two areas.

Table 4.24 COA Municipal and Manufacturing Water Supply/Commitment Comparison (ac-ft/yr)

COA Water Supply	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Municipal and Manufacturing Water Supply	325,000	325,000	325,000	325,000	325,000	325,000	184,677
Municipal and Manufacturing Water Commitment	188,776	197,728	236,601	267,449	306,902	343,675	378,686
Contract Extensions	0	2,399	2,355	5,557	5,441	5,388	5,388
Water Surplus/Need	**136,224**	**124,873**	**86,044**	**51,994**	**12,657**	**(24,063)**	**(199,397)**

Note: The water supply is detailed in *Table 3.27*. The water commitments are detailed in *Tables 2.18* and *3.28*. The Water Commitments presented in *Table 4.24* represent the COA's water commitments and their anticipated expiration dates. The Contract Extensions presented in this table represent the amount of water required to extend the COA contracts through 2060. Note that some current COA wholesale customers will be getting new LCRA raw water contracts, as a requirement of their contract COA will continue to treat and transport their potable water supplies. These customers/contracts are listed in *Table 4.31*.

This table indicates that the COA has sufficient water to meet its municipal and manufacturing needs through the year 2040. By the year 2050, it is anticipated that the COA will have a deficit of approximately 24,000 ac-ft/yr. In 2051, the COA contract with LCRA expires, leading to the very large deficit appearing in 2060, which is addressed by COA exercising its contract option for extension to the year 2101.

Table 4.25 COA Steam Electric Water Supply/Commitment Comparison (ac-ft/yr)

COA Water Supply	Year 2000	Year 2010	Year 2020	Year 2030	Year 2040	Year 2050	Year 2060
Steam Electric Water Supply	43,973	43,971	43,969	40,467	40,465	40,463	8,795
Steam Electric Water Commitment	14,596	31,722	32,802	40,102	49,239	53,239	60,149
Water Surplus/Need	**29,377**	**12,249**	**11,167**	**365**	**(8,774)**	**(12,776)**	**(51,354)**

Note: The water supply is detailed in *Table 3.27*. The water commitments are detailed in *Tables 2.19* and *3.28*. The water commitments presented in *Table 4.25* represent all of the steam electric generating demands for Travis County plus a portion of the Fayette County demands (based on estimated current supply levels and approved projections).

This table indicates that the COA has sufficient water to meet its steam electric needs through the year 2030. By the year 2050, it is anticipated that the COA will have a deficit of approximately

13,000 ac-ft/yr. The COA Fayette Power Project/Sandhill contract with LCRA expires in 2025 (note that the extension of this contract is a water management strategy discussed later in the chapter). The 1999 COA and LCRA contract, which firms up the supplies at Town Lake and Decker, expires in 2051. However, the deficits created by this expiration are addressed by COA exercising its contract option for extension to year 2101.

4.5 EVALUATION AND SELECTION OF WATER MANAGEMENT STRATEGIES

The primary emphasis of the regional water planning effort is the development of regional water management strategies sufficient to meet the projected needs of WUGs throughout the state. Water needs are determined by comparing user group water demands to the water supplies available to that user group. The following sections present information concerning the identification, evaluation, and selection of specific water management strategies to meet specific projected water supply shortages for the LCRWPA (Region K). It should be noted that local plans that are not inconsistent with the regional water supply plan are also eligible to apply for TWDB financial assistance to implement those local plans even though they have not been specifically recommended in this plan.

Regionwide, the comparison of available water supplies under the “No Call” assumption and water demands identified 99 separate WUGs that have projected water supply shortages, or needs, by the year 2030, and an additional 19 WUGs with projected water supply shortages before the year 2060. The estimated water need is approximately 281,000 ac-ft/yr in 2030 and 557,000 ac-ft/yr in 2060. This identified shortage is based on conservative water availability estimates, which assume only water available during a repeat of the worst DOR, that all rights are being fully and simultaneously utilized, and exclude water available from LCRA on an interruptible basis and water available as a result of municipal return flows to the Colorado River. The water management strategies are intended to alleviate these projected water supply shortages. A table of the recommended water management strategies by WUG is contained in *Appendix 4A*. *Appendix 4B* contains the cost breakdown for each strategy and assumptions/methodology for the cost calculations.

The “No Call” model used by Region K was constructed for developing water supplies under the assumption that senior water rights in Region K would not make priority calls on inflows available to Region F reservoirs. Because of the late timing of the adoption of the “No Call” model, it is infeasible for Region K’s consultant to assemble a model inclusive of all water management strategies and necessary model modifications to preserve apt functioning of the “No Call” assumption and allow for the impact assessments required by this plan. Therefore, impact results derived from the “No Call” model should be considered unreliable. .

4.5.1 Utilization of Return Flows

Approximately 60 percent of all municipal diversions by the COA and others are currently returned to the Colorado River as effluent discharges. Unless otherwise authorized by permit, once discharged to the river, this water is subject to diversion under existing water rights’ permits. Further, state law currently allows a water right holder to directly reuse all of its effluent unless its permit restricts such use. As recognized elsewhere in this plan, control and ownership of these return flows is the subject of litigation (refer to Section 4.15 for a discussion of this issue). The November 2004 version of the WAM for the Colorado River that was used for this round of planning (with the “No Call” modifications) excludes all sources of return flows in the model.

This exclusion of return flows in the model leads to identification of water shortages for entities that currently use and rely upon the return flows. For purposes of this plan, the strategies considered projected return flows discharged by the COA, the City of Pflugerville, and Aqua Water Supply Corporation. Strategies related to COA's reuse of treated effluent are described in Section 4.6.2.2. This plan assumed projected levels of effluent to be discharged by the City of Pflugerville and Aqua Water Supply Corporation of 60 percent of the total projected demand for raw water in 2060, or about 10,000 ac-ft/yr. Effluent not being reused by Austin as a strategy and these other projected levels of effluent were made available to water rights according to the prior appropriation doctrine. Therefore, return flow assumptions for purposes of developing LCRA's water strategies set forth herein incorporate and reflect the COA's proposed strategies of direct reuse of effluent to meet municipal demand and demand at the Sand Hill Energy Center in Travis County and indirect reuse of effluent to meet the COA's demands at the Fayette Power Project. These assumptions were included for planning purposes only and are not intended to lend support for or constitute a waiver of any arguments in any pending litigation.

4.5.1.1 COA Return Flows

Based on the COA assumptions, return flows to the river are projected to be 117,464 ac-ft/yr by 2060 (refer to Section 4.6.2.2 and *Tables 4.26* and *4.35*). In calculating its combined firm yield for Lakes Buchanan and Travis, LCRA has previously assumed that approximately 150,000 ac-ft/yr of return flows would be present. As part of the "No Call" analysis conducted by the consultant for Region F, some analysis was done assuming 100,000 ac-ft/yr of return flows. By comparison, therefore, this assumption is much more conservative than presented by the COA for this plan or by LCRA. Due to time constraints and concerns about the stability of the model, the Region F analysis was used in combination with results from LCRA's more simplified approach to modeling reduced flows from Region F, to estimate the level of return flows to allocate to each shortage identified in this Plan.

In this plan, the projected remaining return flows were made available to meet all downstream demands, including environmental, municipal, irrigation, and industrial (including steam electric) water needs, in accordance with the prior appropriation doctrine. As indicated in *Table 4.26*, the presence of these return flows reduces the calculated shortages identified in Chapter 4 for many water rights throughout the basin, both upstream and downstream. This is not a one-to-one correlation. In other words, one ac-ft of return flows does equate to an increase in one ac-ft of availability under a downstream water right. Due to the seniority of the downstream irrigation rights, this analysis suggests that approximately 15,000 ac-ft/yr of return flows in the year 2000 contributed to meeting ROR irrigation water rights. This amount changes to about 23,000 ac-ft/yr in the year 2030 and to approximately 30,000 ac-ft/yr in 2060. Return flows also contribute to satisfying run-of-river diversions for industrial uses (including steam electric). In addition to meeting irrigation and industrial needs, from 10,000 to 20,000 ac-ft/yr of return flows help meet environmental flow needs in this plan. Further, upstream junior water rights benefit from the presence of these return flows by reducing their requirements to pass through inflows to meet downstream senior water rights. For example, the presence of return flows results in an approximate change in water availability for Lakes Travis and Buchanan of 26,000 ac-ft/yr on a firm basis.

The quantity of return flows is projected to increase over the 50-year planning period due to increased water demands in the Austin area even though the quantity of water reused during this period will increase as well, as shown in *Table 4.35*. However, beyond 2060, the COA projects that it will significantly increase its reuse of treated effluent to nearly 100 percent. The COA's pending application for a bed and banks authorization proposes to dedicate 16,350 ac-ft/yr of the effluent to the Texas Water Trust with the TPWD as trustee. As return flows discharged by Austin diminish in the future due to enhanced reclamation of water, other sources may need to be dedicated or developed to meet needs that may currently be met by return flows discharged by Austin.

Table 4.26 Estimated Continued Benefits of Projected COA Return Flows

COA Return Flows	2000	2010	2020	2030	2040	2050	2060
Projected COA Effluent minus reuse	96,167	90,701	99,974	102,902	104,423	112,406	117,464
Estimated Benefits to Major ROR Water Rights [1]							
Highland Lakes [1]	25,076	24,400	26,734	26,100	25,992	25,600	26,158
COA [1]	25,000	25,000	25,000	25,000	30,000	30,000	35,000
STP [1]	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Garwood [2]	780	780	780	780	780	780	780
Gulf Coast [2]	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Lakeside [2]	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Pierce Ranch [2]	4,231	4,231	4,231	4,231	4,231	4,231	4,231
Irrigation [3]	14,603	17,163	19,723	22,283	24,842	27,402	29,962
Estimated Benefit to Matagorda Bay	20,477	13,127	17,506	18,508	12,578	18,393	15,333

Note: Estimates derived from RJ Brandes Company preliminary modeling.
[1] The values for each major water right represent the estimated increase in firm supply available to each water right due to the addition of the City of Austin return flows in the river.
[2] These values represent the gains due to return flows in the portions of the water rights used for non-irrigation purposes.
[3] This value represents the gains due to return flows in the portion of the Irrigation ROR water rights that are used for irrigation purposes.

Opinion of Probable Costs

There are no capital costs associated with the diversion of this water because the diversions are done under existing water rights permits with existing infrastructure.

Issues and Considerations

Issues related to ownership of treated wastewater effluent are discussed in Sections 4.16 and Chapter 8 (Section 8.2.7).

4.5.1.2 Downstream Return Flows

In addition to the COA, return flows for the City of Pflugerville and Aqua Water Supply Corporation were also taken into consideration. This plan assumed projected levels of effluent to be discharged by the City of Pflugerville and Aqua Water Supply Corporation of 60 percent of the total projected demand for raw water in 2060, or about 10,000 ac-ft/yr. *Table 4.27* shows the estimated benefits of these return flows to the major water rights holders in the region.

Table 4.27 Estimated Benefits of Projected Pflugerville and Aqua WSC Return Flows

Return Flows	2000	2010	2020	2030	2040	2050	2060
Projected Effluent				1,000	4,000	7,500	10,000
Estimated Benefits to Major ROR Water Rights [1]							
Highland Lakes [1]				240	960	1,800	2,400
COA [1]				190	760	1,425	1,900
STP [1]				9	36	68	90
Garwood [2]				8	32	60	80
Gulf Coast [2]				145	580	1,088	1,450
Lakeside [2]				80	320	600	800
Pierce Ranch [2]				95	380	713	950
Irrigation [3]				150	600	1,125	1,500
Estimated Benefit to Matagorda Bay				83	332	621	830

Note: Estimates derived from RJ Brandes Company preliminary modeling.
[1] The values for each major water right represent the estimated increase in firm supply available to each water right due to the addition of the Pflugerville and Aqua WSC return flows in the river.
[2] These values represent the gains due to return flows in the portions of the water rights used for non-irrigation purposes.
[3] This value represents the gains due to return flows in the portion of the Irrigation ROR water rights that are used for irrigation purposes.

Opinion of Probable Costs

There are no capital costs associated with the diversion of this water because the diversions are done under existing water rights permits with existing infrastructure.

Issues and Considerations

Issues related to ownership of treated wastewater effluent are discussed in Sections 4.16 and Chapter 8, (Section 8.2.7).

4.6 WHOLESALE WATER PROVIDER MANAGEMENT STRATEGIES

There are two Wholesale Water Providers, as defined by the State planning process in Region K, LCRA and the COA. The COA is also a water customer of LCRA, and together they supply a large portion of Region K's water needs for multiple beneficial purposes.

4.6.1 LCRA Water Management Strategies

LCRA holds water rights to over 2.1 million ac-ft of water in the Colorado River Basin. Combined, these water rights authorize every legal purpose of use, and also provide for protection of certain environmental flow needs. The LCRA is directed by the Texas Legislature to be the steward of this water in serving as the regional water supplier. The LCRA supplies water for municipal, irrigation, manufacturing, steam electric, and mining water uses. The LCRA currently supplies water to entities in Bastrop, Burnet, Colorado, Fayette, Hays, Lampasas (Region G), Llano, Matagorda, San Saba, Travis, Wharton, and Williamson (including the portion of Williamson in Region G) Counties.

4.6.1.1 General LCRA Strategy - LCRA System Operation

The State has directed LCRA to optimize and conserve available water to meet the existing and future water needs of the region. To meet existing water needs in the basin, LCRA has traditionally used its water rights together as a system. To date, LCRA has largely done this through its Water Management Plan (discussed below) and thus, its efforts have been focused on the management of Lakes Buchanan and Travis to meet firm municipal and industrial customer demands while continuing to provide interruptible supplies to downstream irrigators and provide both firm and interruptible supplies to meet environmental flow needs.[1]

To meet increased and changing water needs over time, LCRA plans to continue to employ a "system operations" approach that will necessarily include a more formal expansion to include all of the water rights under its control. Future amendments to LCRA's WMP will be required. As firm demands change over time, the amount of interruptible water supply that will be available from the Lakes to help meet irrigation, environmental, recreational, and other water needs will require adjustment. Further, LCRA's ROR rights that are currently used primarily to meet irrigation needs will be needed to meet increased municipal and industrial needs. LCRA has sought and will continue to seek amendment of all of these other existing water rights to allow for the diversion and use of water for multiple beneficial purposes in other locations as needed to supplement the firm water supply available from the Lakes. Future irrigation water shortages that result from use of these ROR rights to meet other municipal and industrial demands will be largely addressed through continued availability of interruptible water, enhanced water conservation, and development of groundwater. Throughout the basin, LCRA will continue to pursue aggressive water conservation measures and other water use efficiencies to continue to meet new and increasing water needs within LCRA's water service area.

Because studies related to the LSWP are still ongoing, (discussed below in Section 4.6.1.9) this round of planning required use of simplified assumptions. This effort was further complicated by the issues related to upstream shortages in Region F, which delayed development of water supply availability information for Region K. The assumptions, including the development of these strategies, are set forth in the following strategy discussion.

Issues and Considerations

The use of a system operations approach allows LCRA to maximize the various amounts of water available. It also allows interruptible flows to contribute to instream flow needs in all of the river segments prior to the main rice growing areas in the Lower Basin, and allows greater flexibility to meet all needs, including instream flow and bay and estuary needs not only in quantity but also in timing of the flow needs. The system operations approach that LCRA plans to continue to employ, involves the use of a number of specific strategies tied to major projects such as the LSWP and HB 1437 conservation savings, which are examined in greater detail in succeeding sections, with an analysis of the environmental consequences of each.

[1] For a general description of the LCRA Water Management Plan (WMP), see Section 3.2.1.1.1.

4.6.1.2 Amendments to Water Management Plan

To meet increased firm customer demands, LCRA will seek to amend its Water Management Plan to adjust the triggers at which it curtails the availability of interruptible water supply to meet irrigation, environmental and other needs. Both pending and potential revisions to the WMP are considered in this regional plan without waiver of arguments in potential or pending litigation.

4.6.1.2.1. Environmental Flow Assumptions for WMP Revisions

For purposes of environmental flow commitments, this plan reflects conditions specified in the current WMP, as well as certain aspects of the proposed WMP now pending before the Texas Commission on Environmental Quality (TCEQ). The severe time constraints experienced by the planning group precluded inclusion in a WAM run of the proposed "intermediate" trigger for environmental flows now pending before the TCEQ. Rather, a simplified approach of placing an additional 17,000 ac-ft of firm water demand for environmental flow needs was included in the modeling effort. For the simulation of year-2000 conditions, all of the key environmental flow elements of the current WMP are represented in the modeling, including critical instream flow and bay and estuary freshwater inflow criteria engaged all of the time, target instream flow criteria engaged when the system storage is greater than 52 percent of the system conservation storage capacity (2,163,200 ac-ft), and target freshwater inflow criteria engaged when the system storage is greater than 1,660,000 ac-ft, with the maximum environmental flow caps implemented as stipulated in the WMP. Under 2060 conditions, the environmental flow criteria are modified so that the target instream flow criteria are never engaged and the target bay and estuary freshwater inflow criteria are engaged only when the system storage is above 1,700,000 ac-ft, which is about 93 percent of the year-2060 system conservation storage capacity (1,832,000 ac-ft).

Issues and Considerations

The allocation of an additional 17,000 acre feet of firm water for instream and bay and estuary flows provides some additional benefit to those two areas. However, the main issue of growth in municipal, manufacturing and steam electric demand has a potential to reduce the amount of interruptible supply available for providing over and above the minimum amounts currently included in the LCRA Water Management Plan. LCRA's ability to continue to provide interruptible surface water supplies to the lower counties for rice production does provide benefit to instream flows as these interruptible flows make their way through the river system up to the point of diversion. There is also an element of irrigation return flows during July which provides needed instream flows as well as bay and estuary flows during a historically dry time of year.

4.6.1.2.2. Interruptible Water Supply for Irrigation for WMP Revisions

The LCRA supplies water to four major irrigation districts within the three rice-producing counties. These operations include the Lakeside, Gulf Coast, and Garwood Irrigation Districts, which are owned and operated by LCRA and the Pierce Ranch. With the exception of the Pierce Ranch, the irrigation operations each have water rights with very early priority dates to divert surface water from the Colorado River, to the extent it is available, to satisfy their needs up to their permitted rights. These water rights allow the operations to pump water from the river as it is available without calling upon LCRA to release water from storage. However, often in the height of the irrigation season, rainfall inflows are insufficient to supply these needs.

Pursuant to LCRA's Water Management Plan for Lakes Buchanan and Travis, LCRA has been able to provide water stored in these lakes to the rice irrigators on an interruptible basis during periods of low flow when ROR rights are insufficient to meet demands. Under LCRA's water rights, LCRA is permitted to develop contractual commitments with water users whose demands do not have to be met 100 percent of the time. LCRA's Water Management Plan allows such demands for interruptible stored water to be met to the extent water is available each year after firm demands are satisfied. By applying a system operation concept, the portion of the Combined Firm Yield that is not yet committed and the water that is committed but not yet being used determines the interruptible stored water that is available each year. The water that is captured and stored during flood events also adds to the amount of interruptible stored water that is available. Under the 1999 Water Management Plan, interruptible water is gradually curtailed when storage levels in the two lakes on January 1 are less than 52 percent. The curtailment is approximately a 4 percent reduction in available interruptible supply for each 100,000 ac-ft decrease in combined storage. All interruptible supply is cut off when the combined storage is less than 325,000 ac-ft on January 1.

LCRA does not expect its firm customers to fully utilize their commitments for some time. Therefore, continued implementation of the LCRA Water Management Plan will provide interruptible water to rice irrigators when sufficient water is available in the Highland Lakes System.

Over time, as the current firm contracts draw fully on their commitments and the remainder of the Combined Firm Yield is contracted for, there will be less interruptible stored water available on an annual basis and the allocation of that available interruptible supply among the irrigation districts will likely be modified.[2] For this plan, assumed revisions to the WMP curtailment triggers for interruptible water from the Highland Lakes have been incorporated that affect the availability of interruptible supply to meet irrigation demands within the four irrigation districts. For example, in 2060, it has been assumed that interruptible irrigation supplies would be curtailed proportional to the system storage in Lakes Buchanan and Travis beginning when the storage falls below the full conservation capacity, with no interruptible water available when the system storage is below 325,000 ac-ft. The water availability analyses needed to estimate these triggers for this plan, incorporated regional water planning demand projections for LCRA's existing customers, updated estimates for future irrigation water needs in LCRA's lower basin irrigation districts, and assumed levels of water conservation discussed elsewhere in this plan.

As discussed above, this plan includes an analysis of the amount of interruptible water expected to be available during each decade of the planning period using a further simplified version of the "No Call" analysis while also including projected return flows discharged by the COA over the planning period. *Table 4.28* presents the results of this analysis. The amount of interruptible stored water available to irrigators from Lakes Buchanan and Travis will decrease from approximately 241,607 ac-ft/yr in 2000 to 5,461 ac-ft/yr in 2060 due to increased firm demands in the basin.

[2] When LCRA purchased both the Garwood Irrigation District and Pierce Ranch Irrigation Districts' water rights, it made certain commitments to provide interruptible stored water based upon specific requirements in the purchase agreements. This affects the manner in which LCRA allocates available interruptible water supply among the four irrigation districts.

Table 4.28 Available Interruptible LCRA Water Supply for Irrigation (including return flows)

Decade	Average [1] Interruptible Water Supply (ac-ft/yr)
2000	241,607
2010 [2]	238,156
2020 [2]	162,892
2030 [2]	123,534
2040 [2]	84,176
2050 [2]	44,819
2060	5,461

Note: Availability of interruptible supply taken from LCRA estimates (7/18/05).
[1] Average annual interruptible water supply over the 10-year critical drought period.
[2] Limited simulations were conducted for only 2000 and 2060 in view of time and budget constraints. Information for other decades was interpolated from the 2000 and 2060 results.

As the table indicates, the availability of interruptible water supply is expected to decrease significantly in the future as the demands for firm water increase.

Opinion of Probable Costs

Capital expenditures for water supply purposes would not be required to implement this alternative since diversions would be made under existing water rights. The average cost of raw water under this alternative is currently $4.93 per ac-ft. LCRA also charges additional cost for distribution and delivery of this water.

Issues and Considerations

The availability of interruptible supply is a function of the actual demand for firm water supply from LCRA's Lakes Buchanan and Travis and is determined on an annual basis. Therefore, actual availability of this supply from year to year can vary greatly, largely as a function of drought conditions and demands for firm water.

Environmental and Other Impacts

As noted above, the increasing municipal, manufacturing and steam electric demands have reduced the amount of interruptible water that is available for the production of rice, which has the potential to reduce the flows in the lower basin, as more of the land is converted for conservation.

Impacts to Agriculture

Although the management strategies proposed include the amendment of existing water rights to allow uses other than agriculture, the plan is structured to provide the water that agriculture needs according to the forecast demands. Since that is the case, impacts to agriculture are expected to be low, with the possible exception of the increased cost of pumping groundwater for those irrigators using groundwater if permanent drawdowns occur from additional groundwater pumpage for irrigation. The issue of the extent and length of time that drawdowns will occur is still being investigated.

4.6.1.3 Amendments to ROR Rights

Significant amendments to LCRA's ROR irrigation rights are included as a strategy in this plan without waiver of arguments in any pending litigation or contested case hearing as discussed in Section 4.16. These amendments are proposed to meet increased municipal and industrial demand within the Lower Colorado River Basin and are also a necessary component of the LSWP (discussed below). In addition, a demand reduction of approximately 10,000 ac-ft/yr will be used as a strategy due to increased operational efficiencies (Ferguson Power Plant).

LCRA owns 503,750 ac-ft of water per year of water rights on the Lower Colorado River authorized for irrigation use in the Lakeside, Gulf Coast, and Pierce Ranch Irrigation Districts. Projected total irrigation demand for water in 2060 within these three districts is expected to be approximately 250,000 ac-ft/yr, which reflects some moderate level of conservation as projected by TWDB. The future demand, with implementation of advanced agricultural conservation measures as part of the LSWP, is approximately 55,000 ac-ft/yr less than the projected level of demand for these three districts. Analysis conducted to date shows that to meet the 2060 demand, about 150,000 to 200,000 ac-ft of water per year from these three water rights would be used for irrigation, along with advanced conservation, limited groundwater development for LSWP, and some interruptible supply from Lakes Buchanan and Travis. However, the LSWP analysis will continue to be refined throughout the study period to meet the study objectives.

Another existing water right owned by LCRA is the Garwood Irrigation District water right, which authorizes the diversion of up to 133,000 ac-ft of water per year from the Colorado River for irrigation, municipal, and industrial uses. Water demands in the Garwood district are estimated to be approximately 80,000 ac-ft of water per year based on TWDB projections. With extensive conservation measures and improved farming practices implemented, the projected future demand for irrigation water within this district is expected to be on the order of 55,000 ac-ft of water per year.

Significant potential exists to optimize system operations and make additional water supplies from these water rights available to meet future water demands. Portions of these ROR irrigation water rights that are no longer needed for irrigation because of conservation and other factors resulting in reduced irrigation demands are proposed for use as part of a system operation employing off-channel storage, potential new water rights associated with LCRA's permit application for the remaining unappropriated water in the Lower Colorado River Basin, and backup from the Highland Lakes to develop water supplies that would help meet in-basin future needs as well as needs in the San Antonio region and Williamson County. LCRA is also proposing to use some portion of these ROR rights to meet other municipal and industrial demands in the basin. Storage of these water rights in either the Highland Lakes or in the off-channel reservoirs to be constructed as part of the LSWP is projected to increase the firm supply available from these rights on the order of 100,000 ac-ft/yr and is proposed as a strategy to meet in-basin needs by 2060. Moreover, portions of these water rights not used to meet in-basin demands are proposed for storage in off-channel reservoirs for delivery to SAWS as part of the LSWP.

For example, LCRA is proposing to use part of the Gulf Coast and Garwood Irrigation Districts' water rights as early as 2010 to meet municipal and industrial shortages that result from the "No Call" and zero return flow assumptions. LCRA already has pending an application to amend its Garwood water right for such purposes. LCRA is proposing to use the balance of the authorized diversions under the Garwood right (about 75,000 ac-ft/yr) to meet other needs within the Colorado River Basin such as the COA's projected 2060 demand beyond its authorized water rights, the Fayette Power Plant backup demand for LCRA, and other municipal demands in the vicinity of Lake Travis. LCRA is also proposing to use a part of the Gulf Coast and Garwood Irrigation Districts' water rights for meeting the 2060 industrial needs. The amendments of specific irrigation water rights contemplated at this time are provided in *Table 4.29*. These water rights were selected for amendment largely for illustrative purposes, recognizing that LCRA intends to amend any and all of its irrigation water rights to meet future and changing water needs.

Table 4.29 Amendment to Irrigation Water Rights for Municipal and Industrial Needs

Irrigation District	2000	2010	2020	2030	2040	2050	2060
Garwood	(24,000)	(28,000)	(32,000)	(40,000)	(40,000)	(40,000)	(74,600)
Pierce Ranch		(15,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)
Lakeside							(7,000)
Gulf Coast					(10,000)	(10,000)	(10,000)

Note: Estimates derived from RJ Brandes Company preliminary modeling.

Opinion of Probable Costs

Capital expenditures for water supply purposes would not be required to implement this alternative. It is anticipated that diversions of these rights for other purposes will be done at locations already authorized for diversion under other water rights held by LCRA using existing infrastructure. The average cost of providing raw water under this alternative is currently $115 per ac-ft, and is estimated to increase on average about 3 percent per year over the next five years, or up to $140/ac-ft.

Issues and Considerations

Conversion of irrigation rights to serve municipal, manufacturing, and steam electric needs may not have a significant impact on downstream instream and bay and estuary flows as long as water is provided from other sources to meet the rice irrigation needs. In addition, use of this water for municipal needs could result in a greater volume of return flows, which if returned to the river in the Austin and surrounding area locations, would provide for instream flow needs as well. In addition, the flows from such activities are more constant than the flows required for irrigation, all of which are needed during the spring, summer, and early fall. Return flows from municipal supplies are expected to be provided year round. One exception to this is the periods of time where groundwater is used for irrigation in the lower three counties. Under this situation, the irrigation rights are not supplied by water in the Colorado and flows could be less during the months of water use by rice irrigation.

Impacts to Agriculture

As noted above, minimal impacts to agriculture are anticipated as long as alternative supplies are provided. Agricultural users of groundwater may see increased cost of production of groundwater as a result of additional drawdown from LSWP, but whether such drawdowns will occur and the extent and timing is still being investigated for LSWP.

4.6.1.4 LCRA Contract Renewals and Amendments

LCRA has wholesale contracts or Board reservations of raw water that are attributed to numerous water user groups. These contracts or reservations generally expire within the 50-year planning period. It is recommended that, to the extent necessary, those entities with contracts with LCRA seek renewal of these contracts for water before they expire and, as appropriate, increase the contract amount to meet the projected increased demands throughout the planning period. With the exception of the COA's 1999 contract, which includes a COA option to year 2101, LCRA is not expressly obligated by contract to continue providing water to these entities. However, LCRA has indicated that it expects to continue providing water to these entities throughout the 50-year planning period and expects to meet these customers' projected increased demands for water through amendments to existing contracts to increase contract quantities. For purposes of this plan, water supplied to these customers is designated as largely coming from Lakes Buchanan and Travis. However, as discussed in more detail elsewhere in this chapter, LCRA operates its water rights as a system. To the extent that these customers have obtained contracts or amendments to contracts since 1999, their current LCRA contract expressly recognizes that water may be provided under the contract from any source available to LCRA, including supply from Lakes Buchanan and Travis, LCRA's ROR rights, groundwater, or other sources that might come under LCRA's control. To the extent that existing customer contracts do not contain this language, LCRA contracting rules require any customers seeking contract renewals or amendments to existing contracts to convert to a new form of contract that contains this language.

The LCRA Board has reserved approximately 15,000 ac-ft/yr of water in excess of its needs for the steam electric needs of its Ferguson Power Plant on Lake LBJ. LCRA has proposed, as a strategy, an amendment to its internal commitment of water to the Ferguson Power Plant (Steam Electric in Llano County) for purposes of this plan to reduce this commitment so that the additional water supply made available can be used to meet other needs identified using the "No Call" assumptions, refer to *Table 4.30*.

Capital expenditures for water supply purposes would not be required to implement this alternative. The average cost of providing raw water under this alternative is currently $115 per ac-ft and is estimated to increase on average about 3 percent per year. As a result, it was assumed that the preferred strategy for these contractual users would be to renew and amend the contracts with LCRA, as appropriate, to meet their needs through the 50-year planning period. *Table 4.30* contains a summary of the WUGs for which this alternative applies and the amount of water planned for in the contract extension and amendment (where increased amounts of water are needed). Several WUGs have multiple contracts with LCRA that expire at different times; and therefore some of the contract renewals change values over the planning period.

Table 4.30 LCRA Contract Renewals and Amendments

WUG	County	Contract Renewals and Amendments (ac-ft/yr)						
		2000	2010	2020	2030	2040	2050	2060
Aqua WSC	Bastrop	0	0	0	0	0	5,000	5,000
County-Other	Bastrop	0	42	1,392	1,392	1,392	1,392	1,392
Steam Electric	Bastrop	0	0	0	0	2,750	5,970	5,970
Steam Electric	Bastrop					1,280	2,780	2,780
Burnet	Burnet	0	0	0	0	4,100	4,100	4,100
Cottonwood Shores	Burnet	0	0	138	138	138	138	138
Cottonwood Shores	Burnet		9	39	70	101	133	174
Granite Shoals	Burnet	0	0	0	830	830	830	830
Lake LBJ MUD	Burnet	0	0	0	0	0	1,789	1,789
Marble Falls	Burnet	0	0	0	2,000	2,000	3,000	3,000
Meadow Lakes [1]	Burnet		141	273	379	450	512	576

Table 4.30 LCRA Contract Renewals and Amendments (continued)

WUG	County	Contract Renewals and Amendments (ac-ft/yr)						
		2000	2010	2020	2030	2040	2050	2060
County-Other	Burnet	0	345	571	621	651	651	651
County-Other	Fayette	0	85	97	97	97	97	97
Steam Electric (COA)	Fayette	0	0	0	3,500	3,500	3,500	3,500
Dripping Springs WSC	Hays	0	0	0	0	0	560	560
Dripping Springs WSC	Hays		3,031	3,031	3,031	3,031	3,031	3,354
County-Other	Hays	0	0	0	0	0	1,915	1,915
Lometa	Lampasas (Region G)	0	882	882	882	882	882	882
Kingsland WSC	Llano	0	0	0	0	0	0	500
Llano	Llano	0	0	0	0	87	87	87
County-Other	Llano	0	0	1,327	1,327	1,327	1,327	1,327
Steam Electric	Llano		(5,000)	(5,000)	(5,000)	(5,000)	(5,000)	(10,000)
Manufacturing	Matagorda	0	0	8,200	11,422	11,422	14,222	14,222
County-Other	Matagorda	0	0	15	15	15	15	15
Steam Electric [2]	Matagorda	0	0	0	0	38,264	38,315	38,363
County-Other	San Saba	0	20	20	20	20	20	20
Austin - Municipal [3]	Travis	0	0	0	0	0	0	140,323
Austin - Steam Electric [4]	Travis	0	0	0	0	0	0	31,665
Austin - Steam Electric	Travis		(17,392)	(17,493)	(17,594)	(17,695)	(17,796)	(17,898)
Briar Cliff Village	Travis	0	0	0	0	300	300	300
Briar Cliff Village	Travis			4	61	109	160	212
Cedar Park [5]	Travis	0	0	482	482	482	988	1,052
Jonestown WSC	Travis	0	0	0	0	360	360	360
Jonestown WSC	Travis		42	114	176	216	259	308
Lago Vista	Travis	0	0	270	6,770	6,770	6,770	6,770
Lakeway MUD	Travis	0	0	0	2,455	2,455	2,455	2,455
Lakeway MUD	Travis		780	1,482	1,951	2,007	2,037	2,033
Loop 360 WSC	Travis	0	0	0	871	871	871	871
Loop 360 WSC	Travis		247	140	44			
Pflugerville	Travis	0	0	0	0	0	12,000	12,000
River Place on Lake Austin	Travis	0	0	900	900	900	900	900
River Place on Lake Austin	Travis		438	528	392	268	156	55
The Hills	Travis	0	0	0	1,600	1,600	1,600	1,600
Travis County WCID #17	Travis	0	0	554	554	554	554	9,354
Travis County WCID #18	Travis	0	0	1,400	1,400	1,400	1,400	1,400

Table 4.30 LCRA Contract Renewals and Amendments (continued)

WUG	County	Contract Renewals and Amendments (ac-ft/yr)						
		2000	2010	2020	2030	2040	2050	2060
Travis County WCID #18	Travis					4	135	283
Travis County WCID #20	Travis	0	0	0	1,135	1,135	1,135	1,135
West Travis County Regional WS	Travis					431	1,059	1,619
County-Other [6]	Travis	0	604	2,952	8,253	8,253	11,834	11,834
Manufacturing	Travis	0	910	910	910	910	910	910
Cedar Park [5]	Williamson (Region G)	0	0	253	253	253	17,747	17,683
Leander	Williamson (Region G)	0	0	0	6,400	6,400	6,400	6,400
County-Other	Williamson (Region G)	0	0	0	0	0	0	10,000
TOTAL		**0**	**(14,816)**	**3,481**	**37,737**	**85,320**	**137,500**	**324,866**
Contract Renewal Total		**0**	**2,888**	**20,363**	**54,227**	**100,118**	**150,034**	**341,370**
Contract Amendment Total		**0**	**4,688**	**5,611**	**6,104**	**7,897**	**10,262**	**11,394**
Contract Reductions			**(22,392)**	**(22,493)**	**(22,594)**	**(22,695)**	**(22,796)**	**(27,898)**

Note: The un-highlighted rows show the contract renewal value, whereas the highlighted rows indicate the contract amendment value necessary to meet needs.

Region G has proposed a 26,200 ac-ft/yr strategy for Williamson County which currently does not exist under contract and would require an amendment to existing contracts and permit authorizations. This strategy for Cedar Park (25,000 ac-ft/yr) and Liberty Hill (1,200 ac-ft/yr) has not been included in *Table 4.30*. The total amount of water proposed to go to Region G is approximately 77,217 ac-ft/yr: 51,017 ac-ft/yr currently under contract (882 ac-ft/yr for Lometa, 18,735 ac-ft/yr for Cedar Park [a portion of Cedar Park is located in Region K], 6,400 ac-ft/yr for Leander, and 25,000 ac-ft/yr for BRA/HB 1437), and the proposed additional 26,200 ac-ft/yr for Cedar Park and Liberty Hill.

[1] The Meadow Lakes contract is a new LCRA contract.

[2] The Matagorda Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results; Refer to *Table 3.1a*. This number reflects the differences between STPNOC's full demand and the amount of water reliably available from run of the river diversions averaged over the drought-of-record period.

[3] The Austin-Municipal amount, refer to *Table 3.27*, is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of 152,327 ac-ft/yr LCRA contract amount used in the first planning cycle.

[4] The Austin-Steam Electric value is based on the November 2004 TCEQ WAM Run 3 Modified by FNI results instead of 35,197 ac-ft/yr LCRA contract value.

[5] Cedar Park is located in both Region K and Region G, and it serves Williamson-Travis Counties MUD #1 (WUG).

[6] Travis County-Other contains Travis County MUD District #4 that serves Travis County WCID #19 (WUG).

Opinion of Probable Costs

Capital expenditures for water supply purposes would not be required to implement this alternative. The average cost of providing raw water under this alternative is currently $115 per ac-ft and is estimated to increase on average about 3 percent per year.

Issues and Considerations

Renewal and expansion of existing contracts to meet increasing municipal, manufacturing, and steam electric demands will provide for the needs of a growing population, but will reduce the amount of water available for irrigation and environmental flows. As customers use more and more of their allocation, the available interruptible supply pool will shrink and less water will be available. The system operations approach will maximize the use of the remaining interruptible supplies both for irrigation and environmental needs.

Impacts to Agriculture

The increasing municipal and manufacturing needs for water would have had a significant impact on agriculture as the available pool of interruptible yield water gradually diminished over time. However, the strategies as implemented do contain sufficient water such that any impact on agriculture is low.

4.6.1.5 LCRA New Water Sale Contracts

LCRA has identified shortages within its service area that are not currently covered by a water sale contract from LCRA but for which LCRA is willing and able to provide raw water. In particular, many of these include rural communities in the upper portion of the LCRWPA and current customers of the COA whose contract has or is expected to expire during the planning period. The City's current policy is that much of the raw water currently being supplied by the City to wholesale customers may need to be provided by LCRA in the future. The COA will plan to continue to treat and transport this water. As new customers, contracts for water supplied to these customers will come from any source available to LCRA, including supply from Lakes Buchanan and Travis, LCRA's ROR rights, groundwater, or other sources that might come under LCRA's control. *Table 4.31* summarizes the new LCRA contracts over the planning horizon.

Table 4.31 New LCRA Contracts

WUG	County	2000	2010	2020	2030	2040	2050	2060
Creedmoor-Maha WSC	Travis	0	0	290	408	491	577	669
Manor	Travis	0	0	0	336	351	369	388
Manville WSC	Travis	0	0	0	1,839	2,184	2,584	3,034
Rollingwood	Travis	0	0	0	0	372	371	373
West Lake Hills	Travis	0	0	0	2,049	2,178	2,320	2,471
Windermere Utility	Travis	0	0	0	2,201	2,180	2,180	2,180
TOTAL		**0**	**0**	**290**	**6,833**	**7,756**	**8,401**	**9,115**

Opinion of Probable Costs

Capital expenditures for water supply purposes would not be required to implement this alternative. The average cost of providing raw water under this alternative is currently $115 per ac-ft and is estimated to increase on average about 3 percent per year.

Issues and Considerations

Much of the water that would be dedicated to new LCRA contracts is already being supplied from the Highland Lakes system. The only change will be that LCRA will be supplying them with raw water instead of the City of Austin. Austin will continue to treat and transport the water to these entities. As a result, the environmental impact will likely be negligible since switching to LCRA allows LCRA to provide service from any one of their sources of water which increases flexibility and allows greater utilization of existing sources.

Impacts on Agriculture

As noted above, anticipated impacts on agriculture from this strategy are low.

4.6.1.6 Advanced Conservation to Meet Demand for Irrigation

LCRA has two projects that contemplate the implementation of advanced conservation to extend the available water supplies to the four irrigation districts. These projects include those necessary to implement HB 1437 (see Sections 4.8.7 and 4.9.5 herein for a summary of HB 1437) and the LSWP (refer to Sections 4.9). Generally, these strategies include a variety of on-farm conservation measures, in-district irrigation improvements, and development of a new rice variety to reduce water consumption. Water conservation potential under the LSWP is estimated to be up to 118,000 ac-ft/yr and under HB 1437 between 10,000 and 25,000 ac-ft/yr by 2060.

These strategies are more fully described in Section 4.9 of this chapter.

4.6.1.7 Groundwater Development to Meet Irrigation Shortages During Drought

The development and use of groundwater in the Lower Colorado River Basin is also being proposed as a means for meeting some of the demand for irrigation water. The use of this groundwater will reduce dependence of these irrigation districts on the Highland Lakes for backup supplies of surface water during dry periods, thus allowing more water to be retained in storage in the Highland Lakes or used to meet future needs.

Recent information regarding the status of the LSWP groundwater studies and this strategy are more fully described in Section 4.9.3 of this chapter.

4.6.1.8 Application for Unappropriated Flows and Off-Channel Storage

LCRA has pending an application to appropriate remaining flows in the lower part of the Colorado River Basin for storage in off-channel reservoirs. Subject to potential or pending litigation and the discussion in Section 4.16 of this chapter, LCRA intends to capture these flows and use them in conjunction with other water supplies available to it as part of its system operation. This water may ultimately be used to meet firm demands or mitigate environmental impacts of the LSWP, or to meet other demands within the Colorado River Basin. Water available under this permit will depend on the conditions imposed on the permit for purposes of protecting environmental flows. As a very conservative measure, this analysis included an assumption that target in-stream flow and freshwater inflow requirements would be imposed on this junior water right before diversions would occur. For purposes of this plan, these flows were assumed to be used to supply water to SAWS during the planning period and not assumed to meet needs within Region K.

4.6.1.9 LCRA-SAWS Water Project (LSWP)

The 2002 State Water Plan included a proposal to temporarily transfer up to 150,000 ac-ft/yr of water from the Lower Colorado River Basin to the Region L water planning area. The objective of this proposal was and is to satisfy long-term water shortages in both Region K and Region L. In 2001, the Region K planning group also considered and passed a policy that set out a nine-point policy to be considered by the regional planning group in evaluating the proposed inter-basin transfer of this water to Region L. That policy is included in this plan under Section 8.2.1.

In 2004, LCRA entered into an agreement with the San Antonio Water System (SAWS) to effectuate this proposal. This project is now referred to as the LCRA-SAWS Water Project (LSWP). Prior to finalizing the agreement with SAWS, specific legislation was enacted that imposes several restrictions and requirements on the LSWP (Texas Water Code § 222.030). Specifically, the LCRA Board must find that the contract:

1. Protects and benefits the Lower Colorado River watershed and the authority's water service area, including municipal, industrial, agricultural, recreational, and environmental interests
2. Is consistent with regional water plans filed with the Texas Water Development Board on or before January 5, 2001
3. Ensures that the beneficial inflows remaining after any water diversions will be adequate to maintain the ecological health and productivity of the Matagorda Bay system
4. Provides for in-stream flows no less protective than those included in the authority's WMP for the Lower Colorado River Basin, as approved by the commission
5. Ensures that, before any water is delivered under the contract, the municipality has prepared a drought contingency plan and has developed and implemented a water conservation plan that will result in the highest practicable levels of water conservation and efficiency achievable within the jurisdiction of the municipality
6. Provides for a broad public and scientific review process designed to ensure that all information that can be practicably developed is considered in establishing beneficial inflow and instream flow provisions
7. Benefits stored water levels in the authority's existing reservoirs

These and additional requirements contained in the legislation and final agreement between LCRA and SAWS mirror many of those contained in the nine-point policy of the 2001 Plan. For example, the transfer is temporary; it benefits both regions by substantially reducing projected water shortages in Region K and meeting municipal shortages in Region L; the system operation necessary for the project maximizes use of inflows available below Austin; and the goal is to design a project that will has minimal detrimental environmental, social, economic and cultural impacts and provides benefits to lake recreation over what would occur without the project.

Opinion of Probable Costs

The total estimated cost for the LSWP is $1,704,473,000 as developed by the Region L consultant. Per the Definitive Agreement between LCRA and SAWS, SAWS is responsible for LSWP costs. The costs are paid primarily through water use fees and surcharges over the life of the project. Region K is not responsible for the costs associated with the LSWP.

Issues and Considerations

The project is being developed in two phases, study and implementation. The study phase currently underway will determine whether a project can be designed to meet these legislative requirements, and the policies adopted by the Region K Planning Group for inter-basin transfers. At the conclusion of the study period, a determination will be made whether to proceed with the project. This project uses an innovative approach to meeting the demands of two basins by enhancing LCRA's ability to optimize the use of its water rights, in combination with aggressive conservation and development of limited groundwater for in-basin uses. Many of the strategies identified in this plan are also component projects of the LSWP. As such, there is a significant environmental component that must be satisfied prior to any projects from LSWP going forward.

For more information about this strategy refer to Section 4.9.

Impacts to Agriculture

This portion of the plan has a significant beneficial impact on agriculture to the extent that funds will be provided for conservation improvements that could not be afforded by most farmers. Implementation and long term success of conservation measures will require some adaptation by farmers, but many of the more successful farmers have already implemented these measures to try to stay competitive.

4.6.1.10 Description of the Impact of the Management Strategies on Navigation

As noted previously in the regional plan, there is a significant concern with the Water Availability Model that was used to determine the availability of surface water supply in the Colorado River in Region K. The issues and concerns with this model are documented in the report. That being established, the overall impact on navigation in Region K is negligible in the area of the Colorado River and Matagorda Bay that is tidally influenced. This is the area where the most shipping occurs and navigation will be least affected in this zone. Once beyond the tidally influenced areas, the overall impact of the management strategies will be to reduce the amount of currently available interruptible water supplies as the current WUGs increase in demand over time through growth in population. However, the current LCRA Water Management Plan calls for a minimum release of approximately 16,000 acre feet annually through 2010, and then increasing to approximately 33,000 acre feet annually after 2010. These release amounts are contained in *Table 3.1a* and in Section 3.2.1.2.3 on Page 3-20. However, these amounts may change over the planning period as the results of the LSWP studies and mitigation strategies are better known. In addition, inflows originating downstream of the Highland Lakes would add to these release amounts. The 16,000 ac-ft/yr release translates to a rate of approximately 22 cubic feet per second. Navigation on the Colorado upstream of the tidally influenced areas is primarily for pleasure craft, and the impact of the mandated releases under the LCRA Management Plan plus other downstream flows may provide sufficient water for navigation purposes. Based in terms of a high, medium, or low impact, the estimated impact to navigation will be low.

4.6.2 COA Water Management Strategies

The COA provides water for municipal, manufacturing, and steam electric water uses. COA's existing service area covers portions of Travis, Williamson, and Hays Counties.

The COA water management strategies include renewing their LCRA contract, water conservation, and reuse. The total amounts for each WUG are summarized below in *Table 4.32*.

Table 4.32 COA Water Management Strategies (ac-ft/yr)

COA Strategies	2000	2010	2020	2030	2040	2050	2060
Conservation	2,000	7,600	13,000	18,800	25,000	29,500	33,537
Direct Reuse (Municipal and Manufacturing)	2,000	7,600	13,000	18,800	25,000	29,500	33,537
Indirect Reuse (Steam Electric) Fayette		9,810	10,004	13,418	21,272	21,386	27,411
Direct Reuse (Steam Electric) Travis		1,680	2,881	7,083	8,285	12,486	13,690
LCRA Contract Renewal (Municipal)							140,323
LCRA Contract Renewal (Steam Electric)				3,500	3,500	3,500	35,165
TOTAL	**4,000**	**26,690**	**38,885**	**61,601**	**83,057**	**96,372**	**283,663**

4.6.2.1 Water Conservation

The COA began an aggressive water conservation campaign in the mid 1980s in response to rapid growth and a series of particularly dry years. COA has achieved significant reductions in both per capita consumption and peak day to average day demand ratio. For the per capita use calculations, the COA used year 1998 as their base year instead of year 2000, since the COA had mandatory water conservation measures in place during year 2000.

The adopted LCRWPG projections for municipal, manufacturing, and wholesale water commitments for the COA and its wholesale customers are projected to increase from approximately 188,776 ac-ft/yr in the year 2000 to approximately 378,686 ac-ft/yr in 2060 (assuming contract extensions, refer to *Table 4.24*). Projections for water demands in succeeding decades assume the continuation and expansion of the City's conservation programs. These programs represent a roughly 9 percent savings in 2060 over the demands with no per capita reduction. With conservation and reuse an overall per capita reduction of roughly 11 percent is projected.

In 1990, the City's conservation program evolved from primarily reacting to high summertime demands to a comprehensive program with the goals of reducing both per capita consumption and peak day demand. To achieve these broader goals, the City has implemented and anticipates continuing water conservation programs in a number of areas including:

- Public education and outreach including school programs

- Rebate and incentive programs
- Local ordinances that increase water efficiency by customers
- Support of legislation that increases water efficiency in plumbing products and appliances at both the State and Federal level,
- Increased water efficiency in utility operations
- Conservation-oriented rate structures

Through these programs, the COA has made significant advances toward reducing the per capita consumption of water in its service area. The COA states that it is committed to continuing to seek ways to reduce its per capita demands as a Best Management Practice for its utility and to reduce overall capital costs for new construction to meet increasing demands. Through its current comprehensive Water Resources Planning Study, COA is in the process of analyzing its current water conservation programs, goals, and per capita demands. Future plan updates will reflect changes as additional COA water conservation program information becomes available. The range of conservation program costs is from $60 to $830 per acre foot, depending on the program.

Environmental and Other Impacts

Water conservation holds several advantages over alterative strategies in the fact that implementation of conservation practices does not require any additional water system infrastructure and does not require the movement of water between locations. In the event that, over time, water conservation causes changes to wastewater concentrations, treatment processes may need to be adjusted to maintain permitted discharge parameters. In addition, water conservation generally does not result in adverse impacts to environmental flows or other environmental considerations.

Impacts to Agriculture

No adverse impacts to agriculture are anticipated as a result of this strategy.

4.6.2.2 Reclaimed Water Initiative

This COA reclaimed water alternative includes the development of water distribution systems to provide reclaimed water to meet non-potable water demands within the City's service area. The City is currently constructing its Central Reclaimed Water System from the Walnut Creek WWTP. This system is expected to have a planning horizon capacity of 18,000 ac-ft/yr. In addition, the City is constructing a similarly sized South Reclaimed Water System from the South Austin Regional WWTP. Austin has also evaluated the feasibility of developing reclaimed water facilities in other areas of the City. The City projects that it will need to develop the use of reclaimed water to the maximum extent possible, up to, if necessary, 100 percent reuse of its effluent to meet future needs. As the level of authorized reclaimed water use in the COA increases, the amount of flow it returns to the Colorado River may decrease accordingly. Development of reclaimed water facilities necessary to provide for the projected 2060 direct municipal reuse (non-potable) demands of 33,537 ac-ft/yr is anticipated to require a capital expenditure of $178 million. The unit cost of reclaimed water is expected to be $445 per ac-ft.

In addition to the water conservation measures the COA has implemented to reduce water demands, the COA is pursuing the development of reclaimed water as an additional supply of water to meet non-potable demands in the area. The COA has indicated that it will develop and use reclaimed water as the primary strategy to meet the projected needs in 2060, and likely beyond. To meet the total projected water demands, the Water Reclamation Initiative would need to supply up to 33,537 ac-ft/yr for direct municipal non-potable purposes by the year 2060 plus approximately 13,690 ac-ft/yr of COA direct non-potable use for steam electric needs in Travis County. The total amount of this direct reuse supply in Travis County is 47,227 ac-ft/yr. Additionally, Austin has proposed an indirect reuse project for its steam electric demands in Fayette County, at the Fayette Power Project. The projected amount of effluent needed to meet Austin's projected indirect reuse needs at the Fayette Power Project is 27,411 ac-ft/yr. Therefore, the total amount of projected reuse is 74,638 ac-ft/yr.

The City is currently using reclaimed water from its existing reclaimed system to irrigate several golf courses and meet other non-potable needs. The City estimates this use to be 2,000 ac-ft/yr. In order to expand the availability and use of reclaimed water, the COA has completed a series of planning activities, including the publication of the 1998 Water Reclamation Initiative (WRI) Planning Document, and completion of the north and south system master plans. In addition, COA is in the process of developing an implementation plan in conjunction with the Federal Bureau of Reclamation (FBR).

The Department of Interior, through the Bureau of Reclamation, manages a federal cost-share program under Title XVI of Public Law 102-575. The purpose of the program is to identify and promote opportunities for water reclamation. Authorization may be provided for a federal cost-share up to 25 percent of design and construction costs for municipal wastewater projects that will achieve federal water reclamation goals. As a prerequisite to receiving federal matching grants, Austin, in coordination with the Bureau of Reclamation, is preparing a Feasibility Study of its planned reclaimed water system. The Feasibility Study is expected to be complete in December 2005.

The City anticipates that the use of reclaimed water will increase steadily from the current level of 2,000 ac-ft/yr. The COA will continue to pursue implementation of its WRI and anticipates that additional capacity will be available in the future as the needs increase over the planning horizon. *Table 4.33* shows the projected capacity increases for the three main categories of reuse for each decade of the planning period.

Table 4.33 Anticipated Reclaimed Water Capacity

Decade	Direct Reuse - Municipal and Manufacturing (ac-ft/yr)	Direct Reuse – Steam-Electric Travis County (ac-ft/yr)	Indirect Reuse – Steam-Electric Fayette County (ac-ft/yr)
2000	2,000	-	-
2010	7,600	1,680	9,810
2020	13,000	2,881	10,004
2030	18,800	7,083	13,418
2040	25,000	8,285	21,272
2050	29,500	12,486	21,386
2060	33,537	13,690	27,411

Note: Anticipated capacity information provided by COA.

Through its current comprehensive Water Resources Planning Study, COA is in the process of evaluating its water reuse program and options. Future plan updates will reflect changes as additional Austin water reclamation program information becomes available.

Projected Reduction of Return Flows

The COA recognizes that the water demand projections contained in the Lower Colorado Regional Water Plan are only projections. Actual water demands may increase faster or slower than projected. Additionally, Austin's own municipal and manufacturing demand projections exceed the Region K projections for Austin by roughly 10 percent. The City will monitor the growth of its water demands and adjust its reclaimed water program, as well as its other water conservation programs, accordingly. As a result, the City has indicated that it may increase the use of reclaimed water at a faster rate than projected in this plan. The City believes that the increased use of reclaimed water will provide a monetary benefit to the COA through decreased raw water costs and delayed capital expenditures. As return flows discharged by Austin diminish in the future due to increasing reclamation of water, other sources may need to be dedicated or developed to meet needs that may currently be met by return flows discharged by Austin.

Any decrease in municipal return flows will likely be gradual. However, the City projects that it will increase its use of reclaimed water to the maximum extent feasible to meet demands above 325,000 ac-ft/yr, whether those demands occur before or after 2060.

Opinion of Probable Costs

In addition to water conservation, the use of reclaimed water has been identified as a significant source of water to meet the COA's projected demand deficits in 2060. The City has completed planning studies for a Reclaimed Water System to serve potential customers in the City. The system will provide a portion of the water supply required to meet the COA's identified needs. Planning efforts for additional water reclamation options are in progress, including a comprehensive Water Resources Planning Study and a FBR study.

Table 4.34 presents the probable cost for the central and south systems, as currently planned. As previously indicated, the system is designed to have a capacity of approximately 30,000 ac-ft/yr. In 2nd quarter 2002 numbers, the probable cost for Austin to meet all of its planning horizon identified direct reuse needs through the use of reclaimed water (47,227 ac-ft/yr) is approximately $178,060,000. This would result in a total annual cost (including operations and maintenance [O&M]) of approximately $21 million per yr. The opinion of probable unit cost of reclaimed water is $445 per ac-ft, or approximately $1.37 per 1,000 gallons. There is no cost associated with indirect reuse (i.e. the 27,411 ac-ft/yr planned for the steam electric in Fayette County for the Fayette Power Project).

Table 4.34 COA Reclaimed Water Opinion of Probable Unit Costs

Phase	Cost Opinion
Capital Costs	
Plant Pump Station, Storage, and Misc. Improvements [1]	$15,823,711
Transmission System [1]	$90,099,472
System Pumping and Storage [1]	$19,471,154
Total Capital Costs	**$125,394,337**
Engineering, Contingencies and Legal Services (35%)	$43,888,018
Land Acquisition and Survey (5%)	$6,269,717
Environmental and Architectural Studies, Mitigation, and Permitting (2%)	$2,507,887
Total Project Costs	**$178,059,959**
Annual Costs	
Debt Service (6 percent for 30 years)	$12,935,862
Operation and Maintenance [2]	$8,064,981
Total Annual Costs	**$21,000,843**
Available Project Yield (ac-ft/yr)	**47,227**
Unit Cost of Water ($/ac-ft)	**$445**
Unit Cost of Water ($/1000 gallons)	**$ 1.37**

[1] Cost taken from draft U.S. FBR Feasibility Study of COA's Reclaimed Water System (July 2005). Values were converted to 2nd Quarter 2002 using the ENR Construction Cost Index (conversion factor of .877 between 2nd Quarter 2002 and July 2005).

[2] O&M Cost taken from draft U.S. FBR Feasibility Study of COA's Reclaimed Water System (July 2005). O&M costs were adjusted to second quarter 2002 dollars using the U.S. Department of Labor's Consumer Price Index (factor of 0.976)

Capital costs for this strategy were updated to second quarter 2002 dollars using the *Engineering News-Record* (ENR) Construction Cost Index (CCI). Land acquisition, environmental study, and O&M costs were adjusted to second quarter 2002 dollars using the U.S. Department of Labor's Consumer Price Index.

Environmental and Other Impacts

The water quality impacts from direct reuse of reclaimed water is regulated by the TCEQ through 30 TAC Chapter 210. Reclaimed water projects authorized under these regulations are presumed to be protective of human health and the environment. The potential impacts generated through the construction of the proposed pipelines and pump stations will need to be addressed in the preliminary engineering studies to be conducted for these projects. Depending on the outcome of the City's indirect reuse (bed and banks) permit application and implementation of indirect reuse to meet COA municipal and industrial demands, such indirect reuse could have an impact on the flows available to meet environmental flow needs of the river and bay system. These impacts will be considered in accordance with state law as part of the permitting process. The City's pending application for a bed and banks authorization also proposes to dedicate 16,350 ac-ft/yr of the effluent to the Texas Water Trust with the Texas Parks and Wildlife Department as trustee. Even with the reuse proposed for this planning period, however, significant levels of return flows should still be available to help meet environmental flow needs.

The use of reclaimed water presents an alternative for providing water for non-potable uses without the development of new water supplies for the City of Austin for the planning period. The costs and environmental impacts of expanding the City's current reuse system will have to be determined as more specific information, such as the locations of customers to be served, is identified. The extent of pipeline and other transmission facilities will have to be determined before specific environmental impacts can be estimated. However, the majority of the facilities needed will most likely be placed in existing easements and, therefore, minimize the impact upon natural resources.

More apparent environmental impacts can be recognized in the Lower Colorado River Basin where the river will not have the benefit of return flows from the COA. As the City steadily increases its reuse program over the planning period, the benefits of the return flows will be reduced. *Table 4.35* shows the expected return flows from the COA, less the expected amount of reuse.

Impacts to Agriculture

Impact to agriculture is low based on the projected return flow amounts over the planning period.

Table 4.35 Projected COA Effluent Minus Reuse by Decade*

COA Return Flows	2000	2010	2020	2030	2040	2050	2060
Projected COA Effluent minus reuse	96,167	90,701	99,974	102,902	104,423	112,406	117,464

*Based on data provided by COA.

The "No Call" model used by Region K was constructed for developing water supplies under the assumption that senior water rights in Region K would not make priority calls on inflows available to Region F reservoirs. Because of the late timing of the adoption of the "No Call" model, it is infeasible for Region K's consultant to assemble a model inclusive of all water management strategies and necessary model modifications to preserve apt functioning of the "No Call" assumption and allow for the impact assessments required by this plan. Therefore, impact results derived from the "No Call" model should be considered unreliable.

Tables 4.36 and *4.37* show the impact of expected and full return flows from Austin on instream flows in the Colorado River. These estimated impacts on instream flows were developed for control point J10000 (Colorado River at Columbus). The expected return flow volumes used in the year 2000 condition and year 2060 models were obtained from *Table 4.35*. Expected and full return flows for the year 2000 condition are equal as COA has not yet begun to use reuse water to a significant extent. The year 2060 full return flows were determined to be 190,890 ac-ft/yr by adding the 2060 expected return flow and the expected COA reuse strategies. Although some reductions in instream flows result from a change to expected return flows from full return flows, the total lack of return flows from Austin has a far more significant impact on instream flows. None of the scenarios, expected or full return flows for 2000 and 2060, would result in median flow rates near the critical 7Q2 flow for the stream segment. This information is also presented in *Figures 4.3* and *4.4*. However, there are periods of time, which range from 9 percent of months modeled ("No Call" WAM) to 0.30 percent of the months modeled ("No Call" WAM with full COA return flows) depending on whether return flows are present and on which model is used, when flows will be below the 7Q2 flow.

Table 4.36 Year 2000 Median Instream Flow Results for Control Point J10000*

Month	7Q2 acre-feet	"No Call" WAM without Return Flows	"No Call" WAM with COA Expected Return Flows	"No Call" WAM with Full COA Return Flows
January	18,081	41,386	49,177	49,177
February	18,081	53,480	57,497	57,497
March	18,081	60,572	64,272	64,272
April	18,081	75,591	70,726	70,726
May	18,081	135,245	120,491	120,491
June	18,081	116,211	133,792	133,792
July	18,081	59,351	110,669	110,669
August	18,081	51,411	85,325	85,325
September	18,081	61,015	71,233	71,233
October	18,081	43,429	44,786	44,786
November	18,081	33,106	39,002	39,002
December	18,081	37,844	42,042	42,042
Median	18,081	61,428	85,304	85,304

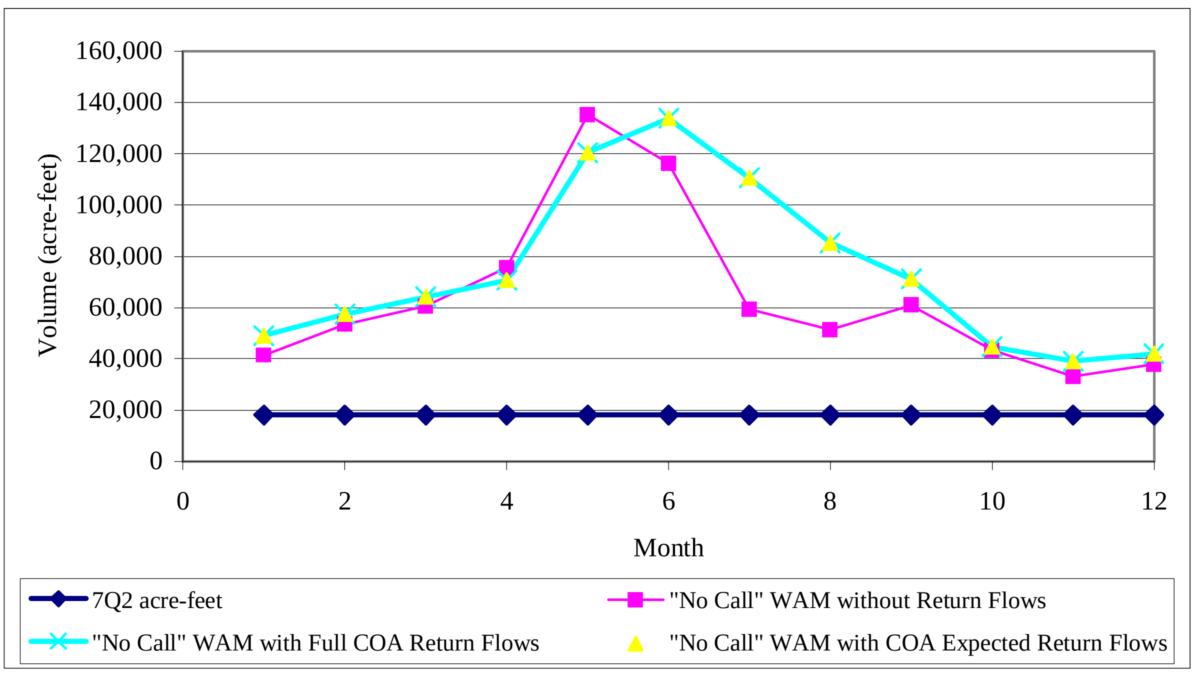
*Comparison of median regulated flows at control point J10000 between "No Call" WAM and "No Call" WAM with expected and full COA return flows. Model output files are included as an attachment to this report.
Refer to the bolded paragraph on Page 4-41.

Table 4.37 Year 2060 Median Instream Flow Results for Control Point J10000*

Month	7Q2 acre-feet	"No Call" WAM without Return Flows	"No Call" WAM with COA Expected Return Flows	"No Call" WAM with Full COA Return Flows
January	18,081	39,409	47,782	52,151
February	18,081	54,353	59,177	64,231
March	18,081	60,510	70,231	75,620
April	18,081	57,415	69,069	69,242
May	18,081	117,730	120,691	123,796
June	18,081	110,770	116,290	118,428
July	18,081	64,380	72,117	75,135
August	18,081	51,894	59,420	64,169
September	18,081	59,625	62,246	67,870
October	18,081	39,070	43,831	49,748
November	18,081	33,149	40,622	47,883
December	18,081	37,955	45,947	50,574
Median	18,081	61,969	68,210	71,185

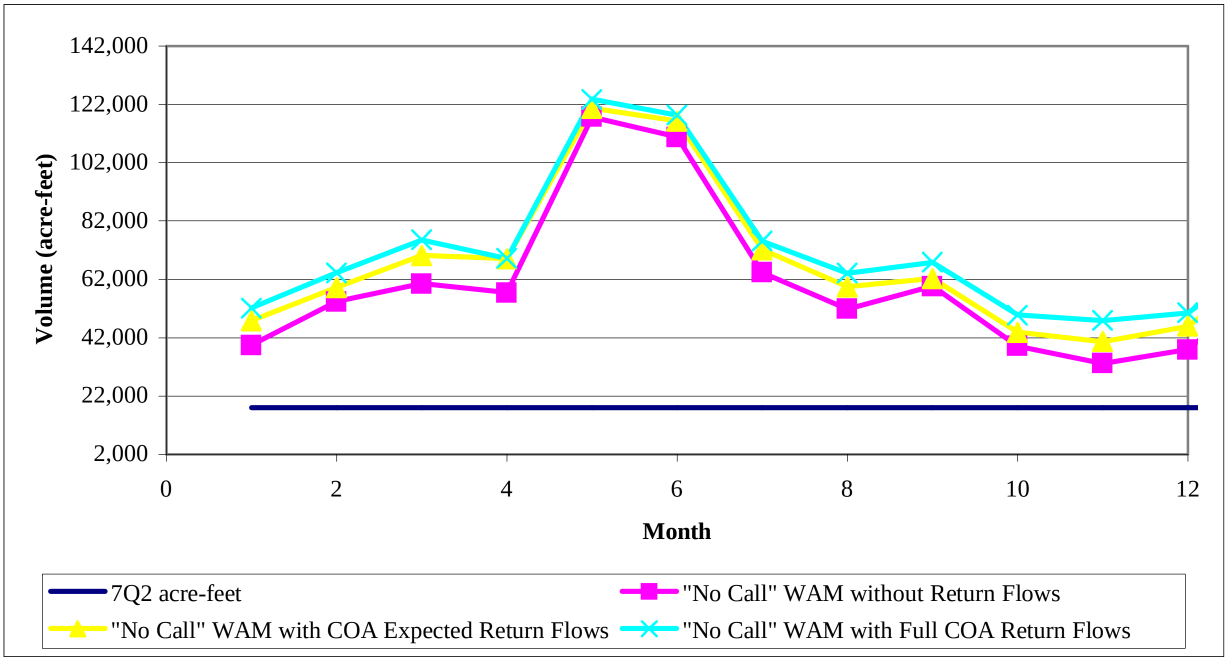
*Comparison of median regulated flows at control point J10000 between "No Call" WAM and "No Call" WAM with expected and full COA return flows. Model output files are included as an attachment to this report. Refer to the bolded paragraph on Page 4-41.

Figure 4.3: Year 2000 Instream Inflow Impacts at Control Point J10000*



*Comparison of median regulated flows at control point J10000 between "No Call" WAM and "No Call" WAM with expected and full COA return flows. Model output files are included as an attachment to this report.

Figure 4.4: Year 2060 Instream Inflow Impacts at Control Point J10000*



*Comparison of median regulated flows at control point J10000 between "No Call" WAM and "No Call" WAM with expected and full COA return flows. Model output files are included as an attachment to this report.

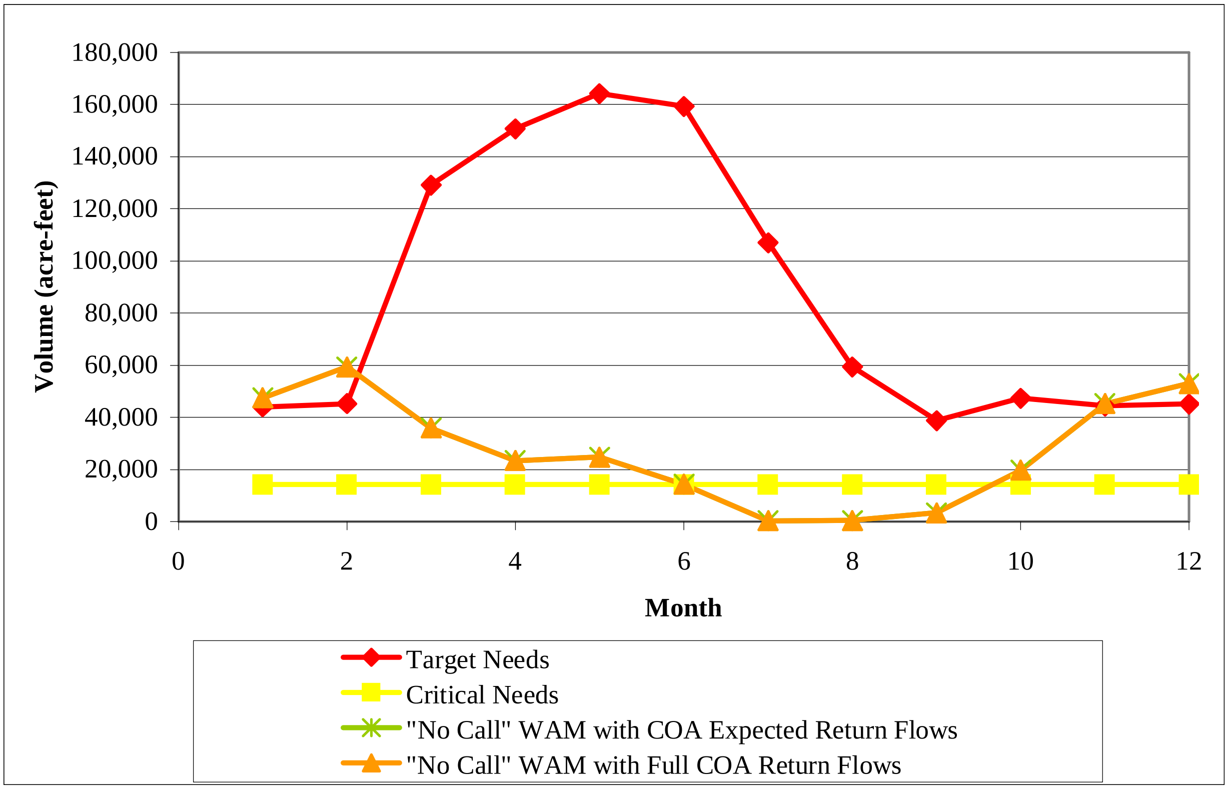
Impacts on bay and estuary freshwater inflows were determined using the WAM and compared against target and critical needs specified in the 1997 Freshwater Inflow Needs Study (FINS) for the Matagorda Bay System from the Colorado River. The reduction in streamflow associated with a change from full COA return flows to expected return flows resulted in an annual reduction of compliance with critical inflows by 3.33 percent. Compliance with annual target inflows was reduced by 1.88 percent as a result of increased reuse. *Table 4.38* compares the impacts to bay and estuary freshwater inflows resulting from the COA reuse strategy. *Figures 4.5* and *4.6* show the seasonal variation of freshwater inflows to Matagorda Bay as a result of reuse in the years 2000 and 2060.

Table 4.38 Impacts to Bay and Estuary Freshwater Inflows Resulting From COA Reuse*

Month	Target Needs (ac-ft)	Critical Needs (ac-ft)	Change in Percent Compliance Between COA Full Return Flows and Expected Return Flows			
			Target Flow Needs		Critical Flow Needs	
			Year 2000	Year 2060	Year 2000	Year 2060
January	44,100	14,260	0.00%	-3.50%	0.00%	-7.60%
February	45,300	14,260	0.00%	-1.70%	0.00%	-2.10%
March	129,100	14,260	0.00%	-1.70%	0.00%	0.00%
April	150,700	14,260	0.00%	-3.50%	0.00%	-5.10%
May	164,200	14,260	0.00%	-0.20%	0.00%	3.40%
June	159,300	14,260	0.00%	0.00%	0.00%	-2.00%
July	107,000	14,260	0.00%	-1.70%	0.00%	-1.60%
August	59,400	14,260	0.00%	0.00%	0.00%	-3.40%
September	38,800	14,260	0.00%	0.00%	0.00%	0.20%
October	47,400	14,260	0.00%	0.00%	0.00%	-9.20%
November	44,400	14,260	0.00%	-5.10%	0.00%	-8.00%
December	45,200	14,260	0.00%	-5.20%	0.00%	-4.60%
Annual	1,034,900	171,120	0.00%	-1.88%	0.00%	-3.33%

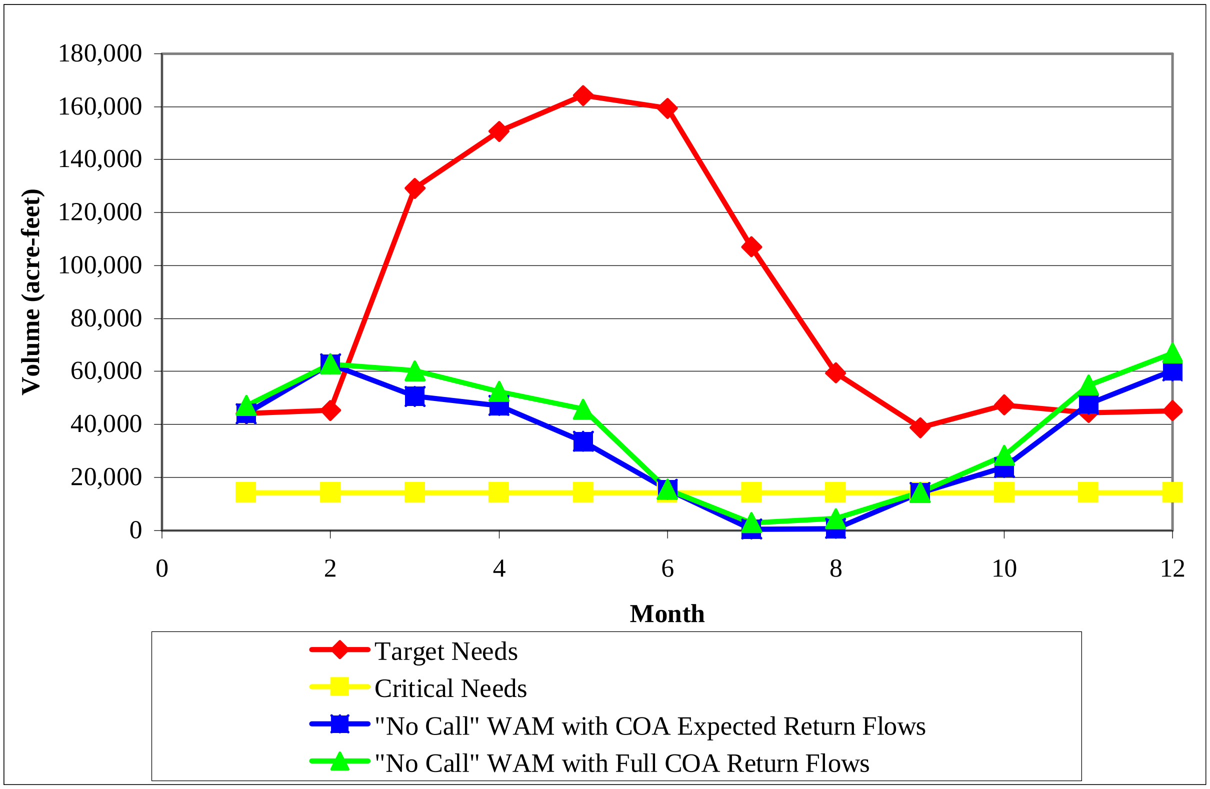
*Comparison between median regulated flows at control point M10000 between “No Call” WAM and “No Call” WAM with expected and full COA return flows. Model output files are included as an attachment to this report. Refer to the bolded paragraph on Page 4-41.

Figure 4.5: Year 2000 Bay and Estuary Freshwater Inflow Impacts*



*Comparison of median instream flow results between "No Call" WAM and "No Call" WAM with expected and full COA return flows. Model output files are included as an attachment to this report.

Figure 4.6: Year 2060 Bay and Estuary Freshwater Inflow Impacts*



*Comparison of median instream flow results between “No Call” WAM and “No Call” WAM with expected and full COA return flows. Model output files are included as an attachment to this report.

The City intends to use reclaimed water to the maximum extent feasible to meet all demands above 325,000 ac-ft/yr, whether those demands occur before or after 2060. As a result, although current projections do not indicate that the City will need to reuse all of its effluent during this planning cycle, this strategy could result in the City potentially reusing all of its effluent to meet growing demands and, ultimately, the City could have zero return flow to the Colorado River from its wastewater treatment plants (WWTP).

The model used for this quantitative evaluation was the “No Call” WAM with Return Flows, which uses a “No Call” routine to allow upstream reservoirs in Region F to capture water. The downstream senior and a number of junior water rights diversions are hard-coded into the model; therefore, additional return flows from the City of Austin do not increase the reliability of these water rights. However, if the diversion limitations of these senior rights were adjusted to allow increased diversions, the impact of the City of Austin’s return flows would have been evaluated. Due to time limitations, it is not feasible to adjust the diversion amounts of these downstream water rights in the “No Call” WAM with Return Flows runs. Water availability for the senior and a number of junior water rights remained hard-coded and therefore the availability of return flow water to these water rights might not be accurately captured. However, these return flows currently provide improved reliability of water rights in the lower basin and this positive impact is projected to increase over the planning period as long as the net discharge of effluent by COA increases.

The Colorado River Basin does not have an updated current conditions WAM model that includes "No Call" routines to reflect the retention of water in upstream reservoirs. Therefore, the "No Call" WAM with return flows was used to determine the environmental impacts of the strategy. The LCRWPG recognizes the uncertainty and ambiguity of the modeling results presented herein, but results are based on the model with "No Call" routine. It is noted, however, that the model used shows that when full utilization of rights is reached then river flows have the potential to fall below the critical needs level. Once again, it is recognized that major improvements are needed to the methodology by which the upstream reservoirs are allowed to draw water from the system in the WAM. Only when these improvements are made will it be possible to obtain a reasonable analysis of the instream impacts. It is recommended that during the next round of regional water planning, if the "No Call" WAM is used to allocate water supplies, that the "No Call" WAM be modified to current conditions to allow for a more precise environmental impact analysis of selected water management strategies.

4.6.2.3 COA Contract Renewals

The City of Austin has wholesale and retail contracts with numerous water user groups. These contracts generally expire within the 50-year planning period. It is recommended that those entities obtaining water from the City seek renewals of these contracts for water before they expire and, as necessary, within the limits of the City's maximum availability of water, increase the contract amount to meet the projected demands throughout the planning period. While the COA is not obligated under the contract to continue providing water to these entities, the City has indicated that they expect to continue providing water to these entities throughout the 50-year planning period. Upon renewal, the majority of current COA wholesale customers will be required to obtain an LCRA raw water contract. Austin will plan to continue to be the contract wholesale provider of treated water to the wholesale customer's master meter(s). Therefore, in these cases, wholesale customers will have two contracts, one for raw water and one for treated and delivered water. Capital expenditures for water supply purposes would not be required for contract renewals with the COA. The average cost of providing water under contracts with the COA would be $795 per ac-ft for treated and delivered water from the COA. It was assumed that the preferred strategy for these contractual users would be to renew the contracts with the City, as appropriate, to meet their needs through the 50-year planning period. *Table 4.39* contains a summary of the WUGs for which this alternative applies and the amount of water planned for in the contract renewal.

Table 4.39 COA Contract Renewals

WUG	County	Contract Renewals (ac-ft/yr)						
		2000	2010	2020	2030	2040	2050	2060
Lost Creek MUD	Travis	0	935	921	906	891	882	882
North Austin MUD #1	Travis	0	0	0	106	103	102	102
Shady Hollow MUD	Travis	0	0	0	716	700	694	694
Wells Branch MUD	Travis	0	0	0	1,472	1,444	1,435	1,435
Anderson Mill MUD	Williamson	0	1,464	1,434	1,405	1,375	1,355	1,355
North Austin MUD #1	Williamson	0	0	0	952	928	920	920
TOTAL		**0**	**2,399**	**2,355**	**5,557**	**5,441**	**5,388**	**5,388**

4.7 REGIONAL WATER MANAGEMENT STRATEGIES

There are several water management strategies that apply to multiple WUG categories. These strategies are discussed in the regional water management section of the report. For strategies specific to a category of water use, (Municipal, Irrigation, Livestock, Manufacturing, Mining, and Steam Electric Power) refer to later sections of the report.

For municipal WUGs with shortages water conservation was considered before these regional strategies, please refer to Section 4.8.1.

4.7.1 Expansion of Current Groundwater Supplies

This group of strategies includes WUGs with existing groundwater sources that will be seeking to expand the amount of groundwater they produce from that source or sources to meet their increasing needs.

4.7.1.1 Carrizo-Wilcox Aquifer

This alternative would involve pumping additional groundwater from the Carrizo-Wilcox aquifer, either using the WUG's existing wells or drilling additional wells. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water.

Table 4.40 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage. It should be noted that Elgin in Bastrop County will pump 1 ac-ft/yr in 2050 and 5 ac-ft/yr in 2060 to supply the portion of Elgin located in Travis County. The county needs for Elgin are separated in the table below but will essentially both be pumped from the Carrizo-Wilcox aquifer.

Table 4.40 Carrizo-Wilcox Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Aqua WSC	Bastrop	Colorado					59	2,124	4,796
Bastrop County WCID #2	Bastrop	Colorado							144
County-Other	Bastrop	Colorado			330	1,987	3,738	5,673	7,172
Elgin	Bastrop	Colorado						87	395
Polonia WSC	Bastrop	Colorado				4	10	17	25
Smithville	Bastrop	Colorado					50	36	294
Manufacturing	Bastrop	Colorado			7	17	25	32	44
Mining	Bastrop	Colorado		4,293	4,297	4,298			
Elgin*	Travis	Colorado						1	5
County Total for Colorado River Basin				**4,293**	**4,634**	**6,306**	**3,882**	**7,970**	**12,875**
Manufacturing	Bastrop	Guadalupe	6	8	10	11	13	14	16
County Total for Guadalupe River Basin			**6**	**8**	**10**	**11**	**13**	**14**	**16**

*This portion of Elgin in Travis County will be supplied from wells in Bastrop County

This strategy was applied to the following WUGs in Bastrop County: Aqua WSC, Bastrop County WCID #2, County-Other, Elgin, Manville WSC, Polonia WSC, Smithville, Manufacturing, and Mining.

Elgin falls into both Bastrop and Travis Counties. It was assumed that the area of the WUG in Travis County would also receive water in 2050 and 2060 from the Carrizo-Wilcox aquifer.

Opinion of Probable Costs

Table 4.41 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be two potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation) and installation of a one-half-mile long transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Carrizo-Wilcox aquifer, the values used were 1.5 mgd, 500 ft, 16 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate approximately 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 feet per second (ft/s) velocity. The smallest assumed diameter was 6 inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well at $2000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.41 Carrizo-Wilcox Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Aqua WSC	Bastrop	Colorado	$2,416,400	$3,487,500	$935,079	$194.97
Bastrop County WCID #2	Bastrop	Colorado			$2,514	$17.46
County-Other	Bastrop	Colorado	$3,797,200	$5,480,400	$1,896,997	$264.50
Elgin	Bastrop	Colorado	$332,000	$479,300	$59,403	$150.39
Polonia WSC	Bastrop	Colorado			$436	$17.46
Smithville	Bastrop	Colorado	$332,000	$479,300	$57,640	$196.06
Manufacturing	Bastrop	Colorado			$768	$17.46
Mining	Bastrop	Colorado	$2,150,400	$3,102,700	$763,561	$177.66
Elgin	Travis	Colorado			$87	$17.46
Manufacturing	Bastrop	Guadalupe			$279	$17.46

For the purposes of developing costs for this strategy, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy, was assumed to acquire the additional groundwater through additional pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures.

The above rule was utilized for all WUGs other than Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission line costs. Each well for Livestock WUGs was estimated to cost $7,500, fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B*.

Environmental Impacts

The environmental impacts of expanded groundwater use will vary depending upon site characteristics. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent, and the disturbance from pipeline construction is temporary. Availability numbers were developed by the Lost Pines Groundwater Conservation District for this aquifer in Bastrop County, and they attempt to limit the groundwater use to the amount that can be replenished on an annual basis. If this is the case, then the impact on the environment should be low.

Impacts to Agriculture

There are currently no irrigation WUGs with supplies of irrigation water or livestock water from the Carrizo-Wilcox Aquifer in Region K. This is not a source of choice, probably because of the depth of the aquifer. In addition, the terrain in Bastrop County is often not conducive to irrigated agriculture. Therefore, the impact on agriculture is low.

4.7.1.2 Edwards BFZ Aquifer

This alternative would involve pumping additional groundwater from the Edwards-BFZ aquifer, either using the WUG's existing wells or drilling additional wells. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water.

Table 4.42 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.42 Edwards-BFZ Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Cimarron Park Water Company	Hays	Colorado	0	17	110	207	305	422	513
County Total for Colorado River Basin			**0**	**17**	**110**	**207**	**305**	**422**	**513**

This strategy was applied to Cimarron Park Water Company in Hays County.

Opinion of Probable Costs

Table 4.43 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be two potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation) and installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Edwards BFZ aquifer, the values used were 0.5 mgd, 400 ft, 8 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate approximately 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), Land Acquisition (assuming 1 acre per well at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.43 Edwards-BFZ Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Cimarron Park Water Company	Hays	Colorado	$424,000	$615,200	$72,989	$142.28

For the purposes of developing costs for this strategy, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through additional pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures.

The above rule was utilized for all WUGs other than Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission line costs. Each well for Livestock WUGs was estimated to cost $7,500, fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs, and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B*.

Environmental Impacts

The environmental impacts of expanded use of the Edward-BFZ Aquifer are in question at the time of this report completion. Water availability for this aquifer was based on modeling performed by the Barton

Springs Edwards Aquifer Conservation District, and documented in a report released late in the planning cycle. The final modeling performed indicates that spring flows may be temporarily reduced to approximately 1 cfs during the worst period of a repeat of the drought of record if all of the permits that have been issued by the District are fully utilized. The 1 cfs spring flow may not be sufficient to support endangered species in the areas downstream of Barton Springs and potential negative environmental impacts could be high. This issue was raised by several individuals during the public comment process. As a result of this finding the District is considering making all future permits conditional, so no additional firm yield would be available from the aquifer. While there was not time to provide an alternative strategy in this planning cycle, this will be a high priority in the next planning cycle. In addition to the potential stream impacts, the installation of pipelines and wells can have an impact on the environment, but it should be limited to the construction period and have little or no impact thereafter if adequate precautions are taken.

Impacts to Agriculture

The increased demand on the Edwards-BFZ aquifer could have a negative impact on agriculture as well. The plan includes agricultural WUGs with reliance on Edwards-BFZ water. If water levels are drawn down to the point that endangered species do not have sufficient water then agricultural uses will likely have already been curtailed. This curtailment could represent a medium to high negative impact on agriculture.

4.7.1.3 Ellenburger-San Saba Aquifer

This alternative would involve pumping additional groundwater from the Ellenburger-San Saba aquifer, either using the WUG's existing wells or drilling additional wells. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water.

Table 4.44 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.44 Ellenburger-San Saba Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Bertram	Burnet	Brazos	19	38	61	90	122	152	194
County Total for Brazos River Basin			**19**	**38**	**61**	**90**	**122**	**152**	**194**
Mining	Burnet	Colorado							49
County Total for Colorado River Basin									**49**

This strategy was applied to the following WUGs in Burnet County: Bertram and Mining.

Opinion of Probable Costs

Table 4.45 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For the purposes of developing costs for this strategy within the Ellenburger-San Saba aquifer, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through added pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures. All WUGs utilizing this strategy in this aquifer fit into this category. Note that annual energy costs were based on the assumed pumping distance, which was taken to be 200 ft plus 5 ft for every 1,000 ft of transmission pipe, as well as $0.06 per kWh. A listing of assumptions and/or methodology is provided in *Appendix 4B*.

Table 4.45 Ellenburger-San Saba Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Bertram	Burnet	Brazos			$3,386	$17.46
Mining	Burnet	Colorado			$855	$17.46

Environmental Impact

The environmental impacts of expanded groundwater use from the Ellenburger San Saba Aquifer will vary depending upon site characteristics but are not expected to be significant. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent and the disturbance from pipeline construction is temporary. No groundwater use is expected to surpass the current, sustainable yield of the aquifer as determined in Chapter 3, except for limited specific instances of overdrafting during the drought of record conditions and during the period from 2000 to 2030 shown later as a temporary overdraft strategy. Beyond 2030, the overdrafting is not needed and the aquifer is expected to recover. However, there is no current model of the Ellenberger San Saba, so it is not possible to determine the potential impacts on spring flows. As a result, long term impacts upon groundwater resources and spring flows are unknown. Additionally, the treated return flows from the City of Llano may introduce additional return flows that contribute to in-stream habitat.

Impacts to Agriculture

The Ellenburger-San Saba is a source of water supply for agricultural interests in Burnet, Blanco, Gillespie and Llano Counties. The additional drafting of this aquifer has the potential to draw down the static and pumping water levels and increase the cost of production for agricultural users. This represents a medium to high impact.

4.7.1.4 Gulf Coast Aquifer

This alternative would involve pumping additional groundwater from the Gulf Coast aquifer, either using the WUG's existing wells or drilling additional wells. This additional water, referred to as remaining supply, was determined by subtracting the water that is currently allocated from the available water.

Table 4.46 presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.46 Gulf Coast Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Mining	Colorado	Brazos-Colorado		19	22	23	24	25	26
County Total for Brazos-Colorado River Basin				**19**	**22**	**23**	**24**	**25**	**26**
Livestock	Colorado	Colorado	14	14	14	14	14	14	14
Mining	Colorado	Colorado		3,626	3,626	2,803	1,650	214	373
County Total for Colorado River Basin			**14**	**3,640**	**3,640**	**2,817**	**1,664**	**228**	**387**
County-Other	Colorado	Lavaca	100	105	109	106	97	93	90
Livestock	Colorado	Lavaca	11	11	11	11	11	11	11
Mining	Colorado	Lavaca (to Colorado)		555	30				
Mining	Colorado	Lavaca		100	132	151	168	184	199
County Total for Lavaca River Basin			**111**	**771**	**282**	**268**	**276**	**288**	**300**
Mining	Fayette	Brazos			4	22	28	29	29
County Total for Brazos River Basin					**4**	**22**	**28**	**29**	**29**
Fayette WSC	Fayette	Colorado			236	428	428	428	428
County Total for Colorado River Basin					**236**	**428**	**428**	**428**	**428**
County-Other	Fayette	Lavaca	29				32	25	16
Fayette WSC	Fayette	Lavaca			21	45	63	86	116
Flatonia	Fayette	Lavaca	12	16	16	11	11	27	47
Manufacturing	Fayette	Lavaca					2	20	43
County Total for Lavaca River Basin			**41**	**16**	**37**	**56**	**108**	**158**	**222**
Livestock	Matagorda	Colorado-Lavaca	56	56	56	56	56	56	56
County Total for Colorado-Lavaca River Basin			**56**	**56**	**56**	**56**	**56**	**56**	**56**
Manufacturing	Wharton	Colorado-Lavaca							8
County Total for Colorado-Lavaca River Basin									**8**

This strategy was applied to County-Other, Livestock, and Mining in Colorado County; County-Other, Fayette WSC, Flatonia, Manufacturing, and Mining in Fayette County; Livestock in Matagorda County; and Manufacturing in Wharton County. Supply for Mining in Colorado and in the Colorado River Basin was obtained by pumping water from the Colorado River Basin, the Brazos-Colorado River Basin, and the Lavaca River Basin. There was not enough available groundwater from just one basin to meet the entire shortage for this WUG.

Opinion of Probable Costs

Table 4.47 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be two potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation) and installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Gulf Coast aquifer, the values used were 0.5 mgd, 500 ft, 8 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate approximately 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.47 Gulf Coast Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Mining	Colorado	Brazos-Colorado			$135	$5.17
Livestock	Colorado	Colorado	$105,000	$105,000	$32,981	$2,355.81
Mining	Colorado	Colorado			$18,763	$5.17
County-Other	Colorado	Lavaca			$1,903	$17.46
Livestock	Colorado	Lavaca	$82,500	$82,500	$25,373	$2,306.68
Mining	Colorado	Lavaca			$1,030	$5.17
Mining	Colorado	Lavaca (to Colorado)	(See WUG above)			
Mining	Fayette	Brazos			$506	$17.46
Fayette WSC	Fayette	Colorado	$464,000	$672,500	$78,336	$183.03
County-Other	Fayette	Lavaca			$559	$17.46
Fayette WSC	Fayette	Lavaca			$751	$17.46
Flatonia	Fayette	Lavaca			$820	$17.46
Manufacturing	Fayette	Lavaca			$751	$17.46
Livestock	Matagorda	Colorado-Lavaca	$420,000	$420,000	$170,439	$3,043.56
Manufacturing	Wharton	Colorado-Lavaca			$140	$17.46

For the purposes of developing costs for this strategy, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through additional pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures. The use of increased annual energy cost only also applied to the Mining-Colorado WUGs because these mines are located over the Recharge Zone of the Gulf Coast Aquifer, and the mines typically extend into the groundwater with their excavations. Therefore, no well costs are assumed for these WUGs and a pumping lift distance of only 50 feet was used in the energy calculation.

In addition, the above rule did not apply to Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission line costs. Each well for Livestock WUGs was estimated to cost $7,500, fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Environmental Impact

The environmental impacts of expanded groundwater use will vary depending upon site characteristics but are not expected to be significant. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal extent and the disturbance from pipeline construction is temporary. No groundwater use is expected to surpass the current, sustainable yield of the aquifers as determined in Chapter 3, except for limited specific instances of overdrafting during the drought of record conditions. However, recent personal observation of springs in the area by Bob Pickens has occurred. Based on his observations, it is not possible to tell whether the springs noted are from perched water tables from years of higher precipitation or springs from the Gulf Coast Aquifer. In any event, the Gulf Coast Aquifer formally had springs identified, but the known springs from the past have not flowed for many years. It appears based on the information above that impacts on the environment from this strategy are likely minimal under current conditions. However the impact on springflows is unknown at this time.

Impacts to Agriculture

The amounts of water proposed in this strategy are based on initial studies of the aquifer as a part of the LSWP. The additional drawdown from these strategies is of some concern and could have an impact on agricultural operations that rely on groundwater. The LSWP studies that are currently underway still need to provide further definition of the extent and timing of additional drawdown, if any.

4.7.1.5 Hickory Aquifer

This alternative would involve pumping additional groundwater, either using their existing wells or drilling additional wells. The WUGs were assumed to pump this additional water from their current supply. *Table 4.48* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.48 Hickory Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
County-Other	Burnet	Colorado					199	199	199
Livestock	Llano	Colorado	62	62	62	62	62	62	62

This strategy was applied to County-Other in Burnet County and Livestock in Llano County.

Opinion of Probable Costs

Table 4.49 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be two potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation) and installation of a one-half-mile- transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Hickory aquifer, the values used were 0.75 mgd, 500 ft, 10 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.49 Hickory Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Burnet	Colorado			$3,474	$17.46
Livestock	Llano	Colorado	$465,000	$465,000	$194,792	$3,141.81

For the purposes of developing costs for this strategy, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through additional pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures.

The above rule was utilized for all WUGs other than Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission line costs. Each well for Livestock WUGs was estimated to cost $7,500, fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Environmental Impact

The sustainable yield of the Hickory aquifer has been provided by analysis of drawdown and pumping records, in the absence of a current model of the aquifer. The impacts from well construction and pipeline construction are limited to the disturbance during construction, and should not be a major environmental factor. The intent is to use no more from the aquifer than is returned to it on an annual basis. This aquifer has limited springs, but in the absence of a model, it is not possible to determine whether or not these springs would be negatively impacted.

Impacts to Agriculture

The Hickory aquifer is used for both livestock watering and irrigation in Burnet, Gillespie, Llano, and San Saba Counties. The amounts used for these activities are far in excess of the amounts proposed in this strategy, and livestock needs will be served from this strategy as well. As a result, anticipated impact on agriculture is low.

4.7.1.6 Marble Falls Aquifer

This alternative would involve pumping additional groundwater, either using their existing wells or drilling additional wells. The WUGs were assumed to pump this additional water from their current supply. *Table 4.50* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG’s individual shortage.

Table 4.50 Marble Falls Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
County-Other	Burnet	Colorado					25	314	718
Mining	Burnet	Colorado	437	681	756	788	811	829	873

This strategy was applied to County-Other and Mining in Burnet County.

Opinion of Probable Costs

Table 4.51 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be two potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation) and installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Marble Falls aquifer, the values used were 0.25 mgd, 500 ft, 8 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining the production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was six inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.51 Marble Falls Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Burnet	Colorado	$1,392,000	$2,017,400	$283,914	$395.42
Mining	Burnet	Colorado	$1,856,000	$2,689,900	$398,765	$456.78

For the purposes of developing costs for this strategy, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through additional pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures.

The above rule was utilized for all WUGs other than Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission line costs. Each well for Livestock WUGs was estimated to cost $7,500, fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Environmental Impact

The sustainable yield of the Marble Falls aquifer has been provided by analysis of drawdown and pumping records, in the absence of a current model of the Aquifer. The impacts from well construction and pipeline construction are limited to the disturbance during construction, and should not be a major environmental factor. The intent is to use no more from the aquifer than is returned to it on an annual basis. This aquifer has limited springs, but in the absence of a model, it is not possible to determine whether or not these springs would be negatively impacted.

Impacts to Agriculture

Burnet and San Saba Counties have significant amounts of water from the Marble Falls aquifer being used for irrigation and livestock purposes. The quantities used are well in excess of the quantities planned for extraction under this strategy. However, it is not possible to determine the impacts to agriculture, since it is not possible to determine the additional drawdown from the additional pumpage. Impacts are estimated as low to medium based on the comparison of the supplies.

4.7.1.7 Queen City Aquifer

This alternative would involve pumping additional groundwater, either using their existing wells or drilling additional wells. The WUGs were assumed to pump this additional water from their current supply. *Table 4.52* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.52 Queen City Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Irrigation	Bastrop	Brazos	40	40	40	40	31	24	17
Irrigation	Bastrop	Colorado	281	58					

This strategy was applied to the following WUG in Bastrop County: Irrigation.

Opinion of Probable Costs

Table 4.53 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For the purposes of developing costs for this strategy within the Queen City aquifer, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through additional pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures. All WUGs utilizing this strategy in this aquifer fit into this category. Note that annual energy costs were based on the assumed pumping distance, which was taken to be 200 ft plus 5 ft for every 1,000 ft of transmission pipe, as well as $0.06 per kWh. A listing of assumptions and/or methodology is provided in *Appendix 4B*.

Table 4.53 Queen City Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Bastrop	Brazos			$698	$17.46
Irrigation	Bastrop	Colorado			$4,905	$17.46

Environmental Impact

The model of the Queen City aquifer had not been released at the time the water supply determinations were made, so the estimate of supply came from previous determinations of water levels and pumpage. The impact on the environment from construction of wells and pipelines is expected to be low, with most of the impact occurring during the construction process itself. It was not possible to determine whether there would be any major impacts to any potential springs from this aquifer.

Impacts to Agriculture

This strategy provides water to meet an agricultural need so this will have a positive impact on agriculture. In addition, the amounts provided are small so the additional demand is unlikely to cause significant additional drawdown to impact other agricultural producers although it is not possible to determine that for certain.

4.7.1.8 Sparta Aquifer

This alternative would involve pumping additional groundwater, either using their existing wells or drilling additional wells. The WUGs were assumed to pump this additional water from their current supply. *Table 4.54* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.54 Sparta Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
County-Other	Fayette	Colorado	34	123	120	19			
Irrigation	Fayette	Lavaca	23	20	18	16	14	12	10
Manufacturing	Fayette	Lavaca	2	45	70	94	115	117	119

This strategy was applied to the following WUGs in Fayette County: County-Other, Irrigation, and Manufacturing.

Opinion of Probable Costs

Table 4.55 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For the purposes of developing costs for this strategy within the Sparta aquifer, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through added pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures. All WUGs utilizing this strategy in this aquifer fit into this category. Note that annual energy costs were based on the assumed pumping distance, which was taken to be 200 ft plus 5 ft for every 1,000 ft of transmission pipe, as well as $0.06 per kWh. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Table 4.55 Sparta Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Fayette	Colorado			$2,147	$17.46
Irrigation	Fayette	Lavaca			$401	$17.46
Manufacturing	Fayette	Lavaca			$2,077	$17.46

Environmental Impact

The model of the Sparta Aquifer had not been released at the time the water supply determinations were made, so the estimate of supply came from previous determinations of water levels and pumpage. The impact on the environment from construction of wells and pipelines is expected to be low, with most of the impact occurring during the construction process itself. It was not possible to determine whether there would be any major impacts to any potential springs from this aquifer.

Impacts to Agriculture

Sparta water is used extensively for agricultural purposes in Fayette County. One of the purposes of this strategy is to provide for an irrigation need, which will have a positive impact on agriculture. The increase in demand is small in comparison to amounts already produced, and it is unlikely to have more than a low impact on agriculture.

4.7.1.9 Trinity Aquifer

This alternative would involve pumping additional groundwater, either using their existing wells or drilling additional wells. The WUGs were assumed to pump this additional water from their current supply. *Table 4.56* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUGs individual shortage.

Table 4.56 Trinity Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
County-Other	Burnet	Colorado	18	266	581	915	986	1,047	1,047
Livestock	Burnet	Brazos	23	23	23	23	23	23	23
Mining	Burnet	Brazos		7	10	12	22	24	25
Goldthwaite *	Mills	Brazos	6	5	5	4	3	3	2
Goldthwaite *	Mills	Brazos (to Colorado)	210	153	63	21			
Goldthwaite *	Mills	Colorado	94	152	209	207	190	149	110
Irrigation	Mills	Brazos	187	180	173	184	177	193	186
Irrigation	Mills	Colorado	217	159	102	57	3		

*Note: The City of Goldthwaite is located in two river basins (Brazos and Colorado) and has needs in both. One proposed strategy to meet their needs is to pump additional Trinity aquifer groundwater. This strategy would be used for all of Goldthwaite (both river basins) and will only have one cost associated with it, but it shows as three pieces due to the river basin split and the availability limitations of the Trinity aquifer in Mills County. Refer to *Appendix 4C* for further discussion of this strategy. It is also noted that although the selected strategy for

Goldthwaite at this time is development of groundwater, LCRA continues to evaluate the needs of Goldthwaite as a part of LSWP.

This strategy was applied to County-Other, Livestock, and Mining in Burnet County; and Goldthwaite and Irrigation in Mills County.

Opinion of Probable Costs

Table 4.57 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be two potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation) and installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Trinity aquifer, the values used were 0.2 mgd (0.04 mgd for Goldthwaite), 500 ft, 8 in, and 200 ft (350 ft in Burnet County), respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.57 Trinity Aquifer Expansion Cost

<table>
<tr><th>WUG Name</th><th>County</th><th>River Basin</th><th>Total Capital Cost</th><th>Total Project Cost</th><th>Largest Annual Cost</th><th>Unit Cost ($/ac-ft)</th></tr>
<tr><td>County-Other</td><td>Burnet</td><td>Colorado</td><td>$2,784,000</td><td>$4,034,800</td><td>$786,359</td><td>$751.06</td></tr>
<tr><td>Livestock</td><td>Burnet</td><td>Brazos</td><td>$172,500</td><td>$172,500</td><td>$64,070</td><td>$2,785.65</td></tr>
<tr><td>Mining</td><td>Burnet</td><td>Brazos</td><td></td><td></td><td>$743</td><td>$29.74</td></tr>
<tr><td>Goldthwaite *</td><td>Mills</td><td>Colorado</td><td>$3,944,000</td><td>$5,744,600</td><td>$612,872</td><td>$1,977.00</td></tr>
<tr><td>Goldthwaite *</td><td>Mills</td><td>Brazos (to Colorado)</td><td colspan="4" rowspan="2">(See WUG above)</td></tr>
<tr><td>Goldthwaite *</td><td>Mills</td><td>Brazos</td></tr>
<tr><td>Irrigation</td><td>Mills</td><td>Brazos</td><td></td><td></td><td>$5,739</td><td>$29.74</td></tr>
<tr><td>Irrigation</td><td>Mills</td><td>Colorado</td><td></td><td></td><td>$6,453</td><td>$29.74</td></tr>
</table>

*Note: The City of Goldthwaite is located in two river basins (Brazos and Colorado) and has needs in both. One proposed strategy to meet their needs is to pump additional Trinity aquifer groundwater. This strategy would be used for all of Goldthwaite (both river basins) and will only have one cost associated with it, but it shows as three pieces due to the river basin split and the availability limitations of the Trinity aquifer in Mills County. Refer to *Appendix 4C* for further discussion of this strategy. It is also noted that although the selected strategy for Goldthwaite at this time is development of groundwater, LCRA continues to evaluate the needs of Goldthwaite as a part of LSWP.

For the purposes of developing costs for this strategy, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through additional pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures.

The above rule was utilized for all WUGs other than Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission line costs. Each well for Livestock WUGs was estimated to cost $7500, fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Environmental Impact

The Trinity aquifer was modeled to allow the use of water from the aquifer until the simulated drought of record springflow with no pumpage from the aquifer was still equal to 90 percent of the observed springflow during the drought of record. In the absence of definitive studies, it is hoped that this amount of spring flow will be sufficient to maintain any threatened or endangered populations, but it is not known for sure if that is the case. The impacts of construction of wells and pipelines, if properly managed, are expected to produce low impact to the environment, and primarily during the construction period itself.

Impacts to Agriculture

This strategy provides small amounts of water for livestock in Burnet County and for irrigation in Mills County, all of which will have a positive impact on agriculture. Increased drawdown from the municipal demands to be served from the aquifer will likely have a low negative impact on agriculture.

4.7.1.10 Other Aquifer

Other Aquifer refers to alluvial groundwater supplies that have not been identified, named, or studied. The most likely source of these Other Aquifer supplies in Region K is the Colorado River alluvium and related terrace deposits.

This alternative would involve pumping additional groundwater either using their existing wells or drilling additional wells. The WUGs were assumed to pump this additional water from their current supply. *Table 4.58* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water to be pumped. Additional groundwater was only allocated to meet each WUG’s individual shortage.

Alluvial water may legally constitute state water for which a water right from the State must be obtained if it is determined to be the ‘underflow’ of a state watercourse. If a direct hydrologic connection exists between the surface water in the stream and the alluvial water, then pumping from the alluvium will diminish the streamflow proportionally.

Table 4.58 Other Aquifer Expansions

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Bastrop	Bastrop	Colorado						300	791

This strategy was applied to Bastrop in Bastrop County.

Opinion of Probable Costs

Table 4.59 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be two potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation) and installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For Aquifer Other, the values used were 0.75 mgd, 100 ft, 10 in, and 20 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.59 Other Aquifer Expansion Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Bastrop	Bastrop	Colorado	$314,000	$457,800	$48,696	$61.56

For the purposes of developing costs for this strategy, any WUG generating a maximum supply, in a single decade, of less than 1/4 mgd (approximately 280 ac-ft/yr) from the strategy was assumed to acquire the additional groundwater through added pumping of existing wells. For these WUGs, only the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures.

The above rule was utilized for all WUGs other than Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission line costs. Each well for Livestock WUGs was estimated to cost $7,500 fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Environmental Impacts

Impacts of additional pumping from the Other Aquifer category are more difficult to pinpoint. There is no model to use to determine the potential drawdown impacts from this strategy, and there is also no means to determine the impact on streamflows if this water is withdrawn. The impact of the construction of wells and pipelines is expected to be low provided that sufficient care is taken to avoid wetland issues in site selection and construction. Construction impacts should be limited primarily to the construction period. Impacts would be expected to be low unless there is a noticeable reduction in streamflows as a result of this strategy.

Impacts to Agriculture

No agricultural WUGs in Bastrop County use Other Aquifer as a source. As a result, no impact to agriculture is anticipated.

4.7.2 Development of New Groundwater Supplies

This group of strategies includes those WUGs that are obtaining groundwater from groundwater sources which they have not tapped previously.

4.7.2.1 Carrizo-Wilcox Aquifer

This alternative would involve developing a new well field to pump water from the Carrizo-Wilcox aquifer in the Guadalupe River Basin. A new well field will consist of acquisition of a site, new wells, 5 miles of distribution line, one-half mile of transmission line, new pump stations, and will assume that the WUG has the available storage capacity to store this additional water. *Table 4.60* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water needed. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.60 Carrizo-Wilcox Aquifer Development

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
County-Other	Bastrop	Colorado							924
County-Other	Bastrop	Guadalupe						23	88

This strategy was applied to the following WUGs in Bastrop County: County-Other in the Guadalupe River Basin.

Opinion of Probable Costs

Table 4.61 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be four potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation), installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system, a 5 mile distribution pipe, and a pump station. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Carrizo-Wilcox aquifer, the values used were 1.5 mgd, 500 ft, 16 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches. Distribution pipe was sized to handle the maximum *total* flow (from all new wells as part of the strategy), again, increased by a factor of two to account for peak demands and assuming a 5 ft/s velocity. The pump station cost estimate was based on $150,000 per mgd, taken from the San Marcos Water Supply Master Plan, December 2004.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well and 5 acres for the pump station, at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M, and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.61 Carrizo-Wilcox Aquifer Development Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
County-Other	Bastrop	Guadalupe (to Colorado)			$16,129	$17.46
County-Other	Bastrop	Guadalupe	$2,312,600	$3,373,200	$336,949	$3,828.97

For the purposes of developing costs for this strategy, for WUGs receiving water from the development of a new well field by another WUG (within the same county but different basin), only the portion of the cost associated with the increased annual energy cost was factored into the unit cost for the strategy, with no capital expenditures.

A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Environmental Impacts

The impacts to the environment from the additional yield being sought from the Carrizo-Wilcox aquifer area expected to be low. Impacts from construction of wells and pipelines should be limited primarily to the construction period as long as care is taken to avoid environmentally sensitive areas and provide proper restoration to the surface when complete.

Impacts to Agriculture

There are currently no irrigation WUGs with supplies of irrigation water or livestock water from the Carrizo-Wilcox Aquifer in Region K. This is not a source of choice, probably because of the depth of the aquifer. In addition, the terrain in Bastrop County is often not conducive to irrigated agriculture. Therefore, the impact on agriculture is low.

4.7.2.2 Ellenburger-San Saba Aquifer

This alternative would involve developing a new well field to pump water from the Ellenburger-San Saba aquifer. A new well field will consist of acquisition of a site, new wells, five (5) miles of distribution line, one-half mile of transmission line, new pump stations, and assumes that the WUG has the available storage capacity to store this additional water. *Table 4.62* presents the WUG that would utilize this strategy along with the implementation decade and the amount of water needed. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.62 Ellenburger-San Saba Aquifer Development

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Llano	Llano	Colorado	478	478	478	478	442	386	334
County Total for Colorado River Basin			**478**	**478**	**478**	**478**	**442**	**386**	**334**

Note: The City of Llano shortage exceeds the amount of Ellenburger-San Saba aquifer water available from 2000 – 2030 after the implementation of other groundwater strategies in the county. The strategy to meet Llano's needs utilizes municipal conservation, a contract renewal, pumping Ellenburger-San Saba aquifer water and temporarily overdrafting this water from 2000 – 2030. This overdraft portion of this strategy is discussed in Section 4.7.4. Refer to *Appendix 4C* for further discussion of this strategy. It should be noted that while the regional plan assumes that Llano's needs will be met with groundwater as noted above, LCRA continues to evaluate the needs for Llano as a part of LSWP.

Opinion of Probable Costs

Table 4.63 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be four potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation), installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system, a 5-mile distribution pipe, and a pump station. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Ellenburger-San Saba aquifer, the values used were 0.1 mgd, 600 ft, 6 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches. Distribution pipe was sized to handle the maximum total flow (from all new wells as part of the strategy), again, increased by a factor of two to account for peak demands and assuming a

5 ft/s velocity. The pump station cost estimate was based on $150,000 per mgd, taken from the San Marcos Water Supply Master Plan, December 2004.

For cost estimating purposes, the amount of water produced by the new well field was taken to be that which can be taken from the available, unallocated aquifer supply (478 ac-ft/yr), as well as the amount that will need to be overdrafted during several decades (176 ac-ft/yr - see Section 4.7.4 for amounts to be overdrafted for the Llano-Llano-Colorado WUG).

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well and 5 acres for the pump station, at $2000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Table 4.63 Ellenburger-San Saba Aquifer Development Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Llano	Llano	Colorado	$4,869,600	$6,714,700	$706,271	$1,079.92

Note: The City of Llano shortage exceeds the amount of Ellenburger-San Saba aquifer water available from 2000 – 2030 after the implementation of other groundwater strategies in the county. The strategy to meet Llano's needs utilizes municipal conservation, a contract renewal, pumping Ellenburger-San Saba aquifer water and temporarily overdrafting this water from 2000 – 2030. This overdraft portion of this strategy is discussed in Section 4.7.4. Refer to *Appendix 4C* for further discussion of this strategy. It should be noted that while the regional plan assumes that Llano's needs will be met with groundwater as noted above, LCRA continues to evaluate the needs for Llano as a part of LSWP.

Environmental Impacts

The additional pumpage from the Ellenburger-San Saba aquifer is in excess of the sustainable yield of the aquifer from Year 2000 to Year 2030. This additional pumpage has the potential to cause reductions in springflows from this aquifer with potentially negative impacts on species that rely on the water for habitat areas. The construction of well sites and pipelines is anticipated to have a low environmental impact primarily during the construction period, if proper precautions are taken to avoid environmentally sensitive areas. There is some potential beneficial impact to streamflows from the increased return flow from Llano.

Impacts to Agriculture

The amount of additional pumping from the Ellenburger-San Saba aquifer may result in additional drawdown that will have a low negative impact on agricultural producers from increased cost to produce water.

4.7.2.3 Trinity Aquifer

This alternative would involve developing a new well to pump water from the Trinity aquifer. A new well field will consist of acquisition of a site, new wells, 5 miles of distribution line, one-half mile of transmission line, new pump stations, and assumes that the WUG has the available storage capacity to store this additional water. *Table 4.64* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water needed. Additional groundwater was only allocated to meet each WUG's individual shortage.

Table 4.64 Trinity Aquifer Development

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Buda	Hays	Colorado			394	869	1,354	1,932	2,224
County Total for Colorado River Basin					**394**	**869**	**1,354**	**1,932**	**2,224**

Opinion of Probable Costs

Table 4.65 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be four potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation), installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system, a 5-mile distribution pipe, and a pump station. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Trinity aquifer, the values used were 0.2 mgd, 500 ft, 8 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches. Distribution pipe was sized to handle the maximum total flow (from all new wells as part of the strategy), again, increased by a factor of two to account for peak demands and assuming a 5 ft/s velocity. The pump station cost estimate was based on $150,000 per mgd, taken from the San Marcos Water Supply Master Plan, December 2004.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well and 5 acres for the pump station, at $2000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Table 4.65 Trinity Aquifer Development Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Buda	Hays	Colorado	$8,341,800	$12,188,100	$1,334,277	$599.94

Environmental Impacts

As noted during the section on expansion of groundwater, this aquifer was modeled to maintain 90 percent of springflow with no pumping during the critical period of the drought of record. If that level is sufficiently protective of local species, then environmental impacts are expected to be low. Impacts from construction of well sites and pipelines are also expected to be low, and confined primarily to the construction period.

Impacts to Agriculture

As noted above, the aquifer was modeled to maintain 90 percent of springflow with no pumping. As a result, potential drawdown is limited and impacts to agriculture are low.

4.7.2.4 Other Aquifer

Other Aquifer refers to alluvial groundwater supplies that have not been identified, named, or studied. The most likely source of these Other Aquifer supplies in Region K is the Colorado River alluvium and related terrace deposits.

This alternative would involve developing a new well to pump water from the Other Aquifer in the Colorado and Lavaca River Basins. A new well field will consist of acquisition of a site, new wells, 5 miles of distribution line, one-half mile of transmission line, new pump stations, and assumes that the WUG has the available storage capacity to store this additional water. *Table 4.66* presents the WUGs that would utilize this strategy along with the implementation decade and the amount of water needed. Additional groundwater was only allocated to meet each WUG's individual shortage.

Alluvial water may legally constitute state water for which a water right from the State must be obtained if it is determined to be the 'underflow' of a state watercourse. If a direct hydrologic connection exists between the surface water in the stream and the alluvial water, then pumping from the alluvium will diminish the streamflow proportionally.

Table 4.66 Other Aquifer Development

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Mining	Colorado	Colorado		4,269	4,269	4,269	4,269	4,269	4,269
Fayette WSC	Fayette	Colorado				79	291	548	889
Livestock	Fayette	Brazos	22	22	22	22	22	22	22

This strategy was applied to Mining in Colorado County and Fayette WSC and Livestock in Fayette County.

Opinion of Probable Costs

Table 4.67 presents a summary of the probable costs for each WUG utilizing this strategy. The four cost components analyzed during cost estimation of this strategy were: Total Capital Cost, Total Project Cost, Annual Cost, and Unit Cost.

For this strategy, there were assumed to be four potential capital expenditures. These were drilling and installation of the required additional wells (including pump installation), installation of a one-half-mile-long transmission pipe(s) to tie the additional well(s) to the distribution system, a 5 mile distribution pipe, and a pump station. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Aquifer Other, the values used were 0.75 mgd, 100 ft, 10 in, and 20 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time for determining production capacity and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was six inches. Distribution pipe was sized to handle the maximum *total* flow (from all new wells as part of the strategy), again, increased by a factor of two to account for peak demands and assuming a 5 ft/s velocity. The pump station cost estimate was based on $150,000 per mgd, taken from the San Marcos Water Supply Master Plan, December 2004.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well and 5 acres for the pump station, at $2,000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M and annual energy costs to pump the water made up the annual cost. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon.

Table 4.67 Other Aquifer Development Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Mining	Colorado	Colorado			$22,090	$5.17
Fayette WSC	Fayette	Colorado	$2,174,000	$3,117,200	$358,561	$403.33
Livestock	Fayette	Brazos	$165,000	$165,000	$54,710	$2,486.81

Because the Mining-Colorado WUG is located over the Recharge Zone of the Gulf Coast aquifer, and the mines typically extend into the groundwater with their excavations, no well costs were assumed for this WUG and a pumping lift distance of only 50 feet was used in the energy calculation. No capital costs were assumed for the Mining WUG.

The methodology also deviated for the Livestock WUGs, whose capital costs were generated assuming one well per ac-ft/yr needed, with no transmission or distribution line costs and no pump station costs. Each well for Livestock WUGs was estimated to cost $7,500, fully installed and operational. In addition, no additional project costs were added in for Livestock WUGs and a 5-year term of debt was utilized when annualizing the capital costs. A listing of assumptions and/or methodology is provided in *Appendix 4B.*

Environmental Impacts

The potential environmental impacts from this strategy are related to whether or not there is a direct impact to streamflow. Other Aquifer in this plan primarily refers to alluvial sands in the vicinity of the Colorado River. The probability of making a significant change in river flow from the withdrawal of this relatively small amount is low and the impacts are likely low as well. Impacts from construction of well sites and pipelines are also expected to be low and confined primarily to the construction period.

Impacts to Agriculture

As noted previously, there are no known agricultural users of Other Aquifer water and impacts would be low to none.

4.7.3 Transfer/Allocate Water From WUGs with Surplus

Significant shortages as well as ample surpluses appear for several WUGs within the Region K planning area. This strategy evaluates the idea of the WUGs with a surplus transferring their water to WUGs with shortages as long as they were in the same vicinity.

Analysis

The WUGs in *Table 4.68* utilize the transfer strategy in which water is transferred either within the same WUG but in a different county or within the same WUG but from a different river basin. There are no costs associated with this strategy.

Table 4.68 Transfer Water Strategy

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Creedmoor-Maha WSC	Bastrop	Colorado			3	8	12	19	30
Manville	Bastrop	Colorado						7	52
Lee County WSC	Fayette	Colorado			48	117	171	232	319
Goforth WSC	Travis	Colorado		3	14	23	30	38	43
TOTAL			**0**	**3**	**65**	**148**	**213**	**296**	**444**

The WUGs in *Table 4.69* have water allocated to them from another WUG usually the County-Other WUG within the same county. These County-Other supplies that are being reallocated using this strategy were estimated in the 2001 Plan. The water demands have changed and the number of WUGs included in County-Other has changed since the last plan; therefore, this strategy involves adjusting the 2001 supply allocation estimates to better represent the current plan conditions.

For Orbit System Inc., the TCEQ Water Utility Database was searched, and it shows that all of the supply for Matagorda County has been dissolved, so the shortage may be based upon a demand that is not truly there anymore. Since Orbit Systems Inc. is a new WUG and was part of County-Other in the last plan, the strategy for this WUG is to reallocate some of the County-Other supply estimated in the 2001 Plan to meet this shortage.

For Brooksmith SUD, the water allocated from County-Other will have costs associated with it since we do not have any information showing that Brooksmith SUD is currently using a groundwater source. Brooksmith SUD is a new WUG this planning cycle and would have been included in County-Other in the last plan.

The Irrigation WUG in Travis County utilizing this strategy will be allocating water Irrigation Local Supplies from the Colorado River Basin to the Guadalupe River Basin. The Irrigation Local Supply Estimates for Travis County were developed in the 2001 Plan and did not show any supply for the Guadalupe River Basin, so this strategy will reallocate supply to better represent the current plan conditions.

Table 4.69 Allocate Water Strategy

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Manufacturing	Blanco	Colorado	1	1	1	1	1	1	1
Manufacturing	Llano	Colorado	2	3	3	3	3	3	3
Orbit Systems Inc	Matagorda	Colorado-Lavaca	2	2	2	2	2	2	2
Brooksmith SUD	Mills	Colorado				7	7	7	7
Manufacturing	Mills	Colorado	1	1	1	1	1	1	1
Irrigation	Travis	Guadalupe	68	124	114	105	97	89	82
TOTAL			**74**	**131**	**121**	**119**	**111**	**103**	**96**

Opinion of Probable Costs

Brooksmith SUD is the only WUG of the group listed in *Tables 4.68* and *4.69*, above, with costs associated with the additional allocation. Two capital expenditures were assumed, the drilling and installation of the required wells (including pump installation) and installation of a one-half-mile- long transmission pipe(s) to tie the additional well(s) to the distribution system. Assumptions were made for well capacity, depth of drilling required, well diameter, and pumping distance according to the aquifer being utilized and the approximate location of the WUG. For the Trinity aquifer, the values used were 0.2 mgd, 500 ft, 8 in, and 200 ft, respectively. These assumptions were based on familiarity with similar projects and project locations, as well as the characteristics of nearby existing wells. Wells were assumed to operate 80 percent of the time, and a unit cost of $25 per in-ft (to include installation, chlorination, and pump) was used to estimate the cost once the well had been sized. Transmission piping was sized based on the maximum flow anticipated in each pipe (the largest strategy amount in one decade, increased by a factor of two to account for peak demands) and an assumed 5 ft/s velocity. The smallest assumed diameter was 6 inches.

Additional project costs included Engineering, Contingencies and Legal Services (35 percent), land acquisition (assuming 1 acre per well at $2000 per acre), and Environmental and Archeological Studies, Mitigation, and Permitting (assumed equal to the land acquisition cost). The total project cost was annualized over a 20-year term of debt. Along with this annualized cost, O&M and annual energy costs to pump the water made up the annual cost. For the purposes of calculating the energy cost, a 75 percent wire to water efficiency in the pumps and motors was assumed. The unit cost was taken as the largest annual cost, divided by the largest volume of water generated by the strategy in any one decade over the planning horizon. *Table 4.70* below summarizes the probable costs for Brooksmith SUD.

Table 4.70 Allocate Water from Mills-County Other

Phase	Cost Opinion
Capital Costs	
Well Costs	$100,000
Transmission Main Costs (1/2 Mile)	$132,000
Total Capital Costs	**$232,000**
Engineering, Contingencies and Legal Services (35%)	$81,200
Environmental and Archeological Studies, Mitigation, and Permitting	$2,000
Site Acquisition	$2,000
Interest Accrued During Construction [1]	$19,032
Interest Earned on Unused Principal [1]	($0)
Total Project Costs	**$336,232**
Annual Costs	
Debt Service (6% for 20 years)	$29,314
Operation and Maintenance	$6,118
Annual Energy Cost	$122
Total Annual Costs	**$35,554**
Unit Cost of Water ($/ac-ft)	**$5,079**
Unit Cost of Water ($/1000 gallons)	**$15.59**

1 Interest earned and accrued based on a one (1) year construction period

Environmental Impacts

Environmental impacts as a result of sharing of existing water supplies are primarily limited to the impacts of construction of pipelines and pump stations. These impacts are generally temporary and only during the construction period as the surface is restored after construction is complete.

Impacts to Agriculture

None of the water being transferred is currently used by agriculture interests this strategy meets an irrigation need. Impacts to agriculture are low to none.

4.7.4 Temporary Overdraft of Aquifers

The following WUGs utilize the temporary aquifer overdraft strategy in which additional groundwater is pumped to meet the projected shortage during the DOR.

For Irrigation in Bastrop County, which already has wells in the Queen City aquifer, the strategy is to pump additional groundwater in the early years to alleviate the drought shortage.

For Manufacturing in Hays County, the strategy is to pump Trinity aquifer groundwater. The TWDB GAM for the Trinity aquifer does not include the Lower Trinity aquifer, and even though Region K does not show additional Trinity water as being available (availability was based upon the GAM), there may actually be groundwater for this WUG as noted below.

According to the demand projections and water availability analysis, Hays County Manufacturing will have a maximum water shortage of 333 ac-ft per year in 2060. To determine groundwater options available for this area, the following resources were consulted: *TWDB Report 339 – Evaluation of the Ground-Water Resources of the Paleozoic and Cretaceous Aquifers in the Hill Country of Central Texas* (August 1992), a general knowledge of the groundwater resources for the area, and TWDB groundwater database information on wells information posted at:
http://wiid.twdb.state.tx.us/ims/wwm_drl/viewer.htm

There are no available supplies of groundwater from the Edwards aquifer and (Upper and Middle) Trinity aquifer after other strategies have been considered. The TWDB well information available for Hays County gave information on several public supply and other wells which have been completed in the (Lower) Trinity aquifer. Water Quality in the Lower Trinity aquifer ranges from fresh to slightly saline. Well depths vary widely because of the high relief of the land surface in much of Hays County. However, Lower Trinity aquifer wells are generally deep as they may have to penetrate the Edwards aquifer, as well as the Upper and Middle Trinity aquifers. Due to the penetration of overlying aquifers, Lower Trinity aquifer wells require casing of sufficient depth to reach the source of water and seal the well bore from intrusion of water the overlying aquifers.

Currently no estimate of the availability of groundwater supplies from the Lower Trinity aquifer in Hays County is available. It is anticipated that the TWDB will soon complete the addition of the Lower Trinity aquifer into the Trinity (Hill Country) aquifer GAM and that in the future, the GAM will be used to develop an available supplies estimate. Until an estimate of available supplies is developed, it is assumed that the approximately 180 foot thickness of the water-bearing portion of the Lower Trinity aquifer is sufficient to provide the groundwater supplies to meet the maximum projected shortage. However, since there is no GAM to determine availability with, and since the water supplies have already been established during previous work on the regional plan, it is assumed that this strategy will involve overpumping the aquifer during the drought years. The small amount of production needed will not provide undue stress on the aquifer, and the next round of planning will likely see the GAM include the supply from the Lower Trinity. (Bluntzer, Robert L. *Evaluation of the Ground-Water Resources of the Paleozoic and Cretaceous Aquifers in the Hill Country of Central Texas*. Texas Water Development Board Report 339, August 1992. Texas Water Development Board: Austin, Texas.)

For Manufacturing in Matagorda County, which already has wells in the Gulf Coast aquifer, the strategy is to pump additional groundwater in 2060 to alleviate the drought shortage.

For the City of Llano, the strategy is to produce sufficient groundwater to meet their needs in the early decades with forecast demand in succeeding decades to be reduced to within the sustainable yield of the aquifer. It should be noted that while the regional plan assumes that Llano's needs will be met with groundwater as noted above, LCRA continues to evaluate the needs for Llano as a part of LSWP.

Table 4.71 Temporary Overdraft Aquifers

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Irrigation	Bastrop	Brazos	34	21	10				
Manufacturing	Hays	Colorado				6	126	234	333
Manufacturing	Matagorda	Colorado							47
Llano *	Llano	Colorado	176	176	97	27			
TOTAL			**210**	**197**	**107**	**33**	**126**	**234**	**380**

*Note: The City of Llano shortage exceeds the amount of Ellenburger-San Saba aquifer water available from 2000 – 2030 after the implementation of other groundwater strategies in the county. The strategy to meet Llano's needs utilizes municipal conservation, a contract renewal, pumping Ellenburger-San Saba aquifer water and temporarily overdrafting this water from 2000 – 2030. This overdraft portion of this strategy is discussed in Section 4.7.4. Refer to *Appendix 4C* for further discussion of this strategy. It should be noted that while the regional plan assumes that Llano's needs will be met with groundwater as noted above, LCRA continues to evaluate the needs for Llano as a part of LSWP.

Opinion of Probable Costs

For all but the Manufacturing-Hays-Colorado WUG, the costs associated with this strategy involve the additional energy cost that will be incurred during the temporary over drafting of the aquifer. This cost assumes that the pumping distance required would be approximately 200 feet plus an additional 5 feet for every 1,000 feet of transmission line the pumped water would need to pass through (one-half- mile used). The energy calculation uses the value of $0.06/kWh, and is also based on the assumption that the wire to water efficiency in the pumps and motors is 75 percent. For the Manufacturing-Hays-Colorado WUG, it will be necessary to install additional wells to tap the Lower Trinity Aquifer in order to achieve the overdraft needed starting in decade 2030. The methodology used to develop the costs associated with installing these additional wells is the same as is described in Section 4.7.1.9. However, for the Lower Trinity aquifer, the well capacity, depth of drilling required, well diameter, and pumping distance values used were 0.2 mgd, 1,200 ft, 8 in, and 300 ft, respectively. The anticipated costs for the 4 WUGs listed above are summarized in *Table 4.72* below.

Table 4.72 Temporary Overdraft of Aquifers Additional Pumping Costs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Bastrop	Brazos			$594	$17.46
Manufacturing	Hays	Colorado	$1,488,000	$2,146,300	$245,894	$738.42
Manufacturing	Matagorda	Colorado			$820	$17.46
Llano *	Llano	Colorado	Refer to *Table 4.63* for Cost information			

*Note: The City of Llano shortage exceeds the amount of Ellenburger-San Saba aquifer water available from 2000 – 2030 after the implementation of other groundwater strategies in the county. The strategy to meet Llano's needs utilizes municipal conservation, a contract renewal, pumping Ellenburger-San Saba aquifer water and temporarily overdrafting this water from 2000 – 2030. This overdraft portion of this strategy is discussed in Section 4.7.4. Refer to *Appendix 4C* for further discussion of this strategy. It should be noted that while the regional plan assumes that Llano's needs will be met with groundwater as noted above, LCRA continues to evaluate the needs for Llano as a part of LSWP.

Issues and Considerations

The overdrafting of the Queen City Aquifer that is proposed will only occur during occurrence of the drought of record, and it will result in a limited additional drawdown of the water table. This additional drawdown will increase the cost of each unit of water produced as a result of the increased pumping lift. During years of more normal rainfall, the aquifer will recharge, and the irrigation demand will be decreased as a result of more rain falling on the crops. During this time period, the aquifer will recover over time and the water levels will return to normal. In addition, the demand decreases over time, so that by 2030, there is no longer an overdraft on the aquifer and the amounts produced are within the sustainable yield. In addition, the nature of agricultural irrigation is that water is produced during a fairly narrow window of time and the aquifer recovers until the next growing season. These conditions tend to further mitigate the additional drawdown that will be produced by the temporary overdrafting. However in areas of the aquifer where the transmissivities are lower, the local impacts and drawdowns will be correspondingly greater.

There are no known impacts to streamflows from water leaving the Queen City as springflow, so there should be no negative impacts on downstream flows as a result of this strategy.

The overdrafting of the Trinity aquifer in Hays County for manufacturing purposes is not scheduled to begin until 2030 and will only be slightly over 100 acre feet annually by 2040. This small amount of water should have limited impact on the Trinity aquifer, and localized drawdown should be minor. In addition, the consultant team has determined that there are a number of entities drawing water from the Lower Trinity sands, which are not currently included in the Trinity Aquifer model that was provided by TWDB for use during this project. It is anticipated that water available from the Lower Trinity may make the overdrafting unnecessary, and the effects would be mitigated further during the next planning round.

There are no known impacts to streamflows as there are no identified springs from the Trinity which contribute to surface streams from the aquifer, so there should be no negative impacts downstream. There may be some beneficial impacts to streamflows if a portion of the demand is returned to the streams following treatment as return flow.

The overdrafting of the Gulf Coast aquifer for manufacturing in Matagorda County does not start until 2060. Therefore, impacts during this planning period will be negligible. In addition, the amount is a small fraction of the water produced from the Gulf Coast aquifer, so only minor and very localized additional drawdowns would be anticipated to result from this strategy. In addition, there is a strategy for desalination of brackish groundwater for the STPNOC that produces sufficient additional water to meet this need. Further definition of the location of this manufacturing demand is needed in the next round of planning to determine whether such a desalination facility might represent a reasonable alternative.

The Gulf Coast aquifer is close to the Gulf of Mexico at this location and there are no know springs which would contribute to instream flows or bay and estuary flows from the aquifer. As a result, there would be no negative impact on streamflows from the production of this additional amount of water, and there could be some positive impact if there are return flows from this location.

In addition to the overdrafting issues noted above, there is also a strategy for overdrafting the Gulf Coast Aquifer in Matagorda and Wharton Counties as a part of the overall LSWP. Each of the components of LSWP is addressed separately in Section 4.9. This overdrafting is part of a strategy of conjunctive use of groundwater and surface water that will minimize the impacts of the additional pumping. The use of surface water when it is available is assured because of its lesser cost to pump into the system. As a result, surface water will be used whenever it is available, significant amounts of groundwater will be used only when surface water is not available, and the aquifer will recover. There is currently some question as to whether the aquifer levels will recover fully in terms of drawdown. The LSWP has a significant portion of its study dedicated to the development of a groundwater availability model that builds upon the current version to make it more site-specific in the lower counties of Region K. This study will provide more definitive data on the long-term impacts to the aquifer and will be incorporated into any deliberations or revisions to the plan.

Environmental Impacts

Impacts from the construction of wells and pipelines associated with this strategy are expected to be low and to be confined primarily to the construction period. The potential overdrafts are relatively small and limited in extent of time that they will occur, with the exception of Hays County Manufacturing, where it is anticipated that this water will actually come from the Lower Trinity which has not yet been modeled or a firm yield established. Some negative impact to springflow may occur.

Impacts to Agricultural Resources

This strategy provides water for agricultural use, which has a positive impact, but at the same time may result in increased costs of water production for some users based on greater pumping lifts from increased drawdown. Further studies are underway to better determine these impacts with more localized groundwater models for the Gulf Coast aquifer, which has the largest amount of irrigation usage and the greatest potential impact.

4.8 MUNICIPAL WATER MANAGEMENT STRATEGIES

Region K has 281 WUGs and 131 are Municipal. The municipal WUGs include cities, water utilities, and County-Other (rural/unincorporated areas of municipal water use aggregated on a county basis). *Table 4.73* shows the water needs for all of the Municipal WUGs in Region K and the number of WUGs with water deficits for each decade.

Table 4.73 Municipal Water Needs (ac-ft/yr)

Category Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Municipal	(1,740)	(9,452)	(20,324)	(47,042)	(56,216)	(102,596)	(300,046)
No. of WUGs	18	30	42	59	64	76	78

Several strategies were identified to meet the municipal shortages including conservation and contract renewals; conservation was the first strategy considered for municipal WUGs with needs. For several municipal WUGs with shortages, the following regional management strategies were selected:

- Expansion of Current Groundwater Supplies
- Development of New Groundwater Supplies
- Transfer/Allocate Water From WUGs with Surplus
- Temporary Overdraft of Aquifers

These regional strategies are explained in detail in Section 4.7 of this report.

In addition to these strategies, several municipal WUGs with shortages purchase water from the LCRA or the COA. Extension or amendment of these contracts or new contracts are also identified as a strategy to meet shortages. These strategies are explained in Sections 4.6.1.4, 4.6.1.5, and 4.6.2.3.

Part of the LSWP feasibility study will also determine how water shortages for rural communities in the upper portion of the LCRWPA can be better met.

In addition to the strategies identified above, additional municipal strategies have been identified to meet specific WUG needs. The following sections provide a description, analysis, and cost breakdown for these municipal strategies.

4.8.1 Water Conservation

Reduction of municipal water demand through conservation is a focal point of the 2006 round of Regional Water Planning in Texas. The water demands approved by TWDB and the individual Regional Water Planning Groups (RWPGs) have already been adjusted to incorporate the effects of the 1991 State Water Saving Performance Standards for Plumbing Fixtures Act. In addition, RWPGs are required to consider further water conservation measures in their plan or explain reasons for not recommending conservation.

The LCRWPA currently anticipates 78 municipal WUGs with shortages in the year 2060. Forty-four of these WUGs have per capita water demands in excess of the 140 gallons per capita per day (gpcd) limit proposed by the Water Conservation Implementation Task Force (WCITF) and may be able to reduce their shortages through conservation practices.

A methodology was developed to determine the anticipated municipal water conservation savings for the WUGs within the LCRWPA. First, WUGs were required to meet the following criteria to be chosen for conservation measures:

- Be a municipal WUG.
- Develop a shortage at some point from 2000 through 2060; WUGs without shortages were not considered.
- Have a year 2000 per capita water usage of greater than 140 gpcd indicating a potential for savings through conservation.

Per capita water demands were determined from the measured or projected population and water demands for each WUG during each decade. The potential reduced per capita demand for the year 2010 was determined from the 2000 per capita demand and from the previous decade (D_{i-1}) for each subsequent decade (D_i) in the following manner:

$$D_i = D_{i-1}(0.99)^{10} \qquad (1)$$

This method follows the recommendation of a 1 percent per year reduction in per capita water demand in order to reach the target demand of 140 gpcd proposed by WCITF. Conservation was applied immediately in 2010 regardless of the beginning year of a WUG shortage so that conservation could be implemented early enough to have significant effects on demand by the time the shortage was realized.

After conservation was applied, several WUGs had very low per capita water usage which did not seem attainable; therefore, a lower limit of 140 gpcd was set. This was done so that conservation was only recommended to reach reasonable levels. For WUGs that were anticipated to reach a per capita usage below 140 gpcd without conservation in later decades, the lower demands approved by the Regional Planning Board and TWDB were carried forward.

The new per capita usage for each decade was then used along with the WUG population to determine the new water demands for each decade. These values were subtracted from the original water demands to determine the amount of water conserved in each decade.

This strategy was evaluated using the criteria above for the following 40 WUGs shown in *Table 4.74*:

Table 4.74 Municipal Water Conservation Savings (ac-ft/yr)

WUG	County	River Basin	Amount Conserved (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Bastrop	Bastrop	Colorado	0	107	254	462	682	813	991
Elgin	Bastrop	Colorado	0	58	41	19	0	0	0
Smithville	Bastrop	Colorado	0	20	0	0	0	0	0
Bertram	Burnet	Brazos	0	20	44	60	64	69	78
Kempner WSC	Burnet	Brazos	0	24	62	111	170	237	321
Lake LBJ MUD	Burnet	Colorado	0	18	42	67	96	129	167
Marble Falls	Burnet	Colorado	0	143	321	518	735	982	1,269
Meadowlakes	Burnet	Colorado	0	60	157	285	436	620	841
Flatonia	Fayette	Lavaca	0	21	43	68	81	83	90
Cimarron Park Water Company	Hays	Colorado	0	24	17	13	9	5	7
Dripping Springs	Hays	Colorado	0	81	277	470	549	661	748
County-Other	Llano	Colorado	0	84	165	234	229	223	223
Lake LBJ MUD	Llano	Colorado	0	109	216	306	386	467	535
Llano	Llano	Colorado	0	86	163	231	291	349	408
Brooksmith SUD	Mills	Colorado	0	1	1	1	1	1	0
Goldthwaite	Mills	Brazos	0	1	1	2	3	2	3
Goldthwaite	Mills	Colorado	0	46	92	134	170	203	235
Richland SUD	San Saba	Colorado	0	13	22	19	15	14	15
Barton Creek West WSC	Travis	Colorado	0	37	68	97	123	147	163
Bee Cave Village	Travis	Colorado	0	45	121	223	321	433	555
Briarcliff Village	Travis	Colorado	0	16	46	78	85	92	102

Table 4.74 Municipal Water Conservation Savings (ac-ft/yr) (Continued)

WUG	County	River Basin	Amount Conserved (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Cedar Park	Travis	Colorado	0	15	48	86	99	113	127
Lago Vista	Travis	Colorado	0	168	446	811	1,167	1,574	2,015
Lakeway	Travis	Colorado	0	294	779	1,390	2,005	2,707	3,465
Loop 360 WSC	Travis	Colorado	0	110	214	306	391	470	541
Lost Creek MUD	Travis	Colorado	0	71	140	200	206	197	197
Pflugerville	Travis	Colorado	0	338	565	676	711	804	899
River Place on Lake Austin	Travis	Colorado	0	132	295	431	549	661	762
Rollingwood	Travis	Colorado	0	31	60	85	109	132	143
Round Rock	Travis	Colorado	0	32	93	179	243	277	312
Shady Hollow MUD	Travis	Colorado	0	5	0	0	0	0	0
The Hills	Travis	Colorado	0	50	123	181	230	259	259
Travis County WCID #17	Travis	Colorado	0	209	451	539	574	645	718
Travis County WCID #19	Travis	Colorado	0	33	64	91	117	141	163
Travis County WCID #20	Travis	Colorado	0	41	79	113	145	174	200
Wells Branch MUD	Travis	Colorado	0	127	203	185	157	148	148
West Lake Hills	Travis	Colorado	0	139	303	495	677	870	1,074
West Travis County Regional WS	Travis	Colorado	0	17	9	0	0	0	0
Wharton	Wharton	Colorado	0	41	29	18	8	4	4
Anderson Mill MUD	Williamson	Brazos	0	80	50	21	0	0	0
TOTAL			**0**	**2,947**	**6,104**	**9,205**	**11,834**	**14,706**	**17,778**

Opinion of Probable Cost

The conservation cost estimates were developed using information from the TWDB GDS Associates Inc. Study; *Quantifying the Effectiveness of Various Water Conservation Techniques in Texas*, May 2003. The study divided each RWPG into urban, suburban, and rural areas. The urban areas in Region K are comprised of the City of Austin and the City of Round Rock. The suburban areas are Travis, Hays, Bastrop, and Williamson Counties; and all of the other counties are considered rural.

For the cost estimates, the conservation savings were divided into plumbing fixture savings and irrigation savings. The plumbing fixture savings include toilet retrofits, showerhead and aerator replacements, and clothes washer rebates. The irrigation savings include irrigation audits. The total conservation savings calculated for each WUG was proportioned between plumbing fixture savings and irrigation savings using an average of the estimated savings per measure in the study. Then the savings costs for plumbing fixture savings and irrigation savings were calculated using the cost per acre foot estimates in the study. These unit costs were only applied to the incremental savings; therefore, the savings that occur the year before will not have a cost the next year, only the additional savings have a cost associated with them.

The table below contains the percent of plumbing savings versus irrigation savings and the cost per ac-ft for the three categories (urban, suburban, and rural).

Table 4.75 Municipal Water Conservation Savings Unit Costs

Conservation Savings	Percent of Total Savings	Cost per Acre-Foot
Urban		
Plumbing Fixture Savings	32%	$590.16
Irrigation Savings	68%	$455.01
Suburban		
Plumbing Fixture Savings	31%	$473.05
Irrigation Savings	69%	$453.05
Rural		
Plumbing Fixture Savings	30%	$403.35
Irrigation Savings	70%	$432.07

It should be noted that much of the information on costs and anticipated savings for conservation measures is based on TWDB Report 362 – *Water Conservation Best Management Practices Guide*, prepared for the TWDB by GDS Associates. This publication is an excellent reference work for WUGs seeking information for starting or expanding their conservation programs.

Environmental Impact

As mentioned with the strategy for City of Austin conservation above, conservation does not require additional infrastructure which has the potential to require environmental mitigation or other measures to address impacts.

Conservation has other potential impacts for WUGs that are served by groundwater. Communities that are served by surface water will divert less water from streams, meaning more water will remain in channels for downstream uses. However, groundwater communities contribute to streamflow by discharging treated groundwater into streams (typically 60 percent of water supplied is discharged following treatment.) Conservation measures implemented by these WUGs may lead to an overall decrease in streamflow, which is derived from groundwater sources. However, streamflow would not be expected to be decreased if the conservation is in the irrigation usage sector.

4.8.1.1 Additional Conservation

An additional conservation scenario for increasing water conservation was proposed and analyzed in the same manner as the original conservation figures developed above. This scenario involved applying a

0.25 percent savings annually to all municipal WUGs with shortages and a per capita demand between 100 and 140 gpcd.

This scenario could be performed in conjunction with conservation practices already recommended in the section above. Additional conservation would be applied until the per capita water demand reached 100 and 140 gpcd, respectively. No conservation would be applied below these respective levels. *Table 4.76* shows the additional amount of water conserved by implementing this scenario. This strategy was considered, but is not recommended at this time.

Table 4.76 Anticipated Savings From Additional Municipal Conservation (ac-ft/yr)

WUG	County	Basin	Amount Conserved (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Aqua WSC	Bastrop	Colorado	0	0	0	0	91	300	701
Bastrop County WCID#2	Bastrop	Colorado	0	0	0	4	19	49	95
County-Other	Bastrop	Colorado	0	20	113	232	455	783	1,253
County-Other	Bastrop	Guadalupe	0	1	2	6	11	20	33
Manville WSC	Bastrop	Colorado	0	0	0	0	2	7	16
Chisholm Trail SUD	Burnet	Brazos	0	6	10	15	21	27	32
Cottonwood Shores	Burnet	Colorado	0	0	0	0	4	8	17
Kingsland WSC	Burnet	Colorado	0	0	0	0	0	2	4
Aqua WSC	Fayette	Colorado	0	0	0	0	2	5	11
County-Other	Fayette	Colorado	0	0	0	0	0	0	2
County-Other	Fayette	Lavaca	0	0	0	0	0	0	1
Fayette WSC	Fayette	Colorado	0	0	0	0	8	56	121
Fayette WSC	Fayette	Lavaca	0	0	0	0	0	4	10
Lee County WSC	Fayette	Colorado	0	0	0	0	3	11	29
County-Other	Hays	Colorado	0	0	0	40	177	441	754
Dripping Springs WSC	Hays	Colorado	0	0	0	3	18	47	81
Kingsland WSC	Llano	Colorado	0	0	3	4	5	14	26
Aqua WSC	Travis	Colorado	0	0	0	0	14	42	86
Jonestown	Travis	Colorado	0	0	0	0	4	11	24
Jonestown WSC	Travis	Colorado	0	0	0	0	0	3	8
Manville WSC	Travis	Colorado	0	0	0	0	51	145	256
North Austin MUD#1	Travis	Colorado	0	0	0	2	2	3	6
North Travis County MUD#5	Travis	Colorado	0	0	1	20	42	82	127
Travis County WCID#18	Travis	Colorado	0	0	0	1	24	50	96
Williamson-Travis County MUD#1	Travis	Colorado	0	0	0	0	0	1	1
Windermere Utility Company	Travis	Colorado	0	0	29	62	85	85	85
North Austin MUD#1	Williamson	Brazos	0	1	10	18	17	31	53
TOTAL			**0**	**28**	**168**	**407**	**1,055**	**2,227**	**3,928**

Anticipated reductions in demand from this scenario are considerably less than the expected savings from the conservation strategy recommended in Section 4.8.1. This strategy could delay the implementation of other larger municipal strategies for these WUGs if they can achieve this level of conservation, but for this analysis it was assumed that this strategy would not preclude additional strategies from coming online, and therefore provides a small surplus.

Opinion of Probable Cost

The costs were calculated using the same methodology for both the municipal conservation and additional municipal conservation strategies. Refer to Section 4.8.1 for a breakdown of the costs for this strategy.

Environmental Impact

The environmental impacts for this strategy are discussed in Section 4.8.1.

Impacts to Agricultural Resources

No impacts to agriculture are anticipated as a result of municipal conservation.

4.8.1.2 Drought Management

The consultant team for Region K recommended that the LCRWPG distinguish between conservation, which reduces the per capita consumption over the long term, and drought management, which reduces peak consumption for a period of time, but does not necessarily have a significant impact on the overall average annual water usage.

The current plan includes water supplies from the drought of record conditions analysis and water demands for below normal rainfall periods. The LCRWPG, as mandated by the TWDB, included conservation as the first management strategy for any WUG with a need and a per capita usage of greater than 140 gpcd. This long term conservation provides reduction of the overall water needs. The LCRWPG considered drought contingency measures as a management strategy, but did not include such measures for the following reasons:

- The LCRWPG adopted the firm yield of the Highland Lakes and other surface water resources as the amount of available supply that would be used. Many other regions used a safe yield which is a more conservative assumption and requires the search for greater volumes of additional supply. However, the firm yield assumption means that at the end of the 10-year drought of record, the reservoirs are empty. This is undesirable for several reasons, not the least of which is that if the new drought is more severe or longer than the 10-year drought of record that is modeled, water supplies may be depleted at a faster rate than predicted. In addition, few if any of the surface water users in the basin have surface water intakes at the very bottom of the reservoir. Most will be out of the pool long before the reservoir is empty and will have to implement restrictions to reduce usage. As a result, there would be significant difficulty getting water if the lake were really empty. The Drought Contingency Plan for the LCRA uses drought contingency measures to extend the supply in the lake anywhere from one to three years to account for the intakes as well as to anticipate a potential future drought that would be longer than the drought of record.

- Implementation of drought contingency measures is generally a short term measure that causes considerable discomfort to the residents but they are willing to put up with it for a short period of time. Measures such as dipping bathwater out of the bathtub and using it to flush toilets with are ways to greatly reduce demand. However it would be difficult to sustain local enthusiasm among young families in keeping up with these types of measures for 10 years of a drought.
- Many smaller cities that have apparently high per capita usage may actually be regional commerce centers that have department stores and other facilities that bring people in from surrounding areas to shop. By the nature of the TWDB statistics, the water used by such facilities is considered municipal water and is included in the per capita usage of the area. Therefore, the smaller the town the larger the per capita usage is for these high commerce areas. It would be difficult to make large reductions in the per capita usage without cutting off the businesses that are using the water in these areas.
- Drought contingency plans are often used to reduce the peak demands to make up for lack of adequate facilities to handle these infrequent peaks. However, in the long term, these measures may not reduce the total usage over a period of time. Utilities that experience declining well capacities often implement drought management strategies to reduce the peak day demand so they can manage on the lower capacity wells for peak summer demand conditions. TCEQ criteria require a peak day to average day factor of 2.4 be used in the absence of data from individual systems. The LCRWPG's consultant team used a factor of 2.0 to scale up from the average annual shortage to determine the required delivery capacity in wells or transmission lines. This lower factor takes advantage of any surplus currently available but may also require the use of drought management measures to lower the peak daily demands to support the lower capacity in the system. Some systems will choose to install additional capacity, and some will choose to use lower capacity and implement drought management measures to make the smaller capacities work. In any event the plan costs were based on the lower peaking factor assumption.

For these reasons, the LCRWPG consultant team believes that conservation is a better means of implementing long term savings rather than drought management.

4.8.2 Purchase Treated Water From Canyon Lake

The City of Blanco has contracted with the Canyon Lake Water Supply Corporation for a supply of water from their regional system. This project, involving the construction of a pipeline from US 281 and Highway 306 to the City of Blanco, is in construction now and is included as a management strategy in this plan. The approximately 10.5-mile pipeline will include a booster pump station and ground storage tank. The project will provide 600 ac-ft annually of treated water from the Canyon Lake WSC regional water treatment plant. Costs are not included in this plan since the pipeline is substantially complete. The 600 ac-ft of municipal supply will be available to the City of Blanco as it is needed.

The same pipeline noted above also has sufficient capacity to serve the needs of Blanco County-Other Municipal WUG shortages. The County-Other shortages tend to be centered around the main growth areas and this pipeline routing is located along a main highway and positioned to serve those needs. For the reasons noted above, the costs of this strategy are not included in this plan since the facilities are substantially complete with financing already arranged.

Table 4.77 Canyon Lake WSC in Blanco County (ac-ft/yr)

WUG	County	Basin	Amount Conserved (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Blanco	Blanco	Guadalupe			600	600	600	600	600
County-Other	Blanco	Guadalupe	225	225	225	225	225	233	263
TOTAL			**225**	**225**	**825**	**825**	**825**	**833**	**863**

4.8.3 Construct GBRA Hays County Pipeline

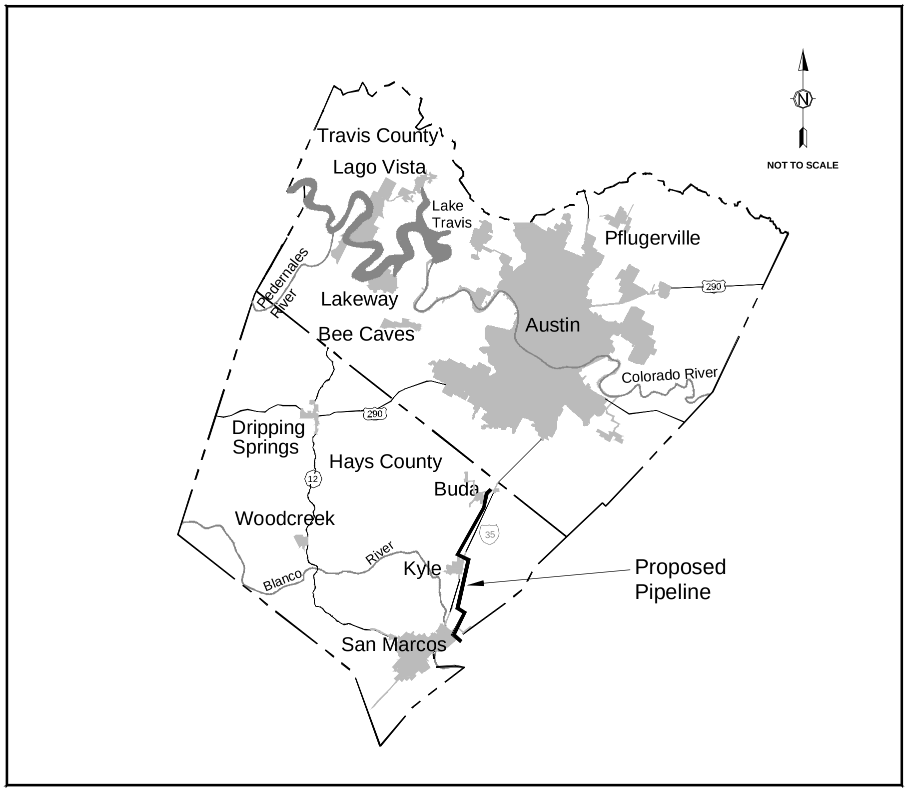
Hays County has begun to experience rapid growth as the nearby Austin metropolitan area continues to expand its population base. Currently, groundwater is the primary source of water for residents in this area. The groundwater supplies in the area are presently showing signs of stress as a result of this intense growth. Therefore, a strategy involving the transfer of surface water from the Guadalupe-Blanco River Authority (GBRA) system to Eastern Hays County was identified.

The GBRA and the City of San Marcos have previously constructed a regional raw water transmission system and a regional surface water treatment plant near San Marcos. GBRA is currently proceeding with a treated water transmission pipeline in the IH 35 corridor which will extend to Buda. This project is already underway with completion anticipated in late 2005. A schematic layout of this project is shown in *Figure 4.7*.

The City of Buda has an existing commitment with GBRA for 1,120 ac-ft of treated water from this pipeline. There is an additional 1,680 ac-ft of treated water available through this line which is allocated to the Region K portion of Hays County-Other. Total yield of the line to the Region K entities is estimated at approximately 2,800 ac-ft through 2050, increasing slightly to 2,982 ac-ft in 2060 to meet an increased need in Buda. This equates to approximately 2.2 million gallons per day through 2050 and 2.3 million gallons per day in 2060.

System participants would be required to assume their pro-rata share of the debt retirement obligations for the raw water delivery system. Additional capacity at the treatment plant, treated water transmission mains approximately 20 miles in length, and a new booster station are currently under contract according the update on the GBRA website. The transmission main will range in size from 12 to 30 inches and would run generally parallel to IH 35. The system is designed to provide average day needs with recipients providing peak day needs through their existing supplies.

Figure 4.7: Obtain Surface Water Through the GBRA System



Opinion of Probable Costs

The probable costs presented in *Table 4.78* are for the portion of the project yield expected to be used by Hays County-Other, which has a yield of approximately 1,680 ac-ft/yr.

Table 4.78 GBRA Waterline – Hays County-Other Portion - Opinion of Probable Cost

Phase	Cost Opinion
Capital Costs	
Pump Station Costs	$385,300
Transmission Main Costs (20 miles)	$1,216,700
Treatment Plant Expansion	$2,311,700
Total Capital Costs	**$3,913,700**
Engineering, Contingencies and Legal Services (35%)	$1,369,800
Environmental and Archeological Studies, Mitigation, and Permitting	$60,800
Site Acquisition	$324,000
Interest Accrued During Construction [1]	$679,000
Interest Earned on Unused Principal [1]	($453,500)
Total Project Costs	**$5,893,800**
Annual Costs [2]	
Debt Service (6% for 30 years)	$428,177
Operation and Maintenance	$744,926
Total Annual Costs	**$1,173,103**
Unit Cost of Water ($/ac-ft)	**$698**
Unit Cost of Water ($/1000 gallons)	**$2.14**

Note: Opinion of probable costs taken from draft report entitled *IH 35 Water Supply Study*, June 2000.
[1] Interest earned and accrued based on a five (5) year construction period
[2] Annual costs based on total capacity of 4.0 mgd being utilized. The O&M cost includes debt service for the existing raw water delivery system at $87 per ac-ft and raw water charge of $84/ac-ft

Capital costs for this strategy were taken from costs developed in the 2001 Region K Plan and updated to second quarter 2002 dollars using the *Engineering News-Record* (ENR) Construction Cost Index (CCI). Land acquisition, environmental study, and O&M costs were adjusted to second quarter 2002 dollars using the U.S. Department of Labor's Consumer Price Index. A factor of 0.375 was then applied to the costs since the percentage of the total project yield (4,480 ac-ft/yr) expected to be used by Hays County-other is approximately 37.5 percent.

The probable costs presented in *Table 4.79* are for the portion of the project yield expected to be used by Buda-Hays-Colorado, which has a yield of approximately 1,302 ac-ft/yr.

Table 4.79 GBRA Waterline – Buda-Portion - Opinion of Probable Cost

Phase	Cost Opinion
Capital Costs	
Pump Station Costs	$298,000
Transmission Main Costs (20 miles)	$940,900
Treatment Plant Expansion	$1,787,700
Total Capital Costs	**$3,026,600**
Engineering, Contingencies and Legal Services (35%)	$1,059,300
Environmental and Archeological Studies, Mitigation, and Permitting	$47,000
Site Acquisition	$250,600
Interest Accrued During Construction [1]	$525,100
Interest Earned on Unused Principal [1]	($350,700)
Total Project Costs	**$4,557,900**
Annual Costs [2]	
Debt Service (6% for 30 years)	$331,124
Operation and Maintenance	$576,076
Total Annual Costs	**$907,200**
Unit Cost of Water ($/ac-ft)	**$697**
Unit Cost of Water ($/1000 gallons)	**$2.14**

Note: Opinion of probable costs taken from draft report entitled "IH 35 Water Supply Study," June 2000.
[1] Interest earned and accrued based on a five (5) year construction period
[2] Annual costs based on total capacity of 4.0 mgd being utilized. The O&M cost includes debt service for the existing raw water delivery system at $87 per ac-ft and raw water charge of $84/ac-ft

Capital costs for this strategy were taken from costs developed in the 2001 Region K Plan and updated to second quarter 2002 dollars using the *Engineering News-Record* (ENR) Construction Cost Index (CCI). Land acquisition, environmental study, and O&M costs were adjusted to second quarter 2002 dollars using the U.S. Department of Labor's Consumer Price Index. A factor of 0.29 was then applied to the costs since the percentage of the total project yield (4,480 ac-ft/yr) expected to be used by Buda-Hays-Colorado is approximately 29 percent.

Issues and Considerations

This alternative would involve an inter-basin transfer of water from the Guadalupe River Basin to the Colorado River Basin. This project would need to be approved through the TCEQ's process for inter-basin transfers. However, since Hays County is split between two basins, it is anticipated that approval of the project could be achieved.

Environmental Impact

An assessment of the potential environmental impacts of this project has not yet been completed. An environmental impact assessment would be required before this alternative could be implemented. Beyond the short-term impact associated with typical construction projects and the potential long-term impacts of decreasing recharge to the Barton Springs segment of the Edwards aquifer, it is anticipated that implementation of this project would have the positive benefit of reducing the demand on the Barton Springs portion of the Edwards aquifer. The pipeline connecting the regional treatment facility to northern Hays County will potentially disturb 145 acres of land assuming a 60-foot easement along the length of the transmission line. The actual impacts of this construction will depend upon the placement of the line along the IH 35 corridor.

Impacts to Agricultural Resources

This strategy does not divert water currently being used for agriculture to other purposes. This only foreseeable impact on agriculture is the development of lands previously used for farming to housing instead.

4.8.4 Recharge Edwards-BFZ With Onion Creek Recharge Structure for Hays County

This alternative would involve the construction of two channel dams across Onion Creek to temporarily retain runoff. This strategy would provide water to Hays County-Other to meet projected water shortages for that WUG. The water retained would be released under controlled conditions to maximize recharge in downstream reaches of Onion Creek. Several channel dam locations have been evaluated in the past. For the purpose of presenting the costs in *Table 4.80* below, estimates for all locations are listed. It should be noted that the anticipated yield is based on the assumption that the Rutherford Recharge Dam and the Centex Quarry would be built. Other sites would also be acceptable and if multiple sites were utilized they could potentially produce a greater yield, but additional analysis is still needed. The anticipated capital expenditure required to implement this alternative for the Rutherford Dam and Centex Quarry sites is expected to be $6.8 million. The total annual expenditures are expected to be approximately $640,600, which includes $146,000 for O&M. The maximum anticipated yield due to the enhanced recharge from the two sites is expected to be 5,043 ac-ft/yr at a unit cost of approximately $127 per ac-ft. This yield is reduced significantly from the yields anticipated in the last plan because of recent research indicating that some of the water would not be retained in storage but would reappear as springflow.

Table 4.80 Onion Creek Recharge Dams Opinion of Probable Cost

Phase	Centex Reservoir	Ruby Reservoir	Rutherford Reservoir	Centex Quarry
Capital Costs				
Dam Construction	$608,000	$974,000	$2,914,000	$1,326,000
Total Capital Costs	**$608,000**	**$974,000**	**$2,914,000**	**$1,326,000**
Engineering, Contingencies, and Legal Services (35%)	$213,000	$341,000	$1,020,000	$464,000
Environmental and Archaeological Studies, Mitigation, and Permitting	$91,000	$146,000	$437,000	$199,000
Site Acquisition	$40,000	$47,000	$210,000	$104,000
Interest Accrued During Construction	$91,000	$146,000	$437,000	$199,000
Interest Earned on Unused Principal				
Total Project Costs	**$971,000**	**$1,538,000**	**$4,673,000**	**$2,135,000**
Annual Costs				
Debt Service (6% for 30 years)	$71,000	$112,000	$339,000	$155,000
Operation and Maintenance	$20,000	$20,000	$66,000	$80,000
Total Annual Costs	**$91,000**	**$132,000**	**$405,000**	**$235,000**
Firm Annual Recharge (ac-ft)	**768**	**1,152**	**5,043**	**5,718**
Unit Cost of Water ($/ac-ft)	**$118**	**$115**	**$80**	**$41**
Unit Cost of Water ($/1000 gal)	**$0.36**	**$0.35**	**$0.25**	**$0.13**

Note: Opinion of probable costs based on costs presented in the report entitled, *Engineering Assessment and Environmental Inventory and Issues Report Artificial Recharge Enhancement Onion Creek, Hays County, Texas*, prepared by Donald G. Rauschuber & Associates, Inc. et. al., April 1992. The costs from the aforementioned report were updated to reflect second Quarter 2002 costs and TWDB Exhibit B costing guidelines prior to presentation here.

Environmental Impact

Construction of these channel dams would tend to change the ecology in the vicinity from an ephemeral riverine system to a palustrine system upstream of the dams. This activity would require a Section 404 Permit from the U.S. Army Corps of Engineers (USACE). A review of available literature indicates that there are no known occurrences of endangered species within the Onion Creek watershed.

This strategy aims to convert surface water supplies to groundwater recharge. This would reduce peak flows during rainfall events when water would be retained and allowed to infiltrate over time. Over time, as increased infiltration and withdrawals from groundwater balance, there would be no net loss or gain from the system. The only loss in water would come from consumptive use that would not be returned to streams. As municipal return flows are approximately 60 percent of municipal water demand, a 4,000 ac-ft/yr increase in supply through enhanced recharge would yield an overall annual loss through consumptive use of 1,600 ac-ft. However, the remaining 2,400 ac-ft/yr that would be discharged would be released throughout the year and continually add to instream flows and habitat instead of being discharged in peak flows during storm events.

Update

A review of the findings of the Barton Springs/Edwards Aquifer Conservation District's (BSEACD) Onion Creek Recharge Study (*Summary of Groundwater Dye Tracing Studies 1996-2002, Barton Springs Segment of the Edwards Aquifer*, Texas, April 2003) was conducted to incorporate any applicable information included into the Region K strategy analysis.

The report referenced above is a cumulative reporting of dye tracing studies in the Barton Springs Segment of the Edwards aquifer from 1996 to 2002. In this report, all the data collected by entities with interests in the aquifer in this region (including BSEACD and the COA) were gathered and reported in one document. The results of the dye studies indicate a rather direct connection between Onion Creek and Barton Springs. The proposed Ruby Reservoir site is approximately equal to the dye study injection Site S in the study, Crippled Crawfish Cave. Data reported in the study indicate that the first arrival of dye from the injection site to the springs is less than 3 days. Similarly, the proposed Centex Reservoir is located near dye study injection Site M in the study, Antioch Cave. Data reported in the study indicate that the first arrival of dye from the injection site to the springs is approximately 7 to 8 days. Lastly, the proposed Centex Quarry site is approximately equal to the dye study injections Site N in the study, Barber Falls. Data reported in the study indicate that the first arrival of dye from this injection site to the springs is approximately 14 to 18 days.

Review of these data, as well as the other data presented in the BSEACD report indicate a strong connection between Onion Creek recharge and Barton Springs. If this is the case, recharge dams constructed on Onion Creek may not perform as previously expected. In general, recharge dams work best when the waters recharged during wet times remain in storage for use during dryer periods. If the results of the dye study are representative of travel times between Onion Creek and Barton Springs during hydrologically wet periods, the waters recharged in these potential structures may not be available during drought when the water is needed. It may discharge out through the springs before the drought begins. While this may be desirable from an environmental enhancement viewpoint, it is undesirable as a water management strategy to provide firm water supply during times of drought.

In addition, new tools are available to analyze the availability of unappropriated water in the reach of Onion Creek where the proposed recharge dams are located. One alternative to the analysis could be to quantify the volume of unappropriated water in this reach using the Colorado WAM.

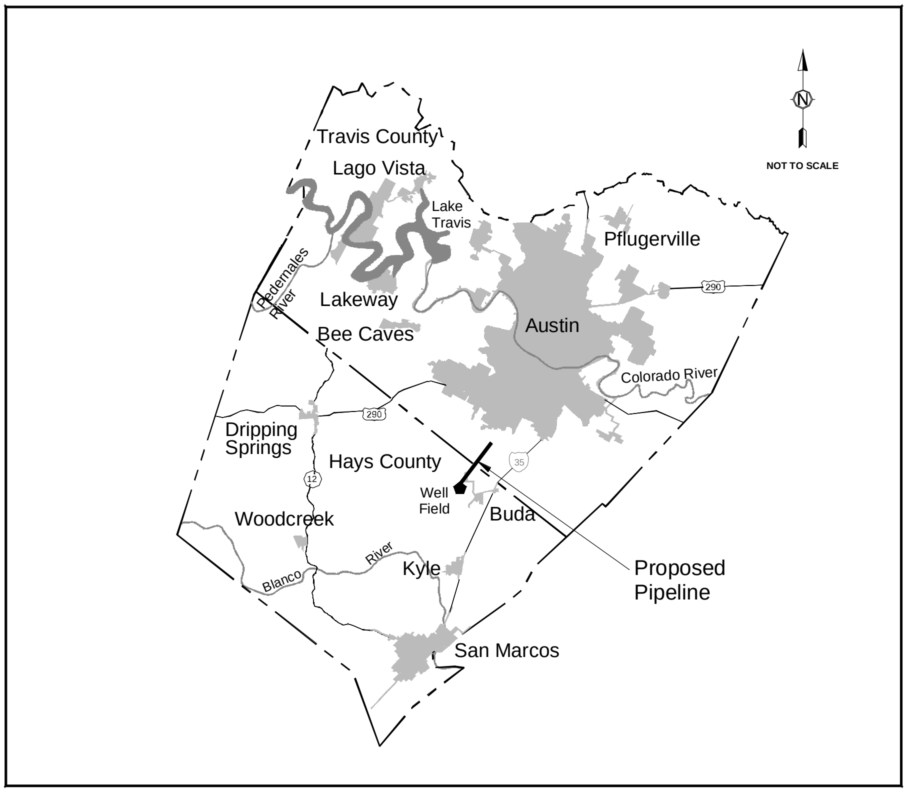
Conclusions

Recent studies compiled by the BSEACD indicate a strong connection between Onion Creek recharge and Barton Springs. If this is the case, recharge dams constructed on Onion Creek may not perform as previously expected. For this reason, although the recharge dams have been retained as a water management strategy for this plan, the yield of the recharge structures has been reduced by approximately 50 percent to account for the increased uncertainty in their operation. Further detailed analyses should be performed before these structures are pursued as a water supply source.

4.8.5 Obtain Surface Water From the COA for Hays County

This alternative would involve the construction of transmission facilities to transport water from the COA's distribution system into Northern Hays County. Water provided by the COA would be specifically designated for the Spillar Ranch and Pfluger Ranch developments (located in Hays County-Other). A schematic layout of this alternative is presented on *Figure 4.8*.

Figure 4.8: Obtain Surface Water From the COA



The improvements necessary to move water from the COA to the proposed developments would involve a looped 16-inch transmission main. These facilities would have the capacity to provide approximately 1,100 ac-ft/yr to the proposed developments.

Opinion of Probable Cost

The probable costs for this alternative are presented in *Table 4.81*. The costs presented include the transmission main from the COA and are based on information provided by City staff.

Table 4.81 COA Waterline Opinion of Probable Cost

Phase	Cost Opinion
Total Project Costs [1]	**$2,280,200**
Annual Costs	
Debt Service (6% for 30 years)	$165,654
Operation and Maintenance	$18,600
Purchase of Treated Water from COA [2]	$875,000
Total Annual Costs	**$1,059,254**
Unit Cost of Water ($/ac-ft)	**$963**
Unit Cost of Water ($/1000 gallons)	**$2.96**

[1] Opinion of probable costs update provided through COA staff 7/5/05.
[2] The purchase of treated wholesale water from COA is assumed to be an average cost of $2.44 per 1,000 gallons.

Capital costs for this strategy were updated to second quarter 2002 dollars using the *Engineering News-Record* (ENR) Construction Cost Index (CCI). O&M costs were adjusted to second quarter 2002 dollars using the U.S. Department of Labor's Consumer Price Index.

Environmental Impact

This strategy would convey treated water from the COA system to customers in Hays County. There may be issues concerning the mixing of treated surface water with groundwater in the Hays County distribution systems. Environmental aspects of the proposed pipe alignment would have to be considered. An assessment of the potential environmental impacts of this project has not been completed and would have to be performed before implementing this alternative. Beyond the short-term impact associated with typical construction costs, it is anticipated that implementation of this project would have the positive benefit of limiting the demand on the Barton Springs segment of the Edwards aquifer.

Impacts to Agricultural Resources

This strategy does not take water from rural areas and should have no impact on agriculture.

4.8.6 Construct Additional Goldthwaite Off-Channel Reservoir in Mills County

In the 2001 Plan a strategy involving the construction of a new off-channel reservoir adjacent to Goldthwaite's existing reservoir on the San Saba Highway was identified.

Analysis

For this strategy, an additional off-channel reservoir adjacent to the City's existing reservoir on the San Saba Highway would be constructed. An additional 350 ac-ft/yr of storage could be added at this site to increase the City's total storage capacity, and therefore its ability to survive extended dry periods. This reservoir would be constructed using a perimeter berm.

Opinion of Probable Cost

The reservoir construction was completed in July 2005, and therefore all of the costs have already been incurred.

Issues and Considerations

The following is a summary of the advantages and disadvantages for this alternative:

Advantages

- Operation of the City's water system would remain the same
- Development of a sufficient supply of water to allow growth in the City's system, may be possible
- Near-term implementation of this alternative is possible (2 to 3 years)

Disadvantages

- Relatively expensive alternative
- Construction of an off-channel reservoir may require a water rights permit amendment
- Construction of an off-channel reservoir may have environmental impacts although they may be lesser impacts than flooding riparian habitat in a stream channel
- No firm yield as currently modeled

Environmental Impact

An off-channel reservoir at Goldthwaite would have many of the same impacts to instream flows as a channel reservoir by capturing peak storm flows. However, the water able to be stored in the reservoir would be so limited in quantity as to provide no firm yield. Most of the flows in the stream, particularly the low flows, would have to be passed downstream and could not be diverted to the new reservoir unless some subordination agreements could be developed with senior rights holders. Impacts upon species and other environmental indicators would be minimal due to the off-channel location of the reservoir that would not inundate riparian habitat.

Impacts on instream flows were determined by comparing the regulated flows at control point F10000 (Colorado River near San Saba) using the "No Call" WAM with the proposed Goldthwaite Off-Channel Reservoir. These flows were then compared to the 7Q2 flow at the F10000 control point (USGS gage number 08147000). The 7Q2 flows were identified by reviewing Figure TAC 307.10(2) – Appendix B – Low Flow Criteria and determining the corresponding USGS gage station for control point F10000. During years 2000 and 2060, the calculated monthly median instream flows at control point F10000 were found to be greater than the monthly 7Q2 flows. The instream flow results for control point F10000 are shown in *Tables 4.82* and *4.83*, and graphically in *Figures 4.9* and *4.10*.

Table 4.82 Year 2000 Median Instream Flow Results for Control Point F10000*

Month	7Q2 acre-feet	WAM	"No Call" WAM	"No Call" WAM with Reservoir
January	2,317	13,902	12,233	12,233
February	2,317	15,448	13,870	13,870
March	2,317	21,890	16,236	16,236
April	2,317	20,475	15,584	15,584
May	2,317	57,117	44,656	44,656
June	2,317	56,476	32,919	32,893
July	2,317	26,330	12,362	12,362
August	2,317	20,635	11,327	11,327
September	2,317	28,679	14,650	14,650
October	2,317	29,175	15,617	15,617
November	2,317	16,001	11,945	11,945
December	2,317	19,488	12,440	12,440
Median	2,317	22,583	14,534	14,534

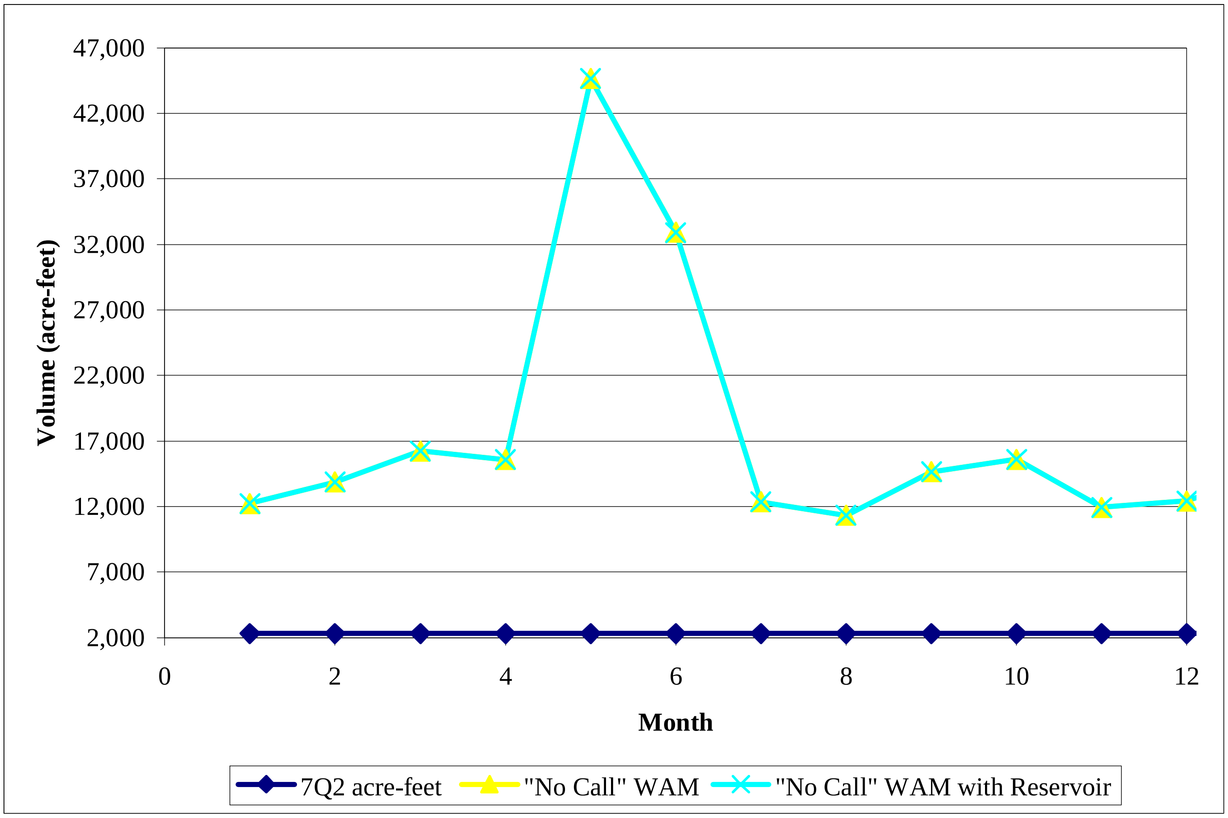
*Comparison between median regulated flows at control point F100000 between "No Call" WAM and "No Call" WAM with Reservoir. Model output files are included as an attachment to this report.
Refer to the bolded paragraph on Page 4-41.

Table 4.83 Year 2060 Median Instream Flow Results for Control Point F10000*

Month	7Q2 acre-feet	WAM	"No Call" WAM	"No Call" WAM with Reservoir
January	2,317	12,595	12,336	12,336
February	2,317	14,969	13,869	13,869
March	2,317	18,058	16,215	16,215
April	2,317	19,425	15,685	15,685
May	2,317	57,164	47,339	46,973
June	2,317	51,525	29,470	29,448
July	2,317	24,721	12,364	12,364
August	2,317	20,635	11,520	11,520
September	2,317	29,723	14,650	14,650
October	2,317	23,476	15,616	15,616
November	2,317	14,292	11,945	11,945
December	2,317	14,562	12,270	12,270
Median	2,317	21,208	14,774	14,774

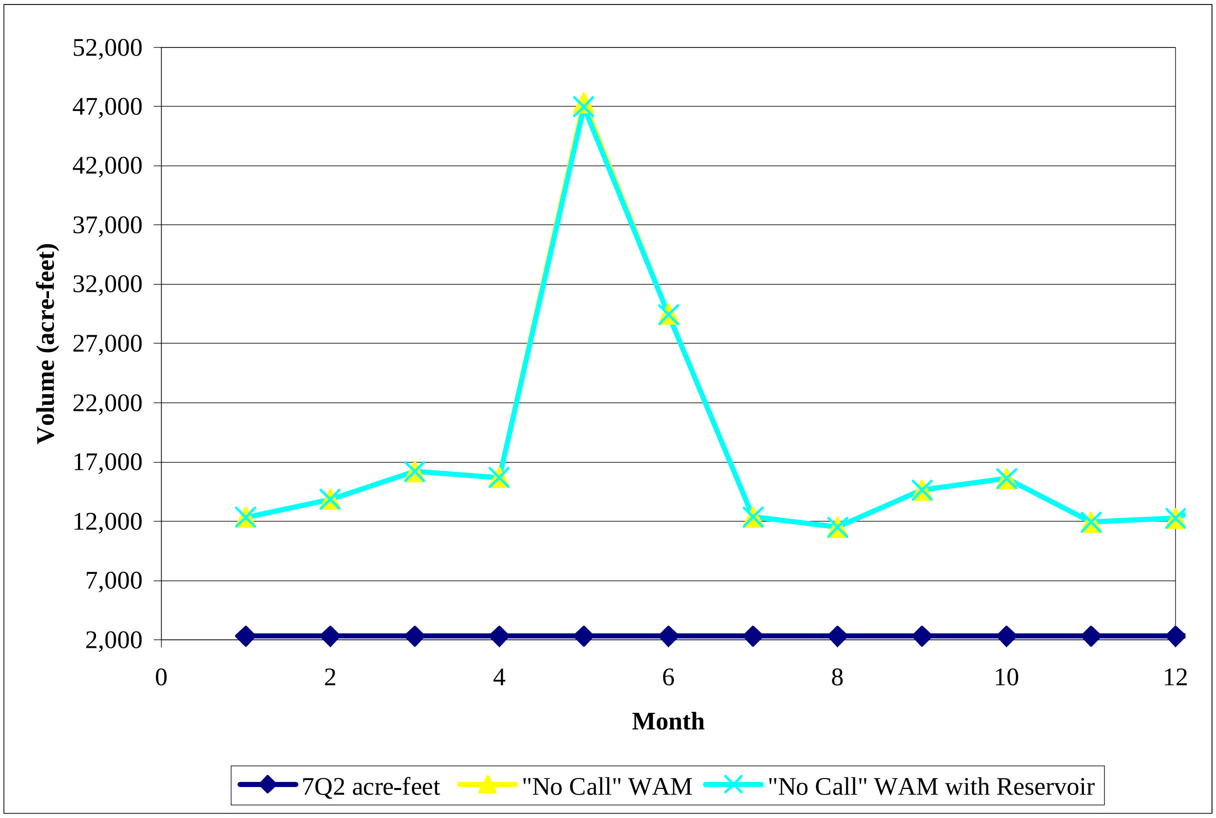
*Comparison between median regulated flows at control point F100000 between "No Call" WAM and "No Call" WAM with Reservoir. Model output files are included as an attachment to this report.
Refer to the bolded paragraph on Page 4-41.

Figure 4.9: Year 2000 Instream Inflow Impacts at Control Point F10000*



*Comparison between median regulated flows at control point F10000 between "No Call" WAM and "No Call" WAM with Reservoir. Model output files are included as an attachment to this report.

Figure 4.10: Year 2060 Instream Inflow Impacts at Control Point F10000*



*Comparison between median regulated flows at control point F10000 between "No Call" WAM and "No Call" WAM with Reservoir. Model output files are included as an attachment to this report.

The impacts to the freshwater inflows for the bay and estuary were determined by comparing the inflow differences between the model with and without the off-channel reservoir. These results were then compared to target and critical bay and estuary freshwater inflow targets as outlined in the LCRA WMP. The impact of the proposed off-channel Goldthwaite Reservoir has no impact on bay and estuary freshwater inflow compliance with targets and critical needs. The impacts to the freshwater inflows are shown in *Table 4.84* and *Figures 4.11* and *4.12*.

The Colorado River Basin does not have an updated current conditions WAM model that includes "No Call" routines to reflect the retention of water in upstream reservoirs. Therefore, the "No Call" WAM was used to determine the environmental impacts of the strategy. The LCRWPG recognizes the uncertainty and ambiguity of the modeling results presented herein, but results are based on the model with "No Call" routine. It is recommended that during the next round of regional water planning, if the "No Call" WAM is used to develop water supplies, that the "No Call" WAM be modified to current conditions to allow for a more precise environmental impact analysis of selected water management strategies.

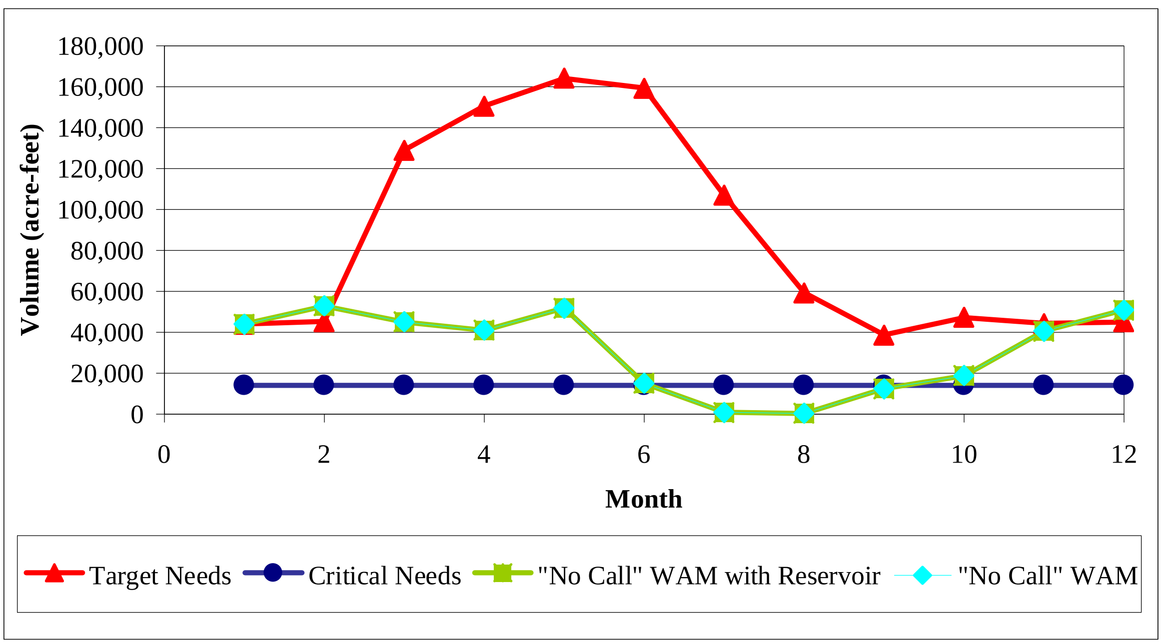
Table 4.84 Impacts to Bay and Estuary Freshwater Inflows Resulting From the Proposed Off-Channel Goldthwaite Reservoir*

Month	Target Needs (ac-ft)	Critical Needs (ac-ft)	Change in Percent Compliance Caused by Addition of Off-Channel Reservoir			
			Target Flow Needs		Critical Flow Needs	
			Year 2000	Year 2060	Year 2000	Year 2060
January	44,100	14,260	0.00%	0.00%	0.00%	0.00%
February	45,300	14,260	0.00%	0.00%	0.00%	0.00%
March	129,100	14,260	0.00%	0.00%	0.00%	0.00%
April	150,700	14,260	0.00%	0.00%	0.00%	0.00%
May	164,200	14,260	0.00%	0.00%	0.00%	0.00%
June	159,300	14,260	0.00%	0.00%	0.00%	0.00%
July	107,000	14,260	0.00%	0.00%	0.00%	0.00%
August	59,400	14,260	0.00%	0.00%	0.00%	0.00%
September	38,800	14,260	0.00%	0.00%	0.00%	0.00%
October	47,400	14,260	0.00%	0.00%	0.00%	0.00%
November	44,400	14,260	0.00%	0.00%	0.00%	0.00%
December	45,200	14,260	0.00%	0.00%	0.00%	0.00%
Annual	1,034,900	171,120	0.00%	0.00%	0.00%	0.00%

*Comparison between median regulated flows at control point M10000 between "No Call" WAM and "No Call" WAM with Reservoir. Model output files are included as an attachment to this report.

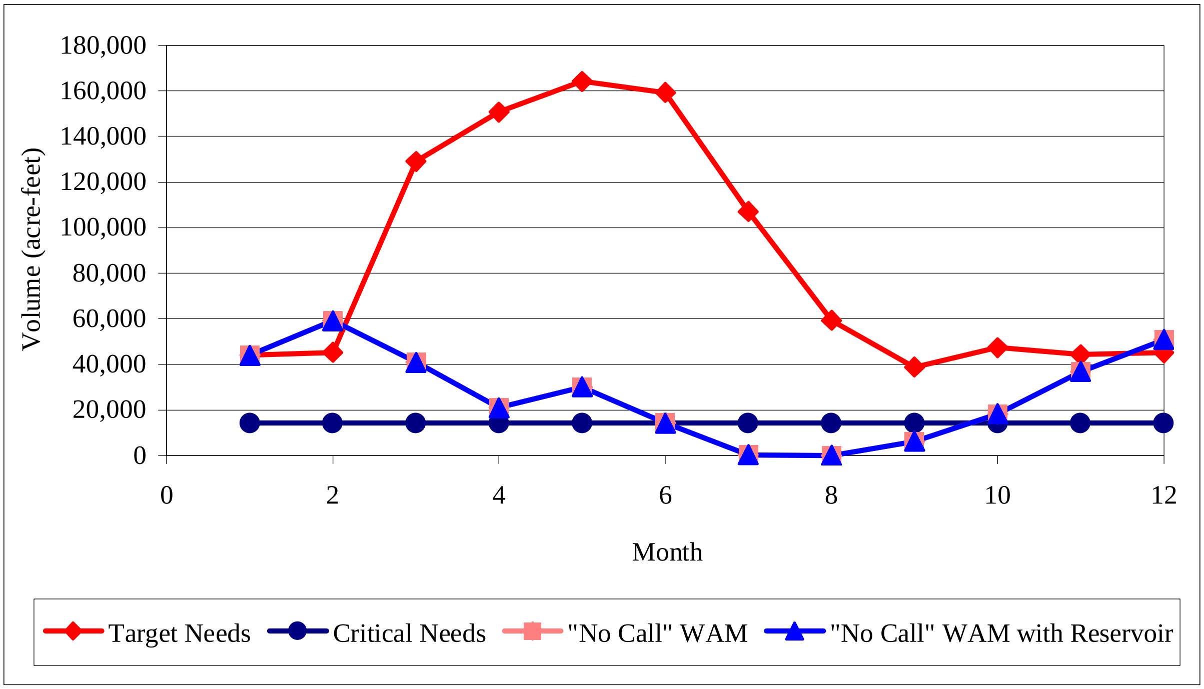
Refer to the bolded paragraph on Page 4-41.

Figure 4.11: Year 2000 Bay and Estuary Freshwater Inflow Impacts*



*Comparison between median regulated flows at control point M10000 between "No Call" WAM and "No Call" WAM with Reservoir l. Model output files are included as an attachment to this report.

Figure 4.12: Year 2060 Bay and Estuary Freshwater Inflow Impacts*



*Comparison between median regulated flows at control point M10000 between "No Call" WAM and "No Call" WAM with Reservoir. Model output files are included as an attachment to this report.

4.8.7 Construct Goldthwaite Channel Dam in Mills County

A strategy involving the construction of a new channel dam below the City's existing diversion structure was identified, however, according to the "No Call" WAM Run 3, this strategy would not provide a firm supply of water during the drought-of-record due to the junior status of the reservoir compared to the other water rights in the river.

A strategy to meet water shortages in this eventuality would be to contract with LCRA for water that would be counted against the firm yield of the Highland Lakes. To the extent this contract would potentially affect existing commitments, amendments to LCRA's irrigation water right would be needed for surplus water made available through conservation measures funded under the LSWP.

Analysis

For this strategy, a channel dam below the City's existing diversion structure would be constructed on the Colorado River. This low dam structure would be located approximately 300 feet downstream of the City's existing structure. The channel dam would be approximately 10 feet in height and the construction of this structure would provide a source of water for the City's diversion pumps, allowing the City to continue providing service for a longer period without flow in the river. The water impounded behind this dam would provide a consistent source of water from which to pump, as well as an additional 400 ac-ft/yr; modeling showed that this supply would not be a firm supply during the drought-of-record. The City would consider entering into a partnership with the Fox Crossing Water District, LCRA, or private landowners to construct the channel dam. The actual size and location of this structure should be determined by engineering studies, this report only contains estimated values.

Opinion of Probable Cost

The opinion of probable project costs is presented in *Table 4.85.*

Table 4.85 New Goldthwaite Channel Dam Opinion of Probable Cost

Phase	Cost Opinion
Capital Costs [1]	
Reservoir Construction	$1,405,950
Total Capital Costs	**$1,405,950**
Engineering, Contingencies and Legal Services (35%)	$492,083
Environmental and Archaeological Studies, Mitigation, and Permitting	$432,000
Site Acquisition	$70,200
Interest Accrued During Construction [2]	$287,533
Interest Earned on Unused Principal [2]	($192,074)
Total Project Costs	**$2,495,692**
Annual Costs	
Debt Service (6% for 40 years)	$165,868
Operations and Maintenance	$54,000
Treatment at Existing Plant	$97,335
Total Annual Costs	**$317,203**
Unit Cost of Water ($/ac-ft)	**NA**
Unit Cost of Water ($/1000 gallons)	**NA**

[1] Cost information taken from LCRA report *Cost Estimation and Location of a Channel Dam on the Colorado River Near Goldthwaite, Texas*, May 1998
[2] Interest earned and accrued based on a five (5) year construction period
[3] The adjustment of the firm yield to zero makes it impossible to calculate per unit cost.

Capital costs and additional treatment cost for this strategy were taken from costs developed in the 2001 Region K Plan, and updated to second quarter 2002 dollars using the *Engineering News-Record* (ENR) Construction Cost Index (CCI). Land acquisition, environmental study, and O&M costs were adjusted to second quarter 2002 dollars using the Department of Labor's Consumer Price Index.

Issues and Considerations

The following is a summary of the advantages and disadvantages for this alternative:

Advantages

- Operation of the City's water system would remain the same

Disadvantages

- Construction of the dam would require acquisition of land or the rights to inundate land
- Construction of a channel dam would require a water rights permit amendment
- Construction of a channel dam may have environmental impacts
- Future sedimentation of the reservoir may become an issue
- Implementation of this alternative may take several years (3 to 5)

Environmental Impact

No downstream water rights would be affected due to the junior status of the reservoir, and compliance with target bay and estuary inflows would be slightly reduced while compliance with critical inflows may be slightly enhanced. Water quality downstream would be beneficially impacted by reduced sediment loading.

Impacts to Agricultural Resources

No water is diverted from agricultural use and impacts to agriculture should be low to none.

4.8.8 HB 1437 (Region G) for Williamson County

In 1999, the 76th Session of the Texas Legislature enacted HB 1437, authorizing LCRA to transfer up to an additional 25,000 ac-ft/year from the Colorado River Basin to new customers within the Brazos River Basin (in Williamson County). This legislation is now codified at Texas Water Code §222.029. HB 1437 represents a water conservation strategy in which improvements are made in farms and in the irrigation districts that reduce agricultural use of surface water. The legislation allows the transfer only if there is "no net loss" to the Colorado River Basin and requires the adverse effects of the transfer to be mitigated. HB 1437 establishes an Agricultural Water Conservation Fund (Ag Fund) to pay for the mitigation, funded through a conservation surcharge set by the LCRA Board and collected from Williamson County customers. To receive funding from the Ag Fund, the mitigation projects must reduce the reliance of irrigated agriculture in the Colorado River Basin on surface water.

LCRA entered into a contract for a 50-year water sale pursuant to HB 1437. The agreement also includes a clause that allows the Brazos River Authority (BRA) to terminate the agreement after 10 years. At the present time, water transfers from LCRA to Williamson County are expected to begin in 2006 at an initial rate of 600 ac-ft/yr. Projections show that by 2025, the annual volume of water transferred could be as high as 16,000 ac-ft/yr. Currently, this strategy envisions two water conservation projects, implemented in phases that match the demand projections from Williamson County. The proposed plan includes a system of automated check structures and control systems in a LCRA irrigation district (to save approximately 12,000 ac-ft/yr) plus precision land leveling of rice farms (to save approximately 13,500 ac-ft/yr) within the irrigation districts to generate the necessary water saving. Implementation of the first phase of the HB 1437 project is expected to be considered by the LCRA Board in the fall of 2005. Upon approval by the LCRA Board, water transfers to Williamson County will begin in 2006.

This Region G strategy affects Round Rock and Chisholm Trial SUD in Region K (these WUGs are shared by the regions). Other customers of BRA within Region G that are affected include Round Rock, Georgetown, Liberty Hill, and the Chisholm Trial SUD.

Table 4.86 HB 1437 Strategy

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Chisholm Trail SUD	Burnet	Brazos	3	18	31	44	58	71	86
Round Rock	Travis	Colorado		126	246	349	426	536	645
TOTAL			**3**	**144**	**277**	**393**	**484**	**607**	**731**

Opinion of Probable Cost

The total estimated construction cost to implement these strategies is $23,624,000. Today, the expected HB 1437 customers pay the current LCRA raw water rate of $115 per ac-ft for water diverted and $57.50 per ac-ft for water reserved but not diverted, and a 25 percent surcharge on all fees collected for water. These surcharge funds will be used to fund these strategies. HB 1437 customers in Williamson County will fund most of the implementation of these strategies through payment of the surcharge. Including the surcharge, the two municipal WUGs listed above will pay a unit cost of $143.75/ac-ft.

Issues and Considerations

The LCRA Board has yet to adopt a formal definition of “no net loss” or approve specific strategies for implementing HB 1437. Action is likely to occur in the fall 2005. Further, some issues have been raised regarding the interaction of HB 1437 and the LSWP (See Chapter 8, Unresolved Issues, for more information).

Environmental Impact

The transfer of water anticipated under HB 1437 would constitute an inter-basin transfer to the Brazos River Basin. With this distinction comes the potential for environmental impacts from the introduction of invasive species and issues resulting from mixing water supplies from multiple sources. The greatest potential impacts on the Colorado River Basin would result from the reduced streamflow resulting from the transfer.

It is difficult to quantify the impacts of this strategy on environmental conditions at this planning stage. A diversion point to the Brazos River Basin will have to be determined, as well as the specific strategies of the Ag Fund for creating no net loss in surface water, before these impacts can be modeled. However, it can be assumed that there would be a reduction in instream flows downstream from the point of diversion to the Brazos River Basin to the point at which the Ag Fund strategies are implemented. However, LCRA will continue to meet the environmental flow requirements as specified in its WMP. The magnitude of these effects will have to be determined once these details become available.

Impacts to Agriculture

This strategy will provide money for agricultural conservation and will not take water that agriculture is currently using so the impacts will be low to none.

4.9 IRRIGATION WATER MANAGEMENT STRATEGIES

Region K has 281 WUGs and 30 are Irrigation. The existing water supplies available to the irrigators in Region K are not sufficient to meet the projected needs. A shortage would occur in all decades of the planning period should the critical drought be repeated. Using the "No Call" version of the November 2004 WAM with no return flows and assuming full use of the ROR irrigation rights to meet irrigation demands in those districts, the maximum annual shortage is projected to decrease from just over 248,000 ac-ft/yr in 2000 to approximately 116,000 ac-ft/yr in 2060. The calculated shortages are expected to decrease due to projected decreases in the amount of acreage placed in rice production. However, these estimated shortages require an upward adjustment to reflect LCRA's strategy for meeting other municipal and industrial firm demands, which includes amending its existing ROR rights to meet these other demands. *Table 4.87* shows the water needs for all of the Irrigation WUGs in Region K and the number of WUGs with water deficits for each decade, and *Table 4.88* shows the irrigation needs for the rice counties in Region K.

Table 4.87 Irrigation Water Needs (ac-ft/yr)

Category Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Irrigation	(248,208)	(218,550)	(197,660)	(179,196)	(161,554)	(144,573)	(116,320)
No. of WUGs	14	14	13	12	12	11	11

Table 4.88 Rice Irrigation Water Needs (ac-ft/yr)

County Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Colorado	(62,060)	(53,902)	(46,664)	(39,663)	(32,886)	(26,297)	(19,990)
Matagorda	(110,374)	(97,445)	(90,482)	(83,776)	(77,352)	(71,171)	(65,215)
Wharton	(74,857)	(66,601)	(60,057)	(55,355)	(50,994)	(46,787)	(30,820)
TOTAL	**(247,291)**	**(217,948)**	**(197,203)**	**(178,794)**	**(161,232)**	**(144,255)**	**(116,025)**

Rice irrigators in Colorado, Wharton, and Matagorda Counties have the largest irrigation needs in Region K. LCRA's strategies to be implemented as part of its sale of water to Williamson County under HB 1437 and those contained within the LSWP are designed to minimize the impacts of these projects to the available water supply for irrigation and otherwise extend the availability of interruptible water supply to meet irrigation demands beyond that which would be expected without the LSWP. The recommended plan to meet the rice irrigation shortage that is reflected in the LSWP is based on recommendations presented by the Irrigation Water Supply Working Group of the LCRWPG for the 2001 Plan. This Working Group included several rice irrigators, representatives from the affected counties, a representative from LCRA, environmental representatives, and representatives interested in the impacts on the Highland Lakes. The recommended plan includes the following components, in priority order. The strategies, which are outlined in detail under Section 4.9 rely heavily on implementation of the LSWP.

Table 4.89 Rice Irrigation Water Management Strategies

Rice Irrigation Strategies	2000	2010	2020	2030	2040	2050	2060
Continued Use of Austin Return Flows	14,603	17,163	19,723	22,283	24,842	27,402	29,962
Continued Use of Downstream Return Flows [1]	0	0	0	150	600	1,125	1,500
Water Management Plan-Interruptible Water Supply	241,607	238,156	162,892	123,534	84,176	44,819	5,461
On-Farm Conservation [2]			36,519	36,519	36,519	36,519	36,519
Irrigation District Conveyance Improvements [2]			46,184	46,184	46,184	46,184	46,184
Conjunctive Use of Groundwater [3]			62,000	62,000	62,000	62,000	62,000
Development of New Rice Varieties [2]			35,297	35,297	35,297	35,297	35,297
LSWP Subtotal			*180,000*	*180,000*	*180,000*	*180,000*	*180,000*
Firm up ROR With Off-Channel Reservoir							47,000
HB 1437	0	4,000	4,000	4,000	4,000	14,800	25,000
Supply Reduction due to LSWP							(71,381)
Transfer ROR Supply to Municipal and Industrial	(24,000)	(38,769)	(42,769)	(50,769)	(57,769)	(67,769)	(90,487)
TOTAL	**232,210**	**220,550**	**323,846**	**279,198**	**235,849**	**200,377**	**127,055**

Note: Limited simulations were conducted for only 2000 and 2060 in view of time and budget constraints. Information for other decades was interpolated from the 2000 and 2060 results.

[1] The downstream return flows are from Pflugerville and Aqua WSC.

[2] Demand reductions through advanced conservation made available under LSWP were distributed to county-basin irrigation WUGs based on the location of shortages. These estimates continue to be refined as a part of the ongoing LSWP studies and it is anticipated that these needs will be addressed by managing all of the components as a LCRA system.

[3] Groundwater supplies made available under LSWP as shown here are estimated for planning and modeling purposes, and were distributed to county-basin irrigation WUGs based on the location of shortages. The modeling conducted for the LSWP strategy was done assuming a long-term average not to exceed 36,000 ac-ft/yr, 62,000 ac-ft/yr as the 10-year rolling average (repeat of the drought of record), and 95,000 ac-ft/yr as the annual maximum limit. These estimates continue to be refined as a part of the ongoing LSWP studies with development of a site-specific GAM. It is anticipated that these needs will be addressed by managing all of the components as a LCRA system.

For Irrigation WUGs with shortages outside of Colorado, Matagorda, and Wharton Counties, the following regional water management strategies were selected:

- Expansion of Current Groundwater Supplies
- Transfer/Allocate Water From WUGs with Surplus

- Temporary Overdraft of Aquifer

These regional strategies are explained in detail in Section 4.7 of this report.

A discussion of the rice irrigation strategies: Continued Use of Austin Return Flows, Water Management Plan-Interruptible Water Supply, Firm up ROR with Off-Channel Reservoir, the Supply Reduction due to LSWP, and the Transfer ROR Supply to Municipal and Industrial are contained in Section 4.6.1.

4.9.1 On-Farm Water Conservation

The water needed for irrigation in Colorado, Wharton, and Matagorda Counties is the largest deficit identified within the LCRWPA. On-farm water conservation for irrigation is one of the water management strategies developed under LSWP to address the issue.

Analysis

It is anticipated that significant water savings can be achieved through the use of precision land leveling, multiple field inlets, and reduced levee intervals. The estimated amount of water savings from on-farm water conservation from the LSWP 2005 Project Viability Assessment (PVA) for the 2006 LCRWPG Water Plan (CH2M HILL 2005) is 36,519 ac-ft/yr of water savings in an average scenario which is slightly less than the 37,348 ac-ft/yr that the 2001 Region K Water Plan estimated.

The conservation estimate was based on updated estimates of total rice acreage in each irrigation district, and the estimates are slightly different from those used in the 2001 Region K Water Plan.

These estimates will continue to be refined throughout the LSWP study period. Recent changes to the conservation estimates are reflected in the table below.

Table 4.90 On-Farm Conservation Estimates

WUG Name	County	River Basin	Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Irrigation	Colorado	Brazos-Colorado			4,715	4,715	4,715	4,715	4,715
Irrigation	Colorado	Lavaca			9,405	9,405	9,405	9,405	9,405
Irrigation	Matagorda	Brazos-Colorado			2,848	2,848	2,848	2,848	2,848
Irrigation	Matagorda	Colorado			502	502	502	502	502
Irrigation	Matagorda	Colorado-Lavaca			3,617	3,617	3,617	3,617	3,617
Irrigation	Wharton	Brazos-Colorado			11,172	11,172	11,172	11,172	11,172
Irrigation	Wharton	Colorado			150	150	150	150	150
Irrigation	Wharton	Colorado-Lavaca			4,110	4,110	4,110	4,110	4,110
TOTAL					**36,519**	**36,519**	**36,519**	**36,519**	**36,519**

Note: Demand reductions through advanced conservation made available under LSWP were distributed to county-basin irrigation WUGs based on the location of shortages. These estimates continue to be refined as a part of the ongoing LSWP studies and it is anticipated that these needs will be addressed by managing all of the components as a LCRA system.

Rice utilizes significantly more water than other Texas crops because of the growing environment adopted for rice production. Rice is grown in standing water during most of its vegetative and reproductive stages to minimize competition from plants that cannot tolerate standing water, basically as a weed control measure. The flood culture is not required to grow rice, but is almost universally accepted as the most economical method to control weeds and sustain the rice crop.

Shallow levees are used to separate the individual cuts in a rice field. Maintenance of a uniform shallow water depth allows the levees to maintain greater freeboard or levee height above the water surface. If there is insufficient freeboard, rainfall can cause the levees to overtop and fail with the worst-case result being loss of water from the entire field. Minimizing the flooding depth allows the producer to capture rainwater, replacing an equal amount of water that would normally have been diverted from the river or pumped from wells. The amount of water saved can vary with rainfall during the growing season, but can replace a significant quantity of the water normally diverted from the river and minimize the amount of tail water or rice field runoff water that can carry dissolved fertilizer and potential pollutants downstream.

There are many potential on-farm irrigation improvements, but in general water savings can best be achieved by minimizing flooding depth and improving management of the flushing and flooding operations. The techniques that have the most significant impact in accomplishing these goals include precision or laser land leveling, use of a field lateral with multiple field inlets, reducing the vertical interval or elevation difference between levees, improved management of water control activities, and improved recordkeeping. Individual water conservation measures are discussed in the following sections.

Opinion of Probable Cost

The total estimated cost for the LCRA-SAWS Water Project is $1,704,473,000, as developed by the Region L consultant. Per the Definitive Agreement between LCRA and SAWS, SAWS is responsible for LSWP costs. The costs are paid primarily through water use fees and surcharges over the life of the project. Region K is not responsible for the costs associated with the LSWP. *Table 4.91* shows the cost of the various conservation strategies based on second quarter 2002 costs.

Table 4.91 Estimated Unit Cost of Agricultural Conservation Improvements

Improvement	Improvement Cost per Acre
Land Leveling	$108.15
Multiple Inlets	$2.16
Reduced Levee Interval	$0.54
Irrigation Pipeline	$178.44

Issues and Considerations

Table 4.92 On-Farm Conservation Issues

Management Strategy	Environmental Flows	Wildlife Habitat	Cultural Resources	Agricultural Resources	Other Water Resources	Social/Economic
On-Farm Conservation	Reduced irrigation return flows to bay and estuaries.	None anticipated.	None anticipated.	None anticipated.	None anticipated.	Cost exceeds irrigators' ability to pay.

Environmental Impact

On-farm conservation for rice production could influence the instream water balance during dry, summer months in two ways: (1) by reducing the amount of return flows introduced to streams and (2) by reducing the amount of water diverted from streams to irrigate for the second rice crop immediately following harvest of the first. The balance of these two impacts could potentially result in a net gain or loss in dry weather instream flows, depending on the farming practices used. First, the reduced application rates required by conservation would negatively impact return flows to streams, which occur during the summer months when this discharge can provide habitat for species and other ecological services. However, following the harvest of the first rice crop, a certain acreage is flooded again to grow a second crop to be harvested in September and October. Second, conservation could have a positive impact on instream flows by reducing the amount of water diverted to provide for rice irrigation at this time.

The overall balance of return flows and withdrawals for this period was estimated from information that was originally assembled for calculating irrigation water demands in Colorado, Matagorda, and Wharton Counties. The ratios of water used for first and second crops for both groundwater and surface water irrigated fields for each county were used to divide the expected conservation, as estimated by LCRA, between the first and second crops. It was assumed that all water that could be conserved by on-farm practices was water that would otherwise be discharged to streams in return flows. In addition, return flows were assumed to be 4 inches for all fields before conservation. The expected surface water withdrawals after implementing conservation were then used to determine an overall balance for water being returned and diverted during the summer.

Results

Table 4.93 shows the instream water balance resulting from recommended conservation in Colorado, Matagorda, and Wharton Counties. This analysis shows that the reduction in return flows to streams is of a greater magnitude than the reduced diversions for irrigating the second crop resulting from conservation. For instance, in Colorado County, the amount of water reentering the streams from rice fields would be reduced by nearly 5,500 ac-ft after conservation, while conservation would only reduce the diversion of water from streams by just under 4,000 ac-ft. Therefore, although on-farm conservation would result in lower average diversions throughout the year and greater average instream flows, the practice would result in a net reduction in instream flows during the summer when flows are typically at their lowest. This is due to the larger number of acres farmed for the first crop than the second crop and because reduced return flows from both groundwater and surface water irrigated lands are impacted by conservation while instream flows only benefit from reduced surface water diversions.

Table 4.93 Anticipated On-Farm Conservation for Rice Crops and Summer Instream Flows [1]

		Colorado	Matagorda	Wharton	Notes
Summer Return Flows	Before Conservation	10,900	9,594	6,739	2
	After Conservation	5,401	4,400	1,825	
	Net Change	(5,499)	(5,194)	(4,914)	
Summer Surface Water Diversions	Before Conservation	66,459	42,502	28,102	3
	After Conservation	62,494	40,212	25,475	
	Net Change	(3,965)	(2,290)	(2,627)	
Net Change in Summer Instream Flows		(1,534)	(2,904)	(2,287)	4

[1] These figures were produced following rice irrigation assumptions developed by the planning group for each of the three counties (i.e. application rate, percent of total acreage for second crop, etc.). Current typical return flows were estimated to be approximately 4 in-ac/ac.
[2] Includes return flows related to summer rice harvests for both fields irrigated with groundwater and surface water. Does not include return flows related to flushing associated with planting of the first crop in the spring.
[3] Includes water required for growth of the second crop for surface water irrigated fields only.
[4] Represent the benefits to instream flows resulting from reduced diversions, less the reduction in return flows associated with conservation.

If this strategy were implemented along with the use of new rice varieties, return flows occurring later in the year would be reduced, but there would be no diversions made for a second crop. Therefore, conservation effects would only negatively impact summer instream flows by reducing the volume of return flows. The implementation of off-channel storage recommended in the comprehensive LCRA-SAWS plan can potentially offset the impacts of conservation by maintaining streamflow during dry periods for at least a portion of the river, depending upon the location. These reservoirs will receive at least a portion of their supply from stored rights which will provide some replacement streamflow.

4.9.1.1 Laser Land Leveling

In the production of rice, there are many benefits to having fields that are almost level but still have some slope for drainage, typically 0.15 foot or less in elevation change for 100 feet of distance. An almost level field will allow a more uniform shallow water depth across the field, reducing the total amount of water applied to the field. Land grading can give a field this desired condition by using a laser-guided grader. Precision leveling or land grading can reduce the amount of water used by 25 to 30 percent and increase production by 10 to 15 percent.

Interest in conservation in the rice industry is almost exclusively confined to those rice growers who own their own land. In that case, improvements benefit the landowner and make sense economically, particularly when there is matching grant money available from the Natural Resources Conservation Service. However, in many cases, land is leased on an annual basis for rice production. There is no long-term agreement between the landowner and farmer. This makes it difficult for the farmer to justify a significant capital expenditure, and limits the amount of land where precision leveling is being implemented. The topography and soil type also may limit the amount of land where this practice could be implemented.

4.9.1.2 Use of Multiple Field Inlets

Another method used by rice producers to conserve water is the utilization of multiple field inlets for applying water to the individual cuts or land sections between levees. The use of multiple inlets allows for many benefits that result in water savings. The water savings is further enhanced when multiple inlets are applied in combination with land leveling. The most significant benefits are the ability to apply water where it is needed and at a shallower depth. Because of the shallow water, rice production is increased while the total water applied is minimized. A side lateral with multiple inlets is often paired with a similar drain, as opposed to draining all water from a field through the lowest cut. This allows the field to drain much quicker, shortening the time to harvest and increasing the potential for production of a ratoon crop.

4.9.1.3 Reduced Levee Intervals

Another approach to minimizing the water depth is to reduce the typical contour interval between levees from 0.2 feet to 0.15 feet. The cost associated with making this change can be very minimal with only a few additional levees plowed into place at the beginning of the rice growing season. The smaller interval allows average flooding depth to be minimized, which is both more compatible with the current dwarf varieties of rice that are grown and allows more freeboard for capturing rainfall. The levees themselves can also be smaller resulting in not only less rice being grown on the levees because they are narrower, but the yield from rice grown on the levees is less impacted. Smaller levees also result in less wear and tear on equipment that must cross the levees during production and harvest. Reducing the levee interval can save about 0.3 feet per acre irrigated when used in conjunction with precision land leveling and 0.4 feet per acre irrigated when applied without precision leveling.

4.9.1.4 Combining Land Leveling With Multiple Field Inlets

Several combinations of conservation practices could be evaluated, but the LCRWPG Rice Irrigation Working Group decided that the most common combined approach that would result in the greatest water savings would be the combination of land leveling with the use of multiple inlets. In many cases the farmers that use these two conservation practices may also implement a reduced levee interval, but the cost associated with the additional combination of conservation practices becomes less discernible as does the water savings.

4.9.2 Irrigation District Conveyance Improvements

The water needed for irrigation in Colorado, Wharton, and Matagorda Counties is the largest deficit identified within the LCRWPA. Irrigation district conveyance improvement is one of the water management strategies developed under LSWP to address the issue.

Analysis

In addition to the water conservation measures implemented on-farm, substantial water can be saved by improving the efficiency of the canal systems that deliver water to the individual irrigator. These improvements would include improving the flow control structures by adding checks structures, automating the operation of the flow control structures, and adding flow regulating reservoirs to balance flows.

The 2004 LSWP PVA estimated 76,891 ac-ft/yr of water savings from improved efficiency of rice irrigation delivery system by the irrigation districts in an average scenario. The 2001 Region K Plan estimated an amount of 45,650 ac-ft/yr of water savings from this water management strategy. The improved efficiency of rice irrigation delivery system savings amount adopted for the 2006 Region K Water Plan is 46,184 ac-ft/yr. This amount is obtained as a difference between the total LSWP irrigation savings dedicated to Region K of 118,000 ac-ft/yr and the total of the other two estimated LCRA-SAWS irrigation savings strategies.

The PVA analysis estimates a higher savings amount for this strategy compared to the Region K water plan because the former takes the water savings by Garwood and Pierce Ranch Water Districts into account which have been acquired by LCRA since the 2001 Region K Water Plan was developed.

These estimates will continue to be refined throughout the LSWP study period. Recent changes to the conservation estimates are reflected in the table below.

Table 4.94 Irrigation District Conveyance Improvement Estimates

WUG Name	County	River Basin	Draft Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Irrigation	Colorado	Brazos-Colorado			5,930	5,930	5,930	5,930	5,930
Irrigation	Colorado	Lavaca			11,704	11,704	11,704	11,704	11,704
Irrigation	Matagorda	Brazos-Colorado			3,755	3,755	3,755	3,755	3,755
Irrigation	Matagorda	Colorado			631	631	631	631	631
Irrigation	Matagorda	Colorado-Lavaca			3,808	3,808	3,808	3,808	3,808
Irrigation	Wharton	Brazos-Colorado			13,951	13,951	13,951	13,951	13,951
Irrigation	Wharton	Colorado			166	166	166	166	166
Irrigation	Wharton	Colorado-Lavaca			6,239	6,239	6,239	6,239	6,239
TOTAL					**46,184**	**46,184**	**46,184**	**46,184**	**46,184**

Note: Demand reductions through advanced conservation made available under LSWP were distributed to county-basin irrigation WUGs based on the location of shortages. These estimates continue to be refined as a part of the ongoing LSWP studies and it is anticipated that these needs will be addressed by managing all of the components as a LCRA system.

Opinion of Probable Cost

The total estimated cost for the LCRA-SAWS Water Project is $1,704,473,000, as developed by the Region L consultant. Per the Definitive Agreement between LCRA and SAWS, SAWS is responsible for LSWP costs. The costs are paid primarily through water use fees and surcharges over the life of the project. Region K is not responsible for the costs associated with the LSWP.

Issues and Considerations

Table 4.95 Irrigation District Conveyance Improvement Issues

Management Strategy	Environmental Flows	Wildlife Habitat	Cultural Resources	Agricultural Resources	Other Water Resources	Social/Economic
Irrigation Delivery System Improvements	Reduced irrigation return flows to bay and estuaries.	None anticipated.	None anticipated.	None anticipated.	None anticipated.	Cost exceeds irrigators' ability to pay.

Environmental Impact

The improvement of existing irrigation conveyances that provide water to farms will allow for customers to be served with fewer losses in transmission. This will result in a reduced overall demand for water and will reduce the volume of diversions that will have to be dedicated to maintaining flow in canals. This may be environmentally beneficial to instream flows in certain portions of the basin, but transfer of water out of the basin may not be beneficial to bay and estuary freshwater inflows or instream flows in the lower portions of the Colorado River.

4.9.3 Conjunctive Use of Groundwater Resources

The water needed for irrigation in Colorado, Wharton, and Matagorda Counties is the largest deficit identified within the LCRWPA. Conjunctive use of groundwater from the Gulf Coast aquifer during drought is one of the water management strategies developed under the LSWP to address the issue.

Analysis

This water management strategy would involve the construction of 43 wells scattered throughout the Lakeside and Gulf Coast Irrigation Districts. The wells in the Lakeside District would be completed into Evangeline and Chicot Formations. The wells in the Gulf Coast District would be completed into the Chicot Formation. Groundwater would be pumped from these wells into the irrigation canal systems during drought conditions when surface water availability is not sufficient to meet the demands.

It was anticipated in the 2001 Plan that conjunctive use of groundwater in LCRWPA could generate an average yield of 62,000 ac-ft/yr during a repeat of the drought of record. The 2005 PVA of LSWP confirmed that at least 62,000 ac-ft/yr of groundwater should be available to support agriculture in the Lower Colorado River Basin on average, and the maximum yield could well exceed 100,000 ac-ft/yr (CH2M HILL 2005). The preliminary analysis performed for the viability study is to be refined by the detailed studies during the LSWP study period. For the 2006 Plan, a value of 62,000 ac-ft/yr is shown in the tables by decade as representing the average annual pumping during the 10 year drought of record conditions. An annual maximum year pumpage of 95,000 acre-feet annually was used in the modeling of the conjunctive use system. Estimated yield of water from this strategy by WUG is presented in *Table 4.96*.

Table 4.96 Development of the Gulf Coast Aquifer Estimated Yield

WUG Name	County	River Basin	Draft Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Irrigation	Colorado	Brazos-Colorado			4,886	4,886	4,886	4,886	4,886
Irrigation	Colorado	Lavaca			9,920	9,920	9,920	9,920	9,920
Irrigation	Matagorda	Brazos-Colorado			14,437	14,437	14,437	14,437	14,437
Irrigation	Matagorda	Colorado			1,473	1,473	1,473	1,473	1,473
Irrigation	Matagorda	Colorado-Lavaca			13,553	13,553	13,553	13,553	13,553
Irrigation	Wharton	Brazos-Colorado			12,766	12,766	12,766	12,766	12,766
Irrigation	Wharton	Colorado			532	532	532	532	532
Irrigation	Wharton	Colorado-Lavaca			4,433	4,433	4,433	4,433	4,433
TOTAL					**62,000**	**62,000**	**62,000**	**62,000**	**62,000**

Note: Groundwater supplies made available under LSWP as shown here are estimated to be annual maximums, and were distributed to county-basin irrigation WUGs based on the location of shortages. These estimates continue to be refined as a part of the ongoing LSWP studies and it is anticipated that these needs will be addressed by managing all of the components as a LCRA system.

Groundwater aquifers located within the three rice irrigation counties are a potential source of water for the irrigators. These groundwater resources could be developed in a manner to be used conjunctively with the existing surface water supply. The groundwater wells would only be used to provide water when the surface water available was not sufficient to meet the demands in conjunction with advanced conservation for LSWP and HB 1437. During these drought conditions, water would be pumped from the ground and released into the irrigation distribution canals.

Modeling Performed for 2000 Region K Water Planning

In the 2001 Plan, three alternative scenarios were evaluated to supplement the supply of water to the Lakeside and Gulf Coast Irrigation Districts with groundwater. The three scenarios included various levels of average groundwater dependence, 25,000 ac-ft/yr, 50,000 ac-ft/yr, and 100,000 ac-ft/yr. It was assumed that the wells would be constructed so that they would be scattered throughout the two irrigation districts. All of the wells in the Gulf Coast Irrigation District were assumed to be located within the Chicot Formation of the Gulf Coast aquifer. For the 25,000 ac-ft/yr alternative, all of the wells in the Lakeside Irrigation District would be in the Evangeline Formation. For the 50,000 and 100,000 ac-ft/yr alternatives, one-third of the wells in the Lakeside Irrigation District would be in the Chicot Formation, and the remainder would be in the Evangeline Formation.

The three alternatives were modeled using the Gulf Coast aquifer hydrologic model to determine the temporary and long-term impacts of the conjunctive use alternatives. The demand for groundwater was simulated based on results from the LCRA's Response Model for various levels of irrigation demands, which incorporates the following assumptions:

- A full drought cycle was modeled based on the 1941 to 1965 historic rainfall condition.
- The drought cycle would begin in the year 2026 and continue through 2050.

- If groundwater pumping is required, it would occur during the first six months of the year.
- The modeling cycle was extended by 10 years to evaluate the aquifer recovery after the drought cycle.
- Each well would have a capacity of 2,000 gpm, which equates to an annual capacity of 1,613 ac-ft based on 6 months of operation.
- The number of wells required was based on the peak demand plus 10 percent.
- The projected demands for groundwater from other WUGs were imposed on the model at the same time.

The number of wells required for each of the alternative scenarios is presented in *Table 4.97.*

Table 4.97 Number of Wells Required for Conjunctive Use

Aquifer	25,000 ac-ft/yr Conjunctive Use	50,000 ac-ft/yr Conjunctive Use	100,000 ac-ft/yr Conjunctive Use
Lakeside District			
Evangeline	16	12	24
Chicot	0	5	11
Gulf Coast District			
Chicot	17	20	42

The conjunctive use of the groundwater wells will have both short-term and long-term impacts on groundwater levels in the region. The predicted impacts on these two formations are presented in *Table 4.98.*

Table 4.98 Impact of Conjunctive Use on Aquifer Levels (ft)

Formation	No Conjunctive Use	25,000 ac-ft/yr Conjunctive Use	50,000 ac-ft/yr Conjunctive Use	100,000 ac-ft/yr Conjunctive Use
Evangeline Formation				
Maximum Short-Term Drawdown	30	90	100	190
Maximum Long-Term Drawdown	30	40	50	60
Chicot Formation				
Maximum Short-Term Drawdown	10	75	90	170
Maximum Long-Term Drawdown	10	12	12	15

As the table indicates, the model results show that the Chicot Formation will almost fully recover following the drought cycle. In addition, the maximum temporary aquifer drawdowns in the Chicot Formation are associated with pumpage from the Gulf Coast District. The temporary drawdowns in the Lakeside District are smaller. The Evangeline Formation is shown to have much larger temporary drawdowns and does not fully recover following the drought cycle.

This alternative was specifically evaluated for the Lakeside and Gulf Coast Irrigation Districts. However, it may be possible to obtain similar results through the conjunctive use of groundwater in the Pierce Ranch Irrigation District.

Status of Modeling for the Current Plan Development

The Groundwater Availability Model for the Gulf Coast aquifer was not completed in time to do a baseline conditions run. For that reason, the availability of groundwater in Colorado, Matagorda, and Wharton Counties was based on the last plan numbers for Colorado County, and the amounts for Matagorda and Wharton Counties were taken from the respective management plans of the groundwater districts in those areas.

Modeling was not done for the future strategies for this project because of the potential for conflict between the PVA noted above and the Region K plan. The LSWP is a long term process that will include significant additional modeling of the aquifer to include the Pierce Ranch contributions, if any, as well. The model results from the LSWP process will be provided to the two groundwater conservation districts (GCD) for their review and comments as a part of the LSWP process. For this version of the plan, the amount of 95,000 ac-ft/yr, annual maximum, is accepted for planning purposes only, however groundwater pumpage is further constrained to a 36,000 ac-ft/yr long term average.

Consistency with Plans of Local Groundwater Conservation Districts

Matagorda and Wharton Counties have existing groundwater conservation districts, each of which have developed groundwater management plans based on the estimation of the sustainable amounts of groundwater that can be produced annually. The addition of the of 95,000 ac-ft/yr annual maximum of groundwater planned for the LSWP to be available during the drought, when added to the existing and proposed groundwater uses of these two counties, will cause the total groundwater demand to exceed the sustainable supplies as defined by the Coastal Bend GCD (Wharton County) and the Coastal Plains GCD (Matagorda County). The amount of additional groundwater to be produced will be produced only during a DOR condition when surface water is not available. Surface water is less expensive to produce and will be chosen over groundwater when it is available. This will allow the aquifer to recover during times of more plentiful surface water. This strategy will require the concurrence of the two GCD noted above.

Opinion of Probable Cost

The total estimated cost for the LSWP is $1,704,473,000, as developed by the Region L consultant. Per the Definitive Agreement between LCRA and SAWS, SAWS is responsible for LSWP costs. The costs are paid primarily through water use fees and surcharges over the life of the project. Region K is not responsible for the costs associated with the LSWP. The portion of these costs related to development of groundwater assumed development of wells that pump the annual maximum amount of groundwater or 95,000 ac-ft/yr.

Issues and Considerations

Table 4.99 Conjunctive Use of Groundwater Issues

Management Strategy	Environmental Flows	Wildlife Habitat	Cultural Resources	Agricultural Resources	Other Water Resources	Social/Economic
Conjunctive Groundwater Use	Increased irrigation return flows to bay and estuaries.	None anticipated.	None anticipated.	None anticipated.	Localized drawdowns of aquifer may affect wells.	Cost exceeds irrigators' ability to pay.

Environmental Impact

- Sustained water fowl habitat.
- Decreases in aquifer level; however, no known significant springs in the area are currently flowing so decreased spring flow would not be an issue.

The use of groundwater supplies to augment surface water diversions during dry periods can potentially sustain rice irrigation during a drought of record. This strategy would introduce groundwater to streams through return flows when there would normally be very little streamflow. This could potentially benefit instream flows in certain portions of the basin, though this water would be diverted from the basin before it could make a positive impact on instream flows and bay and estuary freshwater inflows in the lower portions of the river. Maintaining the acreage of planted rice during dry periods would also provide beneficial habitat for waterfowl.

Increased demands on the aquifer caused by this strategy could result in both short term and long term impacts to aquifer levels. Impacts to existing wells may occur from this additional drawdown. No significant springs are known to be fed by the aquifers in the lower counties of the basin, and therefore there would be no impact to wildlife from short-term increased withdrawals from groundwater. If drawdowns become severe enough to impact rice acreage, the reduced acreage would have a negative impact on wildlife habitat and return flows.

Impacts to Agriculture

This strategy could have both positive and negative impacts on agriculture. Those producers using surface water will have access to sufficient water to grow crops that would not otherwise have been available. However, those producers using primarily groundwater will probably see increased costs for bringing water to the surface for use. These increases will be small, and additional modeling will be needed to determine whether they occur only during the heavy pumping through the drought of record or if the potential long term drawdowns are still present.

4.9.4 Development of New Rice Varieties

The water needed for irrigation in Colorado, Wharton, and Matagorda Counties is the largest deficit identified within the LCRWPA. Development of high yielding/water efficient rice varieties is one of the water management strategies developed under the LSWP to address the water shortage for irrigation.

Analysis

Estimates of savings were originally based on the 2004 PVA of LSWP, but ongoing studies have continued to refine the estimates. Results of the 2005 PVA with the most recent changes to the conservation estimate are reflected in the table below. These amounts assume 100 percent adoption of the new rice variety.

The table below presents the water that the irrigation WUGs would save by implementing this strategy.

Table 4.100 Development of New Rice Varieties

WUG Name	County	River Basin	Draft Water Management Strategies (ac-ft/yr)						
			2000	2010	2020	2030	2040	2050	2060
Irrigation	Colorado	Brazos-Colorado			4,548	4,548	4,548	4,548	4,548
Irrigation	Colorado	Lavaca			9,047	9,047	9,047	9,047	9,047
Irrigation	Matagorda	Brazos-Colorado			2,661	2,661	2,661	2,661	2,661
Irrigation	Matagorda	Colorado			486	486	486	486	486
Irrigation	Matagorda	Colorado-Lavaca			3,468	3,468	3,468	3,468	3,468
Irrigation	Wharton	Brazos-Colorado			10,924	10,924	10,924	10,924	10,924
Irrigation	Wharton	Colorado			144	144	144	144	144
Irrigation	Wharton	Colorado-Lavaca			4,019	4,019	4,019	4,019	4,019
TOTAL					**35,297**	**35,297**	**35,297**	**35,297**	**35,297**

Note: Demand reductions through advanced conservation made available under LSWP were distributed to county-basin irrigation WUGs based on the location of shortages. These estimates continue to be refined as a part of the ongoing LSWP studies and it is anticipated that these needs will be addressed by managing all of the components as a LCRA system.

The availability and cost of water for rice irrigation are key factors in the continued economic viability of the rice industry in the region. Reducing the amount of water needed to irrigate the rice fields would provide the producers a financial benefit, while at the same time address the overall water supply shortage within the basin. Agricultural research has been successful in developing new varieties of crops that meet specific requirements. The development of new, high yield-low water use rice varieties could provide a significant reduction in the water demands.

According to the LSWP report, a study has been conducted by Texas A&M University on the development of a new rice variety. It estimates that this new variety would produce a 24 percent water savings (based on a two-crop system using approximately 3.5 ac-ft/ac of water), take slightly longer to grow, and produce a higher yield. This alternative would eliminate the ratoon crop due to the longer growing season, thus eliminating the income produced by that crop. However, since this variety has a higher yield and would require only one crop, the profits should increase.

Opinion of Probable Cost

The total estimated cost for the LSWP is $1,704,473,000, as developed by the Region L consultant. Per the Definitive Agreement between LCRA and SAWS, SAWS is responsible for LSWP costs. The costs are paid primarily through water use fees and surcharges over the life of the project. Region K is not responsible for the costs associated with the LSWP.

Issues and Considerations

Table 4.101 Development of New Rice Varieties Issues

Management Strategy	Environmental Flows	Wildlife Habitat	Cultural Resources	Agricultural Resources	Other Water Resources	Social/Economic
Development of New Rice Varieties	Reduced reliance on instream surface water	Potential reduction in migratory geese habitat	None anticipated.	None anticipated.	None anticipated.	Cost exceeds irrigators' ability to pay.

This alternative is a concern to the waterfowl hunting industry because of their dependency on the second crop. It is unclear as to how this will affect the income of this industry.

Environmental Impact

The development of new rice varieties that require less water for production would decrease the demand for surface water resources in the LCRWPA and allow more water to be retained instream for ecological uses in some portions of the basin. However, this water would, ultimately, be diverted to Region L before its beneficial impacts on instream flows and bay and estuary inflows were realized in the lower basin. Use of a rice variety that would increase efficiency by eliminating the need for a second crop may limit habitat for waterfowl later in the year, although the primary migratory waterfowl season occurs later in the year.

Impacts to Agricultural Resources

The overall impact on agriculture from the implementation of this strategy should be beneficial. The implementation of a single rice variety that provides the same approximate yield that is now produced from a first and a second crop, will lead to savings in labor and machinery cost in not having to manage and harvest two crops.

4.9.5 HB 1437

HB 1437 requires water being transported out of the Colorado River Basin to the Brazos River Basin to be replaced to the extent that there is no net loss of surface water in the Colorado River Basin. One of the methods for replacing that water is through on-farm conservation in the lower three counties. Through the HB 1437 process, farmers within LCRA's irrigation districts will receive funding of about 80 percent of the total costs, with farmers bearing 20 percent of the cost for implementing laser land leveling for conservation savings. In 2nd Quarter 2002 numbers, this is estimated to cost $14,518,500 for the total 25,000 ac-ft of water expected to be saved in the later decades of the planning horizon by such strategy. *Table 4.102* below lists each of the irrigation WUGs in Region K that will utilize this strategy and the corresponding cost estimates for each. The total estimated cost to be paid by Region K farmers was divided among the various irrigation WUGs based on the amount of supply to be provided to that WUG by the strategy.

Table 4.102 HB 1437 Strategy for Irrigation WUGs

WUG Name	County	River Basin	Total Capital Cost	Total Project Cost	Largest Annual Cost	Unit Cost ($/ac-ft)
Irrigation	Colorado	Brazos-Colorado	$0	$0	$0	$0
Irrigation	Colorado	Lavaca	$0	$0	$0	$0
Irrigation	Matagorda	Brazos-Colorado	$1,417,001	$1,417,001	$123,541	$10.13
Irrigation	Matagorda	Colorado	$23,230	$23,230	$2,025	$10.13
Irrigation	Matagorda	Colorado-Lavaca	$998,870	$998,870	$87,086	$10.13
Irrigation	Wharton	Brazos-Colorado	$418,131	$418,131	$36,455	$10.13
Irrigation	Wharton	Colorado	$23,230	$23,230	$2,025	$10.13
Irrigation	Wharton	Colorado-Lavaca	$23,230	$23,230	$2,025	$10.13

Environmental Impact

On-farm conservation for rice production could influence the instream water balance during dry, summer months in two ways: (1) by reducing the amount of return flows introduced to streams, and (2) by reducing the amount of water diverted from streams to irrigate for the second rice crop immediately following harvest of the first. The balance of these two impacts could potentially result in a net gain or loss in dry weather instream flows, depending on the farming practices used. First, the reduced application rates required by conservation would negatively impact return flows to streams, which occur during the summer months when this discharge can provide habitat for species and other ecological services. However, following the harvest of the first rice crop, a certain acreage is flooded again to grow a second crop to be harvested in September and October. Second, conservation could have a positive impact on instream flows by reducing the amount of water diverted to provide for rice irrigation at this time.

The overall balance of return flows and withdrawals for this period was estimated from information that was originally assembled for calculating irrigation water demands in Colorado, Matagorda, and Wharton Counties. The ratios of water used for first and second crops for both groundwater and surface water irrigated fields for each county were used to divide the expected conservation, as estimated by LCRA, between the first and second crops. It was assumed that all water that could be conserved by on-farm practices was water that would otherwise be discharged to streams in return flows. In addition, return flows were assumed to be 4 inches for all fields before conservation. The expected surface water withdrawals after implementing conservation were then used to determine an overall balance for water being returned and diverted during the summer.

Impacts to Agricultural Resources

The proposed overall strategy replaces water supplies moved to other uses. As long as the alternative supplies are provided and provided in a timely manner, there should be no negative impact on agriculture.

4.10 LIVESTOCK WATER MANAGEMENT STRATEGIES

Region K has 281 WUGs, 30 are Livestock. *Table 4.103* shows the water needs for all of the Livestock WUGs in Region K and the number of WUGs with water deficits for each decade.

Table 4.103 Livestock Water Needs (ac-ft/yr)

Category Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Livestock	(188)	(188)	(188)	(188)	(188)	(188)	(188)
No. of WUGs	6	6	6	6	6	6	6

The following regional water management strategies were selected to meet these Livestock needs:

- Expansion of current groundwater supplies
- Development of new groundwater supplies

These regional strategies are explained in detail in Section 4.7 of this report.

4.11 MANUFACTURING WATER MANAGEMENT STRATEGIES

Region K has 281 WUGs, 30 are Manufacturing. *Table 4.104* shows the water needs for all of the Manufacturing WUGs in Region K and the number of WUGs with water deficits for each decade.

Table 4.104 Manufacturing Water Needs (ac-ft/yr)

Category Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Manufacturing	(2,171)	(4,315)	(9,617)	(14,409)	(16,056)	(20,297)	(22,096)
No. of WUGs	6	6	9	10	10	10	11

Several strategies have been identified to meet manufacturing WUG needs. The following regional water management strategies were selected to meet some of these Manufacturing needs:

- Expansion of current groundwater supplies
- Transfer/Allocate water from WUGS with surplus
- Temporary overdraft of aquifer

These regional strategies are explained in detail in Section 4.7 of this report. Some of these WUGs also utilize contract renewals as a strategy, as discussed in to Sections 4.6.1.4 and 4.6.2.3.

4.12 MINING WATER MANAGEMENT STRATEGIES

Region K has 281 WUGs, 30 are Mining. *Table 4.105* shows the water needs for all of the Mining WUGs in Region K and the number of WUGs with water deficits for each decade.

Table 4.105 Mining Water Needs (ac-ft/yr)

Category Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Mining	(437)	(13,550)	(13,146)	(12,366)	(6,972)	(5,574)	(5,794)
No. of WUGs	1	6	7	7	6	6	6

The following regional water management strategies were selected to meet these Mining needs:

- Expansion of current groundwater supplies
- Development of new groundwater supplies

These regional strategies are explained in detail in Section 4.7 of this report.

4.13 STEAM ELECTRIC POWER WATER MANAGEMENT STRATEGIES

Region K has 281 WUGs, 30 are Steam Electric Power. *Table 4.106* shows the water needs for all of the Steam Electric Power WUGs in Region K and the number of WUGs with water deficits for each decade.

Table 4.106 Steam Electric Power Water Needs (ac-ft/yr)

Category Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Steam Electric	0	0	(401)	(27,720)	(81,467)	(86,351)	(112,867)
No. of WUGs	0	0	1	2	3	3	4

Several strategies have been identified to meet steam electric power WUG needs. The following regional water management strategy was selected to meet some of these Steam Electric Power needs:

- Expansion of current groundwater supplies

This regional strategy is explained in detail in Section 4.7 of this report.

The following sections provide a description, analysis, and cost breakdown for the other steam electric power strategies.

4.13.1 LCRA Steam Electric Water Management Strategies

LCRA has assumed, as part of its strategies discussed in Section 4.6.1, that it will make additional water available to meet shortages in steam electric power water needs from the operation of its system. LCRA intends to use a portion of its Garwood water right to meet its own demand at the Fayette Power Project, although this would require an amendment of the Garwood water right.

4.13.2 COA Steam Electric Water Management Strategies

The City of Austin has steam electric power needs in Fayette, Matagorda, and Travis Counties. Austin's portion of the South Texas Project (STP) demand is included in the STP total steam electric demand in Matagorda County, and is therefore not addressed here. *Table 4.107* shows the steam electric water demands in Fayette and Travis Counties.

Table 4.107 COA Steam Electric Power Water Demand (ac-ft/yr)

County Name	2000 Demand	2010 Demand	2020 Demand	2030 Demand	2040 Demand	2050 Demand	2060 Demand
Fayette – Austin's portion	7,502	14,622	14,702	18,002	25,742	25,742	31,652
Travis	7,494	17,500	18,500	22,500	23,500	27,500	28,500
TOTAL	**14,996**	**32,122**	**33,202**	**40,502**	**49,242**	**53,242**	**60,152**

To meet Austin's steam electric power needs, Austin has identified three main water management strategies. These are COA ROR water rights, LCRA firm water supply contracts, and water reuse—both direct and indirect. These are summarized in *Table 108* showing the steam electric water management strategies in Fayette and Travis Counties.

Table 4.108 COA Steam-Electric Water Management Strategies (ac-ft/yr)

COA Supplies & Strategies	2000	2010	2020	2030	2040	2050	2060
Supplies							
COA Run of River (Steam Electric - Fayette)	1,426	1,312	1,198	1,084	970	856	741
LCRA Contract (Steam Electric - Fayette)	3,500	3,500	3,500				
Strategies							
Indirect Reuse (Steam Electric) Fayette		9,810	10,004	13,418	21,272	21,386	27,411
LCRA Contract Renewal (Steam Electric - Fayette)				3,500	3,500	3,500	3,500
Fayette Total	**4,926**	**14,622**	**14,702**	**18,002**	**25,742**	**25,742**	**31,652**
Supplies							
COA Run of River (Steam Electric - Decker & Town Lake)	8,187	8,165	8,143	8,121	8,099	8,077	8,054
LCRA Contract (Steam Electric Decker & Town Lake)	30,860	30,994	31,128	31,262	31,396	31,530	
Strategies							
Direct Reuse (Steam Electric) Travis		1,680	2,881	7,083	8,285	12,486	13,690
LCRA Contract Renewal (Steam Electric Decker & Town Lake)							31,665
Travis Total	**39,047**	**40,839**	**42,152**	**46,466**	**47,780**	**52,093**	**53,409**
Total Steam-Electric *	**43,973**	**55,461**	**56,854**	**64,468**	**73,522**	**77,835**	**85,061**
**Town Lake Surplus ** **		**(17,392)**	**(17,493)**	**(17,594)**	**(17,695)**	**(17,796)**	**(17,898)**

*Note that some of the projected surplus is due to the contract for water at Decker exceeding projected demand at Decker.

**This water was allocated to the contract for firming Austin's Town Lake steam electric water right with a Highland Lakes release of firm water in *Table 3.27*. However, due to the location of this firmed water relative to the needs, alternate steam electric water management strategies are utilized by COA to meet the steam electric needs identified in this plan.

It is anticipated that there will be additional infrastructure needed. The probable costs associated with the Austin's direct reuse water management strategy for supplying steam electric needs in Travis County are estimated to be approximately $445/ac-ft (see reclaimed cost Section 4.6.2.2, *Table 4.34*). Further, it is anticipated that there will be additional long-term costs associated with Austin's indirect steam electric power water management strategy to meet its projected shortages at the Fayette Power Project over the planning period. It is expected that there will be infrastructure costs associated with increasing the capacity of the pump station, and associated infrastructure, as well as other potential costs. However, it is assumed that these anticipated long-term costs would be essentially the same for all feasible alternatives, and are therefore not quantified here.

4.13.3 STP Nuclear Operating Company Water Management Strategies

The STP Nuclear Operating Company (STPNOC)'s water demand is reflected in *Table 2.10*. This demand is based on higher availability of generation capacity and blowdown of the reservoir to maintain water quality. Without constituting a waiver of any arguments that may be made in litigation or pending or potential contested cases, this demand during the 50-year planning horizon will be satisfied significantly through (1) the management strategies of continued run-of-the-river diversions of up to 102,000 ac-ft/yr, either under Certificate of Adjudication No. 14-5437[3] or under STPNOC's pending water rights application, if granted;[4] (2) continued use of STPNOC's existing off-channel reservoirs authorized under Certificate of Adjudication No. 14-5437; and (3) continued pumpage of groundwater for the purposes of incorporation in STPNOC's processes. Supplementing its run-of-the-river diversions, STPNOC also has a contract with LCRA for stored water through the year 2030. In addition to the potential for contested-case hearings on several competing water-rights applications currently pending with the agency, STPNOC's run-of-the-river diversion management strategy is subject to various planning uncertainties related to pending litigation with LCRA regarding ownership of run-of-the-river water rights upon termination of the current contract. Language in Section 4.16 reflects the agreements reached on this approach for addressing consistency with the regional plan for this strategy.

Refer to Section 1.2.2 for socioeconomic information related to the STP and Section 3.2.1.1.2 for a description of reservoir operation. Based on current projections completed for the 2006 Lower Colorado Regional Water Plan (Region K), shortages of 14,400 ac-ft/yr or more have been identified commencing as early as 2030 for Steam Electric supplies in Matagorda County during a repeat of the DOR, refer to *Table 4.109)*. It is of additional note that STPNOC's run-of-the-river diversions can be affected by water quality at the STPNOC diversion point. In order to support a long-term reliable electric supply for Texas, alternative strategies have been identified for offsetting these shortages and to guard against the continuing escalation in upstream demands which may affect water quality at the current permitted diversion point.

Table 4.109 Steam-Electric Shortages in Matagorda County (ac-ft/yr)

Category Name	2000 Needs	2010 Needs	2020 Needs	2030 Needs	2040 Needs	2050 Needs	2060 Needs
Steam Electric Matagorda County	21,644	7,593	7,594	(14,405)	(52,668)	(52,718)	(52,766)

In order to ensure a long-term, cost-effective water supply beyond expiration of the current LCRA contract in 2030, this regional plan anticipates renegotiation and renewal of contractual supplies to

[3] STPNOC's interest in the water rights evidenced in the certificate are as agent for the STPNOC owners, the City of San Antonio acting through the City Public Service Board, COA, and Texas Genco, LP.

[4] STPNOC's pending application does not involve capital costs (uses the same facilities that would be used to divert water pursuant to Certificate of Adjudication No. 14-5437) nor is it anticipated to increase environmental impacts (continues the same flow restrictions, diversion limitations, and consumptive use limitations) or to impact agricultural resources or other water resources (considering new junior priority date for an existing water use and STPNOC's location as the last diversion point on the river). Significantly, the Application states that: "[STPNOC] agrees to a special condition that in the event it is ultimately determined that the South Texas Project Participants have all rights under Certificate of Adjudication No. 14-5437 upon expiration of the contract with LCRA or sooner, specifically including the sole authorized right to divert and use 102,000 ac-ft per annum from the Colorado River with priority date of June 10, 1974, Applicant's additional appropriation of 102,000 ac-ft of water per annum under this application will be voluntarily relinquished by Applicant." The Application also includes the cancellation of the earlier right under the limited circumstances described therein.

supplement run-of-the river diversions. Additional and alternative strategies include but are not limited to the following:

- Desalination of brackish water (*Table 4.110* on Page 4-130)
- Rainwater harvesting
- Subordination of upstream senior water rights
- Dedication of return flows from other users

Conservation also is an integral part of STPNOC's operational philosophy as documented in the Water Conservation Plan filed with the TCEQ.

4.13.3.1 Desalination

The current interest in desalination practices to expand the universe of available supplies of water has generated STPNOC's interest in a management strategy that would use either seawater or brackish groundwater to meet a need for its steam electric power generation cooling water and/or plant process water. The recent advances in membrane technology and energy recovery have resulted in lower costs for treatment of brackish groundwater and seawater than have ever been seen before. In addition, the Tampa Bay project has demonstrated that there may be significant cost savings in collocating a desalination facility with a power generation facility, both from the standpoint of the energy consumption of such a facility but also of the types of facilities and general environment of power plants.

STPNOC has developed the desalination strategy based on a recent publication by Dr. Charles Holland with Texas A&M University, in cooperation with Sandia National Laboratories, which looked at the feasibility of coupling desalination of brackish groundwater or seawater with nuclear power plants. Basic cost information was generated with that publication, and the costs presented with this strategy will be based on that work.

STPNOC proposes to generate 26.4 million gallons per day of fully treated desalinated water in a desalination plant which will be located on the existing STPNOC holdings. The plant would need a raw water source with a capacity of 40 to 50 million gallons per day, depending upon the source of the raw water feed to the plant. If brackish groundwater is used as the source of supply, then the amount of pretreatment required will be minimized as compared to a surface seawater source. Some anti-scaling and anti-fouling treatments will be needed as a minimum for groundwater if low turbidity groundwaters can be produced in the area. Treatment for a seawater intake will be much more extensive and costly, and can include ultra or nano-filtration, dissolved air flotation, chemical coagulation and clarification, and other suspended solids removal processes.

The proposed desalination facilities will produce one or more waste streams that must be managed. The primary waste stream from a brackish groundwater desalination facility will be a concentrated salt byproduct stream. The salts from the brackish groundwater source will be concentrated in this stream. Options for disposal of this material include a surface discharge to tidally influenced areas, a subsurface discharge into the Gulf of Mexico, and deep well injection. The actual disposal option to be used will require extensive research into the alternatives and is not known at this time. As will be noted below, the estimated costs for a brackish groundwater desalination facility assumed the use of deep well injection for salt solution disposal.

Seawater reverse osmosis will require additional treatment in terms of suspended solids removal, and this additional treatment will also result in a waste stream. The most probable disposal of the sludges produced in this operation is landfilling.

Despite historically high operating costs, seawater desalination holds several advantages for Region K, including:

- Provides drought-proof water supply from a constant supply source.
- Provides a high quality water supply that surpasses most drinking water standards and can support industrial applications requiring very stringent water quality standards.
- Provides a diverse solution for providing an additional water supply as an alternative to typical groundwater and surface water sources.
- Reduces demand for raw surface water that can be used to reduce other shortages.

A desalination facility located in Matagorda County could be utilized to offset some of the identified steam electric shortages. Power generation facilities at this location would be able to partially replace or augment their supplies with a reliable, high-quality water supply from an alternative source that would reduce water-quality issues that have been encountered in the past. Additionally, surface water diversion rights from the Colorado River could be managed consistent with other demands and priorities in the lower basin, especially during drought conditions. STPNOC requested that this strategy be recommended for implementation in 2010.

The most important factor in the viability of a desalination facility in Matagorda County relates to the escalating demands on and associated costs of surface water from the Colorado River for existing and future steam electric demands beyond 2030. These factors along with the water quality issues associated with the existing diversion point within the tidal reaches of the Gulf of Mexico make desalination a reasonable alternative. The desalination facility could be used to supply other freshwater needs in the area within or outside the region from this strategic location.

Permit requirements for the implementation of the project are expected to be minimal, as the facility could be located on existing property associated with the STP. This location will minimize further impacts on threatened and endangered species, wetlands, and other environmental factors, which have already been evaluated under existing permits and licenses. Permits for diversions from the Colorado River may be amended to allow for the plant's operation when that portion of the river is under tidal influence or for the development of a separate intake from the Gulf of Mexico. Waste-stream discharge will require a separate Texas Pollutant Discharge Elimination System (TPDES) discharge permitted outfall.

Environmental and Other Impacts

There is some potential impact on instream and bay and estuary flows related to a desalination facility at the South Texas Project. If the desalination facility uses brackish groundwater to produce the water that is needed, then there will be a need to manage the byproduct salt solution. This material could be in the range of 10,000 to 20,000 parts per million of total dissolved solids (TDS). Discharge of this material to the tidally influenced region of the Colorado River may be feasible, but the impacts of the additional dissolved solids, as well as constituents such as boron will have to be investigated to determine whether or not the concentrating process will increase harmful ions to the point of being a problem for the environment. If seawater desalination is practiced, it is more likely that an offshore discharge will be required. This discharge would most likely be made to an area of 30 feet in depth or greater, to allow maximal dispersion of the salt plume in the water column and minimize any detrimental effects. The potential effects of trace ions and the impact of concentrating them will also need to be accounted for in seawater desalination.

Some additional potential environmental impacts would be related to the potential degradation of the quality of the groundwater in the vicinity of the proposed wells, the impacts of the additional demand on springflows, and the management of the byproducts such as concentrated salt solution. The current groundwater availability models do not include quality information or capability to model changes in water quality. For that reason, it is not possible to determine whether or not the flows being pumped will impact the overall quality of the aquifer in this area. There are no known springs in the area, so it is unlikely there would be any negative impacts from reduced springflow. Management of the concentrated salt solution by deep well injection should adequately confine the materials within deep aquifers with similar salt concentrations to minimize any negative impacts.

Impacts to Agricultural Resources

This strategy does not put increased demand on water supplies already being used by agriculture and does not move supply from agricultural uses to other usage. As a result, there is no anticipated impact on agricultural resources.

Opinion of Probable Costs

The recommended desalination alternative for meeting the steam electric water shortages in Matagorda County is the use of brackish groundwater for a desalination facility feed source. The plant would be sized to provide 26.4 million gallons per day, or 29,568 acre feet annually. Water from this strategy can be produced for an estimated $430/acre foot. This is slightly less than one half of the cost of water from a seawater desalination facility. This strategy would require the location of and drilling of wells capable of supply between 40 and 50 million gallons per day of brackish groundwater. The Gulf Coast aquifer has significant capacity in brackish water at the STPNOC location and development of the wells on STPNOC property greatly simplifies the addressing of environmental and permitting issues. Use of groundwater will require minimal pretreatment, as discussed previously, although some specific pretreatment will be required to reduce scaling or fouling of the membranes to ensure long membrane life. Raw water for this strategy was assumed to contain approximately 2,500 mg/l of total dissolved solids. This cost estimate is further based on deep well injection as the method of disposal of the concentrated salt solution produced in the desalination process. Other studies have looked at disposal methods such as concentration to a solid and reuse of the materials, but there is no cost effective means to accomplish this at the present time. Water would be produced on the STPNOC site with minimal piping needed to take it to the point of use within the existing or proposed plant units.

Table 4.110 Matagorda County Desalination (BWRO) Opinion of Probable Cost

Matagorda County Desalination (BWRO)	Cost Opinion
Assumptions	
Levelized Fixed Charge Rate	8.729%
Interest During Construction Rate	6.00%
Construction Period (years)	2.0
General Escalation Rate [1]	3.00%
Base Year for Dollars [1]	2000
Commercial Operation [1]	2002
Water Usage (acre-ft/year)	**29,568**
Capital Costs (BWRO)	
BWRO Plant	$36,597,000
Well Fields	$8,888,000
Concentrate Disposal	$9,411,000
Storage Tanks	$4,705,000
Transmission Pipeline	$7,319,000
Total Capital Costs	**$66,920,000**
Additional Project Costs	
Engineering, Contingencies and Legal Services (35%)	$23,422,000
Environmental and Archeological Studies, Mitigation, and Permitting	$52,000
Site Acquisition	$0
Interest Accrued During Construction [1]	$6,143,200
Interest Earned on Unused Principal	$0
Total Additional Project Costs	**$29,617,200**
Total Project Costs	**$96,537,200**
Annual Costs	
Labor	$416,000
Chemicals	$1,040,000
Electricity (assumes $0.06/kWh)	$2,080,000
Membrane Replacement	$728,000
Annualized Total Project Cost	$8,426,777
Total Annual Costs	**$12,690,777**
Unit Cost of Water ($/ac-ft)	**$429.21**

Note: BWRO- Brackish Water Reverse Osmosis

[1] To calculate the *Interest Accrued During Construction*, or IDC, the 2000 capital cost was escalated to the mid-point of construction (i.e. 1 year) at the general escalation rate (3.00 percent), after which time the interest during construction rate (6.00 percent) was applied for the last year. Costs taken from NP 2010 Texas Gulf Coast Nuclear Feasibility Study, ED FC07-041D14543 (February 2005). For inclusion in this plan, capital costs for this strategy were updated to second quarter 2002 dollars using the Engineering News-Record (ENR) Construction

Cost Index (CCI). Land acquisition, environmental study, O&M, and other annual costs were adjusted to second quarter 2002 dollars using the Department of Labor's Consumer Price Index.

4.13.3.2 Rainwater Harvesting

STPNOC has proposed rainwater harvesting as a potential management strategy for meeting steam electric power generation water shortages for Matagorda County. STPNOC currently operates a Main Cooling Reservoir with a surface acreage of 7,000 acres and a maximum permitted storage of 202,600 ac-ft, plus a 47-acre Essential Cooling Pond at their facilities in Matagorda County. Both of these reservoirs are currently represented in the WAM models that were developed for the "No Call" scenario. These reservoirs are fed by a ROR diversion right which is backed up by an LCRA contract up to a total maximum development of 102,000 ac-ft/yr. These reservoirs have a required low water level of approximately 59,000 ac-ft to provide necessary reliability of storage for cooling water for STPNOC's nuclear power generation plant. While these facilities are included in the model, there is no separate firm yield calculated for the storage, primarily because of the requirement to maintain a large minimum storage pool.

Since the reservoir is included in the model, the calculations of rainfall and evaporation from the surface are included in the computations of reservoir surface elevations. STPNOC estimates that an inch of rainfall falling upon the surface of the reservoirs translates into potentially 580 ac-ft of water in storage per rainfall occurrence. While the WAM only computes reservoir surfaces on a monthly basis, the impact of significant rainfall is felt on a daily basis if certain significant rainfall events were to occur. In this instance, if the reservoir is modeled as calling for water from the ROR, the water that is otherwise supplied by rainfall results in a potential supply to instream flows to the bay and estuary. Since there is a 6-day travel time between the Highland Lakes and the STP diversion location, any intervening rain cannot be subtracted from the release of inflows that have already been made to satisfy the STPNOC demand as well as meet the freshwater inflow requirements for the bay. Therefore, allowing up to 580 ac-ft to flow by its diversion location may not provide any additional benefit to the yield of the Highland Lakes. In addition, this small amount of water provided at unpredictable times may have a significant impact.

Total Cost $0

Capital Cost $0. All of the necessary infrastructure is already in place to lift water from the river

O&M Cost $0. There is actually a reduction in O&M cost as the water does not have to be pumped from the river into STPNOC's reservoirs

Firm Yield 0 ac-ft annually. It is not possible to come up with a firm yield computation with the current models. However, it is possible to estimate the reduction in the ROR draw based on the amount of rainfall that occurs during the DOR. Amounts of diversion foregone would be larger during years of normal rainfall.

Analysis

STPNOC provided rainfall information from data collected by its plant personnel. The rainfall data covered the period from 1996 through 2004. Annual rainfall during that period ranged from 12.35 inches per year for the low to 58.55 inches per year for the high. These rainfall amounts translate to 7,279 ac-ft/yr under the lowest annual rainfall to approximately 34,000 ac-ft during the highest annual rainfall period. Average rainfall for the area is reported by STPNOC as 42 inches per year and that translates to approximately 24,000 ac-ft/yr.

The entire cooling water need for STPNOC is met either through run of the river diversions or through contract water from LCRA released from the Highland Lakes. In either event, the scheduling of releases is such that rainfall impacting the STPNOC reservoir in small amounts during dry periods does not provide sufficient warning to LCRA to curtail releases, or the plant will not have the cooling water it needs if it doesn't rain, given the amount of time it takes water to travel from the Highland Lakes to STPNOC's location in Matagorda County. As a result, the only potential beneficiary of this water is the instream and bay and estuary flows. This small amount of water provided at unpredictable times may not have a significant benefit to the bay.

Issues and Considerations

There are no known environmental drawbacks from the strategy. It is currently in place and intercepting rainwater. While it is not possible to quantify the amounts of water expected from this strategy, there is certainly a benefit to reducing water drawn from the river, either ROR flows or flow released from storage. Since it is dependent upon rainfall, it is not considered a firm yield supply.

4.14 COUNTY SUMMARIES OF WATER MANAGEMENT STRATEGIES

Table 4.111 contains the total of all of the water management strategies in each county.

There are a few strategies that involve the transfer/allocation of water from a WUG with a surplus to a WUG with a shortage. The amount of water transferred/allocated was included in the table as a strategy, but the corresponding negative shortage (subtraction from surplus) was not included in the table since these totals are going to be compared to the true shortages (WUGs that do not have surpluses). Also, the reduction in LCRA commitments for Travis County Steam-Electric Power and the reduction in LCRA Commitment for Llano County Steam Electric Power due to Improved Efficiency (Ferguson) were not included in the total water management strategy values in the table below because they are only reducing existing surpluses.

Table 4.111 Water Management Strategy County Summary (ac-ft/yr)

County	2000	2010	2020	2030	2040	2050	2060
Bastrop	361	4,647	6,384	8,238	10,042	22,561	29,032
Blanco	226	226	826	826	826	834	864
Burnet	500	1,803	3,120	6,963	12,030	14,463	15,879
Colorado	62,480	63,712	116,440	93,882	76,660	52,180	25,426
Fayette	122	10,142	10,699	17,936	26,127	26,780	33,330
Gillespie	0	0	0	0	0	0	0
Hays	0	7,053	7,729	12,496	13,274	16,660	18,779
Llano	718	995	2,508	2,665	2,824	4,301	4,762
Matagorda	111,042	128,391	191,427	176,358	189,586	185,249	142,545
Mills	715	698	647	618	555	559	544
San Saba	0	33	42	39	35	34	35
Travis	3,125	19,723	41,183	83,064	100,113	134,459	328,174
Wharton	58,871	66,813	62,062	57,416	55,171	49,940	39,721
Williamson	0	1,544	1,484	2,378	2,303	2,275	2,275
TOTAL	**238,160**	**305,780**	**444,551**	**462,879**	**489,546**	**510,295**	**641,366**

Table 4.112 shows the difference between *Table 4.15* (County and Regional Water Supply Condition Summary Excluding Surpluses, which shows the total shortages in each county) and *Table 4.111* (Water Management Strategy County Summary, which shows the strategies for each county). The result is that all of the shortages in Region K are being met from 2010 through 2060, and in some instances there are surpluses due to the strategy implementation. There are also some additional surpluses in counties that contained WUGs that did not have any shortages and had some excess water above their demands; these surpluses are not accounted for in this table.

These surpluses in *Table 4.112* are a direct result of strategy implementation and will change as strategies values are studied, refined, and updated.

Table 4.112 Comparison of County Shortages Versus Total County Strategies (ac-ft/yr)

County	2000	2010	2020	2030	2040	2050	2060
Bastrop	0	227	295	293	91	0	0
Blanco	181	103	656	633	615	600	600
Burnet	(15)	185	386	1,667	5,740	5,750	5,759
Colorado	295	1,111	61,563	46,842	37,541	21,073	454
Fayette	0	9,810	9,603	3,603	53	97	100
Gillespie	0	0	0	0	0	0	0
Hays	0	4,987	2,459	4,708	2,814	474	0
Llano	(70)	190	1,639	1,798	1,859	2,050	2,096
Matagorda	610	30,888	96,408	69,680	50,374	48,795	10,991
Mills	(56)	1	1	0	0	0	0
San Saba	0	33	42	39	32	31	30
Travis	457	11,898	28,108	50,617	63,801	68,693	55,132
Wharton	(15,986)	212	2,005	2,057	4,173	3,153	8,893
Williamson	0	80	50	21	0	0	0
TOTAL	**(14,584)**	**59,725**	**203,215**	**181,958**	**167,093**	**150,716**	**84,055**

4.15 REGIONWIDE WATER MANAGEMENT ALTERNATIVE STRATEGIES EVALUATED

The TWDB rules require the RWPG to evaluate all potentially feasible water management strategies to meet the region's identified demand deficits. Feasibility is based on evaluation criteria established by the TWDB and the RWPG including project cost, unit cost, yield, reliability, environmental impact, local preference, and institutional constraints. Several water management strategies were identified and evaluated in terms of the potential impact on the Lower Colorado Region as a whole. These strategies are discussed in the following sections.

4.15.1 Potential Conservation

The water demands approved by TWDB and the individual Regional Water Planning Groups (RWPGs) have already been adjusted to incorporate the effects of the 1991 State Water Saving Performance Standards for Plumbing Fixtures Act. In addition, RWPGs are required to consider further water conservation measures in their plan or explain reasons for not recommending conservation. In the 2006 LCRWPG Water Plan, conservation was applied to municipal WUGs with identified shortages and a year 2000 per capita water consumption of greater than 140 gpcd as recommended by the Water Conservation Implementation Task Force (WCITF). Additional conservation was applied to the municipal WUGs with shortages and a per capita demand between 100 and 140 gpcd. This section describes an analysis that was performed to determine the possibility for expanding water conservation to municipal WUGs without shortages in the planning area.

There are several WUGs in the LCRWPA that do not have needs. The LCRWPG recommends that these entities consider water conservation as a strategy to lower their per capita water consumption and as a means of extending water supply for the entire region.

Two scenarios for increasing water conservation were proposed and analyzed in the same manner as the original conservation figures developed for the LCRWPA:

Scenario 1 - Apply 0.25 percent savings annually to all municipal WUGs without shortages and with a per capita demand above 140 gpcd.

Scenario 2 - Apply 0.5 percent savings to all municipal WUGs without shortages and with a per capita demand above 140 gpcd; Apply 0.25 percent savings annually to all municipal WUGs with a per capita demand between 100 and 140 gpcd.

Each of the scenarios listed above could be performed in conjunction with conservation practices already recommended earlier in Chapter 4. Conservation in Scenario 1 would be applied until the per capita water demand was between 100 and 140 gpcd, respectively. No conservation would be applied below these respective levels. For Scenario 2, conservation would be applied to municipal WUGs with a demand greater than 140 gpcd until demand dropped below that amount. Conservation was then applied at a rate 0.25 percent for each following decade with the per capita demand not to drop below 100 gpcd. *Table 4.113* shows the amount of water conserved by implementing the conservation practices already outlined in Sections 4.6.2.1 and 4.8.1 and the impacts of practices from each of the two scenarios.

Table 4.113 Anticipated Savings From Municipal Conservation (ac-ft/yr)

Conservation	2000	2010	2020	2030	2040	2050	2060
COA Conservation	2,000	7,600	13,000	18,800	25,000	29,500	33,537
Municipal Conservation	0	2,947	6,104	9,205	11,834	14,706	17,778
Additional Municipal Conservation	0	28	168	407	1,055	2,227	3,928
Scenario 1	0	264	580	990	1,485	2,106	2,949
Scenario 2	0	1,570	2,276	3,238	4,712	6,426	8,276

Note: The City of Austin conservation program is discussed in Section 4.6.2.1. Municipal conservation and additional municipal conservation is discussed in Section 4.8.1. Scenario 1 and 2 are for municipal WUGs that do not have anticipated shortages at this time.

Anticipated reductions in demand from the two scenarios are considerably less than the expected savings from the strategies already recommended in Sections 4.6.2.1 and 4.8.1.

Opinion of Probable Cost

The conservation cost estimates were developed using information from the TWDB GDS Associates Inc. Study, *Quantifying the Effectiveness of Various Water Conservation Techniques in Texas*, May 2003. The study divided each RWPG into urban, suburban, and rural areas. The urban areas in Region K are comprised of the City of Austin and the City of Round Rock. The suburban areas are Travis, Hays, Bastrop, and Williamson Counties; and all of the other counties are considered rural.

For the cost estimates, the conservation savings were divided into plumbing fixture savings and irrigation savings. The plumbing fixture savings included toilet retrofits, showerhead and aerator replacements, and clothes washer rebates. The irrigation savings included irrigation audits. The total conservation savings calculated for each WUG was proportioned between plumbing fixture savings and irrigation savings using an average of the estimated savings per measure in the study. Then the savings costs for plumbing fixture savings and irrigation savings were calculated using the cost per acre foot estimates in the study. These unit costs were only applied to the incremental savings; therefore, the savings that occur the year before will not have a cost the next year, only the additional savings have a cost associated with them.

The table below contains the percent of plumbing savings versus irrigation savings and the cost per ac-ft for the three categories (urban, suburban, and rural).

Table 4.114 Municipal Water Conservation Savings Unit Costs

Conservation Savings	Percent of Total Savings	Cost per Acre-Foot
Urban		
Plumbing Fixture Savings	32%	$590.16
Irrigation Savings	68%	$455.01
Suburban		
Plumbing Fixture Savings	31%	$473.05
Irrigation Savings	69%	$453.05
Rural		
Plumbing Fixture Savings	30%	$403.35
Irrigation Savings	70%	$432.07

Environmental Impact

The environmental impacts for this strategy are discussed in Section 4.8.1.

4.15.2 Brush Management

Texas rangelands were generally described as grassland or open savanna prior to widespread settlement of the area. The pressure on the vegetation created by grazing animals tended to be light and/or periodic, allowing for the establishment of a robust stand of grass. Tree seedlings that were able to survive the competition with the grass stands tended to perish in wildfires, which periodically occur in "natural" rangelands. Thus, with fire and light grazing pressure, grasslands and savannas were stable and sustainable ecosystems characteristic of many Texas rangelands.

Over time, however, the character of rangelands has been altered through increased grazing and fire suppression activities. These changes allowed the development of large stands of trees and other woody vegetation, termed “brush.” Continuous, often heavy, livestock grazing pressure reduced the ability of grasses to suppress tree seedling establishment. Furthermore, some invasive woody species (e.g., juniper and mesquite) have noxious chemicals in their leaves, resulting in livestock tending to avoid the tree seedlings, while repeatedly grazing the adjacent palatable grasses. This selective grazing behavior gives noxious-tasting tree seedlings a competitive advantage over the native grasses.

These changes have allowed juniper and mesquite trees to dominate large areas of the Edwards Plateau. These species have been documented to adversely affect the water yield from the land (groundwater recharge and surface runoff) due to the significant evapotranspiration rates. It has been documented that juniper and the associated litter have an annual interception loss averaging 73 percent of precipitation, compared with 46 percent interception loss for live oak and 14 percent interception loss for grass (Thurow and Hester 1997). These data indicate that the amount of water reaching the soil is markedly different depending on the type of vegetation.

Brush management as a water supply strategy is currently being investigated within the state of Texas. Both field studies and modeling investigations conclude that water yield increases exponentially as brush cover declines (i.e., very little change in water yield from dense brush cover down to about 15 percent brush cover, and a rapid rise in water yield from 15 percent cover to 0 percent brush cover). These findings imply that it is necessary to have sustained removal of most of the brush cover to maximize water yield potential. This conclusion is corroborated by numerous anecdotal observations by ranchers and agency personnel with brush control experience in the region (C. F. Kelton 1975; Willard, et al. 1993). The exponential pattern of water yield increase relative to a decrease in brush cover has also been postulated for the Colorado River Basin (Hibbert 1983). The exponential relationship is believed to occur because the intraspecific competition among trees (Ansley et al. 1998) and interspecific competition with herbaceous vegetation results in little increase in water yield until the tree density becomes sparse. In other words, trees have a capability for luxuriant water use; thus, if a stand is thinned, the remaining trees will expand their root systems to use the extra water in a short time. Only when the thinning reduces tree cover to less than about 15 percent is an opportunity created for significant yields of surplus water.

The use of brush management to increase the supply of water may provide excellent results for individual owners of large tracts of land. However, brush management on a regional scale requires the cooperation of numerous private landowners. It is not realistic to expect communities like Blanco or Goldthwaite to influence the range management practices of enough landowners to make this alternative a reliable long-term source of water. Although brush management is a preferred water supply strategy within the LCRWPA, the LCRWPG supports efforts to develop brush management on a statewide basis, as indicated in Chapter 6 of the regional water planning report.

4.15.3 Weather Modification

The modern science of weather modification began in 1946. By the 1960s and 1970s, Texas was the site for many weather modification studies, including cloud seeding. Water droplets that form in the atmosphere by condensation of water vapor onto existing particles suspended in the atmosphere are called cloud condensation nuclei (CCN). Concentrations of CCN vary from place to place and even from day to day at a given location and are affected by proximity to cities and industrial areas. The most successful attempts to deliberately modify clouds have involved some modification of the population of CCN on which cloud droplets form, or of the ice nuclei (IN), which are responsible for the appearance of ice and are important in the formation of precipitation in some clouds. The background aerosol or small particle concentration in the atmosphere varies between 1,000 particles per cubic centimeter (cm^3) in clean air, to around 100,000 particles/cm^3 in heavily polluted air. These particles range in size from less than 0.01 microns to over 10 microns in diameter; where one micron is one thousandth of a millimeter. An ambitious cloud seeding program might increase (locally and for a very short time) this atmospheric load by 15 percent in the case of clean air or 0.15 percent in an urban environment. Any nuclei added would be almost immediately swept up into the treated cloud and washed out in the resulting rainfall. Silver iodide, dry ice, and potassium chloride crystals have been used as CCN, none of which are harmful to the environment.

Cloud seeding has been used to reduce hail damage in the High Plains and has been investigated as a means of drought prevention in the Edwards aquifer area, Corpus Christi, and West Central Texas. San Angelo and the Colorado River Municipal Water District in Big Spring sponsored testing to see if weather modification increases the amount of water in lakes and boosts cotton yields.

Different sizes and types of clouds are seeded depending upon the weather modification goal. To lessen hail damage, large thunderstorms likely to produce hail are seeded. To increase rainfall, smaller clouds that are likely to grow are seeded. Successful cloud seeding involves many variables due to the array of environmental conditions and seeding procedures that exist; therefore, a successful seeding program in one region does not guarantee success in another. In addition, the unpredictable nature of weather modification in general continues to fuel debate within the scientific community regarding its validity.

As with brush management, weather modification has demonstrated the capacity to provide additional water to a region, but the results may not provide a reliable quantifiable source of additional water to help meet the demand deficits identified within the LCRWPA. Therefore, these strategies should be dealt with more as long-term best management practices rather than specific water supply options to meet demands. In addition, issues concerning the negative impact on rainfall amounts in areas surrounding the target area persist.

4.15.4 Water Reuse

The use of reclaimed water to meet water demands is increasing in Texas. However, with the exception of the City of Austin's uses, this strategy is not deemed appropriate due to the nature of the identified demand deficits. The municipal needs identified in the Hill Country area are generally isolated and stem from a lack of sufficient storage to draw from during extended dry periods when river flows cease. These municipalities generally restrict non-essential water use when the river stops flowing. Therefore, the use of reclaimed water would not extend their water supply. Use of reclaimed water to meet other needs is discussed in Section 4.5.1 of this chapter.

The COA is currently constructing the major infrastructure needed to allow the use of reclaimed water as an additional source of water. Information concerning the City's Water Reclamation Initiative is presented in Section 4.6.2.2.

4.15.5 Rainwater Harvesting

Rainwater catchment systems provide a source of soft, high-quality water, reduce reliance on wells and other water sources, and can be cost-effective. In light of Texas' current regional water planning efforts and increased attention on conservation and sustainability, a renewed interest in rainwater harvesting has emerged due to the following:

- The escalating environmental and economic costs of providing water by centralized water systems or be well drilling
- Health concerns regarding the source and treatment of polluted waters
- A perception that there are cost efficiencies associated with reliance on rainwater

RWPG and the TWDB should focus on rainwater catchment as a water management strategy and develop specific cost and yield data that will enable the consideration of this strategy as a meaningful source of water.

4.15.6 Additional Studies

Two additional analyses are contained in the appendices to this chapter. These analyses were completed with supplemental funding from TWDB during this planning round, but they were completed after the completion of the Initially Prepared Plan. The Sustainability and Advanced Water Conservation Analyses, contained in *Appendix 4D*, looked at developing policies that would fit the supply available to the population to be served, and also included an analysis of the potential for advanced conservation to provide greater use of the existing supplies. The second study, Dry Year Option, is shown in *Appendix 4E*. This study looked at potential buy out of second crops of rice as a means of providing additional water for other uses, or of reducing the need for pumping groundwater.

4.16 CAVEATS TO IDENTIFIED WATER SUPPLY STRATEGIES

The volumes of water for planning purposes available under various strategies for meeting identified shortages are largely dependent upon information developed from the November 2004 WAM (Run 3), as modified by the “No Call” assumption. The Regional Planning Group has recognized that these are subject to potentially significant changes pending further possible technical refinements to the WAM. Further, the availability of, and the necessity for, some of the identified strategies will be affected by the outcome of pending court litigation and pending or future applications at TCEQ, some of which are already or anticipated to be the subject of contested-case hearing and/or litigation. Three areas where the outcome of these proceedings have the most significant potential for impacting strategies involve: (1) strategies to meet Austin’s demands through indirect reuse of treated effluent, (2) strategies to meet some of the water demands for STPNOC through alternative run-of-the-river water rights, and (3) strategies LCRA has identified to meet various demands through the amendment of existing water rights, the Water Management Plan, or obtaining new permits. These are generally described below.

Resolution of disputes regarding ownership and control of treated effluent once discharged to the river (as more fully described in Chapter 8 Section 8.2.7 could affect how available return flows are incorporated in future regional plans. One way to address this uncertainty would be to evaluate alternative strategies that assume different potential outcomes of that litigation, but this approach was deemed too complicated given the time and resource constraints. Instead, for this planning period, COA’s indirect reuse water supply strategy of using its return flows, transported via the bed and banks of the river, to meet Austin’s steam electric shortages at Fayette Power Project is incorporated into the plan. Alternative strategies such as purchase of raw water are simply listed. It is recognized that outcomes may vary considerably depending on which alternative may ultimately be used, and that further refinement may be necessary; however, the intent of including these strategies was to capture a range of possible strategies that could be used to meet Austin’s long-term demands.

Similarly, while strategies to meet water needs at STP involve the renewal of the water sale contract between LCRA and STPNOC beyond 2030 and assume that the water rights permit associated with the facility is without term and continues beyond the contract term, those issues are both the subject of ongoing litigation between LCRA and STPNOC that involves, among other things, interpretation of existing agreements between LCRA and STPNOC related to the ownership of water rights that currently serve the South Texas Project. Resolution of that dispute will affect whether STPNOC is served under an existing run-of-the river water right with stored water backup from the LCRA's system, or a run-of-the-river water right under STPNOC's pending water rights application, if granted. It is recognized in this instance as well, that outcomes may vary considerably depending on which alternative strategy may ultimately be used; however, it is the intent that the strategies for meeting STPNOC's long-term demands capture the range of these possibilities.

Finally, the potential impacts of various water rights amendments, pending applications for new permits and proposed and possible future revisions to the LCRA Water Management Plan, have raised concerns among other water right holders regarding the impacts to water quality and existing water rights and among environmental interests with special focus on the bay impacts. Whether those applications are ultimately granted by TCEQ and the character and magnitude of any special conditions that might be included to protect existing water right holders or meet environmental requirements, could greatly affect the availability of water. The members of this group recognize that the assumptions regarding special conditions may differ markedly from those ultimately included. Inclusion of such assumptions is not intended to be dispositive on what conditions are believed to be appropriate.

By including alternative strategies in this plan, it was expressly recognized and agreed that participants in this planning process have not waived their right to raise legal arguments for or against those strategies or any applications either currently pending or that may be filed in the future. It was also expressly recognized and agreed that the disposition of strategies and alternatives that are affected by the uncertainties involved in pending litigation and contested-case hearings including as related to the applications listed in Chapter 2 of this plan, is not a basis for considering those alternatives to be inconsistent with this plan and the state water plan.

APPENDIX 4A

WATER MANAGEMENT STRATEGY TABLE

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr) 2000	2010	2020	2030	2040	2050	2060
Shortage/Surplus					5,328	4,350	3,039	1,600	(59)	(5,374)	(7,907)
AQUA WSC	BASTROP	COLORADO	Contract Renewal	Highland Lakes						3,250	3,111
AQUA WSC	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox					59	2,124	4,796
Remaining Surplus/Shortage					**5,328**	**4,350**	**3,039**	**1,600**	**0**	**0**	**0**
Shortage/Surplus					701	467	172	(188)	(591)	(1,113)	(1,782)
BASTROP	BASTROP	COLORADO	Conservation		0	107	254	462	682	813	991
BASTROP	BASTROP	COLORADO	Expand Other Aquifer supply	Other Aquifer						300	791
Remaining Surplus/Shortage					**701**	**574**	**426**	**274**	**91**	**0**	**0**
Shortage/Surplus					1,483	830	698	545	370	142	(144)
BASTROP COUNTY WCID #2	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox							144
Remaining Surplus/Shortage					**1,483**	**830**	**698**	**545**	**370**	**142**	**0**
Shortage/Surplus					1,893	1,026	(1,722)	(3,379)	(5,130)	(7,065)	(9,488)
COUNTY-OTHER	BASTROP	COLORADO	Contract Renewal	Highland Lakes		42	1,392	1,392	1,392	1,392	1,392
COUNTY-OTHER	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox			330	1,987	3,738	5,673	7,172
COUNTY-OTHER	BASTROP	COLORADO	New Carrizo-Wilcox well field (Guadalupe basin)	Carrizo-Wilcox							924
Remaining Surplus/Shortage					**1,893**	**1,068**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					159	135	105	69	29	(23)	(88)
COUNTY-OTHER	BASTROP	GUADALUPE	New Carrizo-Wilcox well field	Carrizo-Wilcox						23	88
Remaining Surplus/Shortage					**159**	**135**	**105**	**69**	**29**	**0**	**0**
Shortage/Surplus					4	1	(3)	(8)	(12)	(19)	(30)
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	Transfer water from Creedmoor-Maha WSC (Travis)	Highland Lakes			3	8	12	19	30
Remaining Surplus/Shortage					**4**	**1**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					712	616	481	327	149	(87)	(395)
ELGIN	BASTROP	COLORADO	Conservation		0	58	41	19	0	0	0
ELGIN	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox						87	395
Remaining Surplus/Shortage					**712**	**674**	**522**	**346**	**149**	**0**	**0**
Shortage/Surplus					1,061	1,046	1,028	1,006	980	948	906
LEE COUNTY WSC	BASTROP	COLORADO	Water transferred to Lee County WSC (Fayette)	Carrizo-Wilcox			(48)	(117)	(171)	(232)	(319)
Remaining Surplus/Shortage After Sales					**1,061**	**1,046**	**980**	**889**	**809**	**716**	**587**
Shortage/Surplus					116	101	79	54	27	(7)	(52)
MANVILLE WSC	BASTROP	COLORADO	Transfer water from Manville (Travis)	Highland Lakes						7	52
Remaining Surplus/Shortage					**116**	**101**	**79**	**54**	**27**	**0**	**0**
Shortage/Surplus					14	7	1	(4)	(10)	(17)	(25)
POLONIA WSC	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox				4	10	17	25
Remaining Surplus/Shortage					**14**	**7**	**1**	**0**	**0**	**0**	**0**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	2000	2010	2020	2030	2040	2050	2060
					Water Management Strategies (ac-ft/yr)						
Shortage/Surplus					143	98	84	53	(50)	(36)	(294)
SMITHVILLE	BASTROP	COLORADO	Conservation		0	20	0	0	0	0	0
SMITHVILLE	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox					50	36	294
Remaining Surplus/Shortage					**143**	**118**	**84**	**53**	**0**	**0**	**0**
Shortage/Surplus					(74)	(61)	(50)	(40)	(31)	(24)	(17)
IRRIGATION	BASTROP	BRAZOS	Expand current Queen City supply	Queen City	40	40	40	40	31	24	17
IRRIGATION	BASTROP	BRAZOS	Temporarily Overdraft Queen City	Queen City	34	21	10				
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(281)	(58)	134	305	450	581	694
IRRIGATION	BASTROP	COLORADO	Expand current Queen City supply	Queen City	281	58					
Remaining Surplus/Shortage					**0**	**0**	**134**	**305**	**450**	**581**	**694**
Shortage/Surplus					15	2	(7)	(17)	(25)	(32)	(44)
MANUFACTURING	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox			7	17	25	32	44
Remaining Surplus/Shortage					**15**	**2**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(6)	(8)	(10)	(11)	(13)	(14)	(16)
MANUFACTURING	BASTROP	GUADALUPE	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox	6	8	10	11	13	14	16
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					711	(4,293)	(4,297)	(4,298)	702	703	702
MINING	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	Carrizo-Wilcox		4,293	4,297	4,298			
Remaining Surplus/Shortage					**711**	**0**	**0**	**0**	**702**	**703**	**702**
Shortage/Surplus					8,874	4,720	2,720	720	(4,030)	(8,750)	(8,750)
STEAM ELECTRIC POWER	BASTROP	COLORADO	Contract Renewal	Highland Lakes					2,750	5,970	5,970
STEAM ELECTRIC POWER	BASTROP	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes					1,280	2,780	2,780
Remaining Surplus/Shortage					**8,874**	**4,720**	**2,720**	**720**	**0**	**0**	**0**
Shortage/Surplus					341	318	290	261	240	212	176
BLANCO	BLANCO	GUADALUPE	Purchase water from Canyon Lake WSC	Canyon Lake			600	600	600	600	600
Remaining Surplus/Shortage					**341**	**318**	**890**	**861**	**840**	**812**	**776**
Shortage/Surplus					(44)	(122)	(169)	(192)	(210)	(233)	(263)
COUNTY-OTHER	BLANCO	GUADALUPE	Purchase water from Canyon Lake WSC (Region L strategy for Canyon Lake WSC)	Canyon Lake	225	225	225	225	225	233	263
Remaining Surplus/Shortage					**181**	**103**	**56**	**33**	**15**	**0**	**0**
Shortage/Surplus					8	8	8	8	8	6	6
COUNTY-OTHER	BLANCO	COLORADO	Water allocated to Manufacturing (Blanco County Colorado basin)	Trinity	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Remaining Surplus/Shortage After Sales					**7**	**7**	**7**	**7**	**7**	**5**	**5**
Shortage/Surplus					(1)	(1)	(1)	(1)	(1)	(1)	(1)
MANUFACTURING	BLANCO	COLORADO	Allocate water from County-Other (Blanco County Colorado basin)	Trinity	1	1	1	1	1	1	1
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**

					Water Management Strategies (ac-ft/yr)						
WUG Name	**County**	**River Basin**	**Water Management Strategy Name**	**Source Name**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Shortage/Surplus					(19)	(58)	(105)	(150)	(186)	(221)	(272)
BERTRAM	BURNET	BRAZOS	Conservation		0	20	44	60	64	69	78
BERTRAM	BURNET	BRAZOS	Expand current Ellenburger-San Saba supply	Ellenburger-San Saba	19	38	61	90	122	152	194
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					5,113	4,979	4,819	4,662	401	227	13
BURNET	BURNET	COLORADO	Contract Renewal	Highland Lakes					4,100	4,100	4,100
Remaining Surplus/Shortage					**5,113**	**4,979**	**4,819**	**4,662**	**4,501**	**4,327**	**4,113**
Shortage/Surplus					(3)	(18)	(31)	(44)	(58)	(71)	(86)
CHISHOLM TRAIL SUD	BURNET	BRAZOS	HB 1437 (Region G)	Highland Lakes	3	18	31	44	58	71	86
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					17	(9)	(177)	(208)	(239)	(271)	(312)
COTTONWOOD SHORES	BURNET	COLORADO	Contract Renewal	Highland Lakes			138	138	138	138	138
COTTONWOOD SHORES	BURNET	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		9	39	70	101	133	174
Remaining Surplus/Shortage					**17**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(18)	(611)	(1,152)	(1,536)	(1,861)	(2,211)	(2,615)
COUNTY-OTHER	BURNET	COLORADO	Contract Renewal	Highland Lakes		345	571	621	651	651	651
COUNTY-OTHER	BURNET	COLORADO	Expand current Trinity supply	Trinity	18	266	581	915	986	1,047	1,047
COUNTY-OTHER	BURNET	COLORADO	Expand current Hickory supply	Hickory					199	199	199
COUNTY-OTHER	BURNET	COLORADO	Expand current Marble Falls supply	Marble Falls					25	314	718
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					503	445	377	(525)	(592)	(669)	(763)
GRANITE SHOALS	BURNET	COLORADO	Contract Renewal	Highland Lakes				830	830	830	830
Remaining Surplus/Shortage					**503**	**445**	**377**	**305**	**238**	**161**	**67**
Shortage/Surplus					73	18	(39)	(96)	(147)	(196)	(253)
KEMPNER WSC	BURNET	BRAZOS	Conservation		0	24	62	111	170	237	321
Remaining Surplus/Shortage					**73**	**42**	**23**	**15**	**23**	**41**	**68**
Shortage/Surplus					(9)	(10)	(11)	(12)	(13)	(14)	(95)
KINGSLAND WSC	BURNET	COLORADO	Contract Renewal								78
KINGSLAND WSC	BURNET	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		10	11	12	13	14	17
Remaining Surplus/Shortage					**(9)**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					33	32	33	34	34	(359)	(402)
LAKE LBJ MUD	BURNET	COLORADO	Conservation		0	18	42	67	96	129	167
LAKE LBJ MUD	BURNET	COLORADO	Contract Renewal	Highland Lakes						389	425
Remaining Surplus/Shortage					**33**	**50**	**75**	**101**	**130**	**159**	**190**
Shortage/Surplus					1,384	1,205	984	(1,238)	(1,452)	(2,693)	(2,984)
MARBLE FALLS	BURNET	COLORADO	Contract Renewal	Highland Lakes				2,000	2,000	3,000	3,000
MARBLE FALLS	BURNET	COLORADO	Conservation		0	143	321	518	735	982	1,269
Remaining Surplus/Shortage					**1,384**	**1,348**	**1,305**	**1,280**	**1,283**	**1,289**	**1,285**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr) 2000	2010	2020	2030	2040	2050	2060
		Shortage/Surplus			(6)	(201)	(430)	(664)	(886)	(1,132)	(1,417)
MEADOWLAKES	BURNET	COLORADO	Conservation		0	60	157	285	436	620	841
MEADOWLAKES	BURNET	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		141	273	379	450	512	576
		Remaining Surplus/Shortage			**(6)**	**0**	**0**	**0**	**0**	**0**	**0**
		Shortage/Surplus			(23)	(23)	(23)	(23)	(23)	(23)	(23)
LIVESTOCK	BURNET	BRAZOS	Expand current Trinity supply	Trinity	23	23	23	23	23	23	23
		Remaining Surplus/Shortage			**0**	**0**	**0**	**0**	**0**	**0**	**0**
		Shortage/Surplus			0	(7)	(10)	(12)	(22)	(24)	(25)
MINING	BURNET	BRAZOS	Expand current Trinity supply	Trinity	0	7	10	12	22	24	25
		Remaining Surplus/Shortage			**0**	**0**	**0**	**0**	**0**	**0**	**0**
		Shortage/Surplus			(437)	(681)	(756)	(788)	(811)	(829)	(873)
MINING	BURNET	COLORADO	Expand current Marble Falls supply	Marble Falls	437	681	756	788	811	829	873
MINING	BURNET	COLORADO	Expand current Ellenburger-San Saba supply	Ellenburger-San Saba							49
		Remaining Surplus/Shortage			**0**	**0**	**0**	**0**	**0**	**0**	**49**
		Shortage/Surplus			(100)	(105)	(109)	(106)	(97)	(93)	(90)
COUNTY-OTHER	COLORADO	LAVACA	Expand current Gulf Coast supply	Gulf Coast	100	105	109	106	97	93	90
		Remaining Surplus/Shortage			**0**	**0**	**0**	**0**	**0**	**0**	**0**
		Shortage/Surplus			(20,235)	(17,635)	(15,328)	(13,097)	(10,937)	(8,837)	(6,827)
IRRIGATION	COLORADO	BRAZOS-COLORADO	Supply Reduction due to LSWP		0	0	0	0	0	0	(7,326)
IRRIGATION	COLORADO	BRAZOS-COLORADO	Transfer supply to M&I		(5,544)	(6,468)	(7,392)	(9,240)	(9,240)	(11,550)	(19,025)
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	4,886	4,886	4,886	4,886	4,886
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	4,715	4,715	4,715	4,715	4,715
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	5,930	5,930	5,930	5,930	5,930
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Develop water conserving rice variety		0	0	4,548	4,548	4,548	4,548	4,548
IRRIGATION	COLORADO	BRAZOS-COLORADO	Continuation of LCRA Water Management Plan for interruptible water	Highland Lakes	25,597	24,062	22,528	16,993	11,459	5,924	390
IRRIGATION	COLORADO	BRAZOS-COLORADO	Continued use of Austin return flows	Colorado ROR	313	520	728	936	1,143	1,351	1,559
IRRIGATION	COLORADO	BRAZOS-COLORADO	Continued use of Downstream return flows	Colorado ROR				6	28	55	78
IRRIGATION	COLORADO	BRAZOS-COLORADO	HB-1437: Water conservation		0	0	0	0	0	0	0
IRRIGATION	COLORADO	BRAZOS-COLORADO	Firm up RoR with off-channel storage		0	0	0	0	0	0	11,220
		Remaining Surplus/Shortage			**131**	**479**	**20,615**	**15,677**	**12,532**	**7,022**	**148**

					Water Management Strategies (ac-ft/yr)						
WUG Name	**County**	**River Basin**	**Water Management Strategy Name**	**Source Name**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Shortage/Surplus					(41,825)	(36,267)	(31,336)	(26,566)	(21,949)	(17,460)	(13,163)
IRRIGATION	COLORADO	LAVACA	Supply Reduction due to LSWP		0	0	0	0	0	0	(14,875)
IRRIGATION	COLORADO	LAVACA	Transfer supply to M&I		(11,256)	(13,132)	(15,008)	(18,760)	(18,760)	(23,450)	(38,627)
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	9,920	9,920	9,920	9,920	9,920
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	9,405	9,405	9,405	9,405	9,405
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	11,704	11,704	11,704	11,704	11,704
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Develop water conserving rice variety		0	0	9,047	9,047	9,047	9,047	9,047
IRRIGATION	COLORADO	LAVACA	Continuation of LCRA Water Management Plan for interruptible water	Highland Lakes	52,611	48,975	45,738	34,502	23,265	12,029	792
IRRIGATION	COLORADO	LAVACA	Continued use of Austin return flows	Colorado ROR	634	1,056	1,478	1,900	2,321	2,743	3,165
IRRIGATION	COLORADO	LAVACA	Continued use of Downstream return flows	Colorado ROR				13	56	113	158
IRRIGATION	COLORADO	LAVACA	HB-1437: Water conservation		0	0	0	0	0	0	0
IRRIGATION	COLORADO	LAVACA	Firm up RoR with off-channel storage		0	0	0	0	0	0	22,780
Remaining Surplus/Shortage					**164**	**632**	**40,948**	**31,165**	**25,009**	**14,051**	**306**
Shortage/Surplus					(14)	(14)	(14)	(14)	(14)	(14)	(14)
LIVESTOCK	COLORADO	COLORADO	Expand current Gulf Coast supply	Gulf Coast	14	14	14	14	14	14	14
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(11)	(11)	(11)	(11)	(11)	(11)	(11)
LIVESTOCK	COLORADO	LAVACA	Expand current Gulf Coast supply	Gulf Coast	11	11	11	11	11	11	11
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					7	(19)	(22)	(23)	(24)	(25)	(26)
MINING	COLORADO	BRAZOS-COLORADO	Expand current Gulf Coast supply	Gulf Coast		19	22	23	24	25	26
Remaining Surplus/Shortage					**7**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					992	(8,450)	(7,925)	(7,072)	(5,919)	(4,483)	(4,642)
MINING	COLORADO	COLORADO	New Other Aquifer well Field	Other Aquifer		4,269	4,269	4,269	4,269	4,269	4,269
MINING	COLORADO	COLORADO	Expand Gulf Coast supply (Colorado basin)	Gulf Coast		3,626	3,626	2,803	1,650	214	373
MINING	COLORADO	COLORADO	Expand Gulf Coast supply (Lavaca basin)	Gulf Coast		555	30				
Remaining Surplus/Shortage					**992**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					94	(100)	(132)	(151)	(168)	(184)	(199)
MINING	COLORADO	LAVACA	Expand current Gulf Coast supply	Gulf Coast		100	132	151	168	184	199
Remaining Surplus/Shortage					**94**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					0	0	0	0	0	(168)	(194)
AQUA WSC	FAYETTE	COLORADO	Contract Renewal	Highland Lakes						168	194
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(34)	(208)	(217)	(116)	(47)	(3)	26
COUNTY-OTHER	FAYETTE	COLORADO	Contract Renewal	Highland Lakes		85	97	97	97	97	97
COUNTY-OTHER	FAYETTE	COLORADO	Expand current Sparta supply	Sparta	34	123	120	19			
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**50**	**94**	**123**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	2000	2010	2020	2030	2040	2050	2060
					Water Management Strategies (ac-ft/yr)						
Shortage/Surplus					(29)	41	93	28	(32)	(25)	(16)
COUNTY-OTHER	FAYETTE	LAVACA	Expand current Gulf Coast supply	Gulf Coast	29				32	25	16
Remaining Surplus/Shortage					**0**	**41**	**93**	**28**	**0**	**0**	**0**
Shortage/Surplus					448	111	(236)	(507)	(719)	(976)	(1,317)
FAYETTE WSC	FAYETTE	COLORADO	Expand current Gulf Coast supply	Gulf Coast			236	428	428	428	428
FAYETTE WSC	FAYETTE	COLORADO	New Other Aquifer well field	Other Aquifer				79	291	548	889
Remaining Surplus/Shortage					**448**	**111**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					39	10	(21)	(45)	(63)	(86)	(116)
FAYETTE WSC	FAYETTE	LAVACA	Expand current Gulf Coast supply	Gulf Coast	0	0	21	45	63	86	116
Remaining Surplus/Shortage					**39**	**10**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(12)	(37)	(59)	(79)	(92)	(110)	(137)
FLATONIA	FAYETTE	LAVACA	Conservation		0	21	43	68	81	83	90
FLATONIA	FAYETTE	LAVACA	Expand current Gulf Coast supply	Gulf Coast	12	16	16	11	11	27	47
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					123	36	(48)	(117)	(171)	(232)	(319)
LEE COUNTY WSC	FAYETTE	COLORADO	Transfer water from Lee County WSC (Bastrop)	Carrizo-Wilcox			48	117	171	232	319
Remaining Surplus/Shortage					**123**	**36**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(23)	(20)	(18)	(16)	(14)	(12)	(10)
IRRIGATION	FAYETTE	LAVACA	Expand current Sparta supply	Sparta	23	20	18	16	14	12	10
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(22)	(22)	(22)	(22)	(22)	(22)	(22)
LIVESTOCK	FAYETTE	BRAZOS	New Other Aquifer well field (Colorado Basin)	Other Aquifer	22	22	22	22	22	22	22
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(2)	(45)	(70)	(94)	(117)	(137)	(162)
MANUFACTURING	FAYETTE	LAVACA	Expand current Gulf Coast supply	Gulf Coast					2	20	43
MANUFACTURING	FAYETTE	LAVACA	Expand current Sparta supply	Sparta	2	45	70	94	115	117	119
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					33	13	(4)	(22)	(28)	(29)	(29)
MINING	FAYETTE	BRAZOS	Expand current Gulf Coast supply	Gulf Coast			4	22	28	29	29
Remaining Surplus/Shortage					**33**	**13**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					21,721	193	(401)	(13,315)	(24,769)	(24,883)	(30,908)
STEAM ELECTRIC POWER	FAYETTE	COLORADO	Contract Renewal	Highland Lakes				3,500	3,500	3,500	3,500
STEAM ELECTRIC POWER	FAYETTE	COLORADO	COA reuse	Reuse		9,810	10,004	13,418	21,272	21,386	27,411
Remaining Surplus/Shortage					**21,721**	**10,003**	**9,603**	**3,603**	**3**	**3**	**3**
Shortage/Surplus					229	(638)	(1,514)	(1,989)	(2,474)	(3,052)	(3,526)
BUDA	HAYS	COLORADO	GBRA Contract	Canyon Lake		1,120	1,120	1,120	1,120	1,120	1,302
BUDA	HAYS	COLORADO	New Trinity Well Field	Trinity			394	869	1,354	1,932	2,224
Remaining Surplus/Shortage					**229**	**482**	**0**	**0**	**0**	**0**	**0**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr)						
					2000	2010	2020	2030	2040	2050	2060
Shortage/Surplus					0	(41)	(127)	(220)	(314)	(427)	(520)
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	Conservation		0	24	17	13	9	5	7
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	Expand current Edwards BFZ supply	Edwards BFZ	0	17	110	207	305	422	513
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					385	(759)	(2,072)	(3,416)	(4,784)	(8,400)	(9,738)
COUNTY-OTHER	HAYS	COLORADO	Contract Renewal	Highland Lakes						1,915	1,915
COUNTY-OTHER	HAYS	COLORADO	Construct GBRA Hays County pipeline	Canyon Lake		1,680	1,680	1,680	1,680	1,680	1,680
COUNTY-OTHER	HAYS	COLORADO	Purchase water from COA for Hays County	City of Austin		1,100	1,100	1,100	1,100	1,100	1,100
COUNTY-OTHER	HAYS	COLORADO	Recharge Edwards BFZ with Onion Creek recharge structure	Edwards BFZ				4,000	4,000	4,000	5,043
Remaining Surplus/Shortage					**385**	**2,021**	**708**	**3,364**	**1,996**	**295**	**0**
Shortage/Surplus					239	(520)	(1,296)	(1,737)	(2,185)	(3,300)	(3,736)
DRIPPING SPRINGS	HAYS	COLORADO	Conservation		0	81	277	470	549	661	748
DRIPPING SPRINGS	HAYS	COLORADO	Contract Renewal (Dripping Springs WSC)	Highland Lakes						560	560
DRIPPING SPRINGS	HAYS	COLORADO	Purchase water from LCRA/Highland Lakes (through Dripping Springs WSC)	Highland Lakes		1,875	1,875	1,875	1,875	2,258	2,428
Remaining Surplus/Shortage					**239**	**1,436**	**856**	**608**	**239**	**179**	**0**
Shortage/Surplus					23	(108)	(261)	(420)	(577)	(773)	(926)
DRIPPING SPRINGS WSC	HAYS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		1,156	1,156	1,156	1,156	773	926
Remaining Surplus/Shortage					**23**	**1,048**	**895**	**736**	**579**	**0**	**0**
Shortage/Surplus					413	231	113	(6)	(126)	(234)	(333)
MANUFACTURING	HAYS	COLORADO	Temporary Overdraft of Trinity Aquifer	Lower Trinity Aquifer				6	126	234	333
Remaining Surplus/Shortage					**413**	**231**	**113**	**0**	**0**	**0**	**0**
Shortage/Surplus					1,263	1,256	(66)	(66)	(80)	(74)	(74)
COUNTY-OTHER	LLANO	COLORADO	Conservation		0	84	165	234	229	223	223
COUNTY-OTHER	LLANO	COLORADO	Contract Renewal	Highland Lakes			1,327	1,327	1,327	1,327	1,327
Remaining Surplus/Shortage					**1,263**	**1,340**	**1,426**	**1,495**	**1,476**	**1,476**	**1,476**
COUNTY-OTHER	LLANO	COLORADO	Water allocated to Manufacturing Llano	Ellenburger-San Saba	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Remaining Surplus/Shortage After Sales					**1,261**	**1,337**	**1,423**	**1,492**	**1,473**	**1,473**	**1,473**
Shortage/Surplus					9	10	11	18	24	21	(408)
KINGSLAND WSC	LLANO	COLORADO	Contract Renewal	Highland Lakes							422
Remaining Surplus/Shortage					**9**	**10**	**11**	**18**	**24**	**21**	**14**
Shortage/Surplus					221	191	167	150	135	(1,290)	(1,290)
LAKE LBJ MUD	LLANO	COLORADO	Conservation		0	109	216	306	386	467	535
LAKE LBJ MUD	LLANO	COLORADO	Contract Renewal	Highland Lakes						1,400	1,364
Remaining Surplus/Shortage					**221**	**300**	**383**	**456**	**521**	**577**	**609**

					Water Management Strategies (ac-ft/yr)						
WUG Name	**County**	**River Basin**	**Water Management Strategy Name**	**Source Name**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Shortage/Surplus					(724)	(740)	(738)	(736)	(820)	(822)	(829)
LLANO	LLANO	COLORADO	Conservation		0	86	163	231	291	349	408
LLANO	LLANO	COLORADO	Contract Renewal	Highland Lakes					87	87	87
LLANO	LLANO	COLORADO	New Ellenburger-San Saba Well Field	Ellenburger-San Saba	478	478	478	478	442	386	334
LLANO	LLANO	COLORADO	Temporary Overdraft of Ellenburger-San Saba	Ellenburger-San Saba	176	176	97	27			
Remaining Surplus/Shortage					**(70)**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(62)	(62)	(62)	(62)	(62)	(62)	(62)
LIVESTOCK	LLANO	COLORADO	Expand current Hickory supply	Hickory	62	62	62	62	62	62	62
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(2)	(3)	(3)	(3)	(3)	(3)	(3)
MANUFACTURING	LLANO	COLORADO	Allocate water from Llano County - Other	Ellenburger-San Saba	2	3	3	3	3	3	3
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					14,429	14,643	14,857	14,715	14,541	14,329	14,071
STEAM ELECTRIC POWER	LLANO	COLORADO	Reduction in LCRA Commitment due to Improved Efficiency (Ferguson)			(5,000)	(5,000)	(5,000)	(5,000)	(5,000)	(10,000)
Remaining Surplus/Shortage					**14,429**	**9,643**	**9,857**	**9,715**	**9,541**	**9,329**	**4,071**
Shortage/Surplus					(2)	(2)	(2)	(2)	(2)	(2)	(2)
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	Allocate water from Matagorda County - Other	Gulf Coast	2	2	2	2	2	2	2
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					14,429	14,643	14,857	14,715	14,541	14,329	14,071
COUNTY-OTHER	MATAGORDA	COLORADO	Contract Renewal	Highland Lakes			15	15	15	15	15
Remaining Surplus/Shortage					**14,429**	**14,643**	**14,872**	**14,730**	**14,556**	**14,344**	**14,086**
Shortage/Surplus					3,335	3,321	3,301	3,298	3,306	3,315	3,320
COUNTY-OTHER	MATAGORDA	COLORADO-LAVACA	Water allocated to Orbit Systems Inc	Gulf Coast	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Remaining Surplus/Shortage After Sales					**3,333**	**3,319**	**3,299**	**3,296**	**3,304**	**3,313**	**3,318**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	2000	2010	2020	2030	2040	2050	2060
					Water Management Strategies (ac-ft/yr)						
Shortage/Surplus					(53,889)	(47,813)	(44,540)	(41,388)	(38,369)	(35,463)	(32,665)
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Supply Reduction due to LSWP		0	0	0	0	0	0	(20,213)
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Transfer supply to M&I		0	0	0	0	(3,430)	(3,430)	(3,430)
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	14,437	14,437	14,437	14,437	14,437
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	2,848	2,848	2,848	2,848	2,848
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	3,755	3,755	3,755	3,755	3,755
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Develop water conserving rice variety		0	0	2,661	2,661	2,661	2,661	2,661
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Continuation of LCRA Water Management Plan for interruptible water	Highland Lakes	47,509	40,567	41,626	31,684	21,742	11,800	1,858
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Continued use of Austin return flows	Colorado ROR	6,691	7,608	8,524	9,440	10,357	11,273	12,189
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Continued use of Downstream return flows	Colorado ROR				64	250	463	610
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	HB-1437: Water conservation		0	0	0	0	0	10,800	12,200
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Firm up RoR with off-channel storage		0	0	0	0	0	0	6,370
Remaining Surplus/Shortage					**311**	**362**	**29,311**	**23,501**	**14,251**	**19,144**	**620**
Shortage/Surplus					(5,621)	(4,846)	(4,428)	(4,026)	(3,641)	(3,270)	(2,912)
IRRIGATION	MATAGORDA	COLORADO	Supply Reduction due to LSWP		0	0	0	0	0	0	(2,063)
IRRIGATION	MATAGORDA	COLORADO	Transfer supply to M&I		0	0	0	0	(350)	(350)	(350)
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	1,473	1,473	1,473	1,473	1,473
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	502	502	502	502	502
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	631	631	631	631	631
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Develop water conserving rice variety		0	0	486	486	486	486	486
IRRIGATION	MATAGORDA	COLORADO	Continuation of LCRA Water Management Plan for interruptible water	Highland Lakes	5,076	4,262	4,248	3,233	2,219	1,204	190
IRRIGATION	MATAGORDA	COLORADO	Continued use of Austin return flows	Colorado ROR	683	776	870	963	1,057	1,150	1,244
IRRIGATION	MATAGORDA	COLORADO	Continued use of Downstream return flows	Colorado ROR				6	26	47	62
IRRIGATION	MATAGORDA	COLORADO	HB-1437: Water conservation		0	0	0	0	0	0	200
IRRIGATION	MATAGORDA	COLORADO	Firm up RoR with off-channel storage								650
Remaining Surplus/Shortage					**138**	**192**	**3,782**	**3,268**	**2,403**	**1,873**	**113**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr) 2000	2010	2020	2030	2040	2050	2060
		Shortage/Surplus			(50,864)	(44,786)	(41,514)	(38,362)	(35,342)	(32,438)	(29,638)
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Supply Reduction due to LSWP		0	0	0	0	0	0	(18,975)
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Transfer supply to M&I		0	0	0	0	(3,220)	(3,220)	(3,220)
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	13,553	13,553	13,553	13,553	13,553
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	3,617	3,617	3,617	3,617	3,617
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	3,808	3,808	3,808	3,808	3,808
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Develop water conserving rice variety		0	0	3,468	3,468	3,468	3,468	3,468
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Continuation of LCRA Water Management Plan for interruptible water	Highland Lakes	44,743	38,410	39,077	29,744	20,411	11,078	1,745
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Continued use of Austin return flows	Colorado ROR	6,282	7,142	8,002	8,862	9,723	10,583	11,443
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Continued use of Downstream return flows	Colorado ROR				60	235	434	573
IRRIGATION	MATAGORDA	COLORADO-LAVACA	HB-1437: Water conservation		0	0	0	0	0	0	8,600
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Firm up RoR with off-channel storage								5,980
		Remaining Surplus/Shortage			**161**	**766**	**30,011**	**24,750**	**16,253**	**10,883**	**(5,026)**
		Shortage/Surplus			(56)	(56)	(56)	(56)	(56)	(56)	(56)
LIVESTOCK	MATAGORDA	COLORADO-LAVACA	Expand current Gulf Coast supply	Gulf Coast	56	56	56	56	56	56	56
		Remaining Surplus/Shortage			**0**	**0**	**0**	**0**	**0**	**0**	**0**
		Shortage/Surplus			3,846	2,892	(1,957)	(4,029)	(4,393)	(6,156)	(6,684)
MANUFACTURING	MATAGORDA	BRAZOS-COLORADO	Contract Renewal	Highland Lakes			4,288	5,974	5,974	7,438	7,438
		Remaining Surplus/Shortage			**3,846**	**2,892**	**2,331**	**1,945**	**1,581**	**1,282**	**754**
		Shortage/Surplus			2,773	1,902	(2,522)	(4,410)	(4,741)	(6,351)	(6,831)
MANUFACTURING	MATAGORDA	COLORADO	Contract Renewal	Highland Lakes			3,912	5,448	5,448	6,784	6,784
MANUFACTURING	MATAGORDA	COLORADO	Temporary Overdraft Gulf Coast	Gulf Coast							47
		Remaining Surplus/Shortage			**2,773**	**1,902**	**1,390**	**1,038**	**707**	**433**	**0**
		Shortage/Surplus			21,644	7,593	7,594	(14,405)	(52,668)	(52,718)	(52,766)
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Contract Renewal. New values based on WAM	Highland Lakes					38,264	38,315	38,363
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Desalination	Desalination		29,568	29,568	29,568	29,568	29,568	29,568
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	ROR Increase due to COA Return Flows	Colorado ROR	1,000	1,000	1,000	1,000	1,000	1,000	1,000
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Reduction in LCRA Commitment	Highland Lakes	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	ROR Increase due to downstream Return Flows	Colorado ROR				9	36	68	90
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Reduction in LCRA Commitment	Highland Lakes				(9)	(36)	(68)	(90)
		Remaining Surplus/Shortage			**21,644**	**37,161**	**37,162**	**15,163**	**15,164**	**15,165**	**15,165**
		Shortage/Surplus			1,681	1,681	1,680	(8)	(8)	(8)	(7)
BROOKSMITH SUD	MILLS	COLORADO	Conservation		0	1	1	1	1	1	0
BROOKSMITH SUD	MILLS	COLORADO	Allocate water from Mills County - Other	Trinity				7	7	7	7
		Remaining Surplus/Shortage			**1,681**	**1,682**	**1,681**	**0**	**0**	**0**	**0**
		Shortage/Surplus			94	101	93	56	60	12	16
COUNTY-OTHER	MILLS	COLORADO	Water allocated to Brookesmith SUD	Trinity				(7)	(7)	(7)	(7)
COUNTY-OTHER	MILLS	COLORADO	Water allocated to Manufacturing Mills	Trinity	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		Remaining Surplus/Shortage After Sales			**93**	**100**	**92**	**48**	**52**	**4**	**8**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	2000	2010	2020	2030	2040	2050	2060
					Water Management Strategies (ac-ft/yr)						
Shortage/Surplus					(6)	(6)	(6)	(6)	(6)	(5)	(5)
GOLDTHWAITE	MILLS	BRAZOS	Conservation		0	1	1	2	3	2	3
GOLDTHWAITE	MILLS	BRAZOS	Expand current Trinity supply		6	5	5	4	3	3	2
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(360)	(351)	(364)	(362)	(360)	(352)	(345)
GOLDTHWAITE	MILLS	COLORADO	Conservation		0	46	92	134	170	203	235
GOLDTHWAITE	MILLS	COLORADO	Expand current Trinity supply (Brazos Basin)	Trinity	210	153	63	21			
GOLDTHWAITE	MILLS	COLORADO	Expand current Trinity supply	Trinity	94	152	209	207	190	149	110
GOLDTHWAITE	MILLS	COLORADO	Construct Goldthwaite channel dam	Goldthwaite Res.	0	0	0	0	0	0	0
GOLDTHWAITE	MILLS	COLORADO	Construct additional Goldthwaite off-channel reservoir	Goldthwaite Res.	0	0	0	0	0	0	0
Remaining Surplus/Shortage					**(56)**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(187)	(180)	(173)	(184)	(177)	(193)	(186)
IRRIGATION	MILLS	BRAZOS	Expand current Trinity supply	Trinity	187	180	173	184	177	193	186
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					(217)	(159)	(102)	(57)	(3)	39	90
IRRIGATION	MILLS	COLORADO	Expand current Trinity supply	Trinity	217	159	102	57	3		
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**39**	**90**
Shortage/Surplus					(1)	(1)	(1)	(1)	(1)	(1)	(1)
MANUFACTURING	MILLS	COLORADO	Allocate water from Mills County - Other	Trinity	1	1	1	1	1	1	1
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					7,845	7,817	7,804	7,792	7,780	7,782	7,779
COUNTY-OTHER	SAN SABA	COLORADO	Contract Renewal	Highland Lakes		20	20	20	20	20	20
Remaining Surplus/Shortage					**7,845**	**7,837**	**7,824**	**7,812**	**7,800**	**7,802**	**7,799**
Shortage/Surplus					25	22	11	3	(3)	(3)	(5)
RICHLAND SUD	SAN SABA	COLORADO	Conservation		0	13	22	19	15	14	15
Remaining Surplus/Shortage					**25**	**35**	**33**	**22**	**12**	**11**	**10**
Shortage/Surplus					0	0	0	0	0	(1,582)	(1,695)
AQUA WSC	TRAVIS	COLORADO	Contract Renewal	Highland Lakes						1,582	1,695
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr) 2000	2010	2020	2030	2040	2050	2060
Shortage/Surplus					144,436	130,619	92,535	62,478	23,824	(12,217)	(186,906)
AUSTIN	TRAVIS	COLORADO	Advanced water conservation for the City of Austin		2,000	7,600	13,000	18,800	25,000	29,500	33,537
AUSTIN	TRAVIS	COLORADO	Contract Renewal	Highland Lakes							140,323
AUSTIN	TRAVIS	COLORADO	COA reuse	Reuse	2,000	7,600	13,000	18,800	25,000	29,500	33,537
AUSTIN	TRAVIS	COLORADO	ROR Increase due to COA Return Flows	Colorado ROR	25,000	25,000	25,000	25,000	30,000	30,000	35,000
AUSTIN	TRAVIS	COLORADO	Reduction in LCRA Commitment	Highland Lakes	(25,000)	(25,000)	(25,000)	(25,000)	(30,000)	(30,000)	(35,000)
AUSTIN	TRAVIS	COLORADO	ROR Increase due to downstream Return Flows	Colorado ROR				190	760	1,425	1,900
AUSTIN	TRAVIS	COLORADO	Reduction in LCRA Commitment	Highland Lakes				(190)	(760)	(1,425)	(1,900)
Remaining Surplus/Shortage					**148,436**	**145,819**	**118,535**	**100,078**	**73,824**	**46,783**	**20,491**
AUSTIN	TRAVIS	COLORADO	Contract Renewals	City of Austin	0	(2,399)	(2,355)	(5,557)	(5,441)	(5,388)	(5,388)
AUSTIN	TRAVIS	COLORADO	Water sold to Hays County-Other	City of Austin	(1,100)	(1,100)	(1,100)	(1,100)	(1,100)	(1,100)	(1,100)
AUSTIN	TRAVIS	COLORADO	Water for Travis Manufacturing	City of Austin	(2,159)	(3,347)	(4,136)	(4,927)	(5,726)	(6,458)	(7,103)
Remaining Surplus/Shortage After Sales					**145,177**	**138,973**	**110,944**	**88,494**	**61,557**	**33,837**	**6,900**
Shortage/Surplus					(55)	(53)	(50)	(47)	(45)	(43)	(43)
BARTON CREEK WEST WSC	TRAVIS	COLORADO	Conservation		0	37	68	97	123	147	163
BARTON CREEK WEST WSC	TRAVIS	COLORADO	Purchase additional water from West Travis County RWS	Highland Lakes	55	16					
Remaining Surplus/Shortage					**0**	**0**	**18**	**50**	**78**	**104**	**120**
Shortage/Surplus					(102)	(252)	(453)	(639)	(754)	(877)	(1,004)
BEE CAVE VILLAGE	TRAVIS	COLORADO	Conservation		0	45	121	223	321	433	555
BEE CAVE VILLAGE	TRAVIS	COLORADO	Purchase additional water from West Travis County RWS	Highland Lakes	102	207	332	416	433	444	449
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					117	46	(50)	(139)	(494)	(552)	(614)
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	Conservation		0	16	46	78	85	92	102
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	Contract Renewal	Highland Lakes					300	300	300
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes			4	61	109	160	212
Remaining Surplus/Shortage					**117**	**62**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					0	0	0	0	0	(506)	(570)
CEDAR PARK	TRAVIS	COLORADO	Conservation		0	15	48	86	99	113	127
CEDAR PARK	TRAVIS	COLORADO	Contract Renewal	Highland Lakes						506	570
Remaining Surplus/Shortage					**0**	**15**	**48**	**86**	**99**	**113**	**127**
Shortage/Surplus					15,299	14,702	12,361	7,068	5,954	2,273	2,280
COUNTY-OTHER	TRAVIS	COLORADO	Contract Renewal	Highland Lakes		604	2,952	7,881	7,882	11,463	11,463
Remaining Surplus/Shortage					**15,299**	**15,306**	**15,313**	**14,949**	**13,836**	**13,736**	**13,743**
Shortage/Surplus					764	656	(280)	(390)	(467)	(544)	(623)
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes			283	398	479	563	653
Remaining Surplus/Shortage					**764**	**656**	**3**	**8**	**12**	**19**	**30**
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	Transfer water to Creedmoor-Maha WSC (Bastrop)	City of Austin	0	0	(3)	(8)	(12)	(19)	(30)
Remaining Surplus/Shortage After Sales					**764**	**656**	**0**	**0**	**0**	**0**	**0**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr) 2000	2010	2020	2030	2040	2050	2060
Shortage/Surplus					20	17	(7)	(10)	(12)	(14)	(16)
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	Purchase water from LCRA/Highland Lakes	Highland Lakes			7	10	12	14	16
Remaining Surplus/Shortage					**20**	**17**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					4	5	6	4	2	(1)	(5)
ELGIN	TRAVIS	COLORADO	Expand current Carrizo-Wilcox supply (Bastrop County)	Carrizo-Wilcox						1	5
Remaining Surplus/Shortage					**4**	**5**	**6**	**4**	**2**	**0**	**0**
Shortage/Surplus					8	(3)	(14)	(23)	(30)	(38)	(43)
GOFORTH WSC	TRAVIS	COLORADO	Transfer water from Goforth WSC in Region L	Canyon Reservoir		3	14	23	30	38	43
Remaining Surplus/Shortage					**8**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					6	(29)	(79)	(122)	(400)	(429)	(463)
JONESTOWN	TRAVIS	COLORADO	Contract Renewal	Highland Lakes					251	251	251
JONESTOWN	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		29	79	122	149	178	212
Remaining Surplus/Shortage					**6**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					2	(13)	(35)	(54)	(176)	(190)	(205)
JONESTOWN WSC	TRAVIS	COLORADO	Contract Renewal	Highland Lakes					109	109	109
JONESTOWN WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		13	35	54	67	81	96
Remaining Surplus/Shortage					**2**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					5,276	4,764	3,802	(3,340)	(3,733)	(4,161)	(4,602)
LAGO VISTA	TRAVIS	COLORADO	Conservation		0	168	446	811	1,167	1,574	2,015
LAGO VISTA	TRAVIS	COLORADO	Contract Renewal	Highland Lakes			270	6,770	6,770	6,770	6,770
Remaining Surplus/Shortage					**5,276**	**4,932**	**4,518**	**4,241**	**4,204**	**4,183**	**4,183**
Shortage/Surplus					(198)	(1,074)	(2,261)	(5,796)	(6,467)	(7,199)	(7,953)
LAKEWAY	TRAVIS	COLORADO	Conservation		0	294	779	1,390	2,005	2,707	3,465
LAKEWAY	TRAVIS	COLORADO	Contract Renewal	Highland Lakes				2,455	2,455	2,455	2,455
LAKEWAY	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		780	1,482	1,951	2,007	2,037	2,033
Remaining Surplus/Shortage					**(198)**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					76	(357)	(354)	(1,221)	(1,218)	(1,218)	(1,218)
LOOP 360 WSC	TRAVIS	COLORADO	Conservation		0	110	214	306	391	470	541
LOOP 360 WSC	TRAVIS	COLORADO	Contract Renewal	Highland Lakes				871	871	871	871
LOOP 360 WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		247	140	44			
Remaining Surplus/Shortage					**76**	**0**	**0**	**0**	**44**	**123**	**194**
Shortage/Surplus					0	(935)	(921)	(906)	(891)	(882)	(882)
LOST CREEK MUD	TRAVIS	COLORADO	Conservation		0	71	140	200	206	197	197
LOST CREEK MUD	TRAVIS	COLORADO	Contract Renewal	City of Austin		935	921	906	891	882	882
Remaining Surplus/Shortage					**0**	**71**	**140**	**200**	**206**	**197**	**197**
Shortage/Surplus					2,075	2,056	2,029	325	310	292	273
MANOR	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes				336	351	369	388
Remaining Surplus/Shortage					**2,075**	**2,056**	**2,029**	**661**	**661**	**661**	**661**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr) 2000	2010	2020	2030	2040	2050	2060
Shortage/Surplus					2,016	1,573	953	(1,839)	(2,184)	(2,577)	(2,982)
MANVILLE WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes				1,839	2,184	2,584	3,034
Remaining Surplus/Shortage					**2,016**	**1,573**	**953**	**0**	**0**	**7**	**52**
MANVILLE WSC	TRAVIS	COLORADO	Transfer water to Manville (Bastrop)	Highland Lakes						(7)	(52)
Remaining Surplus/Shortage After Sales					**2,016**	**1,573**	**953**	**0**	**0**	**0**	**0**
Shortage/Surplus					0	0	0	(106)	(103)	(102)	(102)
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	Contract Renewal	City of Austin				106	103	102	102
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					0	0	0	0	0	(1,366)	(1,540)
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	Contract Renewal	Highland Lakes						1,366	1,540
Remaining Surplus/Shortage					**0**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					7,978	7,168	5,012	3,025	1,826	(10,143)	(11,342)
PFLUGERVILLE	TRAVIS	COLORADO	Conservation		0	338	565	676	711	804	899
PFLUGERVILLE	TRAVIS	COLORADO	Contract Renewal	Highland Lakes						10,634	10,460
Remaining Surplus/Shortage					**7,978**	**7,506**	**5,577**	**3,701**	**2,537**	**1,295**	**17**
Shortage/Surplus					(19)	(570)	(1,723)	(1,723)	(1,717)	(1,717)	(1,717)
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	Conservation		0	132	295	431	549	661	762
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	Contract Renewal	Highland Lakes			900	900	900	900	900
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes		438	528	392	268	156	55
Remaining Surplus/Shortage					**(19)**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					740	743	744	746	(372)	(371)	(373)
ROLLINGWOOD	TRAVIS	COLORADO	Conservation		0	31	60	85	109	132	143
ROLLINGWOOD	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes					372	371	373
Remaining Surplus/Shortage					**740**	**774**	**804**	**831**	**109**	**132**	**143**
Shortage/Surplus					79	(158)	(339)	(528)	(669)	(813)	(957)
ROUND ROCK	TRAVIS	COLORADO	Conservation		0	32	93	179	243	277	312
ROUND ROCK	TRAVIS	COLORADO	HB 1437 - Region G	Highland Lakes		126	246	349	426	536	645
Remaining Surplus/Shortage					**79**	**0**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					0	0	0	(716)	(700)	(694)	(694)
SHADY HOLLOW MUD	TRAVIS	COLORADO	Conservation		0	5	0	0	0	0	0
SHADY HOLLOW MUD	TRAVIS	COLORADO	Contract Renewal	City of Austin				716	700	694	694
Remaining Surplus/Shortage					**0**	**5**	**0**	**0**	**0**	**0**	**0**
Shortage/Surplus					1,229	1,033	867	(733)	(729)	(729)	(729)
THE HILLS	TRAVIS	COLORADO	Conservation		0	50	123	181	230	259	259
THE HILLS	TRAVIS	COLORADO	Contract Renewal	Highland Lakes				1,600	1,600	1,600	1,600
Remaining Surplus/Shortage					**1,229**	**1,083**	**990**	**1,048**	**1,101**	**1,130**	**1,130**

					Water Management Strategies (ac-ft/yr)						
WUG Name	**County**	**River Basin**	**Water Management Strategy Name**	**Source Name**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Shortage/Surplus					7,317	6,498	4,856	3,834	3,216	2,529	(6,979)
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	Conservation		0	209	451	539	574	645	718
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	Contract Renewal	Highland Lakes			554	554	554	554	9,354
Remaining Surplus/Shortage					**7,317**	**6,707**	**5,861**	**4,927**	**4,344**	**3,728**	**3,093**
Shortage/Surplus					712	547	(1,075)	(1,278)	(1,404)	(1,535)	(1,683)
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	Contract Renewal	Highland Lakes			1,400	1,400	1,400	1,400	1,400
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes					4	135	283
Remaining Surplus/Shortage					**712**	**547**	**325**	**122**	**0**	**0**	**0**
Shortage/Surplus					0	0	0	(372)	(371)	(371)	(371)
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	Conservation		0	33	64	91	117	141	163
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	Contract Renewal	Highland Lakes				372	371	371	371
Remaining Surplus/Shortage					**0**	**33**	**64**	**91**	**117**	**141**	**163**
Shortage/Surplus					731	673	675	(457)	(456)	(455)	(455)
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	Conservation		0	41	79	113	145	174	200
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	Contract Renewal	Highland Lakes				1,135	1,135	1,135	1,135
Remaining Surplus/Shortage					**731**	**714**	**754**	**791**	**824**	**854**	**880**
Shortage/Surplus					0	0	0	(1,472)	(1,444)	(1,435)	(1,435)
WELLS BRANCH MUD	TRAVIS	COLORADO	Conservation		0	127	203	185	157	148	148
WELLS BRANCH MUD	TRAVIS	COLORADO	Contract Renewal	City of Austin				1,472	1,444	1,435	1,435
Remaining Surplus/Shortage					**0**	**127**	**203**	**185**	**157**	**148**	**148**
Shortage/Surplus					985	815	587	(2,049)	(2,178)	(2,320)	(2,471)
WEST LAKE HILLS	TRAVIS	COLORADO	Conservation		0	139	303	495	677	870	1,074
WEST LAKE HILLS	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes				2,049	2,178	2,320	2,471
Remaining Surplus/Shortage					**985**	**954**	**890**	**495**	**677**	**870**	**1,074**
Shortage/Surplus					2,874	1,951	1,231	527	2	(615)	(1,170)
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	Conservation		0	17	9	0	0	0	0
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes					431	1,059	1,619
Remaining Surplus/Shortage					**2,874**	**1,968**	**1,240**	**527**	**433**	**444**	**449**
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	Water sold to Barton Creek West	Highland Lakes	(55)	(16)					
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	Water sold to Bee Cave Village	Highland Lakes	(102)	(207)	(332)	(416)	(433)	(444)	(449)
Remaining Surplus/Shortage After Sales					**2,717**	**1,745**	**908**	**111**	**0**	**0**	**0**
Shortage/Surplus					338	284	(274)	(344)	(385)	(433)	(482)
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	Contract Renewal	Highland Lakes			482	482	482	482	482
Remaining Surplus/Shortage					**338**	**284**	**208**	**138**	**97**	**49**	**0**
Shortage/Surplus					825	83	18	(2,201)	(2,180)	(2,180)	(2,180)
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	Highland Lakes				2,201	2,180	2,180	2,180
Remaining Surplus/Shortage					**825**	**83**	**18**	**0**	**0**	**0**	**0**

					Water Management Strategies (ac-ft/yr)						
WUG Name	**County**	**River Basin**	**Water Management Strategy Name**	**Source Name**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
			Shortage/Surplus		68	155	237	311	379	426	483
IRRIGATION	TRAVIS	COLORADO	Water allocated to Irrigation (Guadalupe basin)	Irrigation Local Supply	(68)	(124)	(114)	(105)	(97)	(89)	(82)
			Remaining Surplus/Shortage After Sales		**0**	**31**	**123**	**206**	**282**	**337**	**401**
			Shortage/Surplus		(135)	(124)	(114)	(105)	(97)	(89)	(82)
IRRIGATION	TRAVIS	GUADALUPE	Allocate from Irrigation (Colorado basin)	Irrigation Local Supply	68	124	114	105	97	89	82
			Remaining Surplus/Shortage		**(67)**	**0**	**0**	**0**	**0**	**0**	**0**
			Shortage/Surplus		(2,159)	(4,257)	(5,046)	(5,837)	(6,636)	(7,368)	(8,013)
MANUFACTURING	TRAVIS	COLORADO	Contract Renewal	Highland Lakes		910	910	910	910	910	910
MANUFACTURING	TRAVIS	COLORADO	City of Austin	City of Austin	2,159	3,347	4,136	4,927	5,726	6,458	7,103
			Remaining Surplus/Shortage		**0**	**0**	**0**	**0**	**0**	**0**	**0**
			Shortage/Surplus		31,556	21,662	20,774	16,886	15,998	12,110	(20,443)
STEAM ELECTRIC POWER	TRAVIS	COLORADO	Contract Renewal	Highland Lakes							31,665
STEAM ELECTRIC POWER	TRAVIS	COLORADO	COA Reuse	Reuse		1,680	2,881	7,083	8,285	12,486	13,690
STEAM ELECTRIC POWER	TRAVIS	COLORADO	Reduction in LCRA Commitment	Highland Lakes		(17,392)	(17,493)	(17,594)	(17,695)	(17,796)	(17,898)
			Remaining Surplus/Shortage		**31,556**	**5,950**	**6,162**	**6,375**	**6,588**	**6,800**	**7,014**
			Shortage/Surplus		37	18	3	(4)	(4)	0	6
WHARTON	WHARTON	COLORADO	Conservation		0	41	29	18	8	4	4
			Remaining Surplus/Shortage		**37**	**59**	**32**	**14**	**4**	**4**	**10**
			Shortage/Surplus		(52,259)	(47,760)	(44,193)	(40,752)	(37,439)	(34,242)	(22,108)
IRRIGATION	WHARTON	BRAZOS-COLORADO	Supply Reduction due to LSWP		0	0	0	0	0	0	(5,709)
IRRIGATION	WHARTON	BRAZOS-COLORADO	Transfer supply to M&I		(5,184)	(13,802)	(14,666)	(16,394)	(16,394)	(18,554)	(18,601)
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	12,766	12,766	12,766	12,766	12,766
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	11,172	11,172	11,172	11,172	11,172
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	13,951	13,951	13,951	13,951	13,951
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Develop water conserving rice variety		0	0	10,924	10,924	10,924	10,924	10,924
IRRIGATION	WHARTON	BRAZOS-COLORADO	Continuation of LCRA Water Management Plan for interruptible water	Highland Lakes	49,875	57,960	6,966	5,312	3,658	2,004	350
IRRIGATION	WHARTON	BRAZOS-COLORADO	Continued use of Austin return flows	Colorado ROR	0	44	87	131	174	217	261
IRRIGATION	WHARTON	BRAZOS-COLORADO	Continued use of Downstream return flows	Colorado ROR				1	4	9	13
IRRIGATION	WHARTON	BRAZOS-COLORADO	HB-1437: Water conservation		0	3,600	3,600	3,600	3,600	3,600	3,600
			Remaining Surplus/Shortage		**(7,568)**	**42**	**607**	**711**	**2,416**	**1,847**	**6,619**

WUG Name	County	River Basin	Water Management Strategy Name	Source Name	Water Management Strategies (ac-ft/yr) 2000	2010	2020	2030	2040	2050	2060
		Shortage/Surplus			(4,361)	(2,025)	(174)	1,612	3,334	4,994	11,293
IRRIGATION	WHARTON	COLORADO	Supply Reduction due to LSWP		0	0	0	0	0	0	(238)
IRRIGATION	WHARTON	COLORADO	Transfer supply to M&I		(216)	(575)	(611)	(683)	(683)	(773)	(775)
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	532	532	532	532	532
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	150	150	150	150	150
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	166	166	166	166	166
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Develop water conserving rice variety		0	0	144	144	144	144	144
IRRIGATION	WHARTON	COLORADO	Continuation of LCRA Water Management Plan for interruptible water		1,628	2,459	290	221	152	84	15
IRRIGATION	WHARTON	COLORADO	Continued use of Austin return flows		0	2	4	6	7	9	11
IRRIGATION	WHARTON	COLORADO	Continued use of Downstream return flows	Colorado ROR				0	0	1	1
IRRIGATION	WHARTON	COLORADO	HB-1437: Water conservation		0	200	200	200	200	200	200
		Remaining Surplus/Shortage			**(2,949)**	**61**	**701**	**2,348**	**4,002**	**5,507**	**11,499**
		Shortage/Surplus			(18,237)	(16,816)	(15,690)	(14,603)	(13,555)	(12,545)	(8,712)
IRRIGATION	WHARTON	COLORADO-LAVACA	Supply Reduction due to LSWP		0	0	0	0	0	0	(1,982)
IRRIGATION	WHARTON	COLORADO-LAVACA	Transfer supply to M&I		(1,800)	(4,792)	(5,092)	(5,692)	(5,692)	(6,442)	(6,459)
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	Gulf Coast	0	0	4,433	4,433	4,433	4,433	4,433
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation on-farm water conservation		0	0	4,110	4,110	4,110	4,110	4,110
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation delivery system water conservation		0	0	6,239	6,239	6,239	6,239	6,239
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Develop water conserving rice variety		0	0	4,019	4,019	4,019	4,019	4,019
IRRIGATION	WHARTON	COLORADO-LAVACA	Continuation of LCRA Water Management Plan for interruptible water	Highland Lakes	14,568	21,461	2,419	1,845	1,270	696	121
IRRIGATION	WHARTON	COLORADO-LAVACA	Continued use of Austin return flows	Colorado ROR	0	15	30	45	60	76	90
IRRIGATION	WHARTON	COLORADO-LAVACA	Continued use of Downstream return flows	Colorado ROR				0	1	3	5
IRRIGATION	WHARTON	COLORADO-LAVACA	HB-1437: Water conservation		0	200	200	200	200	200	200
		Remaining Surplus/Shortage			**(5,469)**	**68**	**668**	**596**	**1,085**	**789**	**2,064**
		Shortage/Surplus			65	43	31	22	13	5	(8)
MANUFACTURING	WHARTON	COLORADO-LAVACA	Expand current Gulf Coast supply	Gulf Coast							8
		Remaining Surplus/Shortage			**65**	**43**	**31**	**22**	**13**	**5**	**0**
		Shortage/Surplus			0	(1,464)	(1,434)	(1,405)	(1,375)	(1,355)	(1,355)
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	Conservation		0	80	50	21	0	0	0
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	Contract Renewal	City of Austin		1,464	1,434	1,405	1,375	1,355	1,355
		Remaining Surplus/Shortage			**0**	**80**	**50**	**21**	**0**	**0**	**0**
		Shortage/Surplus			0	0	0	(952)	(928)	(920)	(920)
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	Contract Renewal	City of Austin				952	928	920	920
		Remaining Surplus/Shortage			**0**	**0**	**0**	**0**	**0**	**0**	**0**

APPENDIX 4B

WATER MANAGEMENT STRATEGY COST BREAKDOWN & THE COST ASSUMPTIONS & METHODOLOGY

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
AQUA WSC	BASTROP	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 373,750	$ 357,765	3,250	$ 373,750	$ 115.00
AQUA WSC	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ 2,416,400	$ 3,487,548	$ -	$ -	$ -	$ -	$ 935,079	$ 935,079	$ 935,079	4,796	$ 935,079	$ 194.97
BASTROP	BASTROP	COLORADO	Conservation	$ -	$ -	$ -	$ 49,140	$ 67,510	$ 95,524	$ 101,035	$ 60,162	$ 81,747	220	$ 101,035	$ 459.25
BASTROP	BASTROP	COLORADO	Expand Other Aquifer supply	$ 314,000	$ 457,814	$ -	$ -	$ -	$ -	$ -	$ 48,696	$ 48,696	791	$ 48,696	$ 61.56
BASTROP COUNTY WCID #2	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,514	144	$ 2,514	$ 17.46
COUNTY-OTHER	BASTROP	COLORADO	Contract Renewal	$ -	$ -	$ -	$ 4,830	$ 160,080	$ 160,080	$ 160,080	$ 160,080	$ 160,080	1,392	$ 160,080	$ 115.00
COUNTY-OTHER	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ 3,797,200	$ 5,480,433	$ -	$ -	$ 1,896,997	$ 1,896,997	$ 1,896,997	$ 1,896,997	$ 1,896,997	7,172	$ 1,896,997	$ 264.50
COUNTY-OTHER	BASTROP	COLORADO	New Carrizo-Wilcox well field (Guadalupe basin)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,129	924	$ 16,129	$ 17.46
COUNTY-OTHER	BASTROP	GUADALUPE	New Carrizo-Wilcox well field	$ 2,312,584	$ 3,373,240	$ -	$ -	$ -	$ -	$ -	$ 336,949	$ 336,949	88	$ 336,949	$ 3,828.97
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	Transfer water from Creedmoor-Maha WSC (Travis)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
ELGIN	BASTROP	COLORADO	Conservation	$ -	$ -	$ -	$ 26,637	$ -	$ -	$ -	$ -	$ -	58	$ 26,637	$ 459.25
ELGIN	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ 332,000	$ 479,332	$ -	$ -	$ -	$ -	$ -	$ 59,403	$ 59,403	395	$ 59,403	$ 150.39
MANVILLE WSC	BASTROP	COLORADO	Transfer water from Manville (Travis)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	52	$ -	
POLONIA WSC	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ -	$ -	$ -	$ -	$ -	$ 436	$ 436	$ 436	$ 436	25	$ 436	$ 17.46
SMITHVILLE	BASTROP	COLORADO	Conservation	$ -	$ -	$ -	$ 9,185	$ -	$ -	$ -	$ -	$ -	20	$ 9,185	$ 459.25
SMITHVILLE	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ 332,000	$ 479,332	$ -	$ -	$ -	$ -	$ 57,640	$ 57,640	$ 57,640	294	$ 57,640	$ 196.06
IRRIGATION	BASTROP	BRAZOS	Expand current Queen City supply	$ -	$ -	$ 698	$ 698	$ 698	$ 698	$ 698	$ 698	$ 698	40	$ 698	$ 17.46
IRRIGATION	BASTROP	BRAZOS	Temporary Overdraft of Queen City Aquifer	$ -	$ -	$ 594	$ 594	$ 594	$ -	$ -	$ -	$ -	34	$ 594	$ 17.46
IRRIGATION	BASTROP	COLORADO	Expand current Queen City supply	$ -	$ -	$ 4,905	$ 4,905	$ 4,905	$ 4,905	$ 4,905	$ 4,905	$ 4,905	281	$ 4,905	$ 17.46
MANUFACTURING	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ -	$ -	$ -	$ -	$ 768	$ 768	$ 768	$ 768	$ 768	44	$ 768	$ 17.46
MANUFACTURING	BASTROP	GUADALUPE	Expand current Carrizo-Wilcox supply	$ -	$ -	$ 279	$ 279	$ 279	$ 279	$ 279	$ 279	$ 279	16	$ 279	$ 17.46
MINING	BASTROP	COLORADO	Expand current Carrizo-Wilcox supply	$ 2,150,400	$ 3,102,662	$ -	$ 763,561	$ 763,561	$ 763,561	$ 763,561	$ 763,561	$ 763,561	4,298	$ 763,561	$ 177.66
STEAM ELECTRIC POWER	BASTROP	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ 316,250	$ 686,550	$ 686,550	5,970	$ 686,550	$ 115.00
STEAM ELECTRIC POWER	BASTROP	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ -	$ 147,200	$ 319,700	$ 319,700	2,780	$ 319,700	$ 115.00
BLANCO	BLANCO	GUADALUPE	Purchase water from Canyon Lake WSC (Region L strategy for Canyon Lake WSC)												
COUNTY-OTHER	BLANCO	GUADALUPE	Purchase water from Canyon Lake WSC (Region L strategy for Canyon Lake WSC)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
MANUFACTURING	BLANCO	COLORADO	Allocate water from County-Other (Blanco County Colorado basin)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
BERTRAM	BURNET	BRAZOS	Conservation	$ -	$ -	$ -	$ 9,911	$ 11,893	$ 7,929	$ 1,982	$ 2,478	$ 4,460	24	$ 11,893	$ 495.55
BERTRAM	BURNET	BRAZOS	Expand current Ellenburger-San Saba supply	$ -	$ -	$ 3,386	$ 3,386	$ 3,386	$ 3,386	$ 3,386	$ 3,386	$ 3,386	194	$ 3,386	$ 17.46
BURNET	BURNET	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ 471,500	$ 471,500	$ 471,500	4,100	$ 471,500	$ 115.00
CHISHOLM TRAIL SUD	BURNET	BRAZOS	HB 1437 (Region G)	$ -	$ -	$ 431	$ 2,588	$ 4,456	$ 6,325	$ 8,338	$ 10,206	$ 12,363	86	$ 12,363	$ 143.75
COTTONWOOD SHORES	BURNET	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 15,870	$ 15,870	$ 15,870	$ 15,870	$ 15,870	138	$ 15,870	$ 115.00
COTTONWOOD SHORES	BURNET	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 1,035	$ 4,485	$ 8,050	$ 11,615	$ 15,295	$ 20,010	174	$ 20,010	$ 115.00
COUNTY-OTHER	BURNET	COLORADO	Contract Renewal	$ -	$ -	$ -	$ 39,675	$ 65,665	$ 71,415	$ 74,865	$ 74,865	$ 74,865	651	$ 74,865	$ 115.00
COUNTY-OTHER	BURNET	COLORADO	Expand current Trinity supply	$ 2,784,000	$ 4,034,784	$ 786,359	$ 786,359	$ 786,359	$ 786,359	$ 786,359	$ 786,359	$ 786,359	1,047	$ 786,359	$ 751.06
COUNTY-OTHER	BURNET	COLORADO	Expand current Hickory supply	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,474	$ 3,474	$ 3,474	199	$ 3,474	$ 17.46
COUNTY-OTHER	BURNET	COLORADO	Expand current Marble Falls supply	$ 1,392,000	$ 2,017,392	$ -	$ -	$ -	$ -	$ 283,914	$ 283,914	$ 283,914	718	$ 283,914	$ 395.42
GRANITE SHOALS	BURNET	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 95,450	$ 95,450	$ 95,450	$ 95,450	830	$ 95,450	$ 115.00
KEMPNER WSC	BURNET	BRAZOS	Conservation	$ -	$ -	$ -	$ 11,893	$ 18,831	$ 24,282	$ 29,237	$ 33,202	$ 41,626	84	$ 41,626	$ 495.55
KINGSLAND WSC	BURNET	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,970	78	$ 8,970	$ 115.00
KINGSLAND WSC	BURNET	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 1,150	$ 1,265	$ 1,380	$ 1,495	$ 1,610	$ 1,955	17	$ 1,955	$ 115.00
LAKE LBJ MUD	BURNET	COLORADO	Conservation	$ -	$ -	$ -	$ 8,920	$ 11,893	$ 12,389	$ 14,371	$ 16,353	$ 18,831	38	$ 18,831	$ 495.55
LAKE LBJ MUD	BURNET	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 44,735	$ 48,875	425	$ 48,875	$ 115.00
MARBLE FALLS	BURNET	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 230,000	$ 230,000	$ 345,000	$ 345,000	3,000	$ 345,000	$ 115.00
MARBLE FALLS	BURNET	COLORADO	Conservation	$ -	$ -	$ -	$ 70,864	$ 88,208	$ 97,623	$ 107,534	$ 122,401	$ 142,223	287	$ 142,223	$ 495.55
MEADOWLAKES	BURNET	COLORADO	Conservation	$ -	$ -	$ -	$ 29,733	$ 48,068	$ 63,430	$ 74,828	$ 91,181	$ 109,517	221	$ 109,517	$ 495.55
MEADOWLAKES	BURNET	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 16,215	$ 31,395	$ 43,585	$ 51,750	$ 58,880	$ 66,240	576	$ 66,240	$ 115.00
LIVESTOCK	BURNET	BRAZOS	Expand current Trinity supply	$ 172,500	$ 172,500	$ 64,070	$ 64,070	$ 64,070	$ 64,070	$ 64,070	$ 64,070	$ 64,070	23	$ 64,070	$ 2,785.65
MINING	BURNET	BRAZOS	Expand current Trinity supply	$ -	$ -	$ -	$ 743	$ 743	$ 743	$ 743	$ 743	$ 743	25	$ 743	$ 29.74
MINING	BURNET	COLORADO	Expand current Marble Falls supply	$ 1,856,000	$ 2,689,856	$ 398,765	$ 398,765	$ 398,765	$ 398,765	$ 398,765	$ 398,765	$ 398,765	873	$ 398,765	$ 456.78
MINING	BURNET	COLORADO	Expand current Ellenburger-San Saba supply	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 855	49	$ 855	$ 17.46
COUNTY-OTHER	COLORADO	LAVACA	Expand current Gulf Coast supply	$ -	$ -	$ 1,903	$ 1,903	$ 1,903	$ 1,903	$ 1,903	$ 1,903	$ 1,903	109	$ 1,903	$ 17.46
IRRIGATION	COLORADO	BRAZOS-COLORADO	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	25,597	$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	1,559	$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	Continued use of Downstream return flows												
IRRIGATION	COLORADO	BRAZOS-COLORADO	HB-1437: Water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	$ -	
IRRIGATION	COLORADO	BRAZOS-COLORADO	Firm up RoR with off-channel storage	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	LAVACA	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	LAVACA	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	LAVACA	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	COLORADO	LAVACA	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	52,611	$ -	
IRRIGATION	COLORADO	LAVACA	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	3,165	$ -	
IRRIGATION	COLORADO	LAVACA	Continued use of Downstream return flows												
IRRIGATION	COLORADO	LAVACA	HB-1437: Water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	$ -	
IRRIGATION	COLORADO	LAVACA	Firm up RoR with off-channel storage	$ -		$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
LIVESTOCK	COLORADO	COLORADO	Expand current Gulf Coast supply	$ 105,000	$ 105,000	$ 32,981	$ 32,981	$ 32,981	$ 32,981	$ 32,981	$ 32,981	$ 32,981	14	$ 32,981	$ 2,355.81
LIVESTOCK	COLORADO	LAVACA	Expand current Gulf Coast supply	$ 82,500	$ 82,500	$ 25,373	$ 25,373	$ 25,373	$ 25,373	$ 25,373	$ 25,373	$ 25,373	11	$ 25,373	$ 2,306.68
MINING	COLORADO	BRAZOS-COLORADO	Expand current Gulf Coast supply	$ -	$ -	$ -	$ 135	$ 135	$ 135	$ 135	$ 135	$ 135	26	$ 135	$ 5.17
MINING	COLORADO	COLORADO	New Other Aquifer well Field	$ -	$ -	$ -	$ 22,090	$ 22,090	$ 22,090	$ 22,090	$ 22,090	$ 22,090	4,269	$ 22,090	$ 5.17
MINING	COLORADO	COLORADO	Expand Gulf Coast supply (Colorado basin)	$ -	$ -	$ -	$ 18,763	$ 18,763	$ 18,763	$ 18,763	$ 18,763	$ 18,763	3,626	$ 18,763	$ 5.17

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
MINING	COLORADO	COLORADO	Expand Gulf Coast supply (Lavaca basin)	$ -	$ -	$ -	$ 2,872	$ 2,872	$ 2,872	$ 2,872	$ 2,872	$ 2,872	555	$ 2,872	$ 5.17
MINING	COLORADO	LAVACA	Expand current Gulf Coast supply	$ -	$ -	$ -	$ 1,030	$ 1,030	$ 1,030	$ 1,030	$ 1,030	$ 1,030	199	$ 1,030	$ 5.17
AQUA WSC	FAYETTE	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,320	$ 22,310	194	$ 22,310	$ 115.00
COUNTY-OTHER	FAYETTE	COLORADO	Contract Renewal	$ -	$ -	$ -	$ 9,775	$ 11,155	$ 11,155	$ 11,155	$ 11,155	$ 11,155	97	$ 11,155	$ 115.00
COUNTY-OTHER	FAYETTE	COLORADO	Expand current Sparta supply	$ -	$ -	$ 2,147	$ 2,147	$ 2,147	$ 2,147	$ 2,147	$ 2,147	$ 2,147	123	$ 2,147	$ 17.46
COUNTY-OTHER	FAYETTE	LAVACA	Expand current Gulf Coast supply	$ -	$ -	$ 559	$ 559	$ 559	$ 559	$ 559	$ 559	$ 559	32	$ 559	$ 17.46
FAYETTE WSC	FAYETTE	COLORADO	Expand current Gulf Coast supply	$ 464,000	$ 672,464	$ -	$ -	$ 78,336	$ 78,336	$ 78,336	$ 78,336	$ 78,336	428	$ 78,336	$ 183.03
FAYETTE WSC	FAYETTE	COLORADO	New Other Aquifer well field	$ 2,174,046	$ 3,177,242	$ -	$ -	$ -	$ 358,561	$ 358,561	$ 358,561	$ 358,561	889	$ 358,561	$ 403.33
FAYETTE WSC	FAYETTE	LAVACA	Expand current Gulf Coast supply	$ -	$ -	$ -	$ -	$ 2,025	$ 2,025	$ 2,025	$ 2,025	$ 2,025	116	$ 2,025	$ 17.46
FLATONIA	FAYETTE	LAVACA	Conservation	$ -	$ -	$ -	$ 10,407	$ 10,902	$ 12,389	$ 6,442	$ 991	$ 3,469	25	$ 12,389	$ 495.55
FLATONIA	FAYETTE	LAVACA	Expand current Gulf Coast supply	$ -	$ -	$ 820	$ 820	$ 820	$ 820	$ 820	$ 820	$ 820	47	$ 820	$ 17.46
LEE COUNTY WSC	FAYETTE	COLORADO	Transfer water from Lee County WSC (Bastrop)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	FAYETTE	LAVACA	Expand current Sparta supply	$ -	$ -	$ 401	$ 401	$ 401	$ 401	$ 401	$ 401	$ 401	23	$ 401	$ 17.46
LIVESTOCK	FAYETTE	BRAZOS	New Other Aquifer well field (Colorado Basin)	$ 165,000	$ 165,000	$ 54,710	$ 54,710	$ 54,710	$ 54,710	$ 54,710	$ 54,710	$ 54,710	22	$ 54,710	$ 2,486.81
MANUFACTURING	FAYETTE	LAVACA	Expand current Gulf Coast supply	$ -	$ -	$ -	$ -	$ -	$ -	$ 751	$ 751	$ 751	43	$ 751	$ 17.46
MANUFACTURING	FAYETTE	LAVACA	Expand current Sparta supply	$ -	$ -	$ 2,077	$ 2,077	$ 2,077	$ 2,077	$ 2,077	$ 2,077	$ 2,077	119	$ 2,077	$ 17.46
MINING	FAYETTE	BRAZOS	Expand current Gulf Coast supply	$ -	$ -	$ -	$ -	$ 506	$ 506	$ 506	$ 506	$ 506	29	$ 506	$ 17.46
STEAM ELECTRIC POWER	FAYETTE	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 402,500	$ 402,500	$ 402,500	$ 402,500	3,500	$ 402,500	$ 115.00
STEAM ELECTRIC POWER	FAYETTE	COLORADO	COA reuse	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	27,411	$ -	
BUDA	HAYS	COLORADO	Construct GBRA Hays County pipeline	$ 3,026,578	$ 4,557,855	$ -	$ 907,200	$ 907,200	$ 907,200	$ 907,200	$ 907,200	$ 907,200	1,302	$ 907,200	$ 696.77
BUDA	HAYS	COLORADO	New Trinity Well Field	$ 8,341,816	$ 12,188,098	$ -	$ -	$ 1,334,277	$ 1,334,277	$ 1,334,277	$ 1,334,277	$ 1,334,277	2,224	$ 1,334,277	$ 599.94
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	Conservation	$ -	$ -	$ -	$ 11,022	$ -	$ -	$ -	$ -	$ 919	24	$ 11,022	$ 459.25
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	Expand current Edwards BFZ supply	$ 424,000	$ 615,224	$ -	$ 72,989	$ 72,989	$ 72,989	$ 72,989	$ 72,989	$ 72,989	513	$ 72,989	$ 142.28
COUNTY-OTHER	HAYS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 220,225	$ 220,225	1,915	$ 220,225	$ 115.00
COUNTY-OTHER	HAYS	COLORADO	Construct GBRA Hays County pipeline	$ 3,913,678	$ 5,893,778	$ -	$ 1,173,103	$ 1,173,103	$ 1,173,103	$ 1,173,103	$ 1,173,103	$ 1,173,103	1,680	$ 1,173,103	$ 698.28
COUNTY-OTHER	HAYS	COLORADO	Purchase water from COA for Hays County	$ 2,280,200	$ 2,280,200	$ -	$ 1,059,254	$ 1,059,254	$ 1,059,254	$ 1,059,254	$ 1,059,254	$ 1,059,254	1,100	$ 1,059,254	$ 962.96
COUNTY-OTHER	HAYS	COLORADO	Recharge Edwards BFZ with Onion Creek recharge structure	$ 4,240,000	$ 6,808,000	$ -	$ -	$ -	$ 640,594	$ 640,594	$ 640,594	$ 640,594	5,043	$ 640,594	$ 127.03
DRIPPING SPRINGS	HAYS	COLORADO	Conservation	$ -	$ -	$ -	$ 37,199	$ 90,013	$ 88,635	$ 36,281	$ 51,436	$ 39,955	193	$ 88,635	$ 459.25
DRIPPING SPRINGS	HAYS	COLORADO	Contract Renewal (Dripping Springs WSC)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 64,400	$ 64,400	560	$ 64,400	$ 115.00

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
DRIPPING SPRINGS	HAYS	COLORADO	Purchase water from LCRA/Highland Lakes (through Dripping Springs WSC)	$ -	$ -	$ -	$ 215,625	$ 215,625	$ 215,625	$ 215,625	$ 259,670	$ 279,220	2,428	$ 279,220	$ 115.00
DRIPPING SPRINGS WSC	HAYS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 132,940	$ 132,940	$ 132,940	$ 132,940	$ 88,895	$ 106,490	926	$ 106,490	$ 115.00
MANUFACTURING	HAYS	COLORADO	Temporary Overdraft of Trinity Aquifer	$ 1,488,000	$ 2,146,288	$ -	$ -	$ -	$ 245,894	$ 245,894	$ 245,894	$ 245,894	333	$ 245,894	$ 738.42
COUNTY-OTHER	LLANO	COLORADO	Conservation	$ -	$ -	$ -	$ 41,626	$ 40,140	$ 34,193	$ -	$ -	$ -	84	$ 41,626	$ 495.55
COUNTY-OTHER	LLANO	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 152,605	$ 152,605	$ 152,605	$ 152,605	$ 152,605	1,327	$ 152,605	$ 115.00
KINGSLAND WSC	LLANO	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 48,530	422	$ 48,530	$ 115.00
LAKE LBJ MUD	LLANO	COLORADO	Conservation	$ -	$ -	$ -	$ 54,015	$ 53,024	$ 44,600	$ 39,644	$ 40,140	$ 33,697	109	$ 54,015	$ 495.55
LAKE LBJ MUD	LLANO	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 161,000	$ 156,860	1,400	$ 161,000	$ 115.00
LLANO	LLANO	COLORADO	Conservation	$ -	$ -	$ -	$ 42,617	$ 38,157	$ 33,697	$ 29,733	$ 28,742	$ 29,237	86	$ 42,617	$ 495.55
LLANO	LLANO	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,005	$ 10,005	$ 10,005	87	$ 10,005	$ 115.00
LLANO	LLANO	COLORADO	New Ellenburger-San Saba Well Field	$ 4,869,577	$ 6,714,654	$ 706,271	$ 706,271	$ 706,271	$ 706,271	$ 706,271	$ 706,271	$ 706,271	654	$ 706,271	$ 1,079.92
LLANO	LLANO	COLORADO	Temporary overdraft of Ellenburger-San Saba Well Field												
LIVESTOCK	LLANO	COLORADO	Expand current Hickory supply	$ 465,000	$ 465,000	$ 194,792	$ 194,792	$ 194,792	$ 194,792	$ 194,792	$ 194,792	$ 194,792	62	$ 194,792	$ 3,141.81
MANUFACTURING	LLANO	COLORADO	Allocate water from Llano County - Other	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
STEAM ELECTRIC POWER	LLANO	COLORADO	Reduction in LCRA Commitment due to Improved Efficiency (Ferguson)												
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	Allocate water from Matagorda County - Other	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
COUNTY-OTHER	MATAGORDA	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 1,725	$ 1,725	$ 1,725	$ 1,725	$ 1,725	15	$ 1,725	$ 115.00
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	47,509	$ -	$ -
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	12,189	$ -	

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Continued use of Downstream return flows												
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	HB-1437: Water conservation	$ 1,417,001	$ 1,417,001	$ -	$ -	$ -	$ -	$ -	$ 123,541	$ 123,541	12,200	$ 123,541	$ 10.13
IRRIGATION	MATAGORDA	BRAZOS-COLORADO	Firm up RoR with off-channel storage	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	5,076	$ -	$ -
IRRIGATION	MATAGORDA	COLORADO	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	1,244	$ -	
IRRIGATION	MATAGORDA	COLORADO	Continued use of Downstream return flows												
IRRIGATION	MATAGORDA	COLORADO	HB-1437: Water conservation	$ 23,230	$ 23,230	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,025	200	$ 2,025	$ 10.13
IRRIGATION	MATAGORDA	COLORADO	Firm up RoR with off-channel storage	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	44,743	$ -	$ -
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	11,443	$ -	
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Continued use of Downstream return flows												
IRRIGATION	MATAGORDA	COLORADO-LAVACA	HB-1437: Water conservation	$ 998,870	$ 998,870	$ -	$ -	$ -	$ -	$ -	$ -	$ 87,086	8,600	$ 87,086	$ 10.13

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
IRRIGATION	MATAGORDA	COLORADO-LAVACA	Firm up RoR with off-channel storage	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
LIVESTOCK	MATAGORDA	COLORADO-LAVACA	Expand current Gulf Coast supply	$ 420,000	$ 420,000	$ 170,439	$ 170,439	$ 170,439	$ 170,439	$ 170,439	$ 170,439	$ 170,439	56	$ 170,439	$ 3,043.56
MANUFACTURING	MATAGORDA	BRAZOS-COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 493,120	$ 687,010	$ 687,010	$ 855,370	$ 855,370	7,438	$ 855,370	$ 115.00
MANUFACTURING	MATAGORDA	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 449,880	$ 626,520	$ 626,520	$ 780,160	$ 780,160	6,784	$ 780,160	$ 115.00
MANUFACTURING	MATAGORDA	COLORADO	Temporary overdraft of Gulf Coast Aquifer	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 820	47	$ 820	$ 17.46
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Contract Renewal. New values based on WAM	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400,360	$ 4,406,225	$ 4,411,745	38,363	$ 4,411,745	$ 115.00
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Desalination	$ 66,920,320	$ 96,537,717	$ -	$ 12,690,777	$ 12,690,777	$ 12,690,777	$ 12,690,777	$ 12,690,777	$ 12,690,777	29,568	$ 12,690,777	$ 429.21
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	ROR Increase due to COA Return Flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Reduction in LCRA Commitment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	ROR Increase due to downstream Return Flows												
STEAM ELECTRIC POWER	MATAGORDA	COLORADO	Reduction in LCRA Commitment												
BROOKSMITH SUD	MILLS	COLORADO	Conservation	$ -	$ -	$ -	$ 496	$ -	$ -	$ -	$ -	$ -	1	$ 496	$ 495.55
BROOKSMITH SUD	MILLS	COLORADO	Allocate water from Mills County - Other	$ 232,000	$ 336,232	$ -	$ -	$ -	$ 35,554	$ 35,554	$ 35,554	$ 35,554	7	$ 35,554	$ 5,079.20
GOLDTHWAITE	MILLS	BRAZOS	Conservation	$ -	$ -	$ -	$ 496	$ -	$ 496	$ 496	$ -	$ 496	1	$ 496	$ 495.55
GOLDTHWAITE	MILLS	BRAZOS	Expand current Trinity supply												
GOLDTHWAITE	MILLS	COLORADO	Conservation	$ -	$ -	$ -	$ 22,795	$ 22,795	$ 20,813	$ 17,840	$ 16,353	$ 15,858	46	$ 22,795	$ 495.55
GOLDTHWAITE	MILLS	COLORADO	Expand current Trinity supply	$ 3,944,000	$ 5,774,580	$ 612,872	$ 612,872	$ 612,872	$ 612,872	$ 612,872	$ 612,872	$ 612,872	310	$ 612,872	$ 1,977.00
GOLDTHWAITE	MILLS	COLORADO	Expand current Trinity supply (from Brazos basin)												
GOLDTHWAITE	MILLS	COLORADO	Construct Goldthwaite channel dam	$ 1,405,950	$ 2,495,692	$ 317,203	$ 317,203	$ 317,203	$ 317,203	$ 317,203	$ 317,203	$ 317,203	-	$ 317,203	NA
GOLDTHWAITE	MILLS	COLORADO	Construct additional Goldthwaite off-channel reservoir	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-	$ -	
IRRIGATION	MILLS	BRAZOS	Expand current Trinity supply	$ -	$ -	$ 5,739	$ 5,739	$ 5,739	$ 5,739	$ 5,739	$ 5,739	$ 5,739	193	$ 5,739	$ 29.74
IRRIGATION	MILLS	COLORADO	Expand current Trinity supply	$ -	$ -	$ 6,453	$ 6,453	$ 6,453	$ 6,453	$ 6,453	$ 6,453	$ 6,453	217	$ 6,453	$ 29.74
MANUFACTURING	MILLS	COLORADO	Allocate water from Mills County - Other	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
COUNTY-OTHER	SAN SABA	COLORADO	Contract Renewal	$ -	$ -	$ -	$ 2,300	$ 2,300	$ 2,300	$ 2,300	$ 2,300	$ 2,300	20	$ 2,300	$ 115.00
RICHLAND SUD	SAN SABA	COLORADO	Conservation	$ -	$ -	$ -	$ 6,442	$ 4,460	$ -	$ -	$ -	$ 496	13	$ 6,442	$ 495.55
AQUA WSC	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 181,930	$ 194,925	1,695	$ 194,925	$ 115.00
AUSTIN	TRAVIS	COLORADO	Advanced water conservation for the City of Austin	$ -	$ -	$ 845,760	$ 2,368,128	$ 2,283,552	$ 2,452,704	$ 2,621,856	$ 1,902,960	$ 1,707,167	6,200	$ 2,621,856	$ 422.88
AUSTIN	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,137,145	140,323	$ 16,137,145	$ 115.00
AUSTIN	TRAVIS	COLORADO	COA reuse	$ 125,394,337	$ 178,059,959	$ 21,000,843	$ 21,000,843	$ 21,000,843	$ 21,000,843	$ 21,000,843	$ 21,000,843	$ 21,000,843	47,227	$ 21,000,843	$ 444.68
AUSTIN	TRAVIS	COLORADO	ROR Increase due to COA Return Flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
AUSTIN	TRAVIS	COLORADO	Reduction in LCRA Commitment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
AUSTIN	TRAVIS	COLORADO	ROR Increase due to downstream Return Flows												
AUSTIN	TRAVIS	COLORADO	Reduction in LCRA Commitment												
BARTON CREEK WEST WSC	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 16,992	$ 14,237	$ 13,318	$ 11,941	$ 11,022	$ 7,348	37	$ 16,992	$ 459.25
BARTON CREEK WEST WSC	TRAVIS	COLORADO	Purchase additional water from West Travis County RWS	$ -	$ -	$ 6,325	$ 1,840	$ -	$ -	$ -	$ -	$ -	55	$ 6,325	$ 115.00
BEE CAVE VILLAGE	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 20,666	$ 34,903	$ 46,844	$ 45,007	$ 51,436	$ 56,029	122	$ 56,029	$ 459.25
BEE CAVE VILLAGE	TRAVIS	COLORADO	Purchase additional water from West Travis County RWS	$ -	$ -	$ 11,730	$ 23,805	$ 38,180	$ 47,840	$ 49,795	$ 51,060	$ 51,635	449	$ 51,635	$ 115.00
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 7,348	$ 13,778	$ 14,696	$ 3,215	$ 3,215	$ 4,593	32	$ 14,696	$ 459.25
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ 34,500	$ 34,500	$ 34,500	300	$ 34,500	$ 115.00
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ 460	$ 7,015	$ 12,535	$ 18,400	$ 24,380	212	$ 24,380	$ 115.00
CEDAR PARK	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 6,889	$ 15,155	$ 17,452	$ 5,970	$ 6,430	$ 6,430	38	$ 17,452	$ 459.25
CEDAR PARK	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 58,190	$ 65,550	570	$ 65,550	$ 115.00
COUNTY-OTHER	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ 69,460	$ 339,480	$ 906,315	$ 906,430	$ 1,318,245	$ 1,318,245	11,463	$ 1,318,245	$ 115.00
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ 32,545	$ 45,770	$ 55,085	$ 64,745	$ 75,095	653	$ 75,095	$ 115.00
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ 805	$ 1,150	$ 1,380	$ 1,610	$ 1,840	16	$ 1,840	$ 115.00
ELGIN	TRAVIS	COLORADO	Expand current Carrizo-Wilcox supply (Bastrop County)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 87	$ 87	5	$ 87	$ 17.46
GOFORTH WSC	TRAVIS	COLORADO	Transfer water from Goforth WSC in Region L	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
JONESTOWN	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ 28,865	$ 28,865	$ 28,865	251	$ 28,865	$ 115.00
JONESTOWN	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 3,335	$ 9,085	$ 14,030	$ 17,135	$ 20,470	$ 24,380	212	$ 24,380	$ 115.00
JONESTOWN WSC	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,535	$ 12,535	$ 12,535	109	$ 12,535	$ 115.00
JONESTOWN WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 1,495	$ 4,025	$ 6,210	$ 7,705	$ 9,315	$ 11,040	96	$ 11,040	$ 115.00
LAGO VISTA	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 77,154	$ 127,672	$ 167,626	$ 163,493	$ 186,915	$ 202,529	441	$ 202,529	$ 459.25
LAGO VISTA	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 31,050	$ 778,550	$ 778,550	$ 778,550	$ 778,550	6,770	$ 778,550	$ 115.00
LAKEWAY	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 135,020	$ 222,736	$ 280,602	$ 282,439	$ 322,394	$ 348,112	758	$ 348,112	$ 459.25
LAKEWAY	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 282,325	$ 282,325	$ 282,325	$ 282,325	2,455	$ 282,325	$ 115.00
LAKEWAY	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 89,700	$ 170,430	$ 224,365	$ 230,805	$ 234,255	$ 233,795	2,037	$ 234,255	$ 115.00
LOOP 360 WSC	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 50,518	$ 47,762	$ 42,251	$ 39,036	$ 36,281	$ 32,607	110	$ 50,518	$ 459.25
LOOP 360 WSC	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 100,165	$ 100,165	$ 100,165	$ 100,165	871	$ 100,165	$ 115.00

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
LOOP 360 WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 28,405	$ 16,100	$ 5,060	$ -	$ -	$ -	247	$ 28,405	$ 115.00
LOST CREEK MUD	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 32,607	$ 31,688	$ 27,555	$ 2,756	$ -	$ -	71	$ 32,607	$ 459.25
LOST CREEK MUD	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ 743,325	$ 732,195	$ 720,270	$ 708,345	$ 701,190	$ 701,190	935	$ 743,325	$ 795.00
MANOR	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ 38,640	$ 40,365	$ 42,435	$ 44,620	388	$ 44,620	$ 115.00
MANVILLE WSC	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ 211,485	$ 251,160	$ 297,160	$ 348,910	3,034	$ 348,910	$ 115.00
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 84,270	$ 81,885	$ 81,090	$ 81,090	106	$ 84,270	$ 795.00
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 157,090	$ 177,100	1,540	$ 177,100	$ 115.00
PFLUGERVILLE	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 155,227	$ 104,250	$ 50,977	$ 16,074	$ 42,710	$ 43,629	338	$ 155,227	$ 459.25
PFLUGERVILLE	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,222,910	$ 1,202,900	10,634	$ 1,222,910	$ 115.00
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 60,621	$ 74,858	$ 62,458	$ 54,192	$ 51,436	$ 46,384	163	$ 74,858	$ 459.25
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 103,500	$ 103,500	$ 103,500	$ 103,500	$ 103,500	900	$ 103,500	$ 115.00
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ 50,370	$ 60,720	$ 45,080	$ 30,820	$ 17,940	$ 6,325	528	$ 60,720	$ 115.00
ROLLINGWOOD	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 14,237	$ 13,318	$ 11,481	$ 11,022	$ 10,563	$ 5,052	31	$ 14,237	$ 459.25
ROLLINGWOOD	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ -	$ 42,780	$ 42,665	$ 42,895	373	$ 42,895	$ 115.00
ROUND ROCK	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 13,532	$ 25,796	$ 36,368	$ 27,064	$ 14,378	$ 14,801	86	$ 36,368	$ 422.88
ROUND ROCK	TRAVIS	COLORADO	HB 1437 - Region G	$ -	$ -	$ -	$ 18,113	$ 35,363	$ 50,169	$ 61,238	$ 77,050	$ 92,719	645	$ 92,719	$ 143.75
SHADY HOLLOW MUD	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 2,478	$ -	$ -	$ -	$ -	$ -	5	$ 2,478	$ 495.55
SHADY HOLLOW MUD	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 569,220	$ 556,500	$ 551,730	$ 551,730	716	$ 569,220	$ 795.00
THE HILLS	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 24,778	$ 36,175	$ 28,742	$ 24,282	$ 14,371	$ -	73	$ 36,175	$ 495.55
THE HILLS	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 184,000	$ 184,000	$ 184,000	$ 184,000	1,600	$ 184,000	$ 115.00
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 103,570	$ 119,923	$ 43,608	$ 17,344	$ 35,184	$ 36,175	242	$ 119,923	$ 495.55
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 63,710	$ 63,710	$ 63,710	$ 63,710	$ 1,075,710	9,354	$ 1,075,710	$ 115.00
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 161,000	$ 161,000	$ 161,000	$ 161,000	$ 161,000	1,400	$ 161,000	$ 115.00
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ -	$ 460	$ 15,525	$ 32,545	283	$ 32,545	$ 115.00
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 16,353	$ 15,362	$ 13,380	$ 12,884	$ 11,893	$ 10,902	33	$ 16,353	$ 495.55
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 42,780	$ 42,665	$ 42,665	$ 42,665	372	$ 42,780	$ 115.00
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 20,318	$ 18,831	$ 16,849	$ 15,858	$ 14,371	$ 12,884	41	$ 20,318	$ 495.55
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 130,525	$ 130,525	$ 130,525	$ 130,525	1,135	$ 130,525	$ 115.00
WELLS BRANCH MUD	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 62,935	$ 37,662	$ -	$ -	$ -	$ -	127	$ 62,935	$ 495.55
WELLS BRANCH MUD	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 1,170,240	$ 1,147,980	$ 1,140,825	$ 1,140,825	1,472	$ 1,170,240	$ 795.00

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
WEST LAKE HILLS	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 68,881	$ 81,270	$ 95,146	$ 90,190	$ 95,641	$ 101,092	204	$ 101,092	$ 495.55
WEST LAKE HILLS	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ 235,635	$ 250,470	$ 266,800	$ 284,165	2,471	$ 284,165	$ 115.00
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	Conservation	$ -	$ -	$ -	$ 8,424	$ -	$ -	$ -	$ -	$ -	17	$ 8,424	$ 495.55
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ -	$ 49,565	$ 121,785	$ 186,185	1,619	$ 186,185	$ 115.00
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ 55,430	$ 55,430	$ 55,430	$ 55,430	$ 55,430	482	$ 55,430	$ 115.00
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	Purchase water from LCRA/Highland Lakes	$ -	$ -	$ -	$ -	$ -	$ 253,115	$ 250,700	$ 250,700	$ 250,700	2,201	$ 253,115	$ 115.00
IRRIGATION	TRAVIS	GUADALUPE	Allocate from Irrigation (Colorado basin)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
MANUFACTURING	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ 104,650	$ 104,650	$ 104,650	$ 104,650	$ 104,650	$ 104,650	910	$ 104,650	$ 115.00
MANUFACTURING	TRAVIS	COLORADO	City of Austin	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
STEAM ELECTRIC POWER	TRAVIS	COLORADO	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,641,475	31,665	$ 3,641,475	$ 115.00
STEAM ELECTRIC POWER	TRAVIS	COLORADO	COA Reuse	$ -	$ -	$ -	$ 747,060	$ 1,281,119	$ 3,149,660	$ 3,684,163	$ 5,552,259	$ 6,087,652	13,690	$ 6,087,652	$ 444.68
STEAM ELECTRIC POWER	TRAVIS	COLORADO	Reduction in LCRA Commitment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
WHARTON	WHARTON	COLORADO	Conservation	$ -	$ -	$ -	$ 20,318	$ -	$ -	$ -	$ -	$ -	41	$ 20,318	$ 495.55
IRRIGATION	WHARTON	BRAZOS-COLORADO	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	BRAZOS-COLORADO	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	BRAZOS-COLORADO	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	BRAZOS-COLORADO	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	49,875	$ -	$ -
IRRIGATION	WHARTON	BRAZOS-COLORADO	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	261	$ -	
IRRIGATION	WHARTON	BRAZOS-COLORADO	Continued use of Downstream return flows												
IRRIGATION	WHARTON	BRAZOS-COLORADO	HB-1437: Water conservation	$ 418,131	$ 418,131	$ -	$ 36,455	$ 36,455	$ 36,455	$ 36,455	$ 36,455	$ 36,455	3,600	$ 36,455	$ 10.13
IRRIGATION	WHARTON	COLORADO	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	

REGION K WMS COST BREAKDOWN

WUG Name	County	River Basin	Water Management Strategy	Total Capital Cost ($)	Total Project Costs ($)	Total Annual Cost 2000 ($)	Total Annual Cost 2010 ($)	Total Annual Cost 2020 ($)	Total Annual Cost 2030 ($)	Total Annual Cost 2040 ($)	Total Annual Cost 2050 ($)	Total Annual Cost 2060 ($)	Largest Firm Yield (ac-ft/yr)	Largest Annual Cost ($)	Unit Cost ($/ac-ft)
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO	Continued use of Downstream return flows												
IRRIGATION	WHARTON	COLORADO	HB-1437: Water conservation	$ 23,230	$ 23,230	$ -	$ 2,025	$ 2,025	$ 2,025	$ 2,025	$ 2,025	$ 2,025	200	$ 2,025	$ 10.13
IRRIGATION	WHARTON	COLORADO-LAVACA	Supply Reduction due to LSWP	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO-LAVACA	Transfer supply to M&I	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Develop the Gulf Coast aquifer for rice irrigation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation on-farm water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Rice irrigation delivery system water conservation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO-LAVACA	LCRA-SAWS: Develop water conserving rice variety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	
IRRIGATION	WHARTON	COLORADO-LAVACA	Continuation of LCRA Water Management Plan for interruptible water	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	21,461	$ -	$ -
IRRIGATION	WHARTON	COLORADO-LAVACA	Continued use of Austin return flows	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	90	$ -	
IRRIGATION	WHARTON	COLORADO-LAVACA	Continued use of Downstream return flows												
IRRIGATION	WHARTON	COLORADO-LAVACA	HB-1437: Water conservation	$ 23,230	$ 23,230	$ -	$ 2,025	$ 2,025	$ 2,025	$ 2,025	$ 2,025	$ 2,025	200	$ 2,025	$ 10.13
MANUFACTURING	WHARTON	COLORADO-LAVACA	Expand current Gulf Coast supply	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 140	8	$ 140	$ 17.46
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	Conservation	$ -	$ -	$ -	$ 36,740	$ -	$ -	$ -	$ -	$ -	80	$ 36,740	$ 459.25
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	Contract Renewal	$ -	$ -	$ -	$ 1,163,880	$ 1,140,030	$ 1,116,975	$ 1,093,125	$ 1,077,225	$ 1,077,225	1,464	$ 1,163,880	$ 795.00
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	Contract Renewal	$ -	$ -	$ -	$ -	$ -	$ 756,840	$ 737,760	$ 731,400	$ 731,400	952	$ 756,840	$ 795.00
				$ 251,118,777	$ 358,174,068										

List of assumptions/methodology for strategy cost development

Expansion of Groundwater

Assumed that any need less than 1/4 mgd could be met by additional pumping w/o need for additional wells for all WUGs except Livestock
For these WUGS, only the increased Annual Energy Cost was assumed to be required for providing the water.
(livestock received 1 well per ac-ft/yr needed)

Capital Costs Assumed

Wells -
Probable capacity (mgd) of well to be installed based on location and aquifer (see table below)
Assumed well runs 24hrs a day at 80% efficiency
Number of wells anticipated to be installed based on each well's production (@ 80% efficiency) and the largest quantity of water supplied (ac-ft/yr) by the strategy over the planning period, times a factor of two for peak demands.
Quantity includes any amounts supplied to different WUG(s), if applicable
Assumed well diameter based on assumed capacity and guidance from Randy Williams
Depth assumed using guidance from Randy Williams based on location and aquifer
Cost determined by using $25/in-ft - assumed to include all installation, clorination, and pump
Different assumptions used for livestock WUGs
Number wells based on 1ac-ft/yr per well and largest quantity of water supplied (ac-ft/yr) by the strategy over the planning period
8" well diameter assumed (not used in cost calculation)
Cost determined using $7500 per well - asuumed to include all installation, treatment, pump

Transmission Line-
Assumed 1/2 mile transmission line for each well needed to connect to existing system
Max flow in line taken from the largest quantity of water supplied, value converted to cfs
Velocity in line assumed to be 5 ft/s
Calculate cross-sectional area of line based on max flow and assumed velocity.
Calculate required diameter based on circular pipe
Smallest possible diameter allowed = 6". Rounded required diameter up nearest readily available pipe size
Unit cost of X" diameter pipe taken from 2nd Q 2002 value provided by Region H
Cost based on length of 1/2 mile, multiplied by the unit cost, multiplied by the number of wells required from well calc sheet
Different assumptions used for livestock WUGs
No transmission line assumed for livestock WUGs

Project Costs Assumed

Engineering, etc - 35% of the total capital cost
Environmental, etc - Assumed to be equal to the land acquisition cost.
Assumption borrowed from San Marcos Water Supply Master Plan (SMWSMP)
Land acquisition - Assumed 1 acre per well, at $2,000/acre ($2000/acre taken from the SMWSMP)
Interest Earned - Assumes 4% interest and uses an assumed construction time of 1 year
Interest Accrued - Assumes 6% interest and uses an assumed construction time of 1 year
Different assumptions used for livestock WUGs
No Project Costs assumed for livestock WUGs

Annual Costs Assumed

Term of Debt - 20 years assumed for this strategy. Conforms with Exhibit B

O&M - Calculated as 4% of well costs and 1% of transmission/distribution pipe costs plus a 15% contingency

Pumping Water Level Distance - Pumping lift from table below, based on location and aquifer PLUS five feet for every 1000' of transmission pipe required

Annual Energy Cost- Calculated based on the max. quantity of water (ac-ft/yr) provided over the planning period, the pumping distance, and $0.06/kWh*

Unit Cost - Based on the largest quantity of water (ac-ft/yr) provided by the strategy (per decade) and the largest annual cost over the planning period (per decade)

Different assumptions used for livestock WUGs

Term of Debt at 5 years.

*Annual Energy Conversion: acft/yr * 325851 = gal/yr ; gal/yr * 8.34 = lb(water)/yr ; lb(water/yr*head(ft) = lb-ft/yr ; lb-ft/yr * 3.766x10^-7 = kWh/yr

Well assumptions

County	Aquifer	Well capacity (MGD)	Depth (ft)	Diameter (in)	Pumping water level height
Bastrop	Carrizo-Wilcox	1.5	500	16	200
Bastrop	other (alluvial)	0.75	100	10	20
Burnet	Trinity	0.2	500	8	350
Burnet	Marble Falls	0.25	500	8	200
Colorado	other (alluvial)	0.75	100	10	20
Colorado	Gulf Coast	0.5	500	8	200
Fayette	Gulf Coast	0.5	500	8	200
Fayette	other (alluvial)	0.75	100	10	20
Hays	Trinity	0.2	500	8	200
Hays	Edwards BFZ	0.5	400	8	200
Llano	Ellenburger-San Saba	0.1	600	6	200
Mills	Trinity	0.04	500	8	200

List of assumptions/methodology for strategy cost development

New Well or Well Field

Capital Costs Assumed

Wells -	Probable capacity (mgd) of well to be installed from Randy Williams based on location and aquifer Assumed well runs 24hrs a day at 80% efficiency Number of wells anticipated to be installed based on each well's production (@ 80% efficiency) and the largest quantity of water supplied (ac-ft/yr) by the strategy over the planning period, times a factor of two for peak demands. Quantity includes any amounts supplied to different WUG(s), if applicable Assumed well diameter based on assumed capacity and guidance from Randy Williams Depth assumed using guidance from Randy Williams based on location and aquifer Cost determined by using $25/in-ft - assumed to include all installation, clorination, and pump
Transmission Line -	Assumed 1/2 mile transmission line for each well needed to connect to existing system Max flow in pipe taken from the largest quantity of water supplied, value converted to cfs Velocity in line assumed to be 5 ft/s Calculate cross-sectional area of line based on max flow and assumed velocity. Calculate required diameter based on circular pipe Smallest possible diameter allowed = 6". Rounded required diameter up nearest readily available pipe size Unit cost of X" diameter pipe taken from 2nd Q 2002 value provided by Region H Cost based on length of 1/2 mile, multiplied by the unit cost, multiplied by the number of wells required from well calc sheet
Distribution Line -	Assumed 5 mile distribution pipe to transport water from pump station to treatment plant. Assume just one pipe Max flow in pipe taken from the largest quantity of water supplied, multiplied by 2 to account for peak - value converted to cfs Velocity in line assumed to be 5 ft/s Calculate cross-sectional area of line based on max flow and assumed velocity. Calculate required diameter based on circular pipe Smallest possible diameter allowed = 6". Rounded required diameter up nearest readily available pipe size Unit cost of X" diameter pipe taken from 2nd Q 2002 value provided by Region H Cost based on length of 5 miles, multiplied by the unit cost
Pump Station -	Cost estimate based on $150,000/MGD, taken from the SMWSMP. Value converted to $/ac-ft/yr and multiplied by the largest supply provided

Project Costs Assumed

Engineering, etc -	35% of the total capital cost
Environmental, etc -	Assumed to be equal to the land acquisition cost. Assumption borrowed from San Marcos Water Supply Master Plan (SMWSMP)
Land acquisition -	Assumed 5 acres for pump station PLUS 1 acre per well, at $2,000/acre ($2000/acre taken from the SMWSMP)
Interest Earned -	Assumes 4% interest and uses an assumed construction time of 1 year
Interest Accrued -	Assumes 6% interest and uses an assumed construction time of 1 year

Annual Costs Assumed

Term of Debt - 20 years assumed for this strategy. Conforms with Exhibit B

O&M - Calculated as 4% of well costs, 2.5% of pump station costs, and 1% of transmission/distribution pipe costs plus a 15% contingency

Pumping Water Level Distance - Pumping lift from table below, based on location and aquifer PLUS five feet for every 1000' of transmission pipe required PLUS 100' to storage tank

Annual Energy Cost- Calculated based on the max. quantity of water (ac-ft/yr) provided over the planning period, the pumping distance, and $0.06/kWh*

Unit Cost - Based on the largest quantity of water (ac-ft/yr) provided by the strategy (per decade) and the largest annual cost over the planning period (per decade)

*Annual Energy Conversion: acft/yr * 325851 = gal/yr ; gal/yr * 8.34 = lb(water)/yr ; lb(water/yr*head(ft) = lb-ft/yr ; lb-ft/yr * 3.766x10^-7 = kWh/yr

Well assumptions

County	Aquifer	Well capacity (MGD)	Depth (ft)	Diameter (in)	Pumping water level height
Bastrop	Carrizo-Wilcox	1.5	500	16	200
Bastrop	other (alluvial)	0.75	100	10	20
Burnet	Trinity	0.2	500	8	350
Burnet	Marble Falls	0.25	500	8	200
Colorado	other (alluvial)	0.75	100	10	20
Colorado	Gulf Coast	0.5	500	8	200
Fayette	Gulf Coast	0.5	500	8	200
Fayette	other (alluvial)	0.75	100	10	20
Hays	Trinity	0.2	500	8	200
Hays	Edwards BFZ	0.5	400	8	200
Llano	Ellenburger-San Saba	0.1	600	6	200
Mills	Trinity	0.04	500	8	200

List of assumptions/methodology for strategy cost development

Contract Renewal

Annual Costs Assumed

Unit Cost - Based on water purchase price from the major water provided (LCRA - $115/acft, COA - $795/acft)

Total Annual Cost - Based on the amount of water needed mulitplied by the unit cost

List of assumptions/methodology for strategy cost development

House Bill 1437 - Municipal Users

For municipal users, the strategy simply involves the purchase of conserved LCRA water at a 25% premium
Assumes that users have treatment capacity for additional water

Annual Costs Assumed

Unit Cost -	$115/acft increased by 25% - Total of $143.75/ac-ft
Total Annual Cost -	Based on the amount of water supplied mulitplied by the unit cost

List of assumptions/methodology for strategy cost development

House Bill 1437 - Irrigation Users

For irrigation users in Region K, the strategy involves a WUG contribution totalling 20% of the Precision Leveling Construction Cost

2005 estimated cost:	$16,524,000
CCI Factor (2002/2005):	0.878628325
2nd Q 2002 value:	$14,518,454

Capital Costs Assumed

Precision Leveling - The total Region K irrigation WUG contribution was split between WUGs.
Split based on the quantity of supply provided to that WUG
For WUGs whose supply provided varies over each decade, the largest supply provided was used to determine the cost for that WUG.

Annual Costs Assumed

Term of Debt - 20 years assumed for this strategy.
O&M - none
Unit Cost - Based on the largest quantity of water (ac-ft/yr) provided by the strategy (per decade) and the largest annual cost over the planning period (per decade)

List of assumptions/methodology for strategy cost development

<u>Purchase Water from Canyon Lake WSC (region L)</u>

Capital Costs Assumed

Transmission Line -	Capital construction cost for the pipe taken from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values
Pump Station -	Capital construction cost for the pipe taken from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values
Highway Crossings -	Capital construction cost for the pipe taken from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values
Storage Tank -	Capital construction cost for the pipe taken from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values

Project Costs Assumed

Engineering, etc -	35% of the total capital cost
Environmental, etc -	Assumed to be equal to the environmental cost from the old Region K Plan, increased by a factor of 1.08 (increase in Consumer Price Index) to convert to 2nd Q 2002 values
Land acquisition -	Assumed to be equal to the land acquisition cost from the old Region K Plan, increased by a factor of 1.08 (increase in Consumer Price Index) to convert to 2nd Q 2002 values
Interest Earned -	Assumes 4% interest and uses an assumed construction time of 2 years
Interest Accrued -	Assumes 6% interest and uses an assumed construction time of 2 year

Annual Costs Assumed

Term of Debt -	30 years assumed for this strategy. Conforms with Exhibit B
O&M -	Assumed to be equal to the O&M cost from the old Region K Plan, increased by a factor of 1.08 (increase in Consumer Price Index) to convert to 2nd Q 2002 values
Treatment at Existing Facility	Assumed to be equal to the cost from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values
Unit Cost -	Based on the largest quantity of water (ac-ft/yr) provided by the strategy (per decade) and the largest annual cost over the planning period (per decade)

List of assumptions/methodology for strategy cost development

Construct GBRA Hays County pipeline

Capital Costs Assumed

Transmission Line -	Capital construction cost for the pipe taken from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values
Pump Station -	Capital construction cost for the pipe taken from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values
Treatment Plant Expansion	Capital construction cost for the pipe taken from the old Region K Plan, increased by a factor of 1.0815 to convert to 2nd Q 2002 values

Project Costs Assumed

Engineering, etc -	35% of the total capital cost
Environmental, etc -	Assumed to be equal to the environmental cost from the old Region K Plan, increased by a factor of 1.08 (increase in Consumer Price Index) to convert to 2nd Q 2002 values
Land acquisition -	Assumed to be equal to the land acquisition cost from the old Region K Plan, increased by a factor of 1.08 (increase in Consumer Price Index) to convert to 2nd Q 2002 values
Interest Earned -	Assumes 4% interest and uses an assumed construction time of 5 years
Interest Accrued -	Assumes 6% interest and uses an assumed construction time of 5 year

Annual Costs Assumed

Term of Debt -	30 years assumed for this strategy. Conforms with Exhibit B
O&M -	Assumed to be equal to the O&M cost from the old Region K Plan, increased by a factor of 1.08 (increase in Consumer Price Index) to convert to 2nd Q 2002 values
Unit Cost -	Based on the largest quantity of water (ac-ft/yr) provided by the strategy (per decade) and the largest annual cost over the planning period (per decade)

List of assumptions/methodology for strategy cost development

<u>Purchase Water from City of Austin for Hays County</u>

Capital Costs Assumed

Project Costs Assumed

ALL CAPITAL AND PROJECT COSTS PROVIDED AS ONE VALUE FROM THE COA. THIS VALUE WAS DECREASED BY A FACTOR OF 0.877 TO CONVERT TO 2nd Q 2002 VALUES

Annual Costs Assumed

Term of Debt -	30 years assumed for this strategy. Conforms with Exhibit B
O&M -	Assumed to be equal to the O&M cost provided by the COA, decreased by a factor of 0.93 (decrease in Consumer Price Index) to convert to 2nd Q 2002 values
Purchase of water	Dollar amount provided by the COA
Unit Cost -	Based on the largest quantity of water (ac-ft/yr) provided by the strategy (per decade) and the largest annual cost over the planning period (per decade)

List of assumptions/methodology for strategy cost development

Recharge Edwards BFZ from Onion Creek

Costs provided by Alan Plummer Associates, Inc. - Kelly Payne

Capital Costs Assumed

Dam Construction	Capital construction cost taken from the original "Onion Creek Recharge Project" report, April 1992, increased using ENR CCI to 2nd Q 2002 values

Project Costs Assumed

Engineering, etc -	35% of the total capital cost
Environmental, etc -	15% of the total capital cost as done in previous Region K Plan
Land acquisition -	Cost taken from the original "Onion Creek Recharge Project" report, April 1992, increased using ENR CCI to 2nd Q 2002 values
Interest Earned -	Assumes 4% interest and uses an assumed construction time of 2 years
Interest Accrued -	Assumes 6% interest and uses an assumed construction time of 2 year

Annual Costs Assumed

Term of Debt -	30 years assumed for this strategy. Conforms with Exhibit B
O&M -	Cost taken from the original "Onion Creek Recharge Project" report, April 1992, increased using ENR CCI to 2nd Q 2002 values
Unit Cost -	Based on the largest quantity of water (ac-ft/yr) provided by the strategy (per decade) and the largest annual cost over the planning period (per decade)

List of assumptions/methodology for strategy cost development

Cost data provided by Alan Plummer Associates, Inc.

	2nd Quarter 1999 approximately equal to cost update shown in previous SB1 Report, 2000				**2nd Quarter 2002** update for current planning effort			
Phase	Centex Reservoir	Ruby Reservoir	Rutherford Reservoir	Centex Quarry	Centex Reservoir	Ruby Reservoir	Rutherford Reservoir	Centex Quarry
Capital Costs								
Dam Construction	$562,000	$901,000	$2,694,000	$1,226,000	$608,000	$974,000	$2,914,000	$1,326,000
Total Capital Costs	**$562,000**	**$901,000**	**$2,694,000**	**$1,226,000**	**$608,000**	**$974,000**	**$2,914,000**	**$1,326,000**
Engineering, Contingencies, and Legal Services (35%)	$197,000	$315,000	$943,000	$429,000	$213,000	$341,000	$1,020,000	$464,000
Environmental and Archaeological Studies, Mitigation, and Permitting	$84,000	$135,000	$404,000	$184,000	$91,000	$146,000	$437,000	$199,000
Site Acquisition	$37,000	$43,000	$194,000	$96,000	$40,000	$47,000	$210,000	$104,000
Interest During Construction	$18,000	$28,000	$85,000	$39,000	$19,000	$30,000	$92,000	$42,000
~~Interest Earned on Unused Principal~~								
Total Project Costs	**$898,000**	**$1,422,000**	**$4,320,000**	**$1,974,000**	**$971,000**	**$1,538,000**	**$4,673,000**	**$2,135,000**
Annual Costs								
Debt Service (6 % for 30 years)	$65,000	$103,000	$314,000	$143,000	$70,542	$112,000	$339,000	$155,000
Operation and Maintenance	$18,000	$18,000	$61,000	$74,000	$20,000	$20,000	$66,000	$80,000
Total Annual Costs	**$83,000**	**$121,000**	**$375,000**	**$217,000**	**$90,542**	**$132,000**	**$405,000**	**$235,000**
Firm Annual Recharge (af)	**768**	**1,152**	**5,043**	**5,718**	**768**	**1,152**	**5,043**	**5,718**
Unit Cost of Water ($/ac-ft)	**$108**	**$105**	**$74**	**$38**	**$118**	**$115**	**$80**	**$41**
Unit Cost of Water ($/1000 gal.)	**$0.33**	**$0.32**	**$0.23**	**$0.12**	**$0.36**	**$0.35**	**$0.25**	**$0.13**

APPENDIX 4C

GOLDTHWAITE AND LLANO GROUNDWATER STRATEGIES

Groundwater Supply Alternative for the City of Goldthwaite

According to the demand projections and water availability analysis, the City of Goldthwaite will have a maximum water shortage of 310 acre-feet per year (ac-ft/yr) in 2010 after municipal conservation is applied. To determine groundwater options available for this area, the following resources were consulted: TWDB Report 319 – Evaluation of Water Resources in Part of Central Texas (January 1990), a general knowledge of the groundwater resources for the area, and TWDB groundwater database on wells information posted at http://wiid.twdb.state.tx.us/ims/wwm_drl/viewer.htm

The TWDB well information available for Mills County gave information on four of the City of Goldthwaite's wells, and this information was used in evaluating the available options. These wells are around 500 feet deep and are producing water from the Travis Peak Formation in the Trinity Group. These wells are approximately 1 mile outside the city limits and yield water at roughly 30 gallons per minute (gpm).

Using this information, it was assumed that additional wells drilled in the Goldthwaite area would draw from the Travis Peak Formation as well. *Table 1* gives more information on this hydrologic unit.

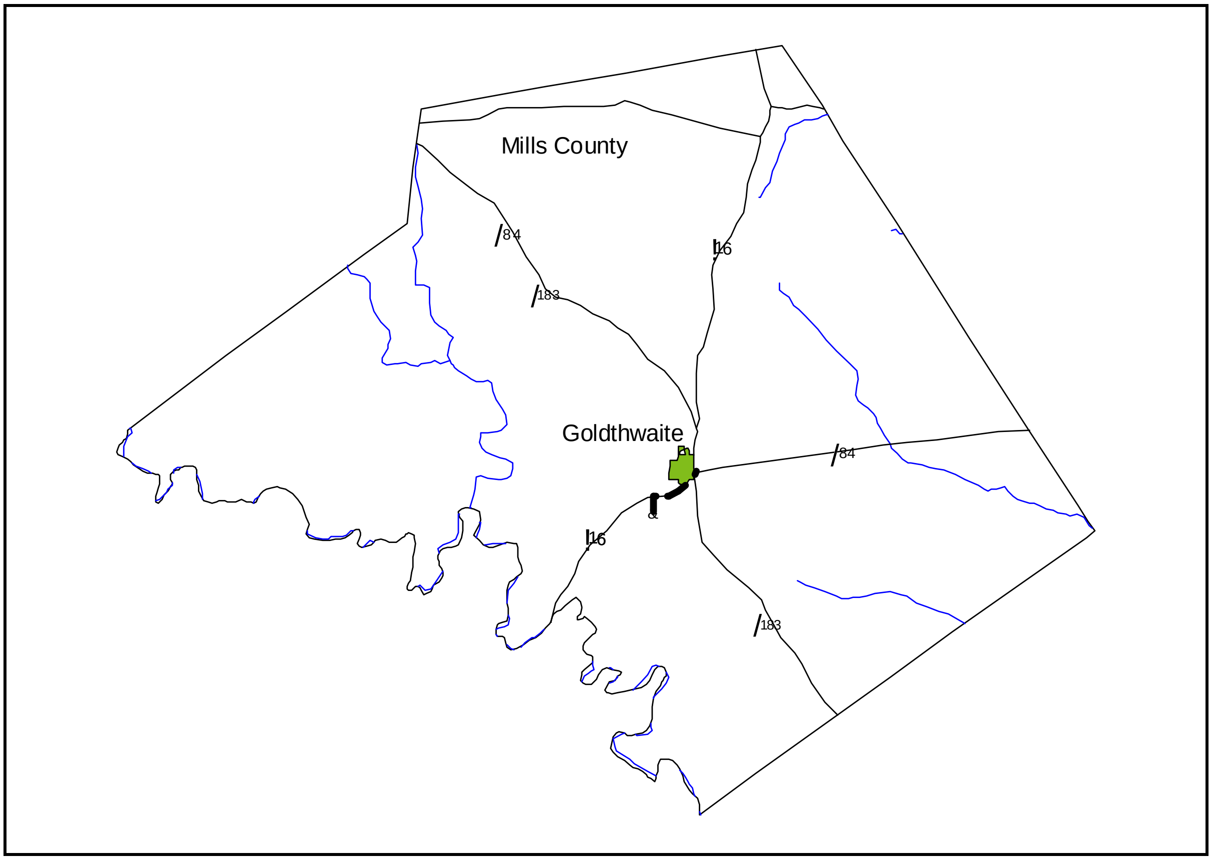
Table 1: Goldthwaite Area Geological and Hydrological Units and Their Water-Bearing Properties*

Geological Units						
Era	Mesozoic					
System	Cretaceous					
Group	Trinity					
Formation	Antlers Formation					
	Travis Peak Formation					
Member or Unit	Hensell Sand Member	Pearsall Member	Cow Creek Limestone Member	Hammett Shale Member	Sligo Member	Hosston Member
Hydrological Units	**Middle Trinity**			**Lower Trinity**		
Approximate Range in thickness (feet)	175	85	130	140	130	1,550
Character of Rocks	Sand, gravel, conglomerate, sandstone, siltstone, & shale. Grades into sandy limestone and dolomite.	Predominately shale interbedded with sand; however, in the calcareous facies, the unit is composed almost entirely of calcareous sediments.	Massive, often sandy, dolomitic limestone, frequently forming cliffs and waterfalls. Contains gypsum & anhydrite beds.	Shale & clay with some sand, dolomitic limestone & conglomerate.	Limestone, dolomite, occasionally sandy, & shale. Thins to the west.	Basal conglomerate grading upward into a mixture of sand, siltstone, & shale, with some limestone beds.
Water-Bearing Properties	Yields small to large quantities of fresh to slightly saline water.		Not known to yield water in the study area.		Yields moderate to large quantities of fresh to moderately saline water.	

*Information taken from the Texas Water Development Board's Report 319: Evaluation of Water Resources in Part of Central Texas (January 1990).

The location suggested for these new wells is approximately 1 mile southwest of the city limits, as shown in *Figure 1*. The production capacity of each well was assumed to be 30 gpm at a well depth of 550 feet. Comparing topographic maps of the area with the water level maps given in the literature resulted in a depth to water of 400 feet. The area's transmissivity was also taken from the literature. This was assumed to be 2,000 gallons per day/foot. Existing wells drilled in the area also have 8-inch diameter screens in the lower 70 feet. Well efficiency was assumed to be 80 percent.

Figure 1: Goldthwaite Groundwater Supply Option



Using the assumed aquifer conditions a system of 8 wells would be sufficient to produce the amount of water required to meeting the maximum projected shortage under average conditions. However, to meet peak demand conditions the number of wells in the well field would have to be expanded to 16. A well field consisting of 16 wells was used for the cost analysis for this strategy.

The overall available groundwater supply from the Trinity aquifer in Mills County remaining after other water management strategies have been considered is sufficient to meet the projected shortage for the City of Goldthwaite. However, neither the Colorado Basin nor the Brazos Basin Trinity aquifer supply is sufficient to meet the projected shortage alone. The location of the City of Goldthwaite is on the Colorado-Brazos Basin Divide. A well field sited in reasonable proximity to the corporate limits of the City might reasonably be assumed to be capable of producing groundwater from the Trinity aquifer groundwater supplies in both the Colorado and Brazos Basins. Under this assumption, the City of Goldthwaite could avoid the cost of constructing a well field in each basin.

Groundwater Supply Alternative for the City of Llano

According to the demand projections and water availability analysis, the City of Llano will have a maximum water shortage of approximately 660 ac-ft/yr in 2010 after municipal conservation is applied. To determine groundwater options available for this area, the following resources were consulted: TWDB Report 346 – The Paleozoic and Related Aquifers of Central Texas (March 1996), a general knowledge of the groundwater resources for the area, and conversations with a drilling contractor familiar with the area of interest.

In discussions with the local drilling contractor, it was learned that wells had recently been drilled in the Riley Mountain area. The area is rather rocky, but the wells yield water at 70-100 gpm. These wells are about 600 feet deep, 6 inches in diameter, and producing water from the Ellenburger-San Saba aquifer.

Using this information, it was assumed that additional wells drilled in the Llano area would draw from the Ellenburger-San Saba aquifer as well. *Table 2* gives more information on this hydrologic unit.

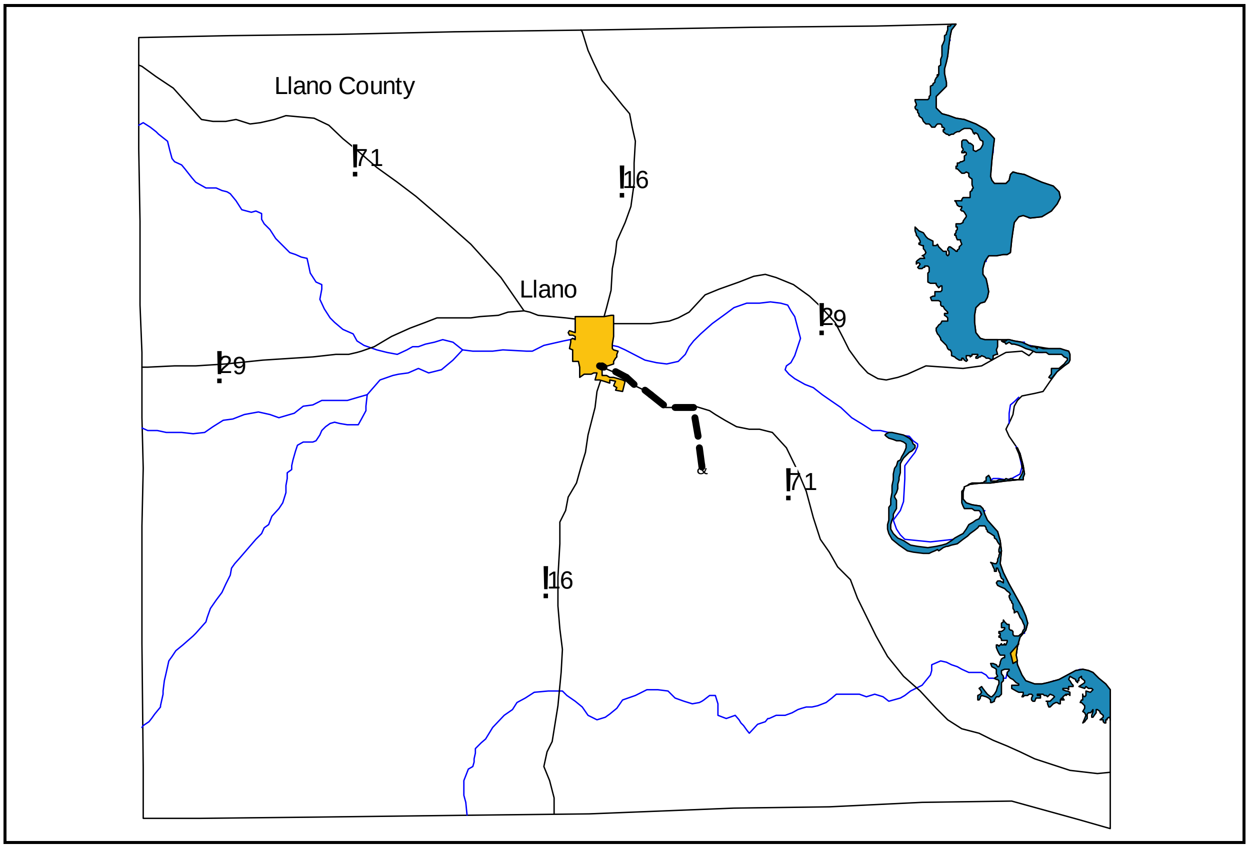
Table 2: Llano Area Geological and Hydrological Units and Their Water-Bearing Properties*

<table>
<tr><th colspan="6">Geologic Units</th></tr>
<tr><td>Era</td><td colspan="5">Paleozoic</td></tr>
<tr><td>System</td><td colspan="4">Ordovician</td><td>Cambrian</td></tr>
<tr><td>Group</td><td colspan="4">Ellenburger Group</td><td>Moore Hollow Group</td></tr>
<tr><td>Formation</td><td>Honeycut Formation</td><td>Gorman Formation</td><td colspan="2">Tanyard Formation</td><td>Wilberns Formation</td></tr>
<tr><td>Member or Unit</td><td>Not Differentiated</td><td>Not Differentiated</td><td>Staendebach Member</td><td>Threadgill Member</td><td>San Saba Aquifer</td></tr>
<tr><td>Hydrological Unit</td><td colspan="5">Ellenburger-San Saba Aquifer</td></tr>
<tr><td>Character of Rocks</td><td>Thinly to thickly bedded, light-gray, aphanitic limestone and thinly to thickly bedded, fine-grained to microgranular, gray dolomite. Both limestone and dolomite have fossiliferous chert.</td><td>Predominantly aphanitic light gray limestone in upper part and predominantly micro-granular to fine-grained, pink, gray and yellowish-gray dolomite in lower part. Has prominent bed containing fossiliferous chert nodules near middle of formation.</td><td>Thickly to thinly bedded, aphanitic, very light gray, cherty limestone and thickly to thinly bedded, fine to medium grained, gray to brownish gray, cherty dolomite. Chert is fossiliferous.</td><td>Predominantly medium to coarse grained, light gray dolomite which may locally and laterally grade to massive, light gray limestone. Lower part may be Cambrian in age.</td><td>Fine to very fine grained, yellowish to brownish to medium gray, thickly to thinly bedded, slightly cherty dolomite. Upper part may be Ordovician in age.</td></tr>
<tr><td>Water-Bearing Properties</td><td colspan="5">Yields very small to very large quantities of fresh to slightly saline water to wells in the Pedernales River Valley in Gillespie and Blanco Counties. Yield of a well is very dependent on the amount and size of fracture openings and cavities encountered by the well bore. Where such openings are encountered, wells may be capable of yielding over 1,000 gallons per minute. Where such openings are not encountered wells may yield less than 5 gallons per minute. Where limestone (calcium carbonate) is encountered well yields may be significantly increased by acidizing. Yields small to very large quantities of fresh water to springs in northwestern Gillespie County and northern Blanco County.</td></tr>
</table>

*Information taken from the Texas Water Development Board's Report 346: The Paleozoic and Related Aquifers of Central Texas (March 1996).

The location suggested for these new wells is approximately 7 miles southeast of the city limits (in the Riley Mountain range), as shown in *Figure 2*. The production capacity of each well was assumed to be 70 gpm at a well depth of 600 feet. Comparing topographic maps of the area with the water level maps given in the literature resulted in a depth to water of 100 feet. The area's transmissivity was also taken from the literature. This was assumed to be 50,000 gallons per day/foot. Six-inch diameter screens in the lower 300 feet were assumed. Well efficiency was assumed to be 80 percent.

Figure 2: Llano Groundwater Supply Option



Using the assumed aquifer conditions a system of 7 wells would be sufficient to produce the amount of water required to meet the maximum projected shortage under average conditions. However, to meet peak demand conditions the number of wells in the well field would have to be expanded to 14. A well field consisting of 14 wells was used for the cost analysis for this strategy.

The maximum projected shortage of water for the City of Llano is 654 ac-ft/yr in 2010. This shortage is projected to be reduced continuously through the planning period. In 2030 the projected shortage is 505 ac-ft/yr and in 2040 the projected shortage is 442 ac-ft/yr. The available groundwater supply from the Ellenburger-San Saba aquifer in Llano County remaining after other water management strategies have been considered is 478 ac-ft/yr. Additional groundwater supplies from the Hickory aquifer are available in Llano County. However, development of these groundwater supplies would require construction of a second well field which will only be utilized for a portion of the planning period. To avoid the cost of a second well field it is assumed that the Ellenburger-San Saba aquifer well field sited in reasonable proximity to the corporate limits of the City Llano will temporarily overdraft the aquifer until the projected shortages for the City are reduced below the available supply value.

References

1. CH2M HILL. "Groundwater Supply Alternatives for the Cities of Blanco, Goldthwaite, and Llano Technical Memorandum." Lower Colorado Regional Water Planning Group: 2001 Region K Water Supply Plan, *Appendix 5B*, August 18, 2000.
2. Baker, Bernard, et al. "Evaluation of Water Resources in Part of Central Texas." Texas Water Development Board Report 319. January 1990. Texas Water Development Board: Austin, Texas.
3. TWDB WIID (Water Information Integration & Dissemination) System Water Well Data: TWDB Groundwater Database: http://wiid.twdb.state.tx.us/ims/wwm_drl/viewer.htm
4. Preston, Richard D., et al. "The Paliozoic and Related Aquifers of Central Texas." Texas Water Development Board Report 346. March 1996. Texas Water Development Board: Austin, Texas.

APPENDIX 4D

SUSTAINABILITY AND ADVANCED WATER CONSERVATION ANALYSES

SUSTAINABILITY AND ADVANCED WATER CONSERVATION ANALYSES

INTRODUCTION

The purpose of this analysis was to compare and contrast three scenarios of sustainable development as follows:

1. Meet projected population increases by finding new water supplies.
2. Meet projected population increases by requiring decreased per capita use for specific entities, where appropriate.
3. Manage population growth to reduce demands to a level which is consistent with existing supplies.

These three scenarios roughly correspond to **Scenario 1** being the plan as submitted, in which the areas with surpluses were used to provide as much water as possible to meet projected shortages before trying to develop new sources for the remaining areas of shortages; **Scenario 2** corresponds to holding the water supply at its current fixed amount and conserving that supply to cover the population increase by requiring reduced per capita consumption within the general service area; and **Scenario 3** limits population growth to only those areas where growth can be supplied by the existing unused water supplies. These three scenarios are further explained below and the impacts to the region for each are compared.

SCENARIO 1

The Lower Colorado Regional Water Planning Group (LCRWPG) Water Plan has been prepared along the lines of this scenario, i.e. maximizing the use of existing supplies. Although established water rights for existing entities have not been arbitrarily reduced even if supplies exceed demands, in most cases, Region K entities have needs during the planning horizon for **all** of their water, and in fact are actively looking for additional supplies. Supplies within the LCRWPG Water Plan were shared across basin splits for a number of water user groups (WUGs) that had supply in one basin and demands in another basin. The wholesale water providers, LCRA, and the City of Austin, both provided updated plans to demonstrate how their water needs would be supplied through maximizing the use of existing supplies. In addition, as required by the regional planning requirements of the Texas Water Development Board, every entity with a need and with a per capita use of greater than 140 gallons per capita day (gpcd) was required to use conservation as their first water management strategy. Therefore, conservation in the amount of a 1 percent reduction per year for each year in which the per capita use was above 140 is included as the first strategy for each entity with a shortage. In addition, there is a significant allocation of resources to “County-Other” (municipal) in anticipation of growth of entities in the suburban areas of the planning region. This suburban development currently has no specific entity in charge of their supply, since the entities to be served do not currently exist. Both LCRA and the City of Austin have included the demands of some of these growing areas in their base demands. In addition, some of the supplies allocated to these areas have been shared between and among the various “County-Other” (municipal) basin splits as appropriate, as well as shared with other WUGs which have needs and are in the same area.

For all of the above reasons, Scenario 1 is adequately represented by the LCRWPG Water Plan and information on potential costs, reliability, quantities of water and environmental impacts from this scenario is already available in the LCRWPG Water Plan.

SCENARIO 2

Scenario 2 is defined in the scope as "meeting projected population increases, but requiring decreased per capita use." As discussed in Scenario 1 above, the municipal conservation measures in the base plan of the LCRWPG Water Plan are only implemented for WUGs with shortages and with per capita usage above 140 gpcd. Therefore, the analysis for Scenario 2 looked at additional conservation and the potential means to implement such measures.

The first step in this analysis was to assemble data on each of the WUGs in terms of population, per capita use, demand, and available supplies both in terms of current supplies and with contract extensions. These tables were extracted from data in previous chapters. The only information that has not appeared elsewhere is the combination of current supplies with contract extensions. This data was then used to determine the shortage by municipal WUG. The data shows a substantial variation in per capita usage for the WUGs in Region K. Even with the implementation of all likely indoor savings mechanisms for 100 percent of the population, plus the elimination of all outdoor watering through the use of rainwater harvesting, the total demand is reduced to only 150 gpcd for single family residences and to 155 gpcd for multi-family populations based on the average per capita use in Region K as reported in the GDS study referenced elsewhere in this text. Neither of these reductions comes close to reducing per capita usage to the amounts required to eliminate the need for new supplies.

Therefore, additional analysis was needed to consider even more stringent conservation measures and to consider how such measures might be implemented and at what cost.

The measures to be implemented needed to be able to be incorporated as much as possible into new housing, as well as to minimize the disruption of the lifestyle indoors. For those and other reasons, the study focused on the installation of both gray water recycle for toilet flushing and on rainwater harvesting for potential indoor use, as well as requiring minimal residential landscape watering. Minimal in this case is in the range of 6 to 10 gallons per capita per day. These measures were applied to growth primarily in urbanized areas where the highest growth is anticipated to occur. Applying these measures to all of the projected growth, without requiring any retrofit of existing facilities resulted in a savings in 2060 of slightly more than 100,000 acre feet annually. This savings would have to be distributed from those with surpluses to those with shortages in order to meet the demands without requiring new supplies, but it would be possible to do so if sharing of the water saved became a reality.

SCENARIO 3

The amount of population growth that can be supplied with the existing supplies is roughly demonstrated by the TWDB Socioeconomic Impact Study which defines the impact of not meeting the water needs, in part, by calculating the population loss that would occur if the needs were not met. Scenario 3 is defined as the limitation of population such that the available supplies are adequate to serve the population already in place. This analysis was included in the TWDB Socioeconomic study that was done for Region K to determine the impact of not meeting the needs. For this analysis, TWDB used a model to determine the impacts on population and a number of other items. This analysis is included as *Appendix C* in Chapter 9. For the purposes of this discussion, the loss of jobs in the TWDB study is equated to a loss in population.

The primary issue in achieving the population limitations assumed from the TWDB study is the lack of availability of water for new growth. However, as noted in Scenario 2 above, there is a need for control of groundwater to the extent that new public water systems and even individual residences could not continue to develop by using groundwater. Where groundwater conservation districts (GCDs) exist there is a potential to control the use of groundwater through permits. However, not all counties in Region K are included in a GCD, and there are limitations on GCD authority that may make it difficult for them to refuse permits. The surface water supplies currently have the appropriate authority to refuse service to those for whom there are not sufficient firm yield water supplies to serve adequately. Effective control of population in an area would require a combination of control of the sources of supply as well as the implementation of strict conservation measures and punitive rates similar to the concepts shown in Scenario 2 above. These measures would tend to move development of both jobs and population to areas which are more favorable to development.

BACKGROUND DATA FOR SCENARIO 2

Table 1 shows the surpluses and shortages by water user group. *Table 2* shows the reductions in acre feet per year that will be required to balance out the supplies with the demand of the increased population. To further quantify the reductions needed, *Table 3* presents the individual per capita reductions that must be achieved in order to accomplish the necessary reductions. As *Table 3* indicates, some of the reductions are in excess of 100 gallons per person per day.

Much of the information and analysis to follow is based on the TWDB study conducted by GDS Associates, "Quantifying the Effectiveness of Various Water Conservation Techniques in Texas." This study examined 10 years worth of population and water usage statistics to develop average usage information for each of the regional water planning areas of the state. This study also looked at incremental amounts of water use through examination of the various data that TWDB had available. Usage was developed for the low use period of December, January, and February which represents primarily indoor water usage, and is called base flow in the GDS study. The study then identified the average daily usage over the year. The difference between the base flow, and the average daily flow is called seasonal use. This increment of use corresponds roughly to the outdoor use of water for ornamental plants and lawns. The third increment of use is an additional amount of water which is used during dry weather conditions. This increment is similarly tied to outdoor water uses. For the Region K area as a whole, the water use for both urban and rural areas comprises a total of 190 gallons per capita per day. The base use is estimated at 137 gpcd for urban areas and 132 gpcd in rural areas. This represents the usage that will be affected by conservation measures such as toilet and showerhead and clothes washer rebates. The seasonal use water and the dry weather use water is that water which will be affected by irrigation audits for single family residences, multi-family residences and commercial businesses, landscaping ordinances, and potentially rainwater harvesting.

The GDS study also looked at various water conservation measures and rated 16 of those measures based on reductions to the gallons per capita per day for single family and multi-family residential measures and also rated commercial savings based on gallons per measure instituted. The analysis included the development of cost information from Year 2002 cost data using 5 percent interest for amortization of capital. No attempt was made to adjust the costs for this portion of the analysis.

This analysis looks at the potential to target specific water conservation measures to each WUG and to determine whether or not there is a likelihood of meeting the needs of the WUGs through conservation efforts. Population growth is expected to continue as identified in the LCRWPG Water Plan, but the management strategies developed in the LCRWPG Water Plan will be discarded and the needs met by contract extension and conservation and/or reuse alone. The analysis will determine the resulting allowable per capita consumption levels of the population and whether or not implementation of each of 16 water saving measures to a level of participation of 80 percent will be sufficient to meet the shortages.

ASSUMPTIONS FOR SCENARIO 2

The actual data shows a substantial variation in per capita usage for the WUGs in Region K. As an example, Aqua WSC, with a substantially rural and single family residential population has a per capita use starting at 139 gpcd in 2000, and reducing to 126 gpcd in 2060. Bastrop, which is becoming a more urbanized trade center, with the addition of the Home Depot and other large scale facilities, has a per capita usage above 200 currently, which reduces to 191 by the end of the planning period. As a result, there is likely to be more room for reduction of commercial demand in Bastrop than there is in Aqua WSC. In order to better target the various reductions the following assumptions are made.

1. The indoor average use from the December, January and February period contains some irrigation when the values are at or above 137 gpcd. The percentage of this water that is used for irrigation is assumed to be 10 percent. This accounts for watering of tender vegetation in advance of a freeze, as well as the maintenance of indoor plants in office buildings, malls, and other such facilities.
2. For systems with a per capita use between 120 and 140, the amount of water that is allocated to irrigation use is assumed to be 5 percent.
3. For systems less than 120 gpcd but greater than 100 gpcd, the irrigation use is assumed to be 2 percent.
4. For systems with per capita use less than or equal to 100 gpcd, irrigation use is assumed to be zero, and all usage is assumed to be residential with no irrigation or dry year components. For all other systems, 100 gpcd is assumed to be the level below which measures such as rainwater harvesting and separation of plumbing indoor reuse are required to effect further savings.
5. 25 percent of the year 2000 population in each WUG is assumed to be already converted to water saving fixtures, both toilets and showerheads/aerators. The maximum savings that can be obtained from these programs is then based on the remaining 75 percent of the year 2000 population. All other growth has taken place after the effective date of the plumbing fixture laws.
6. Systems with per capita usage of less than or equal to 100 gpcd are assumed to have no outdoor water usage and will further be assumed to have some mechanism for restricting outdoor watering in the future.
7. 90 percent of the toilets in single and multi-family residential use have an anticipated life of 25 years. 90 percent of the toilets in commercial use have an anticipated life of 15 years.

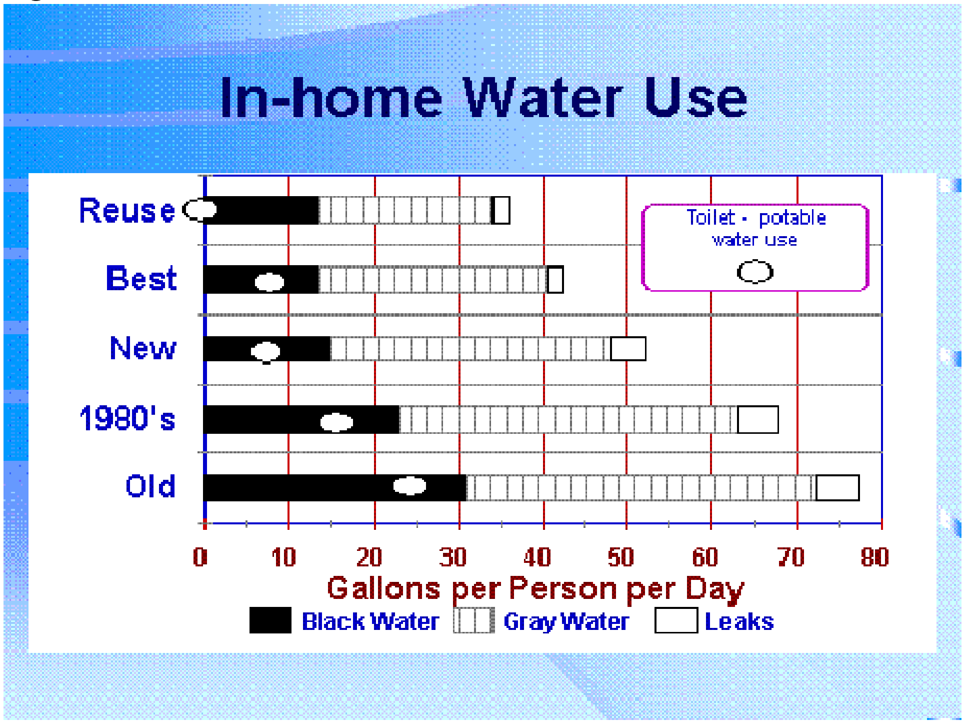
ANALYSIS OF SCENARIO 2

Information concerning the per capita consumption:

The GDS report further included tables of the breakdown of single family versus multi-family residences for each county and other data that was used in developing this document. Those tables are included in this *Appendix 4D* as well. The primary mechanisms that were presented in the GDS report for reducing indoor water usage included replacement of higher flow toilets, showerheads and faucet aerators with low flow fixtures, and use of low volume clothes washing machines for single family residential, multi-family residential, and commercial uses. All new toilets and showerheads are currently required to be low usage fixtures in order to be sold in Texas, but clothes washers are still available which use a greater quantity of water. As a result, the savings from toilet replacements will only occur over a 25 year period and after that time, 90 percent or more of those potential savings have been achieved and any further reductions are already programmed into the gpcd values. This analysis holds true for showerheads and aerator replacements as well. Single family savings from the GDS report indicated savings of 10.5 gallons per person per day and costs of $85 for a toilet rebate program. $50 was added to this cost for the toilet program to cover labor for installation of each toilet to determine the total cost of the strategy. On this basis, the cost of water developed under a toilet rebate program is $360 per acre-foot, also assuming a 25 year life for the new toilet. Using a similar analysis for shower heads and faucet aerators, the cost of water from that program is $61 per acre foot. Costs for washing machine programs were determined to be in the $600 per acre foot range, assuming a 13 year life for each machine. These are the three primary savings mechanisms for indoor usage, and the combined savings is approximately 21 gpcd. Savings for multi-family residences are less because of the higher number of users for each washing machine. In any event, the implementation of all of the indoor savings mechanisms for 100 percent of the population, plus the elimination of all outdoor watering through the use of rainwater harvesting only reduces the total gpcd to 150 for single family residences and to 155 gpcd for multi-family populations. Neither of these comes close to reducing per capita usage to the amounts available.

Some alternatives that could potentially be used to further reduce the per capita consumption in the home include dual systems that would recycle shower water for toilet flushing, waterless fixtures, and composting toilets. These conservation measures work best for new construction. Facilities to separate shower water and sink water from toilet water would be extremely expensive to retrofit on a wholesale basis, but can be built into new housing for a small increase in cost. This same holds true for rainwater harvesting. Designing facilities into the house before it is built allows much greater implementation of water saving features. New construction homes with waterless urinals and constructed on vacuum sewer collection systems which also recycle shower and bath water into flushing of low flow toilets offer the best opportunities for reaching the low per capita usages necessary to avoid management strategies for meeting the municipal needs. Garden tubs, spas, hot tubs, pools, and other water using features would by necessity be prohibited by ordinance.

Figure 1 In-home Water Use



Note: Chart provided by Bill Hoffman, Water Conservation Specialist, City of Austin.

Figure 1 presents information on the approximate breakdown of water used in residential situations strictly for indoor uses. As *Figure 1* indicates, the amount of water actually used indoors is significantly less than that normally associated with residential use. One of the reasons for this is the aggregation of commercial demand with residential demand. Another reason is the indoor use of water for watering plants and maintaining landscapes even where there is no watering of lawn and trees.

There is little data available on costs for the more extensive measures noted above. The cost to retrofit an existing house to separate the plumbing, provide a small storage tank and treatment unit, and pumps is probably in the $8,000 to $10,000 range for houses with slabs on grade. According to *Figure 1*, the average usage for toilet flushing in a home with water saving fixtures is somewhere between 14 and 22 gallons per capita per day, as opposed to the 28 gallons per capita per day found in a previous California study. Providing this volume solely from recycled gray water would reduce the need for fresh water supplies by a minimum of 14 gallons per person per day, or 34 gallons per single family residence. Assuming a $10,000 addition to the principal of a house at a 20 year loan and 6 percent interest, the approximate annual payment would be $870 per year with an estimated 2 percent of construction cost for operation and maintenance of pumps and filtration equipment. This yields a total annual cost of $1,070. Annual savings would be approximately 0.04 acre-feet. The cost per acre foot would then be approximately $25,000. In contrast, the cost of retrofitting houses that were of pier and beam or pad and block construction would be in the $1,000 range, with the additional $1,000 for the tank, pump, and filter apparatus. This $2,000 cost amortized over 20 years at 6 percent interest would be $175 per year, with a similar $200 per year operation and maintenance for a $375 per year total cost. Cost of the retrofit is then slightly less than $10,000 per acre foot. It should be noted that these numbers are considerably greater than those numbers included in the GDS report because that report only includes the cost to the utility or provider of the rebate or rebates instead of the cost of implementing the strategy.

The cost picture is similar when including these features in the design of new housing. The cost of separating the plumbing to capture all of the gray water would be less than $1,000 additional. Adding the tank and pump equipment which would be the same as that discussed above would be approximately $1,000. Operation and maintenance would be the same.

The cost to install a rainwater harvesting facility in an existing house and lot is covered in the GDS report, and is reported at $670. To install a 2,000 gallon tank instead of the 1,000 gallon tank would increase the cost to approximately $1,000, with a yield of 46.7 gallons per day. This translates to approximately $6,000 per acre foot, assuming a 15 year life for the facilities and $200 per year for operation and maintenance. The rainwater harvested in this example would be used primarily inside the home instead of for outdoor watering.

At the same time that interiors are made more water efficient, exterior watering would have to be banned almost entirely. All landscaping would be required to be water efficient, and be able to survive extended drought conditions. Outdoor watering would be prohibited by ordinance as well as through punitive water rates that would require high fees for usage above the minimum levels. Enforcement of these rules would be difficult and expensive, but there is little information currently to determine costs.

The measures discussed above are then applied against the population as follows. The indoor water use is taken from the 1980's bar on *Figure 1*, and assumed to average 68 gallons per capita per day. If the reuse bar at the top of *Figure 1* is used for the indoor use after the implementation of the gray water toilet flushing and the rainwater harvesting for shower and irrigation water, with a value of 36 gpcd, then the resultant savings is 32 gpcd. It is further assumed that TCB's experience with master planned communities is applicable to the Austin area, and that the difference between 68 gpcd for indoor use and 130 gpcd for total use is largely irrigation. If it is further assumed that only 10 percent of the outdoor watering is permitted in the future, then there would be a savings of approximately 56 gpcd for all systems with a per capita use above 130, or the difference between the current use and 68 gpcd minus 10 percent of that difference. All indoor savings will be the same. These savings amounts are applied to the population increases between 2010 and 2060 to determine the magnitude of the potential savings. A projected savings in 2050 of slightly more than 100,000 acre feet can be realized in this manner, as compared to the total regional shortage of approximately 78,000 acre feet. These savings are shown in *Table 3*.

IMPLEMENTATION ISSUES FOR SCENARIO 2

The numbers shown above are a significant departure from the demands that have been projected for this area to continue to grow in the manner that growth has occurred historically. In order to achieve compliance as closely as possible with a severe conservation standard, measures similar to those that are enumerated below will have to be implemented.

1. All new development will have to be closely controlled. The only type of outdoor watering that can potentially be allowed would have to be drip irrigation from either rainwater harvesting or gray water recycle. For the purposes of this discussion, gray water is defined as lavatory, tub, shower, and dish water. A connection could also be made to the clothes washer depending upon whether or not there are diapers routinely processed in the clothes washer. This connection could be valved off and water with heavy bacterial loadings could be sent to the black water or toilet water system instead.

2. All new construction would have to incorporate water saving fixtures as well as dual plumbing system to allow the use of recycled gray water to flush commodes and for limited outside irrigation.
3. All clothes washers would be required to meet high water use efficiency standards, and not just energy efficiency standards.
4. All new dwellings would have to be inspected and approved prior to hooking up the interior plumbing.
5. Punitive rates would have to be implemented to provide incentives for achieving low water use, but to quickly increase to provide disincentives to wasting water. This cannot be the only means of enforcement, since some customers will use all of the water they want regardless of the cost. In addition, since the amount of water used will be related to the number of people in the home, there would have to be an accounting of the number of people present in order to determine whether or not the usage was within standards.
6. Water would have to be shared among communities with those having surpluses being required to provide water for those with shortages.

The six points noted above can generally be implemented by cities with building inspection departments, and utility districts as well. However, information on the number of people in each home is not routinely collected currently. For the unincorporated areas of the counties not served by public water supplies, the control of water use could potentially be through the groundwater districts. The groundwater districts would have to require metering of individual groundwater wells serving residences, which is not currently done. They would also have to require an inspection of the completed dwelling prior to providing service in order to assure that the proper water saving features are in place.

Surface water use would be controlled by the entities that provide treated surface water, since no new connections are anticipated to take place by using raw surface water. Again, this would require new service inspections of all new residences and include the inspection of the dual plumbing systems that would be required and the rainwater harvesting facilities that would be needed to support the new development.

Another feature that would be required to make this scenario a reality is the use of automated metering reading. Remote reading of meters would make possible the identification of residences that were using rates and flows of water from the public system that were in excess of the indoor needs and help identify leaks earlier, as well as to identify those users that were using amounts of irrigation water outside the home.

POTENTIAL RISKS FOR SCENARIO 2

The points laid out above represent a significant departure from the current ways by which water is managed by retail utilities. Many of the features are not permitted in current legislation, particularly for the groundwater districts. In the same vein, cities and water districts do not currently have sufficiently strict standards to actually prohibit outdoor watering of landscapes. The potential pitfalls of this approach are as follows:

8. It would require the unanimous cooperation of a large number of governmental bodies all or nearly all with elected officials and boards.

9. If this Central Texas area enacted such rules and municipalities outside the area did not, there is a significant likelihood that development would move outside the boundaries of the controlled area.
10. Livestock would be difficult to include in the control equation. If outdoor watering is banned, would horses and other recreational livestock be banned as well?
11. A similar area of contention would be home gardens and fruit trees. This would be particularly true of rural areas, although Austin has had community garden areas set aside for a number of years, as well as having a flourishing master gardening program. Use of gray water for gardens could lead to some difficulties with buildup of solids in the soil, as well as uptake of copper from the plumbing systems in the plants if the water is not properly stabilized. If water is used from the potable water system to care for home gardens and fruit trees, would the same rules apply and would the homeowners be penalized by the rate?
12. There would need to be a significantly greater reporting requirement for commercial establishments. There are a number of successful programs for reducing usage in retail establishments, but many of these are very specific to the individual usage type. The individual percentages of residential versus commercial use will continue to have an impact on the overall per capita use.
13. There would be a significant expense incurred in monitoring and enforcing the ordinances. In addition, any ordinances enacted would be subject to court challenges, which could invalidate one or more of the necessary features needed to ensure adherence to the low water use standards.
14. Current regulations require that all water that is piped into a dwelling must be potable water. This regulation was enacted to prevent developers from building subdivisions and providing substandard water but escaping from regulation by claiming that they were not serving potable water. Individual residences could use separated plumbing and recycle gray water for toilet flushing, but apartment complexes could not. Similarly, apartment complexes that provided rainwater harvesting facilities and recycled for showers would be classified as potable water systems and would be required to have certified operators and take samples.
15. The use of gray water for toilet flushing will lead to a reduction in return flows over time. If the return flows diminish, then other strategies could have a greater effect and return less flow to the stream than previously anticipated. This interim reuse step will further concentrate dissolved solids in the wastewater being sent to the treatment plants and will be an issue that will have to be dealt with in future treatment technology.
16. Widespread rainwater harvesting will have a negative effect on the downstream run of the river rights since it will reduce the amount of runoff that reaches the river.
17. The extensive use of automated meter reading to determine what is going on in an individual home could be seen as an infringement on personal liberty and lead to significant legal challenges. In the same way, reporting of the number of persons living in a home for the purpose of determining whether or not water is being wasted would be problematic.
18. Those systems that have spent large sums in developing water supplies to serve their area of jurisdiction have been and are reluctant to share those supplies with other communities either less fortunate or less proactive. This is particularly true where there is the potential that once these supplies are provided they cannot be withdrawn in the future when the supplier entity needs that water for their own needs.

Much further work would need to be pursued with the Lower Colorado Regional Water Planning Group to further define the rules and requirements needed to implement savings at the level discussed briefly above. Limitations to this level have never been imposed on a large and diverse metropolitan area before.

The most likely scenario is that areas which decided to impose such limitations would see growth moved to areas which did not have the same limitations and the planned population growth would not occur. The focus on limitations which would have minimal impact on indoor usage is an attempt to mitigate this possibility, but it will still exist.

TABLE 1
SURPLUSES AND SHORTAGES BY WUG

WUG Name	County	River Basin	Supply + Contract Ext - Demand (ac-ft/yr)						
			S2000	S2010	S2020	S2030	S2040	S2050	S2060
AQUA WSC	BASTROP	COLORADO	(1,786)	(2,632)	(3,755)	(5,035)	(6,585)	(8,534)	(11,067)
BASTROP	BASTROP	COLORADO	(666)	(900)	(1,195)	(1,555)	(1,958)	(2,480)	(3,149)
BASTROP COUNTY WCID #2	BASTROP	COLORADO	2	(101)	(233)	(386)	(561)	(789)	(1,075)
COUNTY-OTHER	BASTROP	BRAZOS	936	347	562	786	992	1,246	1,409
COUNTY-OTHER	BASTROP	COLORADO	(1,291)	(2,143)	(3,297)	(4,615)	(6,144)	(8,079)	(10,502)
COUNTY-OTHER	BASTROP	GUADALUPE	2,202	2,178	2,148	2,112	2,053	2,001	1,936
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	554	545	534	522	510	495	477
ELGIN	BASTROP	COLORADO	585	467	302	118	(90)	(357)	(702)
LEE COUNTY WSC	BASTROP	BRAZOS	234	216	195	172	146	117	83
LEE COUNTY WSC	BASTROP	COLORADO	281	266	248	226	200	168	126
MANVILLE WSC	BASTROP	COLORADO	6,209	6,188	6,161	6,130	6,094	6,048	5,989
POLONIA WSC	BASTROP	COLORADO	1,923	1,918	1,910	1,903	1,897	1,889	1,878
SMITHVILLE	BASTROP	COLORADO	403	322	216	82	(68)	(265)	(523)
Total Municipal Water Totals			**9,586**	**6,671**	**3,796**	**460**	**(3,514)**	**(8,540)**	**(15,120)**
BLANCO	BLANCO	GUADALUPE	341	318	290	261	240	212	176
CANYON LAKE WSC	BLANCO	GUADALUPE	0	0	0	0	0	0	0
COUNTY-OTHER	BLANCO	COLORADO	1,064	1,039	1,001	964	932	682	627
COUNTY-OTHER	BLANCO	GUADALUPE	(44)	(122)	(169)	(192)	(210)	(233)	(263)
JOHNSON CITY	BLANCO	COLORADO	599	567	527	490	458	420	375
Total Municipal Water Totals			**1,960**	**1,802**	**1,649**	**1,523**	**1,420**	**1,081**	**915**
BERTRAM	BURNET	BRAZOS	(19)	(58)	(105)	(150)	(186)	(221)	(272)
BURNET	BURNET	COLORADO	5,113	4,979	4,819	4,662	4,501	4,327	4,113
CHISHOLM TRAIL SUD	BURNET	BRAZOS	(3)	(18)	(31)	(44)	(58)	(71)	(86)
COTTONWOOD SHORES	BURNET	COLORADO	17	(9)	(39)	(70)	(101)	(133)	(174)
COUNTY-OTHER	BURNET	BRAZOS	993	904	794	687	581	468	340
COUNTY-OTHER	BURNET	COLORADO	(18)	(266)	(581)	(915)	(1,210)	(1,560)	(1,964)
GRANITE SHOALS	BURNET	COLORADO	503	445	377	305	238	161	67
KEMPNER WSC	BURNET	BRAZOS	73	18	(39)	(96)	(147)	(196)	(253)
KINGSLAND WSC	BURNET	COLORADO	(9)	(10)	(11)	(12)	(13)	(14)	(17)
LAKE LBJ MUD	BURNET	COLORADO	33	32	33	34	34	30	23
MARBLE FALLS	BURNET	COLORADO	1,384	1,205	984	762	548	307	16
MEADOWLAKES	BURNET	COLORADO	(6)	(201)	(430)	(664)	(886)	(1,132)	(1,417)
Total Municipal Water Totals			**8,061**	**7,021**	**5,771**	**4,499**	**3,301**	**1,966**	**376**
COLUMBUS	COLORADO	COLORADO	341	324	293	283	288	290	302
COUNTY-OTHER	COLORADO	BRAZOS-COLORADO	9	8	7	8	11	12	13

TABLE 1
SURPLUSES AND SHORTAGES BY WUG

WUG Name	County	River Basin	Supply + Contract Ext - Demand (ac-ft/yr)						
			S2000	S2010	S2020	S2030	S2040	S2050	S2060
COUNTY-OTHER	COLORADO	COLORADO	79	76	68	75	93	100	108
COUNTY-OTHER	COLORADO	LAVACA	(100)	(105)	(109)	(106)	(97)	(93)	(90)
EAGLE LAKE	COLORADO	BRAZOS-COLORADO	269	267	264	264	267	268	270
EAGLE LAKE	COLORADO	COLORADO	35	30	25	25	31	33	37
WEIMAR	COLORADO	COLORADO	1,569	1,567	1,563	1,563	1,565	1,567	1,569
WEIMAR	COLORADO	LAVACA	2,017	2,016	2,015	2,014	2,016	2,016	2,017
Total Municipal Water Totals			**4,219**	**4,183**	**4,126**	**4,126**	**4,174**	**4,193**	**4,226**
AQUA WSC	FAYETTE	COLORADO	0	0	0	0	0	0	0
COUNTY-OTHER	FAYETTE	BRAZOS	0	0	0	0	0	0	0
COUNTY-OTHER	FAYETTE	COLORADO	(34)	(123)	(120)	(19)	50	94	123
COUNTY-OTHER	FAYETTE	GUADALUPE	113	135	148	155	160	162	164
COUNTY-OTHER	FAYETTE	LAVACA	(29)	41	93	28	(32)	(25)	(16)
FAYETTE WSC	FAYETTE	COLORADO	448	111	(236)	(507)	(719)	(976)	(1,317)
FAYETTE WSC	FAYETTE	LAVACA	39	10	(21)	(45)	(63)	(86)	(116)
FLATONIA	FAYETTE	GUADALUPE	50	43	36	31	27	22	14
FLATONIA	FAYETTE	LAVACA	(12)	(37)	(59)	(79)	(92)	(110)	(137)
LA GRANGE	FAYETTE	COLORADO	1,709	1,549	1,383	1,248	1,150	1,029	856
LEE COUNTY WSC	FAYETTE	COLORADO	123	36	(48)	(117)	(171)	(232)	(319)
SCHULENBURG	FAYETTE	LAVACA	1,557	1,475	1,386	1,318	1,266	1,200	1,107
Total Municipal Water Totals			**3,964**	**3,240**	**2,562**	**2,013**	**1,576**	**1,078**	**359**
COUNTY-OTHER	GILLESPIE	COLORADO	649	485	312	280	316	334	334
COUNTY-OTHER	GILLESPIE	GUADALUPE	1,255	1,249	1,243	1,242	1,243	1,244	1,244
FREDERICKSBURG	GILLESPIE	COLORADO	1,381	1,040	683	571	599	613	613
Total Municipal Water Totals			**3,285**	**2,774**	**2,238**	**2,093**	**2,158**	**2,191**	**2,191**
BUDA	HAYS	COLORADO	229	(638)	(1,514)	(1,989)	(2,474)	(3,052)	(3,526)
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	0	(41)	(127)	(220)	(314)	(427)	(520)
COUNTY-OTHER	HAYS	COLORADO	385	(759)	(2,072)	(3,416)	(4,784)	(6,485)	(7,823)
DRIPPING SPRINGS	HAYS	COLORADO	239	(520)	(1,296)	(1,737)	(2,185)	(2,740)	(3,176)
DRIPPING SPRINGS WSC	HAYS	COLORADO	23	(108)	(261)	(420)	(577)	(773)	(926)
HILL COUNTRY WSC	HAYS	COLORADO	783	0	0	0	0	0	0
MOUNTAIN CITY	HAYS	COLORADO	0	14	16	16	17	17	17
Total Municipal Water Totals			**1,659**	**(2,052)**	**(5,254)**	**(7,766)**	**(10,317)**	**(13,460)**	**(15,954)**
COUNTY-OTHER	LLANO	COLORADO	1,263	1,256	1,261	1,261	1,247	1,253	1,253
KINGSLAND WSC	LLANO	COLORADO	9	10	11	18	24	21	14

TABLE 1
SURPLUSES AND SHORTAGES BY WUG

WUG Name	County	River Basin	Supply + Contract Ext - Demand (ac-ft/yr) S2000	S2010	S2020	S2030	S2040	S2050	S2060
LAKE LBJ MUD	LLANO	COLORADO	221	191	167	150	135	110	74
LLANO	LLANO	COLORADO	(724)	(740)	(738)	(736)	(733)	(735)	(742)
SUNRISE BEACH VILLAGE	LLANO	COLORADO	170	170	171	173	175	176	176
Total Municipal Water Totals			**939**	**887**	**872**	**866**	**848**	**825**	**775**
BAY CITY	MATAGORDA	BRAZOS-COLORADO	3,119	3,019	2,868	2,810	2,814	2,849	2,880
COUNTY-OTHER	MATAGORDA	BRAZOS-COLORADO	1,169	1,149	1,118	1,113	1,124	1,137	1,144
COUNTY-OTHER	MATAGORDA	COLORADO	900	896	890	890	892	894	896
COUNTY-OTHER	MATAGORDA	COLORADO-LAVACA	3,335	3,321	3,301	3,298	3,306	3,315	3,320
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	(2)	(2)	(2)	(2)	(2)	(2)	(2)
PALACIOS	MATAGORDA	COLORADO-LAVACA	1,436	1,407	1,375	1,365	1,363	1,372	1,379
SOUTHWEST UTILITIES	MATAGORDA	BRAZOS-COLORADO	61	59	56	55	55	56	57
Total Municipal Water Totals			**10,018**	**9,849**	**9,606**	**9,529**	**9,552**	**9,621**	**9,674**
BROOKSMITH SUD	MILLS	COLORADO	1,681	1,681	1,680	(8)	(8)	(8)	(7)
COUNTY-OTHER	MILLS	BRAZOS	94	99	93	64	67	29	32
COUNTY-OTHER	MILLS	COLORADO	94	101	93	56	60	12	16
GOLDTHWAITE	MILLS	BRAZOS	(6)	(6)	(6)	(6)	(6)	(5)	(5)
GOLDTHWAITE	MILLS	COLORADO	(360)	(351)	(364)	(362)	(360)	(352)	(345)
Total Municipal Water Totals			**1,503**	**1,524**	**1,496**	**(256)**	**(247)**	**(324)**	**(309)**
COUNTY-OTHER	SAN SABA	COLORADO	7,845	7,837	7,824	7,812	7,800	7,802	7,799
RICHLAND SUD	SAN SABA	COLORADO	25	22	11	3	(3)	(3)	(5)
SAN SABA	SAN SABA	COLORADO	1,348	1,356	1,363	1,371	1,378	1,384	1,384
Total Municipal Water Totals			**9,218**	**9,215**	**9,198**	**9,186**	**9,175**	**9,183**	**9,178**
ANDERSON MILL MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
AQUA WSC	TRAVIS	COLORADO	0	0	0	0	0	0	0
AUSTIN	TRAVIS	COLORADO	144,436	130,619	92,535	62,478	23,824	(12,217)	(46,583)
BARTON CREEK WEST WSC	TRAVIS	COLORADO	(55)	(53)	(50)	(47)	(45)	(43)	(43)
BEE CAVE VILLAGE	TRAVIS	COLORADO	(102)	(252)	(453)	(639)	(754)	(877)	(1,004)
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	117	46	(50)	(139)	(194)	(252)	(314)
CEDAR PARK	TRAVIS	COLORADO	0	0	0	0	0	0	0
COUNTY-OTHER	TRAVIS	COLORADO	15,299	15,306	15,313	14,949	13,836	13,736	13,743
COUNTY-OTHER	TRAVIS	GUADALUPE	0	0	0	0	0	0	0
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	764	656	(280)	(390)	(467)	(544)	(623)
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	20	17	(7)	(10)	(12)	(14)	(16)
ELGIN	TRAVIS	COLORADO	4	5	6	4	2	(1)	(5)
GOFORTH WSC	TRAVIS	COLORADO	8	(3)	(14)	(23)	(30)	(38)	(43)

TABLE 1
SURPLUSES AND SHORTAGES BY WUG

WUG Name	County	River Basin	Supply + Contract Ext - Demand (ac-ft/yr)						
			S2000	S2010	S2020	S2030	S2040	S2050	S2060
HILL COUNTRY WSC	TRAVIS	COLORADO	543	0	0	0	0	0	0
JONESTOWN	TRAVIS	COLORADO	6	(29)	(79)	(122)	(149)	(178)	(212)
JONESTOWN WSC	TRAVIS	COLORADO	2	(13)	(35)	(54)	(67)	(81)	(96)
LAGO VISTA	TRAVIS	COLORADO	5,276	4,764	4,072	3,430	3,037	2,609	2,168
LAKEWAY	TRAVIS	COLORADO	(198)	(1,074)	(2,261)	(3,341)	(4,012)	(4,744)	(5,498)
LAKEWAY MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
LOOP 360 WSC	TRAVIS	COLORADO	76	(357)	(354)	(350)	(347)	(347)	(347)
LOST CREEK MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
MANOR	TRAVIS	COLORADO	2,075	2,056	2,029	325	310	292	273
MANVILLE WSC	TRAVIS	COLORADO	2,016	1,573	953	(1,839)	(2,184)	(2,577)	(2,982)
MUSTANG RIDGE	TRAVIS	COLORADO	0	0	0	0	0	0	0
MUSTANG RIDGE	TRAVIS	GUADALUPE	0	0	0	0	0	0	0
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	0	0	0	0	0	0	0
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	0	0	0	0	0	0	0
PFLUGERVILLE	TRAVIS	COLORADO	7,978	7,168	5,012	3,025	1,826	491	(882)
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	(19)	(570)	(823)	(823)	(817)	(817)	(817)
ROLLINGWOOD	TRAVIS	COLORADO	740	743	744	746	(372)	(371)	(373)
ROUND ROCK	TRAVIS	COLORADO	79	(158)	(339)	(528)	(669)	(813)	(957)
SHADY HOLLOW MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
THE HILLS	TRAVIS	COLORADO	1,229	1,033	867	867	871	871	871
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	7,317	6,498	5,410	4,388	3,770	3,083	2,375
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	712	547	325	122	(4)	(135)	(283)
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	0	0	0	0	0	0	0
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	731	673	675	678	679	680	680
WELLS BRANCH MUD	TRAVIS	COLORADO	0	0	0	0	0	0	0
WEST LAKE HILLS	TRAVIS	COLORADO	985	815	587	(2,049)	(2,178)	(2,320)	(2,471)
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	2,874	1,951	1,231	527	2	(615)	(1,170)
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	338	284	208	138	97	49	0
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	825	83	18	(2,201)	(2,180)	(2,180)	(2,180)
Total Municipal Water Totals			**194,076**	**172,328**	**125,240**	**79,122**	**33,773**	**(7,353)**	**(46,789)**
COUNTY-OTHER	WHARTON	BRAZOS-COLORADO	4,554	4,531	4,496	4,491	4,509	4,523	4,537
COUNTY-OTHER	WHARTON	COLORADO	610	601	588	587	593	598	604

TABLE 1
SURPLUSES AND SHORTAGES BY WUG

WUG Name	County	River Basin	Supply + Contract Ext - Demand (ac-ft/yr)						
			S2000	S2010	S2020	S2030	S2040	S2050	S2060
COUNTY-OTHER	WHARTON	COLORADO-LAVACA	34	29	22	21	25	27	30
WHARTON	WHARTON	BRAZOS-COLORADO	4,535	4,495	4,461	4,445	4,447	4,455	4,467
WHARTON	WHARTON	COLORADO	37	18	3	(4)	(4)	0	6
Total Municipal Water Totals			**9,770**	**9,674**	**9,570**	**9,540**	**9,570**	**9,603**	**9,644**
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	0	0	0	0	0	0	0
AUSTIN	WILLIAMSON	BRAZOS	0	0	0	0	0	0	0
COUNTY-OTHER	WILLIAMSON	BRAZOS	310	314	318	322	323	323	323
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	0	0	0	0	0	0	0
Total Municipal Water Totals			**310**	**314**	**318**	**322**	**323**	**323**	**323**

TABLE 2
GPCD REDUCTIONS REQUIRED TO MEET SHORTAGES BY WUG

			GPCD REDUCTIONS BY DECADE						
WUG Name	County	River Basin	S2000	S2010	S2020	S2030	S2040	S2050	S2060
AQUA WSC	BASTROP	COLORADO	54	65	75	82	89	95	101
BASTROP	BASTROP	COLORADO	111	123	133	143	149	156	162
BASTROP COUNTY WCID #2	BASTROP	COLORADO		40	65	80	90	99	105
COUNTY-OTHER	BASTROP	COLORADO	116	115	117	118	118	119	119
ELGIN	BASTROP	COLORADO					8	28	47
SMITHVILLE	BASTROP	COLORADO					8	27	45
COUNTY-OTHER	BLANCO	GUADALUPE	23	55	66	66	65	66	67
BERTRAM	BURNET	BRAZOS	15	40	62	77	85	90	99
CHISHOLM TRAIL SUD	BURNET	BRAZOS	23	90	111	122	133	136	139
COTTONWOOD SHORES	BURNET	COLORADO		7	26	38	48	55	62
COUNTY-OTHER	BURNET	COLORADO	1	14	25	33	38	43	47
KEMPNER WSC	BURNET	BRAZOS			31	61	79	91	101
KINGSLAND WSC	BURNET	COLORADO	26	24	23	22	21	21	22
MEADOWLAKES	BURNET	COLORADO	4	99	157	193	215	233	248
COUNTY-OTHER	COLORADO	LAVACA	28	28	28	27	24	23	23
COUNTY-OTHER	FAYETTE	COLORADO	6	32	45	11			
COUNTY-OTHER	FAYETTE	LAVACA	12				87	109	112
FAYETTE WSC	FAYETTE	COLORADO			22	38	47	56	64
FAYETTE WSC	FAYETTE	LAVACA			23	39	47	56	64
FLATONIA	FAYETTE	LAVACA	10	28	40	49	54	61	70
LEE COUNTY WSC	FAYETTE	COLORADO			18	36	46	55	64
BUDA	HAYS	COLORADO		71	97	102	107	110	112
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	0	15	38	54	66	76	83
COUNTY-OTHER	HAYS	COLORADO		28	55	70	80	88	93
DRIPPING SPRINGS	HAYS	COLORADO		87	124	133	139	145	149
DRIPPING SPRINGS WSC	HAYS	COLORADO		39	64	78	85	92	96
HILL COUNTRY WSC	HAYS	COLORADO		0	0	0	0	0	0
MOUNTAIN CITY	HAYS	COLORADO							
LLANO	LLANO	COLORADO	194	195	195	194	193	194	196
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	74	69	66	64	62	62	62
BROOKSMITH SUD	MILLS	COLORADO				155	152	155	142
GOLDTHWAITE	MILLS	BRAZOS	198	198	191	191	191	159	159
GOLDTHWAITE	MILLS	COLORADO	181	177	177	175	173	169	168
RICHLAND SUD	SAN SABA	COLORADO					2	2	3
AUSTIN	TRAVIS	COLORADO						8	27

TABLE 2
GPCD REDUCTIONS REQUIRED TO MEET SHORTAGES BY WUG

			GPCD REDUCTIONS BY DECADE						
WUG Name	**County**	**River Basin**	**S2000**	**S2010**	**S2020**	**S2030**	**S2040**	**S2050**	**S2060**
BARTON CREEK WEST WSC	TRAVIS	COLORADO	34	32	31	29	28	26	26
BEE CAVE VILLAGE	TRAVIS	COLORADO	139	237	302	336	349	362	372
BRIARCLIFF VILLAGE	TRAVIS	COLORADO			25	54	66	77	86
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO			35	42	46	49	52
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE			34	42	46	49	52
ELGIN	TRAVIS	COLORADO						6	26
GOFORTH WSC	TRAVIS	COLORADO		9	33	44	51	58	60
JONESTOWN	TRAVIS	COLORADO		13	29	39	44	49	54
JONESTOWN WSC	TRAVIS	COLORADO		13	28	37	42	47	52
LAKEWAY	TRAVIS	COLORADO	22	89	139	166	178	189	198
LOOP 360 WSC	TRAVIS	COLORADO		114	113	111	111	111	111
MANVILLE WSC	TRAVIS	COLORADO				73	77	81	85
PFLUGERVILLE	TRAVIS	COLORADO							12
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	6	114	140	140	139	139	139
ROLLINGWOOD	TRAVIS	COLORADO					229	227	227
ROUND ROCK	TRAVIS	COLORADO		78	109	128	141	150	157
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO						10	19
WEST LAKE HILLS	TRAVIS	COLORADO				401	399	398	398
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO					(0)	47	80
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO				105	104	104	104
WHARTON	WHARTON	COLORADO				1	1	0	(2)

TABLE 3
AF/YR REDUCTIONS FOR 100% IMPLEMENTATION ON GROWTH PAST 2010

WUG Name	County	River Basin	Growth 2020-2060	Cons. Savings ac-ft/yr
AQUA WSC	BASTROP	COLORADO	53,576	5,293
BASTROP	BASTROP	COLORADO	9,343	963
BASTROP COUNTY WCID #2	BASTROP	COLORADO	5,897	600
COUNTY-OTHER	BASTROP	BRAZOS	2,182	205
COUNTY-OTHER	BASTROP	COLORADO	53,367	5,003
COUNTY-OTHER	BASTROP	GUADALUPE	1,424	134
CREEDMOOR-MAHA WSC	BASTROP	COLORADO	325	19
ELGIN	BASTROP	COLORADO	5,919	662
LEE COUNTY WSC	BASTROP	BRAZOS	583	56
LEE COUNTY WSC	BASTROP	COLORADO	908	87
MANVILLE WSC	BASTROP	COLORADO	1,363	118
POLONIA WSC	BASTROP	COLORADO	388	18
SMITHVILLE	BASTROP	COLORADO	5,082	524
BASTROP COUNTY TOTAL SAVINGS				**13,683**
BLANCO	BLANCO	GUADALUPE	741	76
CANYON LAKE WSC	BLANCO	GUADALUPE	1,921	198
COUNTY-OTHER	BLANCO	COLORADO	2,215	116
COUNTY-OTHER	BLANCO	GUADALUPE	1,192	62
JOHNSON CITY	BLANCO	COLORADO	719	74
BLANCO COUNTY TOTAL SAVINGS				**527**
BERTRAM	BURNET	BRAZOS	934	96
BURNET	BURNET	COLORADO	4,486	462
CHISHOLM TRAIL SUD	BURNET	BRAZOS	304	31
COTTONWOOD SHORES	BURNET	COLORADO	1,126	95
COUNTY-OTHER	BURNET	BRAZOS	5,357	248
COUNTY-OTHER	BURNET	COLORADO	16,919	785
GRANITE SHOALS	BURNET	COLORADO	2,263	230
KEMPNER WSC	BURNET	BRAZOS	1,102	114
KINGSLAND WSC	BURNET	COLORADO	256	25
LAKE LBJ MUD	BURNET	COLORADO	554	57
MARBLE FALLS	BURNET	COLORADO	3,255	335
MEADOWLAKES	BURNET	COLORADO	2,663	274
BURNET COUNTY TOTAL SAVINGS				**2,754**
COLUMBUS	COLORADO	COLORADO	102	11
COUNTY-OTHER	COLORADO	BRAZOS-COLORADO	26	1
COUNTY-OTHER	COLORADO	COLORADO	171	10
COUNTY-OTHER	COLORADO	LAVACA	83	5
EAGLE LAKE	COLORADO	BRAZOS-COLORADO	29	3
EAGLE LAKE	COLORADO	COLORADO	66	6
WEIMAR	COLORADO	COLORADO	36	4
WEIMAR	COLORADO	LAVACA	16	2
COLORADO COUNTY TOTAL SAVINGS				**41**
AQUA WSC	FAYETTE	COLORADO	585	58
COUNTY-OTHER	FAYETTE	BRAZOS	0	
COUNTY-OTHER	FAYETTE	COLORADO	(1,846)	
COUNTY-OTHER	FAYETTE	GUADALUPE	(121)	
COUNTY-OTHER	FAYETTE	LAVACA	(728)	
FAYETTE WSC	FAYETTE	COLORADO	9,035	747
FAYETTE WSC	FAYETTE	LAVACA	794	66
FLATONIA	FAYETTE	GUADALUPE	120	12

TABLE 3

AF/YR REDUCTIONS FOR 100% IMPLEMENTATION ON GROWTH PAST 2010

WUG Name	County	River Basin	Growth 2020-2060	Cons. Savings ac-ft/yr
FLATONIA	FAYETTE	LAVACA	415	43
LA GRANGE	FAYETTE	COLORADO	3,428	353
LEE COUNTY WSC	FAYETTE	COLORADO	2,043	196
SCHULENBURG	FAYETTE	LAVACA	1,587	164
FAYETTE COUNTY TOTAL SAVINGS				**1,638**
COUNTY-OTHER	GILLESPIE	COLORADO	738	51
COUNTY-OTHER	GILLESPIE	GUADALUPE	26	2
FREDERICKSBURG	GILLESPIE	COLORADO	571	59
GILLESPIE COUNTY TOTAL SAVINGS				**112**
BUDA	HAYS	COLORADO	14,026	1,445
CIMARRON PARK WATER COMPANY	HAYS	COLORADO	2,571	265
COUNTY-OTHER	HAYS	COLORADO	41,549	4,105
DRIPPING SPRINGS	HAYS	COLORADO	9,750	1,005
DRIPPING SPRINGS WSC	HAYS	COLORADO	4,965	465
HILL COUNTRY WSC	HAYS	COLORADO	8,336	798
MOUNTAIN CITY	HAYS	COLORADO	0	
HAYS COUNTY TOTAL SAVINGS				**8,084**
COUNTY-OTHER	LLANO	COLORADO	0	
KINGSLAND WSC	LLANO	COLORADO	0	
LAKE LBJ MUD	LLANO	COLORADO	0	
LLANO	LLANO	COLORADO	0	
SUNRISE BEACH VILLAGE	LLANO	COLORADO	0	
LLANO COUNTY TOTAL SAVINGS				
BAY CITY	MATAGORDA	BRAZOS-COLORADO	1,024	106
COUNTY-OTHER	MATAGORDA	BRAZOS-COLORADO	380	22
COUNTY-OTHER	MATAGORDA	COLORADO	76	4
COUNTY-OTHER	MATAGORDA	COLORADO-LAVACA	281	16
ORBIT SYSTEMS INC	MATAGORDA	COLORADO-LAVACA	2	0
PALACIOS	MATAGORDA	COLORADO-LAVACA	282	24
SOUTHWEST UTILITIES	MATAGORDA	BRAZOS-COLORADO	37	2
MATAGORDA COUNTY TOTAL SAVINGS				**174**
BROOKSMITH SUD	MILLS	COLORADO	(1)	
COUNTY-OTHER	MILLS	BRAZOS	(4)	
COUNTY-OTHER	MILLS	COLORADO	(8)	
GOLDTHWAITE	MILLS	BRAZOS	0	
GOLDTHWAITE	MILLS	COLORADO	(4)	
MILLS COUNTY TOTAL SAVINGS				
COUNTY-OTHER	SAN SABA	COLORADO	506	0
RICHLAND SUD	SAN SABA	COLORADO	148	15
SAN SABA	SAN SABA	COLORADO	9	1
SAN SABA COUNTY TOTAL SAVINGS				**16**
ANDERSON MILL MUD	TRAVIS	COLORADO	0	
AQUA WSC	TRAVIS	COLORADO	3,484	344
AUSTIN	TRAVIS	COLORADO	601,301	61,966
BARTON CREEK WEST WSC	TRAVIS	COLORADO	0	
BEE CAVE VILLAGE	TRAVIS	COLORADO	1,072	110
BRIARCLIFF VILLAGE	TRAVIS	COLORADO	1,446	149
CEDAR PARK	TRAVIS	COLORADO	1,396	144
COUNTY-OTHER	TRAVIS	COLORADO	(15,217)	
COUNTY-OTHER	TRAVIS	GUADALUPE	0	

TABLE 3

AF/YR REDUCTIONS FOR 100% IMPLEMENTATION ON GROWTH PAST 2010

WUG Name	County	River Basin	Growth 2020-2060	Cons. Savings ac-ft/yr
CREEDMOOR-MAHA WSC	TRAVIS	COLORADO	3,574	209
CREEDMOOR-MAHA WSC	TRAVIS	GUADALUPE	92	5
ELGIN	TRAVIS	COLORADO	86	9
GOFORTH WSC	TRAVIS	COLORADO	261	16
HILL COUNTRY WSC	TRAVIS	COLORADO	2,559	245
JONESTOWN	TRAVIS	COLORADO	1,112	101
JONESTOWN WSC	TRAVIS	COLORADO	540	45
LAGO VISTA	TRAVIS	COLORADO	5,958	614
LAKEWAY	TRAVIS	COLORADO	10,219	1,053
LAKEWAY MUD	TRAVIS	COLORADO	0	
LOOP 360 WSC	TRAVIS	COLORADO	0	
LOST CREEK MUD	TRAVIS	COLORADO	0	
MANOR	TRAVIS	COLORADO	422	43
MANVILLE WSC	TRAVIS	COLORADO	13,543	1,174
MUSTANG RIDGE	TRAVIS	COLORADO	224	23
MUSTANG RIDGE	TRAVIS	GUADALUPE	60	6
NORTH AUSTIN MUD #1	TRAVIS	COLORADO	0	
NORTH TRAVIS COUNTY MUD #5	TRAVIS	COLORADO	5,475	530
PFLUGERVILLE	TRAVIS	COLORADO	30,698	3,164
RIVER PLACE ON LAKE AUSTIN	TRAVIS	COLORADO	0	
ROLLINGWOOD	TRAVIS	COLORADO	39	4
ROUND ROCK	TRAVIS	COLORADO	2,674	276
SHADY HOLLOW MUD	TRAVIS	COLORADO	0	
THE HILLS	TRAVIS	COLORADO	0	
TRAVIS COUNTY WCID #17	TRAVIS	COLORADO	17,653	1,819
TRAVIS COUNTY WCID #18	TRAVIS	COLORADO	5,044	437
TRAVIS COUNTY WCID #19	TRAVIS	COLORADO	0	
TRAVIS COUNTY WCID #20	TRAVIS	COLORADO	0	
WELLS BRANCH MUD	TRAVIS	COLORADO	0	
WEST LAKE HILLS	TRAVIS	COLORADO	1,482	153
WEST TRAVIS COUNTY REGIONAL WS	TRAVIS	COLORADO	5,943	612
WILLIAMSON-TRAVIS COUNTY MUD #1	TRAVIS	COLORADO	1,904	138
WINDERMERE UTILITY COMPANY	TRAVIS	COLORADO	0	
TRAVIS COUNTY TOTAL SAVINGS				**73,390**
COUNTY-OTHER	WHARTON	BRAZOS-COLORADO	545	35
COUNTY-OTHER	WHARTON	COLORADO	206	13
COUNTY-OTHER	WHARTON	COLORADO-LAVACA	110	7
WHARTON	WHARTON	BRAZOS-COLORADO	312	32
WHARTON	WHARTON	COLORADO	143	15
WHARTON COUNTY TOTAL SAVINGS				**102**
ANDERSON MILL MUD	WILLIAMSON	BRAZOS	0	
AUSTIN	WILLIAMSON	BRAZOS	55,528	5,722
COUNTY-OTHER	WILLIAMSON	BRAZOS	9,527	982
NORTH AUSTIN MUD #1	WILLIAMSON	BRAZOS	0	
WILLIAMSON COUNTY TOTAL SAVINGS				**6,704**
REGION K TOTAL SAVINGS				**107,226**

APPENDIX 4E

DRY YEAR OPTION

DRY YEAR OPTION ANALYSIS

INTRODUCTION

The Dry Year Option Analysis had its beginnings in the last planning round and was carried over into this planning round because funds were not available to analyze the impacts of such a management strategy at that time. This strategy is an outgrowth of concern on the part of the rice growers in the lower basin about priorities for surface water use. It was not the intention of the rice growers to try to suggest more ways to divert water from agricultural to municipal uses, but rather a way to try to find some means of compensation if water was going to be diverted to other uses anyway.

BACKGROUND

Current methods of culturing rice in the lower three counties of the Region, Colorado, Matagorda, and Wharton (partial) include the growth of a first crop of rice that involves complete preparation of the land, seeding of the rice, and flooding of the fields for weed control. Fields are kept flooded throughout the growing season, and then drained in time for them to dry out prior to harvest. A percentage of the farmers who grow a first crop also grow a second crop from the stubble of the first crop. This second, or ratoon, crop does not involve the expense of seedbed preparation or seed so there are fewer expenses. At the same time, however, the yield is also less per acre than the first crop yield. This second crop requires additional water during what is historically one of the driest times of the year. The purpose of this analysis is to determine whether or not water could be made available for other uses if farmers were paid a payment that would induce them not to grow a second crop of rice so that water could be made available for other uses.

DATA COLLECTION

Some of the data that was instrumental in determining the potential availability of water under a Dry Year Option was collected as a part of the process for determining the water demands of the rice industry. Meetings were held with rice growing interests in each of the counties, as well as a joint meeting with rice growing interests in Region H to the east and Region P to the west. The meetings with Region P were especially important considering that Wharton County is split between the two regions, with Region K using predominantly surface water and Region P using predominantly groundwater for irrigation of rice. Regional Water Planning Group (RWPG) members representing agriculture and small business with ties to the rice industry were asked to provide lists of contacts in their counties who would be information resources in determining the current practices for their areas. These individuals were contacted and asked to participate in a meeting to discuss rice irrigation habits and customs related to water usage. The groups included local rice farmers, county agricultural extension agents, local officials, and others as needed.

In each case the meetings noted above gathered together individuals who were familiar with the county and with the farmers operating in that county, to the extent of knowing who farmed what property and how many acres were farmed in many cases. *Table 1* was the product of those discussions. Individual discussions were held for each of the three counties. As a result of these discussions, the RWPGs were presented information on a variety of ways to determine the proposed revisions to the irrigation demands in their respective areas. Region P chose to use the spreadsheet as shown while Region K elected to use values derived from Texas Water Development Board (TWDB) data from 1995 forward on acreages irrigated. The primary reason for the difference in selected methodologies is the fact that Region K uses predominantly surface water, the vast majority of which is supplied by Lower Colorado Regional

Authority (LCRA) through its canal systems. As a result, Region K had better information on acres planted already represented in the TWDB numbers. Region P, on the other hand, relies more heavily on groundwater and the planning group felt that their demands were underrepresented in the TWDB data. As *Table 1* shows, the local representatives established the numbers of acres planted, broken down by surface water or groundwater for irrigation. They agreed on the amount of water diverted for a first crop of rice, the estimated losses in delivering that water to the rice fields, and the estimated on-farm usage. The anticipated return flow from the rice fields to the drainage basin was developed in a later task. The next piece of information that was assembled was the percent of first crop acreage that was second cropped, as well as the water usage per acre for the second cropping operations. This data formed the initial estimate of the amount of water that could potentially be available in the Dry Year Option.

Members of the RWPG with knowledge and information on economics in the rice industry were queried by telephone and during RWPG meetings concerning the financial incentive that would be needed to cause the second crop farmers to forego the second crop entirely. These discussions were held later in the planning process because of the timing of the funding of the supplemental projects. The consensus of the three individuals queried was that payments of between \$20 and \$50 per acre would be sufficient to induce farmers to forego the second crop and make that water available for other uses. The data in *Table 1* was then used to determine the number of acre-feet of water that would have been used per acre and the cost of the buyout was spread out over that number of acre-feet. In addition, it was assumed that the water to be sold would be sold at the firm yield system price of \$105 per acre-foot. This information was then used to determine the cost per acre-foot of the strategy by county. The variations in cost are due to the variation in the amount of water used per acre in each of the three lower counties.

Once the initial amounts of water to be potentially available were established, members of the consultant team met with LCRA staff and Bob Brandes with RJB Company to discuss the issue of how much of the second crop water was going to still be potentially available after other conservation measures were implemented. The LCRA-SAWS Water Project (LSWP) 2004 Project Viability Assessment (PVA) was used to come up with the anticipated implementation rate of the new rice variety. The new rice variety development is anticipated to provide a variety that will produce a higher yield but that yield will be produced over a longer growing season. As a result, farmers will not have enough time to plant a ratoon crop and most of the water from the second crop culture could be saved. The longer growing season for the first crop rice does increase the water use for the first crop by approximately 8 to 10 percent.

The 2004 PVA shows anticipated rates of conversion to the new rice variety by planted rice acreage. The most optimistic projection is that 100 percent of the rice crop areas convert to the new variety. The average adoption rate is anticipated to be 75 percent, and the pessimistic adoption rate is anticipated to be 50 percent. *Table 2* below contains estimated water available and estimated cost for this strategy based on the degree of conversion to the new rice variety.

Table 2 Supply Quantity and Costs

County	Percent Conversion to New Rice Variety*			
	100%	75%	50%	0%
	ac-ft/yr	ac-ft/yr	ac-ft/yr	ac-ft/yr
Colorado	0	13,718	27,436	54,878
Matagorda	0	7,269	14,538	27,077
Eastern Wharton	0	7,619	15,237	30,475

* See explanation in Issues and Considerations Section.

County	2nd Crop Usage ac-ft/yr	Payment $/acre	LCRA Water Cost $/ac-ft	Strategy Cost $/ac-ft*
Colorado	2.47	$50	$115	$135
Matagorda	2.77	$50	$115	$133
Eastern Wharton	1.94	$50	$115	$141

* Costs calculated based on the estimated usage per acre including conveyance losses, $115 per acre-foot for LCRA system water, and $50 per acre payment.

The discussions with LCRA staff and Bob Brandes determined that the modeling that was done in determining the availability of system yield water for the Lower Colorado River Basin under the LCRA management plan assumed that the conversion to the new rice variety was 100 percent. If that were the case, then no water would be available as a Dry Year Option strategy.

A key feature of the Dry Year Option is that it would not unduly cripple the rice industry, along with its supporting infrastructure. Many other facets of the agricultural economy, including the rice mills, railroads, and trucking industry rely upon the rice harvest for support. By diverting only the second crop portion, the supporting industry would still have the main crop to provide employment and cash flow from.

A second feature that could be of considerable interest is the ability of this strategy to provide environmental water during times of low flows in the river. Use of this water for environmental flow needs, including both instream flows and bay and estuary needs would not require the modification of any permits or adjustment to the amounts diverted. If sufficient funds were available to pay the cost of the per acre payments to the farmers plus the cost of the water from the LCRA, then the flows could be released during the driest period of time from August through September and still be within the normal flow times for agricultural demands. In addition, if the water were termed interruptible water by LCRA, the cost would be significantly less than the amount calculated in the table.

Water could be made available through this strategy by providing an opportunity for the rice industry to provide bids to LCRA for water purchase. LCRA could then solicit users to determine whether or not there was interest in the amounts available and the timing of those amounts. Farmers would have to demonstrate a consistent record of growing a second crop, with proof of growth for the past three years being a potential benchmark. Once a bid is accepted, then the potential user would negotiate with LCRA for release of the water and any potential issues related to the relocation of the diversion point.

It was noted during discussions at one or more Region K planning group meetings that LCRA has no plans and no mechanism to begin a strategy to purchase water under a Dry Year Option. This strategy is being reviewed for informational purposes only; there is no obligation on the part of LCRA to implement any purchases until and unless there is a clear expression of interest on the part of a potential buyer of this water, and there is no other water available under the current management plan.

ISSUES AND CONSIDERATIONS

The strategy above provides benefits to the agricultural community as noted through keeping some amount of business for the ancillary industries with the first crop growth. It provides potential benefits to the environmental community as a source of water to augment both instream and bay and estuary flows when the conditions warrant, if funds can be accumulated to make the necessary payments and if the rainfall conditions can be accurately predicted in the winter for the following summer. The reservation for the water would have to occur early in the spring in order for the farmers to properly schedule those times where ratoon crops would not be grown. This water could be long-term water that could be reserved only for those times when environmental flows are the most critical without the cost of trying to acquire rights.

It is noted that the some of the firm yield LCRA irrigation rights are being converted to municipal and manufacturing uses. Agricultural needs will be met with water from the LCRA management plan yield, and this water will include interruptible supplies. This water would still potentially benefit the environment if it was purchased for that purpose, but it would have limited effect upon users relying on firm yield water.

Another issue that can potentially reduce the amount of water available for this strategy is the inclusion of canal losses. The numbers used for the calculation above include an amount of canal losses, and represent total water diverted to the farmers for the second crop. Another facet of the LSWP is the reconstruction of the canal delivery system to reduce losses in the delivery process. These improvements will reduce the amount of water diverted per acre for the second crop and reduce the total amount of water available for redirection. The price will vary somewhat as the $50 payment per acre will be averaged over fewer acre-feet to determine the total cost per acre-foot.

The uncertainties noted above make this strategy unlikely to be implemented, unless drought of record conditions occur in the very near future. It is more likely that this potential strategy will be looked at in greater detail once the improved rice varieties being anticipated are developed and tested. If the new rice varieties have sufficient appeal to see widespread adoption, then no water will be available under this strategy.

Another consideration that would have to be accounted for is the entry into the pool of available water sellers. As a minimum, it is recommended that farmers have a past history of growing a second crop for 3 of the last 4 years. Otherwise, there would likely be a number of farmers wanting to sign up for the payments and no real ability to decide how much water would be saved. There would then be the difficulty of determining whether a year signed up not planting a second crop would constitute a year of not planting and potentially take that farmer out of the available pool for the following year. The difficulty in administering such a program makes it a less likely candidate for implementation. It could work reasonably well for one year, but in a prolonged drought, it would be difficult to manage over multiple years.

QUANTITATIVE ENVIRONMENTAL IMPACT ANALYSIS

The strategy noted may have differing environmental impacts based on the assumption of the percent of growers that convert to the new rice variety. If 100 percent conversion to the new rice variety is assumed, then the environmental impact will be a delay in the release of return flows from the first crop water by the length of the addition to the growing season. Instream flows in the river may be reduced, depending upon whether or not any of the second crop water would have been released from storage upstream.

If water is bid for and purchased by environmental groups, and is available for use, then the instream and bay an estuary flows could benefit by whatever amount is purchased, up to and including the amounts shown in *Table 2* for the various new rice variety adoption assumptions.

As an example, currently the water being released as tail water is released two times during the harvest season. The first release is after the completion of the growing season of the first crop, and the second release is after the completion of the growing season of the second crop. The second release normally occurs sometime in October. The release is estimated at approximately 2 to 3 inches per acre for the entire acreage being second cropped for rice. Using the spreadsheet numbers, the number of acres using surface water for a second rice crop is 22,418 acres for Colorado County, 9,775 acres for Matagorda County, and 15,709 acres for eastern Wharton County. At a per acre amount of 2 to 3 inches of flood that is released as return flows, the amount of water that will not be released to the drainage area from the second crop is 3,736 to 5,604 acre-feet in Colorado County, 1,629 to 2,444 acre-feet in Matagorda County, and 2,618 to 3,927 acre-feet in Wharton County. It is noted however, that if the new rice variety sees a 100 percent implementation, these return flows will be eliminated in that event also. These return flows currently take place generally in the month of October.

In addition to the impacts noted above, the three counties and their rice growing areas are important to migratory waterfowl. The waterfowl come to feed on the fields and pick up rice that was left at the harvest. The change in timing of the last flooding of the rice fields may have an impact on these migratory birds, but there is not sufficient data at this point to estimate what those impacts might be. This is called out as a need for additional investigation in the next plan update.

IMPACT ON AGRICULTURAL RESOURCES

As noted above, the impact of reducing production of the second crop has the impact of reducing the length of time over which jobs are maintained in the area. With the second crop culture, more essentially the same amount of rice is produced, but it impacts the milling and trucking and other ancillary businesses over a longer period of time. Production of the same amount of rice in a single crop will create more competition for those resources, but the harvest will be over more quickly. The overall impact is to conserve the milling and ancillary businesses by continuing to have first crop rice production as opposed to paying farmers not to plant at all, or of simply not having the water for them to use to plant. If rice production ceases entirely for one or more years, the mills and other ancillary businesses may close and move away, which will result in further impediments to future rice production when adequate water is available.

Many rice farmers are currently involved in game management on their farms, particularly with regard to migratory waterfowl. These farmers may derive significant income from these activities, and if the cessation of the second crop impacts this industry, then there could be an adverse effect on agricultural resources.

Table 1 Year 2000 Irrigation Statistics

WHARTON COUNTY (Region K)

	Year 2000 NASS Acres	Total Acres in Region K	% Crop Irrigated	1st Crop (acres)	1st Crop water use (in/acre)	1st Crop water use (ac-ft/ac)	% Conduit Loss (%/acre)	Conduit Loss (ac-ft/ac)	Total 1st Crop (ac ft/ac)	Total 1st Crop (ac-ft)	% Acreage 2nd Crop	2nd Crop (acres)	2nd Crop water use (% of 1st crop)	2nd Crop water use (ac-ft/ac)	TOTAL 2ND CROP (ac-ft)	TOTAL (ac-ft)
RICE	**53,000**	57%	**%**	**30,210**												
GROUND			20%	6,042	28	2.33	20%	0.47	2.80	16,918	70%	4,229	60%	1.68	7,105	24,023
SURFACE			80%	24,168	32	2.67	35%	0.93	3.60	87,005	65%	15,709	54%	1.94	30,539	117,543
COTTON	**86,500**	71%		61,415												
irrigated			20%	**12,283**	12	1.00			1.00	12,283						12,283
CORN	**34,200**	81%		27,702												
irrigated			35%	**9,696**	12	1.00			1.00	9,696						9,696
MILO	**66,100**	48%		31,728												
irrigated			10%	**3,173**	6	0.50			0.50	1,586						1,586
SOYBEANS	**13,300**	81%		10,773												
irrigated			25%	**2,693**	12	1.00			1.00	2,693						2,693
TURFGRASS				**8,000**	60	5.00			5.00	40,000						40,000
TOTAL IRRIGATION				**66,055**												**207,825**
WATERFOWL HABITAT			3%	**6,000**	18	1.50			1.50	9,000						**9,000**
AQUACULTURE				**1,200**	50	4.17			4.17	5,000						**5,000**
LIVESTOCK (head)				**26,000**		0.028	10%	0.003	0.03	801						**801**
25gl. * 365 / 325,851																
MUNICIPAL																**4,163**
MANUFACTURING																**369**
POWER COOLING															BOLING	**120**
MINING																**2,370**
TOTALS																**229,648**

Total ac-ft per acre used (1st + 2nd Crop)
4.48 groundwater
5.54 surface water

Table 1 Year 2000 Irrigation Statistics

MATAGORDA COUNTY (Region K)

	Year 2000 NASS Acres		% Crop Irrigated	1st Crop (acres)	1st Crop water use (in/acre)	1st Crop water use (ac-ft/ac)	% Conduit Loss (%/acre)	Conduit Loss (ac-ft/ac)	Total 1st Crop (ac-ft/ac)	Total 1st Crop (ac-ft)	% Acreage 2nd Crop	2nd Crop (acres)	2nd Crop water use (% of 1st crop)	2nd Crop water use (ac-ft/ac)	TOTAL 2ND CROP (ac-ft)	TOTAL (ac-ft)
RICE	**23,000**		**%**													
GROUND			**15%**	3,450	**35**	2.92	20%	0.58	3.50	12,075	25%	863	60%	2.10	1,811	13,886
SURFACE			**85%**	19,550	**41**	3.42	35%	1.20	4.61	90,174	50%	9,775	60%	2.77	27,052	117,227
COTTON																
irrigated			5%		12	1.00			1.00							
CORN																
irrigated			5%		12	1.00			1.00							
MILO																
irrigated			**5%**		10	0.83			0.83							
SOYBEANS																
irrigated			20%		12	1.00			1.00							
TURFGRASS					60	5.00			5.00							
TOTAL IRRIGATION																**131,113**
WATERFOWL HABITAT			2%	**2,000**	12	1.00			1.00	2,000						**2,000**
AQUACULTURE				**1,600**	50	4.20			4.20	6,720						**6,720**
LIVESTOCK (head)						0.028	10%	0.003	0.03							
25gl. * 365 / 325,851																
MUNICIPAL																
MANUFACTURING																
POWER COOLING																
MINING																
TOTALS																**139,833**

Total ac-ft per acre used (1st + 2nd Crop)
5.60 groundwater
7.38 surface water

Table 1 Year 2000 Irrigation Statistics

COLORADO COUNTY (Region K)

	Year 2000 NASS Acres		% Crop Irrigated	1st Crop (acres)	1st Crop water use (in/acre)	1st Crop water use (ac-ft/ac)	% Conduit Loss (%/acre)	Conduit Loss (ac-ft/ac)	Total 1st Crop (ac-ft/ac)	Total 1st Crop (ac-ft)	% Acreage 2nd Crop	2nd Crop (acres)	2nd Crop water use (% of 1st crop)	2nd Crop water use (ac-ft/ac)	TOTAL 2ND CROP (ac-ft)	TOTAL (ac-ft)
RICE	**31,136**		**%**													
GROUND			4%	1,245	30	2.50	20%	0.50	3.00	3,736	80%	996	80%	2.40	2,391	6,128
SURFACE			96%	29,891	34	2.83	35%	0.99	3.83	114,331	75%	22,418	65%	2.49	55,737	170,068
COTTON																
irrigated			30%		12	1.00			1.00							
CORN																
irrigated			50%		12	1.00			1.00							
MILO																
irrigated			**30%**		12	1.00			1.00							
SOYBEANS																
irrigated			80%		12	1.00			1.00							
TURFGRASS				**25**	60	5.00			5.00	125						125
TOTAL IRRIGATION				**25**												**176,321**
WATERFOWL HABITAT			3%	**5,000**	15	1.25			1.25	6,250						**6,250**
AQUACULTURE					50	4.20			4.20							
LIVESTOCK (head)						0.028	10%	0.003	0.03							
25gl. * 365 / 325,851																
MUNICIPAL																**3,115**
MANUFACTURING																**318**
POWER COOLING																
MINING																**57**
TOTALS																**186,061**

Total ac-ft per acre used (1st + 2nd Crop)
5.40 groundwater
6.31 surface water

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APPENDICES

CHAPTER 5.0: IMPACTS OF WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY AND IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS

5.1 SCOPE OF WORK

This activity is part of a consensus-based planning effort to include local concerns in the statewide water supply planning process. This chapter presents the results of Task 5 of the project scope, which addresses:

- Impacts of Water Management Strategies on Key Parameters of Water Quality
- Impacts of Moving Water from Rural and Agricultural Areas

Additional scope items included the development of legislative recommendations regarding water quality impacts as a result of the strategies outlined in Chapter 4 and discussed herein. The legislative recommendations developed by the Lower Colorado Regional Water Planning Group (LCRWPG) are discussed further in Chapter 8 of this report.

5.2 IMPACTS OF WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY

The potential impacts that water management strategies (WMS) may have on water quality are discussed in this section, including the identified water quality parameters which are deemed important to the use of the water resources within the region. Under the Clean Water Act, Texas must define designated uses for all major water bodies and, consequently, the water quality standards that are appropriate for that designated water use. The water quality parameters which are listed for the Lower Colorado Regional Water Planning Area (LCRWPA) below were selected based on the *TCEQ Water Quality Inventory for Designated Water Body Uses* as well as the water quality parameters identified in the Texas Commission on Environmental Quality (TCEQ) 303d list of impaired water bodies. For reference purposes, *Appendix 5A* contains the TCEQ 303d list of impaired waters within the region as well as the tabular summaries of use support for the water bodies that are part of LCRWPA.

5.2.1 Surface Water

Key surface water parameters identified within LCRWPA fall into two broad categories:

Nutrients and Non-Conservative Substances

- Bacteria
- pH
- Dissolved Oxygen
- Total Suspended Solids (TSS)
- Temperature
- Nutrients (nitrogen, phosphorus)
- Minerals and conservative Substances:
  - Total Dissolved Solids (TDS)

- Chlorides
- Mercury
- Salinity
- Sediment Contaminants

Non-conservative substances are those parameters that undergo rapid degradation or change as the substance flows downstream, such as nutrients which are consumed by plant life. Nutrients and non-conservative loadings to surface water originate from a variety of natural and man-made sources. One significant source of these loads is wastewater treatment facilities. As population increases, the number and size of these wastewater discharges will likely increase as well. Stormwater runoff from certain land use types constitutes another significant source of nutrient loading to the region's watercourses, including such land use types as agricultural areas, golf courses, residential development, or other landscaped areas where fertilizers are applied. Nutrient loads in LCRWPA are typically within the limits deemed acceptable for conventional water treatment facilities and are, therefore, not considered a major concern as related to source of supply.

Conservative Substances

Conservative substances are those that do not undergo rapid degradation or do not significantly change in water as the substance flows downstream, such as metals. Minerals and other conservative substances contributing to surface water generally originate from three sources: (1) nonpoint source runoff or groundwater seepage from mineralized areas, either natural or man-made, (2) wastewater discharges, and (3) sea water migration above estuaries. Wastewater discharges in general, and industrial discharges in particular, have improved over the past 30 years due to the requirements of the Clean Water Act. If local concentrations of conservative contaminants are identified, they are remediated by the appropriate agency. Natural features such as elevation tend to limit salinity migration above estuaries.

5.2.2 Groundwater

Groundwater in the LCRWPA is generally of good quality with no usage limitations. Quality parameters of interest include TDS, metals, and hardness. Groundwater in the Gulf Coast aquifer containing less than 500 mg/l dissolved solids is located at various depths throughout the lower three counties, but at no greater than 3,200 feet. The Carrizo-Wilcox aquifer has localized areas of water quality problems which include hydrogen sulfide, methane, increased salinity levels, and dissolved solids. The Edwards aquifer is typically fresh, although hard, with dissolved solids concentrations typically less than 500 mg/l.

Water quality from the Trinity aquifer is acceptable for most municipal and industrial purposes; however, excess concentrations of certain constituents in many places exceed drinking water standards. Heavy pumpage and water level declines in this region have contributed to deteriorating water quality in the aquifer. Wells completed in the Middle Trinity aquifer (especially the Hensell Sand) may exhibit levels of sodium, sulfate, and chloride, which are believed to be the result of leakage from the overlying Glen Rose Formation. This is less likely to be true for wells completed in the Lower Trinity aquifer. The Hammett Shale acts as an aquitard and effectively prevents leakage from the overlying formations. In some areas, poor quality water occurs in and near wells that have not been properly cased. These wells may have deteriorated casings, insufficient casing or cement, or the casing may have been perforated at multiple depths in an effort to maximize the well yield. These wells serve as a conduit for poor quality water originating in the evaporite beds near the contact of the Upper and Lower Glen Rose Formations. Water quality declines in the downdip direction of all of the Trinity aquifer water-bearing units.

Natural chemical quality of Edwards-Trinity (Plateau) water ranges from fresh to slightly saline. The water is typically hard and may vary widely in concentrations of dissolved solids, composed mostly of calcium and bicarbonate. The salinity of the groundwater tends to increase toward the west. Water quality of springs issuing from the aquifer in the southern and eastern border areas is typically excellent.

In general, the quality of water from the Hickory aquifer could be described as moderate to low quality. The TDS concentrations vary from 300 to 500 mg/l. In some areas the groundwater may have dissolved solids concentrations as high as 3,000 mg/l. The water may contain alpha particle and total radium concentrations that may exceed the safe drinking water levels of the U.S. Environmental Protection Agency (EPA) and TCEQ. Radon gas may also be entrained, although no limits have been established for radon. Most of the radioactive groundwater is thought to be produced from the middle Hickory unit, while the upper Hickory unit produces water that exceeds secondary limits for concentration of iron. High nitrate levels may be found in the shallower portions of the aquifer where there may be interaction with surface activities such as fertilizer applications and septic systems.

Throughout most of the LCRWPA, the chemical quality of the Queen City aquifer water is excellent, but water quality may deteriorate fairly rapidly downdip. The water may be fairly acidic (low pH), have high iron concentrations, or contain hydrogen sulfide gas. All of these conditions are relatively easy to remedy with standard water treatment methods.

Usable quality water is commonly found within the Sparta aquifer outcrop and for a few miles downdip. The water quality in most of this aquifer is excellent, but the quality does decrease in the downdip direction. In some areas, the water can contain iron concentrations exceeding the secondary drinking water standards.

Water produced from the Ellenburger-San Saba aquifer may have dissolved concentrations that range from 200 mg/l to as high as 3,000 mg/l, but in most cases is usually less than 1,000 mg/l. The quality of water declines rapidly in the downdip direction.

The water produced from the Marble Falls aquifer is suitable for most purposes, but some wells in Blanco County have produced water with high nitrate concentrations. The downdip portion of the aquifer is not extensive, but in these areas, the water becomes highly mineralized. Because the limestone formation comprising this aquifer is relatively shallow, it is susceptible to pollution by surface uses and activities.

5.2.3 Management Strategies

The Lower Colorado River Authority (LCRA) has implemented regulatory programs within their jurisdiction to aid in pollution prevention. LCRA regulations include both land-based activities and surface water usage. Land-based activities include on-site sewage facilities, septic systems, construction, and nonpoint source pollution. In addition, LCRA has supported the "no discharge" designation by TCEQ for the Highland Lakes. LCRA also sponsors household hazardous waste collection days to remove potential sources of contamination from the basin.

The water quality parameters and water management strategies selected by the LCRWPG were evaluated to determine the impacts on water quality as a result of these recommended strategies. This evaluation used the data available to compare current conditions to future conditions with LCRWPA management strategies in place. The recommended management strategies, as described in Chapter 4 of this report and used in this evaluation, are:

- Water Conservation (Municipal and Industrial)
- Reclaimed Water Initiative (City of Austin [COA])
- Contract Renewals (LCRA and COA)
- Expansion of Current Groundwater Supplies
- Development of New Groundwater Supplies
- Transfer/Allocate/Purchase Water From Water User Groups (WUGs) With Surplus
- Treated Water From Canyon Lake Water Supply
- Guadalupe-Blanco River Authority (GBRA)-Hays County Pipeline
- Recharge Edwards-Balcones Fault Zone (BFZ) With Onion Creek Recharge Structure
- Construct Goldthwaite Channel Dam
- Additional Goldthwaite Off-Channel Reservoir
- House Bill (HB) 1437
- Desalination of Seawater or Brackish Groundwater
- Lower Colorado River Authority-San Antonio Water System (LCRA-SAWS) Water Project: Gulf Coast Aquifer
- LCRA-SAWS Water Project: On-Farm Water Conservation
- LCRA-SAWS Water Project: Irrigation Delivery System Water Conservation
- LCRA-SAWS Water Project: Water Conserving Rice Variety
- LCRA Water Management Plan for Interruptible Supplies
- COA Return Flows for Downstream Needs (as available)
- Matagorda County Seawater and Brackish Groundwater Desalination Project
- Amendment of LCRA irrigation water rights
- LCRA excess flows permit and off-channel storage

The following paragraphs discuss the impacts of each management strategy on the chosen water quality parameters.

<u>Water Conservation</u>, including municipal and industrial, can have both positive and negative impacts on water quality. Water that is being processed through a wastewater treatment plant typically has acquired additional dissolved solids prior to discharge to the waters of the state. Conventional wastewater treatment reduces suspended solids, but does not reduce dissolved solids in the effluent. Water conservation measures will reduce the volume of water passing through the wastewater plants without reducing the mass loading rates (a 1.6-gallon flush carries the same waste mass to the plant that a 6-gallon flush once carried). This may result in increased constituent loads to the wastewater treatment plants. In the event that, over time, water conservation causes changes to wastewater concentrations, treatment processes may need to be adjusted to maintain permitted discharge parameters. It should be noted that during low flow conditions, the wastewater effluent in a stream may represent water that helps to augment and maintain the minimum streamflows.

The impacts on water quality of the <u>Expansion of Current Groundwater Supplies and Development of New Groundwater Supplies</u> are uncertain. However, they are not expected to have adverse impacts to the water quality in the aquifer or sustainable water levels. During drought of record (DOR) conditions, some limited over-pumping of the Gulf Coast Aquifer in Colorado, Matagorda, and Wharton Counties is expected to occur to meet temporary water supply shortages. As rainfall conditions return to normal, this limited over-pumping of the aquifer is expected to decline and water levels in the aquifer should return to near normal levels without impacting water quality.

In some particular situations, this strategy may negatively influence water quality. As previously stated, water quality in the Hickory aquifer could be described as moderate to low quality. The use of this aquifer by municipal users may require additional treatment compared to a standard groundwater treatment plant, especially in areas of high concentrations of TDS, areas that may contain alpha particle and total radium concentrations that may exceed the safe drinking water levels of the EPA and TCEQ, and areas with high nutrient levels. The use of this aquifer by irrigators potentially could release the above constituents into surface water sources, thus causing increased levels of the above described water quality parameters. In addition this plan is consistent with the nine point policy identified by the RWPG for inter-basin transfers.

The LCRA-SAWS Water Project is subject to a number of special legislative environmental conditions as well as statutory requirements. A part of the project includes the conservation of irrigation water (through on-farm water conservation measures, irrigation district conveyance improvements, and new high yielding/water efficient rice varieties), pump limited amounts of groundwater during drought conditions, and primarily capture the remaining permitted portion of Colorado River flows. Return flows generated by runoff from rice irrigation are returned via tail water runoff in the Colorado River Basin or the coastal basin.

Tail water is the term used to describe that water returned to the stream after application to irrigated cropland. Tail water may carry nutrients, sediments, salts, and other pollutants from the farmland. This return flow can have a negative impact on water quality, and by implementing conservation measures which reduce tail water losses, the nutrient and sediment loading can be reduced. However, this return flow tends to be introduced into the receiving stream during normally dry periods so it may have a net beneficial effect in terms of maintaining minimum streamflow conditions. The conjunctive use of groundwater would not result in any additional, foreseen impacts on water quality. The use of new rice varieties may impact water quality as a result of changes in the amount of tail water that would be returned to streams following harvest. As part of the project, a study is being conducted to determine whether the project benefits both Region L and the LCRWPA without adverse impacts to the river and bay system. However, the location of the diversion may be a significant distance from or in another basin than the location where tail water is discharged.

The Reclaimed Water Initiative is part of the COA's management strategy to meet future growth and subsequent water supply shortages. The COA plans to use a portion of their wastewater effluent to extend current supplies and help alleviate future shortages. The COA will either use indirect reuse, if authorized by TCEQ, or direct reuse with piping to move to the location of shortage. This reuse is projected to occur gradually over time as the overall water use of the LCRWPA increases. While reuse is projected to increase, municipal return flows are also projected to increase over the planning period. When available on an interruptible basis, downstream water rights can continue to divert, in seniority order, these return flows. Because the exact amount of reuse and downstream diversion cannot be determined, the amount of return flow available for environmental purposes is uncertain. In any event, the quality of water produced by City of Austin wastewater facilities is such that no adverse impacts on water quality are anticipated.

Contract Renewals, Reallocation of Surplus Supplies, and Contract Increases as management strategies can decrease instream and bay and estuary freshwater inflows as a result of the full utilization of water supplies. Fully utilizing existing water supply projects may amplify some existing concerns, particularly contaminant concentrations due to reduced opportunities for instream dilution. The continued return of flows via wastewater treatment facility discharges will provide some mitigation of that effect. Typical municipal return flows are approximately 60 percent of the total quantity diverted for use.

Treated Water From Canyon Lake Water Supply and GBRA Hays County Pipeline management strategies potentially reduce the instream flows in the Guadalupe River Basin as a result of greater utilization of existing supplies, but potentially increase instream flows in the Colorado River Basin. However, these strategies are not expected to create any new water quality issues.

The Recharge Edwards-BFZ With Onion Creek Recharge Structure management strategy potentially could cause water quality in the Edwards-BFZ to reflect any contaminant loading potentially found in Onion Creek. The recharge structure, which increases groundwater recharge, potentially could increase the introduction of pollutants into the aquifer by increasing recharge as a result of increased detention time of runoff.

Additional Goldthwaite Channel Dams will reduce instream flows by capturing interruptible flow during periods of normal conditions. During periods of drought, the reservoir will pass inflows to meet downstream senior water rights. The on-channel reservoirs will potentially beneficially impact the quality of water by allowing sediment and other water quality pollutants to settle out and subsequently release a higher quality water downstream.

Additional Goldthwaite Off-Channel Reservoir potentially will have positive impact on water quality since it will operate as a "scalping reservoir." The water that is diverted and stored in reservoirs would allow some sediments to settle out, so that water released from the reservoir would be of higher quality. However, the water would be stored for consumptive use, and instream flows along with bay and estuary freshwater inflows would slightly decrease. In general, increased return flows will occur in this region as demand increases, and this increase in return flows will continue to occur during low flow events, thus, potentially increasing instream flows during DOR conditions.

LCRA Water Management Plan for Interruptible Supplies allows LCRA to supply rice irrigators in the Lower Colorado River Basin with interruptible supplies of water from the Highland Lakes, when available. When these interruptible supplies are not available, LCRA will supply irrigators with groundwater produced as a part of the LSWP. Additional demand reductions will be achieved through conservation.

The House Bill (HB) 1437 management strategy involves the transfer of up to 25,000 acre-feet of water from the Colorado River Basin to certain users in Williamson County under contract with BRA. As part of this strategy, HB 1437 provides that no net loss of water occurs in the basin of origin funded by a surcharge on the sale of water authorized by HB 1437. To assist with this clause, the LCRA is investing in irrigation conservation measures. Environmental instream flow and freshwater inflow requirements contained in LCRA's Water Management Plan will continue to be met. The effects on water quality as a result of this strategy are not qualifiable at this time. Under both HB 1437 and the LCRA-SAWS Water Project, the transfer of water would be to off-channel storage facilities and treatment plants, rather than a raw water discharge to a stream.

Tail water is the term used to describe that water returned to the stream after application to irrigated cropland. Tail water may carry nutrients, sediments, salts, and other pollutants from the farmland. This return flow can have a negative impact on water quality, and by implementing conservation measures which reduce tail water losses, the nutrient and sediment loading can be reduced. Once again, however, this return flow tends to be introduced into the receiving stream during normally dry periods so it may have a net beneficial effect in terms of maintaining minimum streamflow conditions. Furthermore, the loss of the return flows could be offset by a reduction in irrigation diversions resulting in no net affect on the streamflow. However, the location of the diversion may be a significant distance from or in another basin than the location where tail water is discharged.

The Matagorda County Seawater or Brackish Groundwater Desalination Project will provide a usable water supply with a level of dissolved solids low enough to be used in steam-electric power generation. A significant side effect of this strategy is the disposal of wastes generated from the desalination process. The discharge of this brine, with a TDS loading rate of between 10,000 to 20,000 parts per million, to the tidally influenced segment of the Colorado River may have impacts on environmental factors from the associated increased loading of dissolved solids and concentration of constituents in the water. An offshore discharge point may be required to minimize the effects of this discharge. Due to the location of this strategy, none of the water quality impacts associated with desalination can potentially affect the implementation of other water management strategies upstream.

Post-treatment will be necessary for the water leaving the desalination process so that it is non-aggressive toward power generation equipment and compatible with instream water chemistry. The use of this desalinated water for steam-electric power will also introduce some additional return flows that are discharged from the power generation process. However, there may be impacts from the elevated temperature of water leaving the power generation facility.

5.3 IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS

Currently, the water used in rural (livestock) and agricultural areas represent 63 percent of the total water used in LCRWPA. It is estimated that this will be reduced to 37 percent of the region's 1,301,700 acre-feet (ac-ft) demand projected in year 2060 as a result of growth in municipal and industrial demands and a decrease in agricultural production. A projected decrease in irrigation demand is anticipated to be approximately 25 percent between 2000 and 2060. Livestock demand is constant over the planning period.

The most significant impact on agricultural water supplies is not from specific water management strategies recommended in the Plan but in the general assumptions of the "No Call" on inflows to lower basin reservoirs to the advantage of upper basin reservoirs. As outlined in detail within Chapter 3, the use of the "No Call" Water Availability Model (WAM) allowed firm irrigation rights in the lower basin to be subject to the "No Call" planning assumption to provide water for users in the upper basin that had limited options for meeting their needs. Sufficient strategies are proposed within the Plan to meet identified agricultural needs even with the "No Call" WAM assumption. These specific strategies include: (1) the use of interruptible supplies, (2) COA return flows when available, and (3) several water supply strategies recommended as a part of the LCRA-SAWS Water Project.

Water management strategies, along with current sources of water supply, are available to agricultural users throughout the planning period; therefore, the impacts on agricultural users are not directly related to moving water from these areas. The potential impacts of moving water from rural and agricultural areas are mainly associated with socio-economic impacts to third parties. The potential impetus for moving water is expected to occur from two sources: (1) the cost of raw water may become too great for the local irrigator to afford, and he may elect to voluntarily leave the industry for economic reasons; or (2) the value of the raw water for municipal or industrial purposes may create a market for the wholesale owner to redirect the sale of the water making it unavailable to the irrigator. Several management strategies are outlined in the Plan to provide water to irrigators, especially in the lower basin counties of Colorado, Wharton, and Matagorda.

The LCRA-SAWS strategies represent a unique solution to obtaining additional water supplies for municipal uses while enhancing agricultural resources. By participating in this program, the LCRWPA will achieve an additional 180,000 ac-ft of water supply annually through conservation and groundwater (62,000 ac-ft/yr averaged over the total years of the drought of record with a maximum of 95,000 ac-ft/yr during the worst year of the drought) improvements funded by SAWS. A portion of the water conserved, above this amount, will be provided by SAWS to meet its municipal demands. This approach is an example of implementing management strategies with mutual benefit to meet both urban and rural needs. As has been noted previously in this document, the LSWP allows the needs of the various parties to the agreement to be met. However, there are significant studies underway to determine whether or not the needs of the environment will be met as well. The LSWP is required by statute to demonstrate that it can be implemented without significant detriment to the environment. The LCRWPG looks forward to receiving the results of the studies that are currently underway during future plan revision efforts.

As illustrated by the LCRA-SAWS strategy, it may be feasible for a third party to pay for conservation measures and then utilize the saved water for their own needs (through recontracting or other agreements) and allow the irrigator to remain in business; however, there are few contractual and institutional measures in effect to allow this trade-off to occur at this time. The intent of this Plan is to provide water or the conservation means to meet all projected water demands, including agricultural and rural needs, throughout the planning period.

APPENDIX 5A

TCEQ 303(D) LIST OF IMPAIRED WATERS

PARTIAL LIST ON THOSE WATERWAYS IN LCRWPA AND TABULAR SUMMARIES FOR WATER BODY USE SUPPORT BY RIVER BASIN

DRAFT 2004 Texas 303(d) List for the Lower Colorado River Water Planning Area (May 13, 2005)

The Texas Commission on Environmental Quality (TCEQ) is required, under Section 303(d) of the federal Clean Water Act, to identify water bodies for which effluent limitations are not stringent enough to implement water quality standards. The TCEQ also develops a schedule identifying Total Maximum Daily Loads (TMDLs) that will be initiated in the next two years for priority impaired waters. Water quality permitting in 303(d)-listed water bodies is described in the TCEQ regulatory guidance document *Procedures to Implement the Texas Surface Water Quality Standards* (August 2002, RG-194).

Explanation of Column Headings

SegID: May be one of two types of numbers. The first type is a classified segment number (4 digits, *e.g.* 0218), as defined in the *Texas Surface Water Quality Standards*. The second type is an unclassified water body (0218A), not defined in the Standards, associated with a classified water body because it is in the same watershed.

Area: This describes the specific area in which one or more water quality standards are not met.

Parameter: These are pollutants or water quality conditions that screening procedures indicate are the reason the water quality standards are not met.

NP: Point sources of pollutants contribute to the impairment of this parameter.

NPS: Nonpoint sources of pollutants contribute to the impairment of this parameter.

Category: One of five categories is assigned to each combination of one parameter and one water body to provide information about the water quality status and management activities. Category 5 is divided into three subcategories; when a water body has parameters in multiple subcategories, its overall category is the highest category. The category and its subcategories are defined below:

<u>Category 5:</u> The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants.

Category 5a - A TMDL is underway, scheduled, or will be scheduled.

Category 5b - A review of the water quality standards for this water body will be conducted before a TMDL is scheduled.

Category 5c - Additional data and information will be collected before a TMDL is scheduled.

Rank: Water bodies in Category 5 have been prioritized by TCEQ. For Category 5a, a rank of High (H), Medium (M), or Low (L) is given for the urgency to initiate a TMDL. Once a TMDL project is initiated, the rank changes to "U" for Underway. Rankings are based on the current understanding of the causes of the non-support of the water quality standards and the sources of pollution, the importance of the resource, the severity of the impact, and the likelihood of TMDL success.

For water bodies in Category 5b, a ranking of "S" has been assigned to indicate that a standards review will be conducted before a TMDL is scheduled. For water bodies in Category 5c, a ranking of "D" has been assigned to indicate that additional data and information will be collected before a TMDL is scheduled.

For Categories 5b and 5c, TCEQ will develop a separate prioritized schedule for standards review or the collection of additional data and information. These activities will be conducted at the same time that TMDLs are being developed for the parameters in Category 5a.

SegID: **1217** **Lampasas River Above Stillhouse Hollow Lake** Category: **5c**

Water body location: From a point immediately upstream of the confluence of Rock Creek in Bell County to FM 2005 in Hamilton County

Area	Parameter	PS	NPS	Category	Rank
From the FM 1690 crossing to the CR 117 crossing	bacteria		Y	5c	D

SegID: **1217A** **Rocky Creek (unclassified water body)** Category: **5b**

Water body location: From the confluence of the Lampasas River north of Okalla in Burnet County to the confluences of the North and South Rocky Creeks south of Oakalla in Burnet County

Area	Parameter	PS	NPS	Category	Rank
Entire creek	depressed dissolved oxygen		Y	5b	S

SegID: **1302** **San Bernard River Above Tidal** Category: **5c**

Water body location: From a point 3.2 km (2.0 miles) upstream of SH 35 in Brazoria County to the county road southeast of New Ulm in Austin County

Area	Parameter	PS	NPS	Category	Rank
Lower 50 miles	bacteria		Y	5c	D

SegID: **1305** **Caney Creek Above Tidal** Category: **5b**

Water body location: From a point 1.9 km (1.2 miles) upstream of the confluence of Linnville Bayou in Matagorda County to Old Caney Road in Wharton County

Area	Parameter	PS	NPS	Category	Rank
25 miles surrounding SH 35	bacteria		Y	5c	D
25 miles surrounding SH 35	depressed dissolved oxygen		Y	5b	S

SegID: **1403A** **Bull Creek (unclassified water body)** Category: **5c**

Water body location: From the confluence of Lake Austin in northwest Austin in Travis County to the upstream perennial portion of the stream north of Austin in Travis County

Area	Parameter	PS	NPS	Category	Rank
From most downstream xing to most upstream xing of Spicewood Springs Rd.	impaired macrobenthos community		Y	5c	D

SegID: **1403J** **Spicewood Tributary to Shoal Creek (unclassified water body)** Category: **5c**

Water body location: From the MoPac Expressway in north Austin in Travis County to a point west of Hart Lane in Travis County

Area	Parameter	PS	NPS	Category	Rank
Entire water body	bacteria		Y	5c	D

SegID: **1403K** **Taylor Slough South (unclassified water body)** Category: **5c**

Water body location: Form the confluence of Lake Austin in Travis County to a point west of Pecos Street in Austin in Travis County

Area	Parameter	PS	NPS	Category	Rank
Entire water body	bacteria		Y	5c	D

SegID: **1416A** **Brady Creek (unclassified water body)** Category: **5c**

Water body location: From the confluence of the San Saba River southwest of San Saba in San Saba County to Brady Lake Dam west of Brady in McCulloch County

Area	Parameter	PS	NPS	Category	Rank
From FM 714 upstream to Brady Lake dam	depressed dissolved oxygen	Y	Y	5c	D

SegID: **1427** **Onion Creek** Category: **5c**

Water body location: From the confluence with the Colorado River in Travis County to the most upstream crossing of FM 165 in Blanco County

Area	Parameter	PS	NPS	Category	Rank
From end of segment upstream to US 183	depressed dissolved oxygen	Y	Y	5c	D

SegID: **1427A** **Slaughter Creek (unclassified water body)** Category: **5c**

Water body location: Intermittent stream with perennial pools from the confluence with Onion Creek to above US 290 west of Austin

Area	Parameter	PS	NPS	Category	Rank
Entire water body	impaired macrobenthos community		Y	5c	D

SegID: **1428C** **Gilleland Creek (unclassified water body)** Category: **5a**

Water body location: Perennial stream and intermittent stream with perennial pools from the confluence with the Colorado River up to the spring source (Ward Spring) northwest of Pflugerville, in Travis County

Area	Parameter	PS	NPS	Category	Rank
From the Colorado River upstream to Taylor Lane	bacteria	Y		5a	U

SegID: **1429B** **Eanes Creek (unclassified water body)** Category: **5c**

Water body location: From the confluence of Town Lake in central Austin in Travis County to the upstream perennial portion of the stream in west Austin in Travis County

Area	Parameter	PS	NPS	Category	Rank
Entire water body	bacteria		Y	5c	D

SegID: **1429C** **Waller Creek (unclassified water body)** Category: **5c**

Water body location: From the confluence of Town Lake in central Austin in Travis county to the upstream portion of the stream in north Austin in Travis County

Area	Parameter	PS	NPS	Category	Rank
From the confluence with Town Lake to East MLK Blvd.	bacteria	Y	Y	5c	D
From the confluence with Town Lake to East MLK Blvd.	impaired macrobenthos community		Y	5c	D

SegID: **1501** **Tres Palacios Creek Tidal** Category: **5b**

Water body location: From the confluence with Tres Palacios Bay in Matagorda County to a point 1.0 km (0.6 miles) upstream of the confluence of Wilson creek in Matagorda County

Area	Parameter	PS	NPS	Category	Rank
Entire segment	depressed dissolved oxygen		Y	5b	S

SegID: **1502** **Tres Palacios Creek Above Tidal** Category: **5c**

Water body location: From a point 1.0 km (0.6 miles) upstream of the confluence of Wilson Creek in Matagorda County to US 59 in Wharton County

Area	Parameter	PS	NPS	Category	Rank
Middle 23 miles of segment	bacteria	Y		5c	D

SegID: **1803C** **Peach Creek (unclassified water body)** Category: **5a**

Water body location: From the confluence of the Guadalupe River southeast of Gonzales in Gonzales County to the upstream perennial portion of the stream northeast of Waelder in Gonzales County

Area	Parameter	PS	NPS	Category	Rank
Lower 25 miles of water body	bacteria	Y	Y	5a	U

SegID: **2441** **East Matagorda Bay** Category: **5a**

Water body location:

Area	Parameter	PS	NPS	Category	Rank
13.1 square miles in the eastern portion of the bay (OW)	bacteria (oyster waters)		Y	5a	M

SegID: **2442** **Cedar Lakes** Category: **5c**

Water body location:

Area	Parameter	PS	NPS	Category	Rank
Entire segment	bacteria (oyster waters)		Y	5c	D

SegID: **2451** **Matagorda Bay/Powderhorn Lake** Category: **5a**

Water body location:

Area	Parameter	PS	NPS	Category	Rank
21.7 square miles at the east end of the bay (OW)	bacteria (oyster waters)		Y	5a	M
East half of main bay	depressed dissolved oxygen		Y	5c	D

SegID: **2452** **Tres Palacios Bay/Turtle Bay** Category: **5a**

Water body location:

Area	Parameter	PS	NPS	Category	Rank
7.2 square miles - upper half Tres Palacios Bay and Turtle Bay (OW)	bacteria (oyster waters)		Y	5a	M
Palacios area	depressed dissolved oxygen	Y	Y	5c	D

<u>Basin Tabular Summaries</u>

For each basin, there are two documents: Tabular Summary of Use Support and Tabular Summary of Water Quality Concerns

Tabular Summary of Use Support

This series of tables provides a quick, detailed reference to water quality status within a basin. The summary identifies the indicators used to assess support of designated uses. For each indicator, support codes are used to identify the level of attainment as fully supporting (FS), partial supporting (PS), not supporting (NS), not assessed (NA), and not applicable (X). Indicators that contribute to partially supporting and not supporting uses are in bold type.

Tabular Summary of Water Quality Concerns

This series of tables provides a quick, detailed reference to water quality problems within a basin. The summary identifies the indicators used to assess water quality concerns. For each indicator, the presence of a water quality problem is identified as a concern (C), no concern (NC), threatened (TH), not assessed (NA), or not applicable (X). Indicators that contribute to concerns are in bold type.

Brazos River Basin Tabular Summary of Use Support

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1201 Brazos River Tidal	1202 Brazos River Below Navasota River	1202H Allen's Creek	1202I Bessie's Creek	1202J Big Creek	1202K Mill Creek	1203 Whitney Lake	1203A Steele Creek	1204 Brazos River Below Lake Granbury	1205 Lake Granbury	1206 Brazos River Below Possum Kingdom Lake	1206D Palo Pinto Creek below Palo Pinto Reservoir
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	**NS**	NA	**NS**	FS	FS	NA	FS	FS	FS	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	FS	X	X	X	X	FS	X	X	FS	X	FS
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	NA	FS	FS	FS	NA	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	FS	X	X	X	X	FS	X	FS	FS	FS	X
pH	FS	FS	X	X	X	X	FS	X	FS	FS	FS	X
Chloride	X	FS	X	X	X	X	FS	X	FS	FS	FS	X
Sulfate	X	FS	X	X	X	X	FS	X	FS	FS	FS	X
Total Dissolved Solids	X	FS	X	X	X	X	FS	X	FS	FS	FS	X

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1207 Possum Kingdom Lake	1208 Brazos River Above Possum Kingdom Lake	1209 Navasota River Below Lake Limestone	1209A Country Club Lake	1209B Fin Feather Lake	1209C Carters Creek	1209D Country Club Branch	1209G Cedar Creek	1209H Duck Creek	1209I Gibbons Creek	1209J Shepherd Creek	1209K Steele Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	**NS**	NA	NA	**NS**	NA	**NS**	FS	**NS**	**NS**	**NS**
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	X	FS	X	X	X	X	X	X	X	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	NA	NA	FS	NA	FS	FS	**NS**	NA	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	FS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	FS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	FS	FS	X	X	X	X	X	X	X	X	X
pH	FS	FS	FS	X	X	X	X	X	X	X	X	X
Chloride	FS	FS	FS	X	X	X	X	X	X	X	X	X
Sulfate	FS	FS	FS	X	X	X	X	X	X	X	X	X
Total Dissolved Solids	FS	FS	FS	X	X	X	X	X	X	X	X	X

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1210 Lake Mexia	1210A Navasota River above Lake Mexia	1211 Yegua Creek	1211A Davidson Creek	1212 Somerville Lake	1212A Middle Yegua Creek	1212B East Yegua Creek	1213 Little River	1214 San Gabriel River	1215 Lampasas River Below Stillhouse Hollow Lake	1216 Stillhouse Hollow Lake	1217 Lampasas River Above Stillhouse Hollow Lake
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	**NS**	FS	**NS**	FS	FS	**NS**	FS	FS	FS	FS	**NS**
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	X	FS	X	FS	X	X	FS	FS	FS	FS	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	X	FS	X	FS	X	X	FS	FS	FS	FS	FS
pH	FS	X	FS	X	**PS**	X	X	FS	FS	FS	FS	FS
Chloride	FS	X	FS	X	FS	X	X	FS	FS	FS	FS	FS
Sulfate	FS	X	FS	X	FS	X	X	FS	FS	FS	FS	FS
Total Dissolved Solids	FS	X	FS	X	FS	X	X	FS	FS	FS	FS	FS

Brazos River Basin Tabular Summary of Use Support (continued)

<u>Key to support codes</u> FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1217A Rocky Creek	1217B Sulphur Creek	1217C Simms Creek	1218 Nolan Creek/ South Nolan Creek	1219 Leon River Below Belton Lake	1220 Belton Lake	1220A Cowhouse Creek	1221 Leon River Below Proctor Lake	1221A Resley Creek	1221B South Leon River	1222 Proctor Lake	1222A Duncan Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	FS	**NS**	NA	FS	FS	**NS**	NA	FS	FS	NA
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	X	X	FS	FS	X	FS	X	X	FS	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	FS	FS	FS	FS	FS	NA	FS	FS	NA
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	X	FS	FS	FS	X	FS	X	X	FS	X
pH	X	X	X	FS	FS	FS	X	FS	X	X	FS	X
Chloride	X	X	X	FS	FS	FS	X	FS	X	X	FS	X
Sulfate	X	X	X	FS	FS	FS	X	FS	X	X	FS	X
Total Dissolved Solids	X	X	X	FS	FS	FS	X	FS	X	X	FS	X

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1222B Rush-Copperas Creek	1222C Sabana River	1223 Leon River Below Leon Reservoir	1224 Leon Reservoir	1225 Waco Lake	1225A Hog Creek	1226 North Bosque River	1226A Duffau Creek	1226B Green Creek	1226C Meridian Creek	1226D Neils Creek	1226E Indian Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	FS	NA	FS	FS	FS	FS	**NS**	FS	FS	**NS**
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	FS	FS	FS	X	FS	X	X	X	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	NA	FS	NA	FS	FS	FS	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	FS	NA	FS	X	FS	X	X	X	X	X
pH	X	X	FS	NA	FS	X	FS	X	X	X	X	X
Chloride	X	X	FS	FS	FS	X	FS	X	X	X	X	X
Sulfate	X	X	FS	FS	FS	X	FS	X	X	X	X	X
Total Dissolved Solids	X	X	FS	FS	FS	X	FS	X	X	X	X	X

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1226F Sims Creek	1226G Spring Creek	1227 Nolan River	1228 Lake Pat Cleburne	1229 Paluxy River /North Paluxy River	1230 Lake Palo Pinto	1231 Lake Graham	1232 Clear Fork Brazos River	1232A California Creek	1232B Deadman Creek	1233 Hubbard Creek Reservoir	1234 Lake Cisco
DESIGNATED USE SUPPORT												
Contact Recreation Use	**NS**	FS	**NS**	NA	FS	NA	NA	FS	FS	FS	NA	NA
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	X	FS	FS	FS	FS	X	X	X	FS	FS
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	NA	FS	NA	NA	FS	FS	FS	FS	NA
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	FS	NA	FS	NA	NA	FS	X	X	FS	NA
pH	X	X	FS	NA	FS	NA	NA	FS	X	X	FS	NA
Chloride	X	X	FS	NA	FS	NA	NA	FS	X	X	FS	NA
Sulfate	X	X	**NS**	NA	FS	NA	NA	FS	X	X	FS	NA
Total Dissolved Solids	X	X	FS	NA	FS	NA	NA	FS	X	X	FS	NA

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1235 Lake Stamford	1236 Fort Phantom Hill Reservoir	1237 Lake Sweetwater	1238 Salt Fork Brazos River	1239 White River	1240 White River Lake	1240A White River above White River Reservoir	1241 Double Mountain Fork Brazos River	1241A N. Fork Double Mtn. Fork Brazos River	1242 Brazos River Above Navasota River	1242A Marlin City Lake System	1242D Thompson Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	NA	NA	NA	FS	NA	FS	NA	FS	FS	**NS**	NA	**NS**
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	FS	FS	X	FS	FS	X	X	X	FS	FS	X
Aquatic Life Use												
Dissolved Oxygen grab min	NA	NA	NA	FS	NA	FS	NA	FS	FS	FS	NA	**PS**
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	NA	NA	NA	FS	X	FS	X	FS	X	FS	X	X
pH	NA	NA	NA	FS	X	FS	X	FS	X	FS	X	X
Chloride	NA	NA	NA	**NS**	X	**NS**	X	FS	X	FS	X	X
Sulfate	NA	NA	NA	FS	X	FS	X	FS	X	FS	X	X
Total Dissolved Solids	NA	NA	NA	**NS**	X	FS	X	FS	X	FS	X	X

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1242E Little Brazos River	1242F Pond Creek	1242I Campbells Creek	1242J Deer Creek	1242K Mud Creek	1242L Pin Oak Creek	1242M Spring Creek	1242N Tehuacana Creek	1242O Walnut Creek	1242P Big Creek	1243 Salado Creek	1244 Brushy Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	**NS**	FS	**NS**	**NS**	**NS**	**NS**	FS	**NS**	FS	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	X	X	X	X	X	X	X	X	FS	FS
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	X	X	X	X	X	X	X	X	FS	FS
pH	X	X	X	X	X	X	X	X	X	X	FS	FS
Chloride	X	X	X	X	X	X	X	X	X	X	FS	FS
Sulfate	X	X	X	X	X	X	X	X	X	X	FS	FS
Total Dissolved Solids	X	X	X	X	X	X	X	X	X	X	FS	FS

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	Brushy Creek Above South Brushy Creek 1244A	Upper Oyster Creek 1245	Middle Bosque/South Bosque River 1246	Tonk Creek 1246D	Wasp Creek 1246E	Granger Lake 1247	Willis Creek 1247A	San Gabriel/North Fork San Gabriel River 1248	Berry Creek 1248A	Huddleston Branch 1248B	Mankins Branch 1248C	Lake Georgetown 1249
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	**NS**	FS	FS	**NS**	FS	**NS**	FS	FS	NA	NA	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	FS	X	X	X	FS	X	FS	X	X	X	FS
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	FS	FS	FS	FS	FS	NA	NA	NA	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	FS	FS	X	X	FS	X	FS	X	X	X	FS
pH	X	FS	FS	X	X	FS	X	FS	X	X	X	FS
Chloride	X	FS	FS	X	X	FS	X	FS	X	X	X	FS
Sulfate	X	FS	FS	X	X	FS	X	FS	X	X	X	FS
Total Dissolved Solids	X	FS	FS	X	X	FS	X	**NS**	X	X	X	FS

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	South Fork San Gabriel River 1250	North Fork San Gabriel River 1251	Lake Limestone 1252	Navasota River Below Lake Mexia 1253	Aquilla Reservoir 1254	Upper North Bosque River 1255	Goose Branch 1255A	North Fork Upper North Bosque River 1255B	Scarborough Creek 1255C	South Fork North Bosque River 1255D	Unnamed tributary of Goose Branch 1255E	Unnamed tributary of Scarborough Creek 1255F
DESIGNATED USE SUPPORT												
Contact Recreation Use	NA	NA	FS	FS	FS	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	FS	FS	FS	FS	X	X	X	X	X	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	FS	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	FS	FS	FS	FS	FS	X	X	X	X	X	X
pH	FS	FS	FS	FS	FS	FS	X	X	X	X	X	X
Chloride	FS	FS	FS	FS	FS	FS	X	X	X	X	X	X
Sulfate	FS	FS	FS	FS	FS	FS	X	X	X	X	X	X
Total Dissolved Solids	FS	FS	FS	FS	FS	FS	X	X	X	X	X	X

Brazos River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1255G Woodhollow Branch	1256 Brazos River/Lake Brazos	1256A Aquilla Creek	1257 Brazos River Below Lake Whitney
DESIGNATED USE SUPPORT				
Contact Recreation Use	**NS**	FS	FS	FS
Noncontact Recreation Use	X	X	X	X
Public Water Supply Use	X	FS	X	FS
Aquatic Life Use				
Dissolved Oxygen grab min	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA
Habitat	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA
Fish Consumption Use				
Advisories and Closures	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA
GENERAL USE SUPPORT				
Water Temperature	X	FS	X	FS
pH	X	FS	X	FS
Chloride	X	FS	X	FS
Sulfate	X	FS	X	FS
Total Dissolved Solids	X	FS	X	FS

Brazos River Basin Tabular Summary of Water Quality Concerns

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1201 Brazos River Tidal	1202 Brazos River Below Navasota River	1202H Allen's Creek	1202I Bessie's Creek	1202J Big Creek	1202K Mill Creek	1203 Whitney Lake	1203A Steele Creek	1204 Brazos River Below Lake Granbury	1205 Lake Granbury	1206 Brazos River Below Possum Kingdom Lake	1206D Palo Pinto Creek below Palo Pinto Reservoir
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NC	NA	NA	NA	NC	NA	NA	NC	NA	NC	NA
Nitrite + Nitrate Nitrogen	NC	NC	NC	NA	NC	NC	**C**	NA	NC	NC	NC	NC
Orthophosphorus	NC	NC	**C**	NA	NC	NC	NC	NA	NC	NC	NC	NC
Total Phosphorus	NC	NC	NA	NA	NA	NC	NA	NA	NA	NA	NC	NA
Algal Growth												
Chlorophyll *a*	NC	**C**	NA	NA	NA	NC	NA	NA	NA	NA	NC	NA
Public Water Supply												
Finished Water: Chloride	NC	NC	X	X	X	X	NC	X	X	NC	X	NC
Finished Water: Sulfate	NC	NC	X	X	X	X	NC	X	X	NC	X	NC
Finished Water: TDS	NC	NC	X	X	X	X	NC	X	X	NC	X	NC
Surface Water: Chloride	NA	NC	X	X	X	X	**C**	X	X	**C**	X	NC
Surface Water: Sulfate	NA	NC	X	X	X	X	NC	X	X	NC	X	**C**
Surface Water: TDS	NA	NC	X	X	X	X	NC	X	X	**C**	X	NC

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1207 Possum Kingdom Lake	1208 Brazos River Above Possum Kingdom Lake	1209 Navasota River Below Lake Limestone	1209A Country Club Lake	1209B Fin Feather Lake	1209C Carters Creek	1209D Country Club Branch	1209G Cedar Creek	1209H Duck Creek	1209I Gibbons Creek	1209J Shepherd Creek	1209K Steele Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	**C**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	**C**	**C**	NC	**C**	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite + Nitrate Nitrogen	NC	NC	NC	NA	NA	**C**	NA	NC	NC	NC	NC	NC
Orthophosphorus	NC	NC	NC	NA	NA	**C**	NA	NC	NC	NC	NC	NC
Total Phosphorus	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Algal Growth												
Chlorophyll *a*	NA	**C**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Public Water Supply												
Finished Water: Chloride	**C**	X	NC	X	X	X	X	X	X	X	X	X
Finished Water: Sulfate	**C**	X	NC	X	X	X	X	X	X	X	X	X
Finished Water: TDS	**C**	X	NC	X	X	X	X	X	X	X	X	X
Surface Water: Chloride	**C**	X	NC	X	X	X	X	X	X	X	X	X
Surface Water: Sulfate	**C**	X	NC	X	X	X	X	X	X	X	X	X
Surface Water: TDS	**C**	X	NC	X	X	X	X	X	X	X	X	X

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1210 Lake Mexia	1210A Navasota River above Lake Mexia	1211 Yegua Creek	1211A Davidson Creek	1212 Somerville Lake	1212A Middle Yegua Creek	1212B East Yegua Creek	1213 Little River	1214 San Gabriel River	1215 Lampasas River Below Stillhouse Hollow Lake	1216 Stillhouse Hollow Lake	1217 Lampasas River Above Stillhouse Hollow Lake
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NA	NA	NA	NA	NA	NA	NA	NC	NC	NC	NA
Nitrite + Nitrate Nitrogen	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Orthophosphorus	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Total Phosphorus	**C**	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA
Algal Growth												
Chlorophyll *a*	NC	NA	NA	NA	NA	NA	NA	NA	NC	NC	NA	NA
Public Water Supply												
Finished Water: Chloride	NC	X	NC	X	NC	X	X	NC	NC	NC	NC	X
Finished Water: Sulfate	NC	X	NC	X	NC	X	X	NC	NC	NC	NC	X
Finished Water: TDS	NC	X	NC	X	NC	X	X	NC	NC	NC	NC	X
Surface Water: Chloride	NC	X	NC	X	NC	X	X	NC	NC	NC	NC	X
Surface Water: Sulfate	NC	X	NC	X	NC	X	X	NC	NC	NC	NC	X
Surface Water: TDS	NC	X	NC	X	NC	X	X	NC	NC	NC	NC	X

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1217A Rocky Creek	1217B Sulphur Creek	1217C Simms Creek	1218 Nolan Creek/ South Nolan Creek	1219 Leon River Below Belton Lake	1220 Belton Lake	1220A Cowhouse Creek	1221 Leon River Below Proctor Lake	1221A Resley Creek	1221B South Leon River	1222 Proctor Lake	1222A Duncan Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	**C**	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NA	NA	NC	NC	NC	NC	NC	NA	NC	NC	NA
Nitrite + Nitrate Nitrogen	NC	NC	NC	**C**	NC	**C**	NC	NC	NA	NC	NC	NA
Orthophosphorus	NC	NC	NC	**C**	NC	NC	NC	NC	NA	NC	NC	NA
Total Phosphorus	NA	NA	NA	**C**	NA	NC	NA	NC	NA	NC	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NA	NA	NC	NA	NC	NA	**C**	NA	NC	NA	NA
Public Water Supply												
Finished Water: Chloride	X	X	X	X	NC	NC	X	NC	X	X	NC	X
Finished Water: Sulfate	X	X	X	X	NC	NC	X	NC	X	X	NC	X
Finished Water: TDS	X	X	X	X	NC	NC	X	NC	X	X	NC	X
Surface Water: Chloride	X	X	X	X	NC	NC	X	NC	X	X	NC	X
Surface Water: Sulfate	X	X	X	X	NC	NC	X	NC	X	X	NC	X
Surface Water: TDS	X	X	X	X	NC	NC	X	NC	X	X	NC	X

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1222B Rush-Copperas Creek	1222C Sabana River	1223 Leon River Below Leon Reservoir	1224 Leon Reservoir	1225 Waco Lake	1225A Hog Creek	1226 North Bosque River	1226A Duffau Creek	1226B Green Creek	1226C Meridian Creek	1226D Neils Creek	1226E Indian Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrite + Nitrate Nitrogen	NC	NC	NC	NC	**C**	NC	NC	NC	NC	NC	NC	**C**
Orthophosphorus	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Total Phosphorus	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Algal Growth												
Chlorophyll *a*	NA	NC	NC	NC	**C**	NC	**C**	NC	**C**	NC	NC	NA
Public Water Supply												
Finished Water: Chloride	X	X	NC	NC	NC	X	NC	X	X	X	X	X
Finished Water: Sulfate	X	X	NC	NC	NC	X	NC	X	X	X	X	X
Finished Water: TDS	X	X	NC	NC	NC	X	NC	X	X	X	X	X
Surface Water: Chloride	X	X	NC	NC	NC	X	NC	X	X	X	X	X
Surface Water: Sulfate	X	X	NC	NC	NC	X	NC	X	X	X	X	X
Surface Water: TDS	X	X	NC	NC	NC	X	NC	X	X	X	X	X

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1226F Sims Creek	1226G Spring Creek	1227 Nolan River	1228 Lake Pat Cleburne	1229 Paluxy River /North Paluxy River	1230 Lake Palo Pinto	1231 Lake Graham	1232 Clear Fork Brazos River	1232A California Creek	1232B Deadman Creek	1233 Hubbard Creek Reservoir	1234 Lake Cisco
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NC	NC	NA	NC	NA	NA	NC	NA	NC	NC	NA
Nitrite + Nitrate Nitrogen	NC	NC	**C**	NA	NC	NA	NA	**C**	**C**	**C**	NC	NA
Orthophosphorus	NC	NC	**C**	NA	NC	NA	NA	**C**	NC	**C**	NC	NA
Total Phosphorus	NC	NC	NC	NA	NC	NA	NA	NC	NA	**C**	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NA	NC	NA	NC	NA	NA	NC	NA	NC	NA	NA
Public Water Supply												
Finished Water: Chloride	X	X	X	NC	NC	NC	NC	X	X	X	NC	NC
Finished Water: Sulfate	X	X	X	NC	NC	NC	NC	X	X	X	NC	NC
Finished Water: TDS	X	X	X	NC	NC	NC	NC	X	X	X	NC	NC
Surface Water: Chloride	X	X	X	NA	NC	NA	NA	X	X	X	NC	NA
Surface Water: Sulfate	X	X	X	NA	NC	NA	NA	X	X	X	NC	NA
Surface Water: TDS	X	X	X	NA	NC	NA	NA	X	X	X	NC	NA

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1235 Lake Stamford	1236 Fort Phantom Hill Reservoir	1237 Lake Sweetwater	1238 Salt Fork Brazos River	1239 White River	1240 White River Lake	1240A White River above White River Reservoir	1241 Double Mountain Fork Brazos River	1241A N. Fork Double Mtn. Fork Brazos River	1242 Brazos River Above Navasota River	1242A Marlin City Lake System	1242D Thompson Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NA	NA	**C**	NA	NA	NA	NC	NC	NC	NA	NA
Nitrite + Nitrate Nitrogen	NA	NA	NA	NC	NA	NC	NA	NC	**C**	NC	NA	**C**
Orthophosphorus	NA	NA	NA	NC	NA	NC	NA	NC	NA	NC	NA	**C**
Total Phosphorus	NA	NA	NA	NC	NA	NA	NA	NC	NC	NA	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NA	NA	NC	NA	NA	NA	NC	**C**	NA	NA	NA
Public Water Supply												
Finished Water: Chloride	**C**	NC	NC	X	NC	NC	X	X	X	NC	NC	X
Finished Water: Sulfate	**C**	NC	**C**	X	NC	NC	X	X	X	NC	NC	X
Finished Water: TDS	**C**	NC	NC	X	NC	NC	X	X	X	NC	NC	X
Surface Water: Chloride	NA	NA	NA	X	NA	NC	X	X	X	NC	NC	X
Surface Water: Sulfate	NA	NA	NA	X	NA	NC	X	X	X	NC	NC	X
Surface Water: TDS	NA	NA	NA	X	NA	NC	X	X	X	NC	NC	X

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1242E Little Brazos River	1242F Pond Creek	1242I Campbells Creek	1242J Deer Creek	1242K Mud Creek	1242L Pin Oak Creek	1242M Spring Creek	1242N Tehuacana Creek	1242O Walnut Creek	1242P Big Creek	1243 Salado Creek	1244 Brushy Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite + Nitrate Nitrogen	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**C**	**C**
Orthophosphorus	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**C**
Total Phosphorus	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Public Water Supply												
Finished Water: Chloride	X	X	X	X	X	X	X	X	X	X	NC	NC
Finished Water: Sulfate	X	X	X	X	X	X	X	X	X	X	NC	NC
Finished Water: TDS	X	X	X	X	X	X	X	X	X	X	NC	NC
Surface Water: Chloride	X	X	X	X	X	X	X	X	X	X	NC	NC
Surface Water: Sulfate	X	X	X	X	X	X	X	X	X	X	NC	NC
Surface Water: TDS	X	X	X	X	X	X	X	X	X	X	NC	NC

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	Brushy Creek Above South Brushy Creek 1244A	Upper Oyster Creek 1245	Middle Bosque/South Bosque River 1246	Tonk Creek 1246D	Wasp Creek 1246E	Granger Lake 1247	Willis Creek 1247A	San Gabriel/North Fork San Gabriel River 1248	Berry Creek 1248A	Huddleston Branch 1248B	Mankins Branch 1248C	Lake Georgetown 1249
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	**C**	NC	NC	NC	NC	NC	NC	NC	NC	NC	**C**	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NC	NC	NC	NC	NC	NA	NC	NC	NA	NA	NC
Nitrite + Nitrate Nitrogen	NC	NC	**C**	**C**	**C**	**C**	**C**	NC	NC	NA	NA	NC
Orthophosphorus	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA	NC
Total Phosphorus	NA	NC	NC	NC	NC	NC	NA	NC	NC	NA	NA	NC
Algal Growth												
Chlorophyll *a*	NA	NC	NC	NC	NC	NC	NA	NC	NC	NA	NA	NC
Public Water Supply												
Finished Water: Chloride	X	NC	X	X	X	NC	X	NC	X	X	X	NC
Finished Water: Sulfate	X	NC	X	X	X	NC	X	NC	X	X	X	NC
Finished Water: TDS	X	NC	X	X	X	NC	X	NC	X	X	X	NC
Surface Water: Chloride	X	NC	X	X	X	NC	X	NC	X	X	X	NC
Surface Water: Sulfate	X	NC	X	X	X	NC	X	NC	X	X	X	NC
Surface Water: TDS	X	NC	X	X	X	NC	X	NC	X	X	X	NC

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	South Fork San Gabriel River 1250	North Fork San Gabriel River 1251	Lake Limestone 1252	Navasota River Below Lake Mexia 1253	Aquilla Reservoir 1254	Upper North Bosque River 1255	Goose Branch 1255A	North Fork Upper North Bosque River 1255B	Scarborough Creek 1255C	South Fork North Bosque River 1255D	Unnamed tributary of Goose Branch 1255E	Unnamed tributary of Scarborough Creek 1255F
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NC	NA	**C**	NC	**C**	**C**	**C**	**C**	**C**	**C**	NC
Nitrite + Nitrate Nitrogen	NC	NC	**C**	NC	**C**	**C**	**C**	NC	NC	NC	NC	NC
Orthophosphorus	NC	NC	NC	NC	NC	**C**	**C**	**C**	**C**	NC	**C**	NC
Total Phosphorus	NC	NC	NA	NC	NC	**C**	**C**	NC	**C**	NC	**C**	NC
Algal Growth												
Chlorophyll *a*	NC	NC	NA	**C**	NC	**C**	NA	**C**	NA	**C**	NA	NA
Public Water Supply												
Finished Water: Chloride	NC	NC	NC	NC	NC	X	X	X	X	X	X	X
Finished Water: Sulfate	NC	NC	NC	NC	NC	X	X	X	X	X	X	X
Finished Water: TDS	NC	NC	NC	NC	NC	X	X	X	X	X	X	X
Surface Water: Chloride	NC	NC	NC	NC	NC	X	X	X	X	X	X	X
Surface Water: Sulfate	NC	NC	NC	NC	NC	X	X	X	X	X	X	X
Surface Water: TDS	NC	NC	NC	NC	NC	X	X	X	X	X	X	X

Brazos River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1255G Woodhollow Branch	1256 Brazos River/Lake Brazos	1256A Aquilla Creek	1257 Brazos River Below Lake Whitney
WATER QUALITY CONCERNS				
Sediment Contaminants	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA
Narrative	NC	NC	NC	NC
Nutrient Enrichment				
Ammonia Nitrogen	NC	NC	NA	NA
Nitrite + Nitrate Nitrogen	NC	NC	NC	NC
Orthophosphorus	NC	NC	NC	NC
Total Phosphorus	NC	NC	NA	NA
Algal Growth				
Chlorophyll *a*	NA	NC	NA	NA
Public Water Supply				
Finished Water: Chloride	X	NC	X	NC
Finished Water: Sulfate	X	NC	X	NC
Finished Water: TDS	X	NC	X	NC
Surface Water: Chloride	X	NC	X	NC
Surface Water: Sulfate	X	NC	X	NC
Surface Water: TDS	X	NC	X	NC

Brazos-Colorado Coastal Basin Tabular Summary of Use Support

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1301 San Bernard River Tidal	1302 San Bernard River Above Tidal	1304 Caney Creek Tidal	1304A Linnville Bayou	1305 Caney Creek Above Tidal
DESIGNATED USE SUPPORT					
Contact Recreation Use	FS	**NS**	FS	FS	**NS**
Noncontact Recreation Use	X	X	X	X	X
Public Water Supply Use	X	FS	X	X	X
Aquatic Life Use					
Dissolved Oxygen grab min	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	FS	NA
Organics in water	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA
Fish Consumption Use					
Advisories and Closures	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	FS	NA
GENERAL USE SUPPORT					
Water Temperature	FS	FS	FS	X	FS
pH	FS	FS	FS	X	FS
Chloride	X	FS	X	X	FS
Sulfate	X	FS	X	X	FS
Total Dissolved Solids	X	FS	X	X	FS

Brazos-Colorado Coastal Basin Tabular Summary of Water Quality Concerns

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1301 San Bernard River Tidal	1302 San Bernard River Above Tidal	1304 Caney Creek Tidal	1304A Linnville Bayou	1305 Caney Creek Above Tidal
WATER QUALITY CONCERNS					
Sediment Contaminants	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA
Narrative	NC	NC	**C**	NC	**C**
Nutrient Enrichment					
Ammonia Nitrogen	NC	NC	NC	**C**	NC
Nitrite + Nitrate Nitrogen	NC	NC	NC	NC	NC
Orthophosphorus	NC	NC	NC	NC	NC
Total Phosphorus	NC	NC	NC	NC	NC
Algal Growth					
Chlorophyll *a*	NC	NC	NC	NC	NC
Public Water Supply					
Finished Water: Chloride	X	NC	X	X	X
Finished Water: Sulfate	X	NC	X	X	X
Finished Water: TDS	X	NC	X	X	X
Surface Water: Chloride	X	NC	X	X	X
Surface Water: Sulfate	X	NC	X	X	X
Surface Water: TDS	X	NC	X	X	X

Colorado River Basin Tabular Summary of Use Support

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1401 Colorado River Tidal	1402 Colorado River Below La Grange	1402A Cummins Creek	1402C Buckners Creek	1402F Blue Creek	1402G Fayette Reservoir	1402H Skull Creek	1403 Lake Austin	1403A Bull Creek	1403B West Bull Creek	1403C Cow Fork Bull Creek	1403D Barrow Preserve Tributary
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	FS	NA	NA	FS	FS	FS	FS	NA	NA	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	FS	X	X	X	FS	X	FS	X	X	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	FS	NA	FS	NA	FS	FS	FS	NA	NA
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	**NS**	NA	NA	NA	NA	NA	**NS**	FS	FS	NA
Fish Community	NA	NA	**NS**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	FS	X	X	X	X	X	FS	X	X	X	X
pH	FS	FS	X	X	X	X	X	FS	X	X	X	X
Chloride	X	FS	X	X	X	X	X	FS	X	X	X	X
Sulfate	X	FS	X	X	X	X	X	FS	X	X	X	X
Total Dissolved Solids	X	FS	X	X	X	X	X	FS	X	X	X	X

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1403E Stillhouse Hollow	1403F Unnamed Tributary to Bull Creek	1403G Tanglewood Tributary to Bull Creek	1403H Unnamed Tributary to Bull Creek	1403I Unnamed Tributary to Bull Creek	1403J Spicewood Tributary to Shoal Creek	1403K Taylor Slough South	1403L Unnamed Tributary to Lake Austin	1403M Turkey Creek	1403N Panther Hollow Creek	1403O Cuernavaca Creek	1403P Bee Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	FS	FS	FS	**NS**	**NS**	FS	NA	NA	NA	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	X	X	X	X	X	X	X	X	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	FS	FS	FS	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	FS	FS	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X
Chloride	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate	X	X	X	X	X	X	X	X	X	X	X	X
Total Dissolved Solids	X	X	X	X	X	X	X	X	X	X	X	X

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1403Q Bear Creek	1403R Unnamed tributary to Lake Austin	1404 Lake Travis	1404A Hamilton Creek	1404B Cow Creek	1404C Long Hollow Creek	1405 Marble Falls Lake	1406 Lake Lyndon B. Johnson	1406A Sandy Creek	1407 Inks Lake	1408 Lake Buchanan	1409 Colorado River Above Lake Buchanan
DESIGNATED USE SUPPORT												
Contact Recreation Use	NA	FS	FS	NA	NA	NA	FS	FS	FS	FS	FS	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	FS	X	X	X	FS	FS	X	FS	FS	FS
Aquatic Life Use												
Dissolved Oxygen grab min	NA	NA	FS	NA	NA	NA	FS	FS	FS	**PS**	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	FS
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	FS
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	FS	X	X	X	FS	FS	X	FS	FS	FS
pH	X	X	FS	X	X	X	FS	FS	X	FS	FS	FS
Chloride	X	X	FS	X	X	X	FS	FS	X	FS	FS	FS
Sulfate	X	X	FS	X	X	X	FS	FS	X	FS	FS	FS
Total Dissolved Solids	X	X	FS	X	X	X	FS	FS	X	FS	FS	FS

Colorado River Basin Tabular Summary of Use Support (continued)

<u>Key to support codes</u> FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1410 Colorado River Below O. H. Ivie Reservoir	1411 E. V. Spence Reservoir	1412 Colorado River Below Lake J. B. Thomas	1412A Lake Colorado City	1412B Beals Creek	1412C Deep Creek	1413 Lake J. B. Thomas	1414 Pedernales River	1414B Cypress Creek	1414C Live Oak Creek	1414D Miller Creek	1415 Llano River
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	NA	NA	NA	NA	NA	NA	FS	FS	NA	NA	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	FS	X	FS	X	X	FS	FS	X	X	X	FS
Aquatic Life Use												
Dissolved Oxygen grab min	FS	NA	FS	NA	FS	FS	NA	FS	FS	NA	NA	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	FS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	FS	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	NA	FS	X	X	X	NA	FS	X	X	X	FS
pH	FS	NA	FS	X	X	X	NA	FS	X	X	X	FS
Chloride	FS	NA	FS	X	X	X	NA	FS	X	X	X	FS
Sulfate	FS	NA	FS	X	X	X	NA	FS	X	X	X	FS
Total Dissolved Solids	FS	NA	FS	X	X	X	NA	FS	X	X	X	FS

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1415A Johnson Fork Creek	1416 San Saba River	1416A Brady Creek	1417 Lower Pecan Bayou	1418 Lake Brownwood	1418A Hords Creek	1418B Jim Ned Creek	1419 Lake Coleman	1420 Pecan Bayou Above Lake Brownwood	1421 Concho River	1421A Dry Hollow Creek	1421B Kickapoo Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	NA	FS	FS	FS	NA	FS	NA	NA	FS	FS	NA	NA
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	FS	X	X	FS	X	X	FS	FS	FS	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	NA	FS	FS	FS	NA	FS	NA	NA	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	FS	FS	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	FS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	FS	NA	NA	NA	NA	NA	NA	NA	**NS**	NA	NA
Fish Community	NA	FS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	FS	FS	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	FS	X	FS	NA	X	X	NA	FS	FS	X	X
pH	X	FS	X	FS	NA	X	X	NA	FS	FS	X	X
Chloride	X	FS	X	FS	FS	X	X	FS	FS	FS	X	X
Sulfate	X	FS	X	FS	FS	X	X	FS	FS	FS	X	X
Total Dissolved Solids	X	FS	X	FS	FS	X	X	FS	FS	FS	X	X

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1421C Lipan Creek	1421D Little Concho River	1422 Lake Nasworthy	1423 Twin Buttes Reservoir	1423A Spring Creek	1423B Dove Creek	1424 Middle Concho/South Concho River	1425 O. C. Fisher Lake	1425A North Concho River	1426 Colorado River Below E. V. Spence Reservoir	1426A Oak Creek Reservoir	1426B Elm Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	NA	NA	FS	NA	FS	NA	FS	NA	NA	FS	NA	NA
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	FS	FS	X	X	FS	FS	X	FS	FS	X
Aquatic Life Use												
Dissolved Oxygen grab min	NA	FS	FS	NA	FS	NA	FS	NA	NA	FS	NA	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	FS	NA	X	X	FS	NA	X	FS	X	X
pH	X	X	FS	NA	X	X	FS	NA	X	FS	X	X
Chloride	X	X	FS	FS	X	X	FS	**NS**	X	**NS**	X	X
Sulfate	X	X	FS	FS	X	X	FS	FS	X	FS	X	X
Total Dissolved Solids	X	X	FS	FS	X	X	FS	**NS**	X	**NS**	X	X

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1427 Onion Creek	1427A Slaughter Creek	1427B Williamson Creek	1427C Bear Creek	1427D Boggy Creek	1427E Marble Creek	1427F Rinard Creek	1427G Unnamed Tributary to Slaughter Creek	1428 Colorado River Below Town Lake	1428A Boggy Creek	1428B Walnut Creek	1428C Gilleland Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	FS	NA	NA	FS	FS	NA	FS	NA	FS	**NS**
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	X	X	X	X	X	X	X	FS	X	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	NA	NA	FS	FS	NA	FS	NA	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	FS	**NS**	FS	NA	NA	NA	NA	NA	NA	NA	FS	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	X	X	X	X	X	X	X	FS	X	X	X
pH	FS	X	X	X	X	X	X	X	FS	X	X	X
Chloride	FS	X	X	X	X	X	X	X	FS	X	X	X
Sulfate	FS	X	X	X	X	X	X	X	FS	X	X	X
Total Dissolved Solids	FS	X	X	X	X	X	X	X	FS	X	X	X

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1428D Little Walnut Creek	1428E Fort Branch Creek	1428F Tannehill Branch Creek	1428G Wells Branch	1428H Carson Creek	1428I Decker Creek	1428J Harris Branch	1429 Town Lake	1429A Shoal Creek	1429B Eanes Creek	1429C Waller Creek	1429D East Bouldin Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	X	X	X	X	X	FS	X	X	X	X
Aquatic Life Use												
Dissolved Oxygen grab min	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	FS	NA	NA	NA	NA	FS	NA	FS	NA	**NS**	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	X	X	X	X	X	FS	X	X	X	X
pH	X	X	X	X	X	X	X	FS	X	X	X	X
Chloride	X	X	X	X	X	X	X	FS	X	X	X	X
Sulfate	X	X	X	X	X	X	X	FS	X	X	X	X
Total Dissolved Solids	X	X	X	X	X	X	X	FS	X	X	X	X

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1429E West Bouldin Creek	1429F Blum Creek	1429G Harper's Branch	1429H Johnson Creek	1430 Barton Creek	1430A Barton Springs	1430B Tributaries to Barton Creek	1431 Mid Pecan Bayou	1432 Upper Pecan Bayou	1433 O. H. Ivie Reservoir	1434 Colorado River above La Grange	1434B Cedar Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	NA	NA	NA	NA	FS	FS	FS	FS	FS	NA	FS	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	X	X	X	X	X	X	FS	FS	FS	X
Aquatic Life Use												
Dissolved Oxygen grab min	NA	NA	NA	NA	FS	FS	FS	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	FS	FS	NA	NA	FS	NA	FS	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	X	X	X	X	FS	X	X	FS	FS	FS	FS	X
pH	X	X	X	X	FS	X	X	FS	FS	NA	FS	X
Chloride	X	X	X	X	FS	X	X	FS	FS	NA	FS	X
Sulfate	X	X	X	X	FS	X	X	FS	FS	NA	FS	X
Total Dissolved Solids	X	X	X	X	FS	X	X	FS	FS	NA	NA	X

Colorado River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1434C Lake Bastrop
DESIGNATED USE SUPPORT	
Contact Recreation Use	FS
Noncontact Recreation Use	X
Public Water Supply Use	X
Aquatic Life Use	
Dissolved Oxygen grab min	FS
Dissolved Oxygen 24-hour avg	NA
Dissolved Oxygen 24-hour min	NA
Metals in water	NA
Organics in water	NA
Water Toxicity tests	NA
Sediment Toxicity tests	NA
Habitat	NA
Macrobenthos Community	NA
Fish Community	NA
Fish Consumption Use	
Advisories and Closures	NA
Human Health Criteria	NA
GENERAL USE SUPPORT	
Water Temperature	X
pH	X
Chloride	X
Sulfate	X
Total Dissolved Solids	X

Colorado River Basin Tabular Summary of Water Quality Concerns

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1401 Colorado River Tidal	1402 Colorado River Below La Grange	1402A Cummins Creek	1402C Buckners Creek	1402F Blue Creek	1402G Fayette Reservoir	1402H Skull Creek	1403 Lake Austin	1403A Bull Creek	1403B West Bull Creek	1403C Cow Fork Bull Creek	1403D Barrow Preserve Tributary
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NC	NC	NC	NA	NC	NA	NC	NC	NC	NA	NC
Nitrite + Nitrate Nitrogen	NC	NC	NC	NC	NA	NC	NA	NC	NC	NC	NA	**C**
Orthophosphorus	NC	NC	NC	NC	NA	NC	NA	NC	NC	NC	NA	NC
Total Phosphorus	NC	NC	NC	NC	NA	NC	NA	NC	NC	NC	NA	NC
Algal Growth												
Chlorophyll *a*	NC	NC	NC	**C**	NA	**C**	NA	NC	NC	NA	NA	NA
Public Water Supply												
Finished Water: Chloride	X	NC	X	X	X	NC	X	NC	X	X	X	X
Finished Water: Sulfate	X	NC	X	X	X	NC	X	NC	X	X	X	X
Finished Water: TDS	X	NC	X	X	X	NC	X	NC	X	X	X	X
Surface Water: Chloride	X	NC	X	X	X	NC	X	NC	X	X	X	X
Surface Water: Sulfate	X	NC	X	X	X	NC	X	NC	X	X	X	X
Surface Water: TDS	X	NC	X	X	X	NC	X	NC	X	X	X	X

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1403E Stillhouse Hollow	1403F Unnamed Tributary to Bull Creek	1403G Tanglewood Tributary to Bull Creek	1403H Unnamed Tributary to Bull Creek	1403I Unnamed Tributary to Bull Creek	1403J Spicewood Tributary to Shoal Creek	1403K Taylor Slough South	1403L Unnamed Tributary to Lake Austin	1403M Turkey Creek	1403N Panther Hollow Creek	1403O Cuernavaca Creek	1403P Bee Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA	NA	NC
Nitrite + Nitrate Nitrogen	**C**	NC	NC	NC	NC	**C**	**C**	NC	NA	NA	NA	NC
Orthophosphorus	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA	NA	NC
Total Phosphorus	NC	NC	NC	NC	NC	NC	NA	NA	NA	NA	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Public Water Supply												
Finished Water: Chloride	X	X	X	X	X	X	X	X	X	X	X	X
Finished Water: Sulfate	X	X	X	X	X	X	X	X	X	X	X	X
Finished Water: TDS	X	X	X	X	X	X	X	X	X	X	X	X
Surface Water: Chloride	X	X	X	X	X	X	X	X	X	X	X	X
Surface Water: Sulfate	X	X	X	X	X	X	X	X	X	X	X	X
Surface Water: TDS	X	X	X	X	X	X	X	X	X	X	X	X

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1403Q Bear Creek	1403R Unnamed tributary to Lake Austin	1404 Lake Travis	1404A Hamilton Creek	1404B Cow Creek	1404C Long Hollow Creek	1405 Marble Falls Lake	1406 Lake Lyndon B. Johnson	1406A Sandy Creek	1407 Inks Lake	1408 Lake Buchanan	1409 Colorado River Above Lake Buchanan
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NC	NC	NA	NA	NA	NC	NC	NC	**C**	NC	NC
Nitrite + Nitrate Nitrogen	NA	NC	NC	NA	NA	NA	NC	NC	NC	NC	NC	NC
Orthophosphorus	NA	NC	NC	NA	NA	NA	NC	NC	NC	NC	NC	NC
Total Phosphorus	NA	NA	NC	NA	NA	NA	NC	NC	NC	NC	NC	NC
Algal Growth												
Chlorophyll *a*	NA	NA	NC	NA	NA	NA	NC	NC	NC	NC	**C**	NC
Public Water Supply												
Finished Water: Chloride	X	X	NC	X	X	X	NC	NC	X	NC	NC	NC
Finished Water: Sulfate	X	X	NC	X	X	X	NC	NC	X	NC	NC	NC
Finished Water: TDS	X	X	NC	X	X	X	NC	NC	X	NC	NC	NC
Surface Water: Chloride	X	X	NC	X	X	X	NC	NC	X	NC	NC	NC
Surface Water: Sulfate	X	X	NC	X	X	X	NC	NC	X	NC	NC	NC
Surface Water: TDS	X	X	NC	X	X	X	NC	NC	X	NC	NC	NC

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1410 Colorado River Below O. H. Ivie Reservoir	1411 E. V. Spence Reservoir	1412 Colorado River Below Lake J. B. Thomas	1412A Lake Colorado City	1412B Beals Creek	1412C Deep Creek	1413 Lake J. B. Thomas	1414 Pedernales River	1414B Cypress Creek	1414C Live Oak Creek	1414D Miller Creek	1415 Llano River
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NA	NC	NA	NA	NA	NA	NC	NC	NA	NA	NC
Nitrite + Nitrate Nitrogen	NC	NA	NC	NA	**C**	NA	NA	NC	NC	NA	NA	NC
Orthophosphorus	NC	NA	NC	NA	NA	NA	NA	NC	NC	NA	NA	NC
Total Phosphorus	NC	NA	NA	NA	NA	NA	NA	NC	NC	NA	NA	NC
Algal Growth												
Chlorophyll *a*	NC	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NC
Public Water Supply												
Finished Water: Chloride	NC	NA	X	NC	X	X	NC	NC	X	X	X	NC
Finished Water: Sulfate	NC	NA	X	**C**	X	X	NC	NC	X	X	X	NC
Finished Water: TDS	NC	NA	X	**C**	X	X	NC	NC	X	X	X	NC
Surface Water: Chloride	**C**	**C**	X	NA	X	X	NA	NC	X	X	X	NC
Surface Water: Sulfate	NC	**C**	X	NA	X	X	NA	NC	X	X	X	NC
Surface Water: TDS	NC	**C**	X	NA	X	X	NA	NC	X	X	X	NC

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1415A Johnson Fork Creek	1416 San Saba River	1416A Brady Creek	1417 Lower Pecan Bayou	1418 Lake Brownwood	1418A Hords Creek	1418B Jim Ned Creek	1419 Lake Coleman	1420 Pecan Bayou Above Lake Brownwood	1421 Concho River	1421A Dry Hollow Creek	1421B Kickapoo Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NC	NC	NC	NA	NC	NA	NC	NC	**C**	NA	NA
Nitrite + Nitrate Nitrogen	NA	NC	**C**	**C**	NA	NC	NA	NC	NC	**C**	**C**	**C**
Orthophosphorus	NA	NC	**C**	NC	NA	NC	NA	NC	NC	NC	NA	NA
Total Phosphorus	NA	NC	**C**	NC	NA	NC	NA	NC	NA	NC	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NC	**C**	**C**	NA	**C**	NA	NC	NA	**C**	NA	NA
Public Water Supply												
Finished Water: Chloride	X	NC	X	X	NC	X	X	NC	NC	**C**	X	X
Finished Water: Sulfate	X	NC	X	X	NC	X	X	NC	NC	**C**	X	X
Finished Water: TDS	X	NC	X	X	NC	X	X	NC	NC	**C**	X	X
Surface Water: Chloride	X	NC	X	X	NC	X	X	NC	NC	**C**	X	X
Surface Water: Sulfate	X	NC	X	X	NC	X	X	NC	NC	**C**	X	X
Surface Water: TDS	X	NC	X	X	NC	X	X	NC	NC	**C**	X	X

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1421C Lipan Creek	1421D Little Concho River	1422 Lake Nasworthy	1423 Twin Buttes Reservoir	1423A Spring Creek	1423B Dove Creek	1424 Middle Concho/South Concho River	1425 O. C. Fisher Lake	1425A North Concho River	1426 Colorado River Below E. V. Spence Reservoir	1426A Oak Creek Reservoir	1426B Elm Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NA	**C**	NA	**C**	NA	NC	**C**	NA	**C**	NA	NA
Nitrite + Nitrate Nitrogen	NA	**C**	NC	NA	NC	NA	NC	NC	NA	NC	NA	**C**
Orthophosphorus	NA	NA	NC	NA	NC	NA	NC	NC	NA	NC	NA	NA
Total Phosphorus	NA	NA	NC	NA	NA	NA	NC	NA	NA	NC	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NA	NC	NA	NA	NA	NC	NA	NA	**C**	NA	NA
Public Water Supply												
Finished Water: Chloride	X	X	NC	NC	X	X	NC	NC	X	NC	NA	X
Finished Water: Sulfate	X	X	NC	NC	X	X	NC	NC	X	NC	**C**	X
Finished Water: TDS	X	X	NC	NC	X	X	NC	NC	X	NC	NA	X
Surface Water: Chloride	X	X	**C**	NC	X	X	NC	**C**	X	**C**	NA	X
Surface Water: Sulfate	X	X	NC	NC	X	X	NC	NC	X	**C**	NA	X
Surface Water: TDS	X	X	NC	NC	X	X	NC	NC	X	**C**	NA	X

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1427 Onion Creek	1427A Slaughter Creek	1427B Williamson Creek	1427C Bear Creek	1427D Boggy Creek	1427E Marble Creek	1427F Rinard Creek	1427G Unnamed Tributary to Slaughter Creek	1428 Colorado River Below Town Lake	1428A Boggy Creek	1428B Walnut Creek	1428C Gilleland Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	**C**	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NC	NC	NA	NA	NC	NC	NA	NC	NA	NC	NC
Nitrite + Nitrate Nitrogen	NC	NC	NC	NA	NA	NC	NC	NA	**C**	NA	**C**	**C**
Orthophosphorus	NC	NC	NC	NA	NA	NC	NC	NA	**C**	NA	NC	**C**
Total Phosphorus	NC	NC	NC	NA	NA	NC	NC	NA	NC	NA	**C**	NC
Algal Growth												
Chlorophyll *a*	NC	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NC
Public Water Supply												
Finished Water: Chloride	NC	X	X	X	X	X	X	X	NC	X	X	X
Finished Water: Sulfate	NC	X	X	X	X	X	X	X	NC	X	X	X
Finished Water: TDS	NC	X	X	X	X	X	X	X	NC	X	X	X
Surface Water: Chloride	NC	X	X	X	X	X	X	X	NC	X	X	X
Surface Water: Sulfate	NC	X	X	X	X	X	X	X	NC	X	X	X
Surface Water: TDS	NC	X	X	X	X	X	X	X	NC	X	X	X

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

<u>Key to concern codes</u> NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1428D Little Walnut Creek	1428E Fort Branch Creek	1428F Tannehill Branch Creek	1428G Wells Branch	1428H Carson Creek	1428I Decker Creek	1428J Harris Branch	1429 Town Lake	1429A Shoal Creek	1429B Eanes Creek	1429C Waller Creek	1429D East Bouldin Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**C**
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**C**	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA
Nitrite + Nitrate Nitrogen	NA	NA	NA	NA	NA	NA	NA	**C**	NA	NA	NA	NA
Orthophosphorus	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA
Total Phosphorus	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA
Algal Growth												
Chlorophyll *a*	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA
Public Water Supply												
Finished Water: Chloride	X	X	X	X	X	X	X	NC	X	X	X	X
Finished Water: Sulfate	X	X	X	X	X	X	X	NC	X	X	X	X
Finished Water: TDS	X	X	X	X	X	X	X	NC	X	X	X	X
Surface Water: Chloride	X	X	X	X	X	X	X	NC	X	X	X	X
Surface Water: Sulfate	X	X	X	X	X	X	X	NC	X	X	X	X
Surface Water: TDS	X	X	X	X	X	X	X	NC	X	X	X	X

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	West Bouldin Creek 1429E	Blunn Creek 1429F	Harper's Branch 1429G	Johnson Creek 1429H	Barton Creek 1430	Barton Springs 1430A	Tributaries to Barton Creek 1430B	Mid Pecan Bayou 1431	Upper Pecan Bayou 1432	O. H. Ivie Reservoir 1433	Colorado River above La Grange 1434	Cedar Creek 1434B
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	**C**	**C**	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NA	NA	NA	NA	NC	NC	NC	NC	NC	NA	NC	NC
Nitrite + Nitrate Nitrogen	NA	NA	NA	NA	NC	NC	NC	**C**	NC	NA	**C**	NC
Orthophosphorus	NA	NA	NA	NA	NC	NC	NC	**C**	NC	NA	NC	NC
Total Phosphorus	NA	NA	NA	NA	NC	NC	NC	**C**	NC	NA	NC	NC
Algal Growth												
Chlorophyll *a*	NA	NA	NA	NA	NC	NC	NA	NC	NC	NA	NC	NC
Public Water Supply												
Finished Water: Chloride	X	X	X	X	X	X	X	X	NC	NC	NC	X
Finished Water: Sulfate	X	X	X	X	X	X	X	X	NC	NC	NC	X
Finished Water: TDS	X	X	X	X	X	X	X	X	NC	NC	NC	X
Surface Water: Chloride	X	X	X	X	X	X	X	X	NC	**C**	NC	X
Surface Water: Sulfate	X	X	X	X	X	X	X	X	NC	NC	NC	X
Surface Water: TDS	X	X	X	X	X	X	X	X	NC	**C**	NA	X

Colorado River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1434C Lake Bastrop
WATER QUALITY CONCERNS	
Sediment Contaminants	NA
Fish Tissue Contaminants	NA
Narrative	NC
Nutrient Enrichment	
Ammonia Nitrogen	NC
Nitrite + Nitrate Nitrogen	NC
Orthophosphorus	NC
Total Phosphorus	NC
Algal Growth	
Chlorophyll *a*	NC
Public Water Supply	
Finished Water: Chloride	X
Finished Water: Sulfate	X
Finished Water: TDS	X
Surface Water: Chloride	X
Surface Water: Sulfate	X
Surface Water: TDS	X

Colorado-Lavaca Coastal Basin Tabular Summary of Use Support

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1501 Tres Palacios Creek Tidal	1502 Tres Palacios Creek Above Tidal
DESIGNATED USE SUPPORT		
Contact Recreation Use	FS	**NS**
Noncontact Recreation Use	X	X
Public Water Supply Use	X	X
Aquatic Life Use		
Dissolved Oxygen grab min	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA
Dissolved Oxygen 24-hour min	NA	NA
Metals in water	NA	NA
Organics in water	NA	NA
Water Toxicity tests	NA	NA
Sediment Toxicity tests	NA	NA
Habitat	NA	NA
Macrobenthos Community	NA	NA
Fish Community	NA	NA
Fish Consumption Use		
Advisories and Closures	NA	NA
Human Health Criteria	NA	NA
GENERAL USE SUPPORT		
Water Temperature	FS	FS
pH	FS	FS
Chloride	X	FS
Sulfate	X	FS
Total Dissolved Solids	X	FS

Colorado-Lavaca Coastal Basin Tabular Summary of Water Quality Concerns

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1501 Tres Palacios Creek Tidal	1502 Tres Palacios Creek Above Tidal
WATER QUALITY CONCERNS		
Sediment Contaminants	NA	NA
Fish Tissue Contaminants	NA	NA
Narrative	NC	NC
Nutrient Enrichment		
Ammonia Nitrogen	NC	NC
Nitrite + Nitrate Nitrogen	NC	NC
Orthophosphorus	NC	NC
Total Phosphorus	NC	NC
Algal Growth		
Chlorophyll *a*	NC	NC
Public Water Supply		
Finished Water: Chloride	X	X
Finished Water: Sulfate	X	X
Finished Water: TDS	X	X
Surface Water: Chloride	X	X
Surface Water: Sulfate	X	X
Surface Water: TDS	X	X

Lavaca River Basin Tabular Summary of Use Support

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1601 Lavaca River Tidal	1601A Catfish Bayou	1601B Redfish Bayou	1602 Lavaca River Above Tidal	1603 Navidad River Tidal	1604 Lake Texana	1604A East Mustang Creek	1604B West Mustang Creek	1604C Sandy Creek	1605 Navidad River Above Lake Texana
DESIGNATED USE SUPPORT										
Contact Recreation Use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	X	X	FS	X	FS	X	X	X	FS
Aquatic Life Use										
Dissolved Oxygen grab min	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use										
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT										
Water Temperature	FS	X	X	FS	FS	FS	X	X	X	FS
pH	FS	X	X	FS	FS	FS	X	X	X	FS
Chloride	X	X	X	FS	X	FS	X	X	X	FS
Sulfate	X	X	X	FS	X	FS	X	X	X	FS
Total Dissolved Solids	X	X	X	FS	X	FS	X	X	X	FS

Lavaca River Basin Tabular Summary of Water Quality Concerns

Key to concern codes
NC = no concern
C = concern
TH = threatened
NA = not assessed
X = not applicable

	1601 Lavaca River Tidal	1601A Catfish Bayou	1601B Redfish Bayou	1602 Lavaca River Above Tidal	1603 Navidad River Tidal	1604 Lake Texana	1604A East Mustang Creek	1604B West Mustang Creek	1604C Sandy Creek	1605 Navidad River Above Lake Texana
WATER QUALITY CONCERNS										
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment										
Ammonia Nitrogen	NA	NA	NA	NA	NA	**C**	**C**	NA	NA	NA
Nitrite + Nitrate Nitrogen	NA	NA	NA	NC	NC	**C**	NC	NC	NC	NC
Orthophosphorus	NA	NA	NA	NC	NC	**C**	NC	NC	NC	NC
Total Phosphorus	NA	NA	NA	NA	NA	**C**	NC	NA	NA	NA
Algal Growth Concern										
Chlorophyll *a*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Public Water Supply Concern										
Finished Water: Chloride	X	X	X	NC	X	NC	X	X	X	NC
Finished Water: Sulfate	X	X	X	NC	X	NC	X	X	X	NC
Finished Water: TDS	X	X	X	NC	X	NC	X	X	X	NC
Surface Water: Chloride	X	X	X	NC	X	NC	X	X	X	NC
Surface Water: Sulfate	X	X	X	NC	X	NC	X	X	X	NC
Surface Water: TDS	X	X	X	NC	X	NC	X	X	X	NC

Guadalupe River Basin Tabular Summary of Use Support

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1801 Guadalupe River Tidal	1802 Guadalupe River Below San Antonio River	1803 Guadalupe River Below San Marcos River	1803A Elm Creek	1803B Sandies Creek	1803C Peach Creek	1804 Guadalupe River Below Comal River	1804A Geronimo Creek	1805 Canyon Lake	1806 Guadalupe River Above Canyon Lake	1806A Camp Meeting Creek	1807 Coleto Creek
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	FS	FS	NA	**NS**	**NS**	FS	FS	FS	**NS**	NA	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	X	FS	FS	X	X	X	FS	X	FS	FS	X	FS
Aquatic Life Use												
Dissolved Oxygen grab min	FS	FS	FS	NA	FS	FS	FS	FS	FS	FS	NA	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	FS	FS	X	X	X	FS	X	FS	FS	X	FS
pH	FS	FS	FS	X	X	X	FS	X	FS	FS	X	FS
Chloride	X	FS	FS	X	X	X	FS	X	FS	FS	X	FS
Sulfate	X	FS	FS	X	X	X	FS	X	FS	FS	X	FS
Total Dissolved Solids	X	FS	FS	X	X	X	FS	X	FS	FS	X	FS

Guadalupe River Basin Tabular Summary of Use Support (continued)

Key to support codes FS = fully supporting PS = partially supporting NS = not supporting NA = not assessed X = not applicable	1808 Lower San Marcos River	1809 Lower Blanco River	1810 Plum Creek	1811 Comal River	1811A Dry Comal Creek	1812 Guadalupe River Below Canyon Dam	1813 Upper Blanco River	1814 Upper San Marcos River	1815 Cypress Creek	1816 Johnson Creek	1817 North Fork Guadalupe River	1818 South Fork Guadalupe River
DESIGNATED USE SUPPORT												
Contact Recreation Use	FS	NA	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Noncontact Recreation Use	X	X	X	X	X	X	X	X	X	X	X	X
Public Water Supply Use	FS	FS	X	FS	X	FS	FS	FS	FS	FS	FS	FS
Aquatic Life Use												
Dissolved Oxygen grab min	FS	NA	FS	FS	FS	FS	FS	FS	FS	FS	FS	FS
Dissolved Oxygen 24-hour avg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Oxygen 24-hour min	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals in water	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA	NA
Organics in water	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment Toxicity tests	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Macrobenthos Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Community	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Consumption Use												
Advisories and Closures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Human Health Criteria	NA	NA	NA	NA	NA	NA	FS	NA	NA	NA	NA	NA
GENERAL USE SUPPORT												
Water Temperature	FS	NA	FS	FS	X	FS	FS	FS	FS	FS	FS	NA
pH	FS	NA	FS	FS	X	FS	FS	FS	FS	FS	FS	NA
Chloride	FS	NA	FS	FS	X	FS	FS	FS	FS	FS	FS	FS
Sulfate	FS	NA	FS	FS	X	FS	FS	FS	FS	FS	FS	FS
Total Dissolved Solids	FS	NA	FS	FS	X	FS	FS	FS	FS	FS	FS	FS

Guadalupe River Basin Tabular Summary of Water Quality Concerns

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1801 Guadalupe River Tidal	1802 Guadalupe River Below San Antonio River	1803 Guadalupe River Below San Marcos River	1803A Elm Creek	1803B Sandies Creek	1803C Peach Creek	1804 Guadalupe River Below Comal River	1804A Geronimo Creek	1805 Canyon Lake	1806 Guadalupe River Above Canyon Lake	1806A Camp Meeting Creek	1807 Coleto Creek
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	**C**	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NC	NC	NA	**C**	**C**	NC	NC	NC	NC	NA	NC
Nitrite + Nitrate Nitrogen	**C**	**C**	NC	NA	NC	NC	NC	**C**	NC	NC	NA	NC
Orthophosphorus	NC	NA	NA	NA	NA	NA	NC	NA	NC	NC	NA	NC
Total Phosphorus	NC	NC	NC	NA	NC	NC	NC	NC	NC	NC	NA	NC
Algal Growth												
Chlorophyll *a*	NC	NC	NC	NA	NC	NC	**C**	NC	NC	NC	NA	NC
Public Water Supply												
Finished Water: Chloride	X	NC	NC	X	X	X	NC	X	NC	NC	X	NC
Finished Water: Sulfate	X	NC	NC	X	X	X	NC	X	NC	NC	X	NC
Finished Water: TDS	X	NC	NC	X	X	X	NC	X	NC	NC	X	NC
Surface Water: Chloride	X	NC	NC	X	X	X	NC	X	NC	NC	X	NC
Surface Water: Sulfate	X	NC	NC	X	X	X	NC	X	NC	NC	X	NC
Surface Water: TDS	X	NC	NC	X	X	X	NC	X	NC	NC	X	NC

Guadalupe River Basin Tabular Summary of Water Quality Concerns (continued)

Key to concern codes NC = no concern C = concern TH = threatened NA = not assessed X = not applicable	1808 Lower San Marcos River	1809 Lower Blanco River	1810 Plum Creek	1811 Comal River	1811A Dry Comal Creek	1812 Guadalupe River Below Canyon Dam	1813 Upper Blanco River	1814 Upper San Marcos River	1815 Cypress Creek	1816 Johnson Creek	1817 North Fork Guadalupe River	1818 South Fork Guadalupe River
WATER QUALITY CONCERNS												
Sediment Contaminants	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA	NA
Fish Tissue Contaminants	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA	NA
Narrative	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nutrient Enrichment												
Ammonia Nitrogen	NC	NA	**C**	NC	NC	NC	NC	NC	NC	NA	NA	NA
Nitrite + Nitrate Nitrogen	NC	NA	**C**	NC	NC	NC	NC	NC	NC	NC	NC	NA
Orthophosphorus	NA	NA	NA	NC	NA	NC	NC	NA	NA	NA	NC	NA
Total Phosphorus	NC	NA	**C**	NC	NC	NC	NC	NC	NC	NA	NA	NA
Algal Growth												
Chlorophyll *a*	NC	NA	NC	NC	NC	NC	NC	NC	NC	NA	NA	NA
Public Water Supply												
Finished Water: Chloride	NC	NC	X	NC	X	NC	NC	NC	NC	NC	NC	NC
Finished Water: Sulfate	NC	NC	X	NC	X	NC	NC	NC	NC	NC	NC	NC
Finished Water: TDS	NC	NC	X	NC	X	NC	NC	NC	NC	NC	NC	NC
Surface Water: Chloride	NC	NA	X	NC	X	NC	NC	NC	NC	NC	NC	NC
Surface Water: Sulfate	NC	NA	X	NC	X	NC	NC	NC	NC	NC	NC	NC
Surface Water: TDS	NC	NA	X	NC	X	NC	NC	NC	NC	NC	NC	NC

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APPENDICES

CHAPTER 6.0: WATER CONSERVATION AND DROUGHT MANAGEMENT PLANS

This chapter presents the minimum necessary requirements for conservation plans and drought contingency plans as well as presents model conservation plans and drought contingency plans for the various water user categories (*Appendices 6A* and *6B*). The model conservation plans and drought contingency plans were developed specifically for the Lower Colorado Region (Region K) in accordance with and as described in Texas Water Code §11.1271 and 11.1272.

Irrigation water usage represents 63 percent of the total water used in the Lower Colorado Regional Water Planning Area (LCRWPA) in 2000 where irrigation of rice makes up a significant portion of total irrigation water demand. There is a potential for significant conservation savings in rice production, and conservation of water in rice irrigation may have one of the greatest impacts in reducing water usage in the LCRWPA. However, if the amount of water used in the cultivation of rice declines over time, as projected, and municipal and manufacturing demand continues to grow, as projected, the significance of planning for conservation savings in the municipal and manufacturing categories will become increasingly important. The following sections discuss which entities are required to have plans and what the plans, if required, must contain.

6.1 WATER CONSERVATION PLAN

Water conservation plans are required by the Texas Commission on Environmental Quality (TCEQ, formerly the TNRCC) and/or the Texas Water Development Board (TWDB) for the following water users:

- Applicants who apply for TWDB loans
- Applicants for new or amended surface water rights
- Any holder of an existing permit, certified filing, or certificate of adjudication if requested by TCEQ/TWDB for appropriation of a surface water right greater than 1,000 acre-feet per year (ac-ft/yr) for municipal, industrial, and other uses excluding irrigation. For irrigation uses, the threshold is 10,000 ac-ft/yr.

Conservation plans developed for submittal with water right applications for appropriation of State water should discuss the evaluation of water conservation with respect to their application. This would include discussions of water conservation as an alternative to the potentially appropriated State water as well as the evaluation of any other conservation best management practices (BMP) as an alternative to the new water right.

Minimum conservation and drought management plan requirements for specific water use categories are discussed in the following subsections.

6.1.1 Municipal Uses by Public Water Suppliers[1]

Water conservation plans for municipal water use by public water suppliers (i.e., documented Lower Colorado Regional Municipal Water User Groups) must include specific information. If the plans do not provide information for each requirement, the public water supplier shall include in the plans an explanation of why the requirement is not applicable. The required water conservation plan information for municipal uses by public drinking water suppliers is as follows:

- A utility profile including, but not limited to, information regarding population and customer data, water use data, water supply system data, and wastewater system data.
- Specification of conservation goals including, but not limited to, municipal per capita water use goals, the basis for the development of such goals, and a time frame for achieving the specified goals (until May 1, 2005).
- After May 1, 2005, specific, quantified 5-year and 10-year targets for water savings to include goals for water loss programs and goals for municipal use in gallons per capita per day. The goals established by a public water supplier under this subparagraph are not enforceable.
- Metering device(s) within an accuracy of plus or minus 5.0 percent in order to measure and account for the amount of water diverted from the source of supply.
- A program for universal metering of both customer and public uses of water, for meter testing and repair, and for periodic meter replacement.
- 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.).
- A program of continuing public education and information regarding water conservation.
- 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.
- 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.
- A means of implementation and enforcement which should be shown by either of the following:
  - A copy of the ordinance, resolution, or tariff indicating official adoption of the water conservation plan by the water supplier, or
  - A description of the authority by which the water supplier will implement and enforce the conservation plan.
- Documentation of coordination with the Lower Colorado Regional Water Planning Group (LCRWPG) for the service area of the public water supplier to ensure consistency with the appropriate, approved Lower Colorado Regional Water Plan.

[1] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2.

Water conservation plans for municipal uses by public drinking water suppliers serving a current population of 5,000 or more and/or a projected population of 5,000 or more within the next 10 years subsequent to the effective date of the plan must also include the following information:

- A program of leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system to control unaccounted-for uses of water.
- A record management system to record water pumped, water deliveries, water sales, and water losses that allows for the desegregation of water sales and uses into residential, commercial, public and institutional, and industrial users.
- 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 this chapter. If the customer intends to resell the water, 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 this chapter.

If the conservation goals cannot be achieved through the minimum conservation plan requirements, the water supplier can implement water conservation strategies to help achieve their goals. TCEQ can also require the water supplier to implement a conservation BMP strategy to achieve the goals set in the conservation plan. Some of the water conservation BMPs are listed below, and a more detailed list can be found in the *Water Conservation Best Management Practices Guide, Report 362* of the Texas Water Development Board, November 2004.

- Conservation-oriented water rates and water rate structures such as uniform or increasing block rate schedules, and/or seasonal rates, but not flat rate or decreasing block rates.
- Adoption of ordinances, plumbing codes, and/or rules requiring water-conserving plumbing fixtures to be installed in new structures and existing structures undergoing substantial modification or addition.
- A program encouraging the replacement or retrofit of existing structures built prior to 1991 with water conserving plumbing fixtures.
- Reuse and/or recycling of wastewater and/or graywater.
- A program for pressure control and/or reduction in the distribution system and/or for customer connections.
- A program and/or ordinance(s) for landscape water management.
- A method for monitoring the effectiveness and efficiency of the water conservation plan.
- Any other water conservation practice, method, or technique which the water supplier shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

A water conservation plan prepared in accordance with 31 TAC §363.15 (relating to Required Water Conservation Plan) of the TWDB, and substantially meeting the requirements of this section and other applicable commission rules, may be submitted to meet application requirements in accordance with a memorandum of understanding between the commission and the TWDB.

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 5-year and 10-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 no later than May 1, 2009, and every 5 years after that date to coincide with the Lower Colorado Regional Water Planning Group's regional water plan update.

6.1.2 Industrial or Mining[2]

Water conservation plans for industrial or mining uses of water must provide the information as outlined below. If the plan does not provide information for each requirement, the industrial or mining water user shall include in the plan an explanation of why the requirement is not applicable. Water conservation plans for industrial or mining uses of water should include, at a minimum, the following information.

- A description of the use of the water in the production process, including how the water is diverted and transported from the source(s) of supply, how the water is utilized in the production process, and the estimated quantity of water consumed in the production process and therefore unavailable for reuse, discharge, or other means of disposal.
- Until May 1, 2005, specification of conservation goals, the basis for the development of such goals, and a time frame for achieving the specified goals.
- Beginning May 1, 2005, specific, quantified 5-year and 10-year targets for water savings and the basis for the development of such goals. The goals established by industrial or mining water users under this paragraph are not enforceable.
- A description of the device(s) and/or method(s) within an accuracy of plus or minus 5.0 percent to be used in order to measure and account for the amount of water diverted from the source of supply.
- Leak-detection, repair, and accounting for water loss in the water distribution system.
- Application of state-of-the-art equipment and/or process modifications to improve water use efficiency.
- Any other water conservation practice, method, or technique which the user shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

Beginning May 1, 2005, an industrial or mining water user shall review and update its water conservation plan, as appropriate, based on an assessment of previous 5-year and 10-year targets and any other new or updated information. The industrial or mining water user shall review and update the next revision of its water conservation plan no later than May 1, 2009, and every 5 years after that date to coincide with the Lower Colorado Regional Water Planning Group regional water plan update.

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[2] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.3.

6.1.3 Agriculture[3]

A water conservation plan for agricultural use of water must provide information in response to the following subsections. If the plan does not provide information for each requirement, the agricultural water user must include in the plan an explanation of why the requirement is not applicable.

For an individual agricultural user other than irrigation:

- A description of the use of the water in the production process, including how the water is diverted and transported from the source(s) of supply, how the water is utilized in the production process, and the estimated quantity of water consumed in the production process and therefore unavailable for reuse, discharge, or other means of disposal.
- Until May 1, 2005, specification of conservation goals, the basis for the development of such goals, and a time frame for achieving the specified goals.
- Beginning May 1, 2005, specific, quantified five-year and ten-year targets for water savings and the basis for the development of such goals. The goals established by agricultural water users under this subparagraph are not enforceable.
- A description of the device(s) and/or method(s) within an accuracy of plus or minus 5.0 percent to be used in order to measure and account for the amount of water diverted from the source of supply.
- Leak-detection, repair, and accounting for water loss in the water distribution system.
- Application of state-of-the-art equipment and/or process modifications to improve water use efficiency.
- Any other water conservation practice, method, or technique which the user shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

For an individual irrigation user:

- A description of the irrigation production process which shall include, but is not limited to, the type of crops and acreage of each crop to be irrigated, monthly irrigation diversions, any seasonal or annual crop rotation, and soil types of the land to be irrigated.
- A description of the irrigation method or system and equipment including pumps, flow rates, plans, and/or sketches of the system layout.
- A description of the device(s) and/or methods within an accuracy of plus or minus 5.0 percent to be used in order to measure and account for the amount of water diverted from the source of supply.
- Until May 1, 2005, specification of conservation goals including, where appropriate, quantitative goals for irrigation water use efficiency and a pollution abatement and prevention plan.
- Beginning May 1, 2005, specific, quantified 5-year and 10-year targets for water savings including, where appropriate, quantitative goals for irrigation water use efficiency and a pollution abatement and

[3] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.4.

prevention plan. The goals established by an individual irrigation water user under this subparagraph are not enforceable.

- Water-conserving irrigation equipment and application system or method including, but not limited to, surge irrigation, low pressure sprinkler, drip irrigation, and nonleaking pipe.
- Leak-detection, repair, and water-loss control.
- Scheduling the timing and/or measuring the amount of water applied (e.g., soil moisture monitoring).
- Land improvements for retaining or reducing runoff and increasing the infiltration of rain and irrigation water including, but not limited to, land leveling, furrow diking, terracing, and weed control.
- Tail water recovery and reuse.
- Any other water conservation practice, method, or technique which the user shows to be appropriate for preventing waste and achieving conservation.

For a system providing agricultural water to more than one user:

- A system inventory for the supplier's:
  - Structural facilities including the supplier's water storage, conveyance, and delivery structures.
  - Management practices, including the supplier's operating rules and regulations, water pricing policy, and a description of practices and/or devices used to account for water deliveries.
  - A user profile including square miles of the service area, number of customers taking delivery of water by the system, types of crops, types of irrigation systems, types of drainage systems, and total acreage under irrigation, both historical and projected.
- Until May 1, 2005, specification of water conservation goals including maximum allowable losses for the storage and distribution system.
- Beginning May 1, 2005, specific, quantified 5-year and 10-year targets for water savings including maximum allowable losses for the storage and distribution system. The goals established by a system providing agricultural water to more than one user under this subparagraph are not enforceable.
- A description of 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.
- A monitoring and record management program of water deliveries, sales, and losses.
- A leak-detection, repair, and water loss control program.
- A program to assist customers in the development of on-farm water conservation and pollution prevention plans and/or measures.
- 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 this chapter. If the customer intends to resell the water, 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 applicable provisions of this chapter.

- 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.
- Any other water conservation practice, method, or technique which the supplier shows to be appropriate for achieving conservation.
- Documentation of coordination with the regional water planning groups in order to ensure consistency with appropriate approved regional water plans.

A water conservation plan, prepared in accordance with the rules of the U.S. Department of Agriculture's Natural Resources Conservation Service, the Texas State Soil and Water Conservation Board, or other Federal or State agencies and substantially meeting the requirements of this section and other applicable commission rules, may be submitted to meet application requirements in accordance with a memorandum of understanding between the commission and that agency.

Beginning May 1, 2005, an agricultural water user shall review and update its water conservation plan, as appropriate, based on an assessment of previous 5-year and 10-year targets and any other new or updated information. An agricultural water user shall review and update the next revision of its water conservation plan no later than May 1, 2009, and every 5 years after that date to coincide with the Lower Colorado Regional Water Planning Group regional water plan update.

6.1.4 Wholesale Water Providers[4]

A water conservation plan for a wholesale water supplier must provide information in response to each of the following paragraphs. If the plan does not provide information for each requirement, the wholesale water supplier shall include in the plan an explanation of why the requirement is not applicable. All water conservation plans for wholesale water suppliers must include the following elements:

- A description of the wholesaler’s service area, including population and customer data, water use data, water supply system data, and wastewater data.
- Until May 1, 2005, specification of conservation goals including, where appropriate, target per capita water use goals for the wholesaler’s service area, maximum acceptable unaccounted-for water, the basis for the development of these goals, and a time frame for achieving these goals.
- Beginning May 1, 2005, specific, quantified 5- and 10-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. The goals established by wholesale water suppliers under this subparagraph are not enforceable.
- 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.
- A monitoring and record management program for determining water deliveries, sales, and losses.

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[4] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.5.

- A program of metering and leak detection and repair for the wholesaler's water storage, delivery, and distribution system.
- 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, 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 applicable provisions of this chapter.
- 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.
- 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.
- 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 Lower Colorado Regional Water Plan.

Additional Conservation Strategies

Any combination of the following strategies shall be selected by the water wholesaler, in addition to the minimum requirements of paragraph (1) of this section, if they are necessary in order to achieve the stated water conservation goals of the plan. The commission may require by commission order that any of the following strategies be implemented by the water supplier if the commission determines that the strategies are necessary in order for the conservation plan to be achieved.

- Conservation-oriented water rates and water rate structures such as uniform or increasing block rate schedules, and/or seasonal rates, but not flat rate or decreasing block rates.
- A program to assist agricultural customers in the development of conservation and pollution prevention and abatement plans.
- A program for reuse and/or recycling of wastewater and/or graywater.
- Any other water conservation practice, method, or technique which the wholesaler shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

Review and update requirements. Beginning May 1, 2005, the wholesale water supplier shall review and update its water conservation plan, as appropriate, based on an assessment of previous 5-year and 10-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 no later than May 1, 2009, and every 5 years after that date to coincide with the Lower Colorado Regional Water Planning Group regional water plan update.

6.1.5 Other Water Uses[5]

A water conservation plan for any other purpose or use not covered in this subchapter shall provide information where applicable about those practices, techniques, and technologies that will be used to reduce the consumption of water, prevent or reduce the loss or waste of water, maintain or improve the efficiency in the use of water, increase the recycling and reuse of water, or prevent the pollution of water.

Model water conservation plans specifically for the Lower Colorado Region were developed for each water use category and are located *Appendix 6A*.

6.2 DROUGHT CONTINGENCY PLAN[6]

Drought contingency plans can be required by the TCEQ/TWDB for certain applicants and water rights holders.

- The Commission shall by rule require wholesale and retail public water suppliers and irrigation districts to develop drought contingency plans consistent with the appropriate approved regional water plan to be implemented during periods of water shortages and drought.
- The wholesale and retail public water suppliers and irrigation districts shall provide an opportunity for public input during preparation of their drought contingency plans and before submission of the plans to the commission.

Beginning in May 2005, the following are additional requirements in the drought contingency plan:

- Specific, quantified targets for water use reductions to be achieved during periods of water shortages and drought. The entity preparing the plan shall establish the targets.
- The commission and the board by joint rule shall identify quantified target goals for drought contingency plans that wholesale and retail public water suppliers, irrigation districts, and other entities may use as guidelines in preparing drought contingency plans. Goals established under this subsection are not enforceable requirements.

The commission and the board jointly shall develop model drought contingency programs for different types of water suppliers that suggest best management practices for accomplishing the highest practicable levels of water use reductions achievable during periods of water shortages and drought for each specific type of water supplier.

6.2.1 Municipal Uses by Public Water Suppliers[7]

Drought contingency plans for retail public water suppliers, where applicable, and for public water suppliers, must include the following minimum elements.

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[5] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.6.

[6] Model drought contingency plans specifically for the Lower Colorado Region were developed for each water use category and are located at the end of this Chapter.

[7] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2.0

- Preparation of the plan shall include provisions to actively inform the public and affirmatively provide opportunity for public input. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the public and providing written notice to the public concerning the proposed plan and meeting.
- Provisions shall be made for a program of continuing public education and information regarding the drought contingency plan.
- The drought contingency plan must document coordination with the regional water planning groups for the service area of the retail public water supplier to ensure consistency with the appropriate approved regional water plans.
- The drought contingency plan must include a description of the information to be monitored by the water supplier and specific criteria for the initiation and termination of drought response stages, accompanied by an explanation of the rationale or basis for such triggering criteria.
- The drought contingency plan must include drought or emergency response stages providing for the implementation of measures in response to at least the following situations:
    - Reduction in available water supply up to a repeat of the drought of record.
    - Water production or distribution system limitations.
    - Supply source contamination.
    - System outage due to the failure or damage of major water system components (e.g., pumps).
- The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this subparagraph are not enforceable.
- The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following:
    - Curtailment of nonessential water uses.
    - Utilization of alternative water sources and/or alternative delivery mechanisms with the prior approval of the executive director as appropriate (e.g., interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.).
- The drought contingency plan must include the procedures to be followed for the initiation or termination of each drought response stage, including procedures for notification of the public.
- The drought contingency plan must include procedures for granting variances to the plan.
- The drought contingency plan must include procedures for the enforcement of mandatory water use restrictions, including specification of penalties (e.g., fines, water rate surcharges, discontinuation of service) for violations of such restrictions.

Privately owned water utilities shall prepare a drought contingency plan in accordance with this section and incorporate such plan into their tariff.

Any water supplier that receives all or a portion of its water supply from another water supplier shall consult with that supplier and shall include in the drought contingency plan appropriate provisions for responding to reductions in that water supply. A wholesale or retail water supplier shall notify the executive director within 5 business days of the implementation of any mandatory provisions of the drought contingency plan.

The retail public water supplier shall review and update, as appropriate, the drought contingency plan, at least every 5 years, based on new or updated information, such as the adoption or revision of the Lower Colorado Regional Water Plan.

6.2.2 Irrigation Uses[8]

A drought contingency plan for an irrigation use, where applicable, must include the following minimum elements. Drought contingency plans for irrigation water suppliers must include policies and procedures for the equitable and efficient allocation of water on a pro rata basis during times of shortage in accordance with Texas Water Code, §11.039. Drought contingency plans for irrigation water suppliers should include at a minimum the following information:

- Preparation of the plan shall include provisions to actively inform and to affirmatively provide opportunity for users of water from the irrigation system to provide input into the preparation of the plan and to remain informed of the plan. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the water users and providing written notice to the water users concerning the proposed plan and meeting.
- The drought contingency plan must document coordination with the regional water planning groups to ensure consistency with the appropriate approved regional water plans.
- The drought contingency plan must include water supply criteria and other considerations for determining when to initiate or terminate water allocation procedures, accompanied by an explanation of the rationale or basis for such triggering criteria.
- The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this subparagraph are not enforceable.
- The drought contingency plan must include methods for determining the allocation of irrigation supplies to individual users.
- The drought contingency plan must include a description of the information to be monitored by the water supplier and the procedures to be followed for the initiation or termination of water allocation policies.
- The drought contingency plan must include procedures for use accounting during the implementation of water allocation policies.
- The drought contingency plan must include policies and procedures, if any, for the transfer of water allocations among individual users within the water supply system or to users outside the water supply system.

[8] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2.1

- The drought contingency plan must include procedures for the enforcement of water allocation policies, including specification of penalties for violations of such policies and for wasteful or excessive use of water.
- Wholesale water customers. Any irrigation water supplier that receives all or a portion of its water supply from another water supplier shall consult with that supplier, and shall include in the drought contingency plan appropriate provisions for responding to reductions in that water supply.
- Protection of public water supplies. Any irrigation water supplier that also provides or delivers water to a public water supplier(s) shall consult with that public water supplier(s) and shall include in the plan, mutually agreeable and appropriate provisions to ensure an uninterrupted supply of water necessary for essential uses relating to public health and safety. Nothing in this provision shall be construed as requiring the irrigation water supplier to transfer irrigation water supplies to non-irrigation use on a compulsory basis or without just compensation.

Irrigation water users shall review and update, as appropriate, the drought contingency plan at least every 5 years, based on new or updated information such as adoption or revision of the Lower Colorado Regional Water Plan.

6.2.3 Wholesale Water Providers[9]

A drought contingency plan for a wholesale water provider should include at a minimum the following information:

- Preparation of the plan shall include provisions to actively inform the public, to affirmatively provide opportunity for user input in the preparation of the plan, and for informing wholesale customers about the plan. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the public and providing written notice to the public concerning the proposed plan and meeting.
- The drought contingency plan must document coordination with the Lower Colorado Regional Water Planning Group for the service area of the wholesale water provider to ensure consistency with the Lower Colorado Regional Water Plan.
- The drought contingency plan must include a description of the information to be monitored by the water supplier and specific criteria for the initiation and termination of drought response stages, accompanied by an explanation of the rationale or basis for such triggering criteria.
- The drought contingency plan must include a minimum of three drought or emergency response stages providing for the implementation of measures in response to water supply conditions during a repeat of the drought-of-record.
- The drought contingency plan must include the procedures to be followed for the initiation or termination of drought response stages, including procedures for notification of wholesale customers regarding the initiation or termination of drought response stages.

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[9] Information in this subsection was obtained from the Texas Administrative Code, specifically TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2.2

- The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this paragraph are not enforceable.
- The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following:
- Pro rata curtailment of water deliveries to or diversions by wholesale water customers as provided in Texas Water Code, §11.039; and
- Utilization of alternative water sources with the prior approval of the executive director as appropriate (e.g., interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.).
- The drought contingency plan must include a provision in every wholesale water contract entered into or renewed after adoption of the plan, including contract extensions, that in case of a shortage of water resulting from drought, the water to be distributed shall be divided in accordance with Texas Water Code, §11.039.
- The drought contingency plan must include procedures for granting variances to the plan.
- The drought contingency plan must include procedures for the enforcement of any mandatory water use restrictions, including specification of penalties (e.g., liquidated damages, water rate surcharges, discontinuation of service) for violations of such restrictions.
- The wholesale water provider shall notify the executive director within five business days of the implementation of any mandatory provisions of the drought contingency plan. The wholesale water provider shall review and update, as appropriate, the drought contingency plan at least every 5 years, based on new or updated information such as adoption or revision of the Lower Colorado Regional Water Plan.

6.3 EXISTING WATER CONSERVATION PLANS

Region K has two wholesale water providers (WWPs), the Lower Colorado River Authority (LCRA) and the City of Austin, both of which have approved TCEQ water conservation and drought contingency plans. The water conservation programs for these WWPs are summarized below.

Information about the STP Nuclear Operating Company's water conservation plan has also been included in this section.

6.3.1 LCRA Water Conservation Programs

LCRA's municipal water conservation programs are predicated on the fact that the implementation of conservation measures must occur largely at the local level. Wholesale water use accounts for more than 90 percent of all LCRA potable water supply use. It is a mandatory requirement for LCRA, as the wholesale water rights holder, to require customers with new and amended plans to develop a water conservation plan. LCRA Water Conservation Rules for Water Sale Contracts, developed in 1991, are used to implement this requirement. LCRA also provides technical assistance with the development and review of wholesale customer water conservation plans and programs. LCRA assists with the development of rules and regulations that encourage water conservation, such as adding water conservation components into landscape ordinances.

LCRA provides public outreach activities in the area of conservation landscaping. LCRA programs that focus in this area are adoption of Hill Country Landscapes in new developments and with new homeowners, landscape irrigation audits for existing retail homeowners, and distribution of Grow Green landscaping materials to nurseries around the Highland Lakes. The Major Rivers 4th grade curriculum teacher workshops and materials are also provided through the LCRA Natural Science Centers.

LCRA's efforts in agricultural water conservation are focused on promoting water conservation at its irrigation districts, Lakeside, Gulf Coast, and Garwood. Proposed conservation efforts in the next 5- to 10-year period include laser land leveling on individual farms, adding automatic check valves and a control system for the Garwood Irrigation District, and replacement of lock control structures in the Lane City Pumping Plant canal system.

Each of LCRA's three power plants has industrial water conservation plans, which address water usage and return flow for the facilities. Opportunities to conserve water in the once-through cooling water process and boiler water treatment are not readily available because of efficiencies in existing processes. However, the plants' specific 5- and 10-year goals focus on reducing losses, reducing use, and reusing water.

6.3.2 City of Austin Water Conservation Program

Currently, the City of Austin has an aggressive water conservation program, one of the most active in the state, and it currently meets 20 of the 22 municipal best management practices recommended by the Water Conservation Implementation Task Force Report of the 79th Texas Legislature. The Water Conservation Program offers its customers a wide variety of initiatives for all customer classes designed to develop awareness of the need for water conservation. These initiatives include incentives to conserve water, services to reduce demand, educational programs, and regulatory measures.

Programs designed to reduce residential indoor water use include free water efficient toilets and toilet rebates, free water-efficient showerheads and sink aerators, high efficiency clothes washer rebates, and free leak detection kits. Programs designed to reduce residential outdoor water use include free irrigation system audits performed by licensed irrigators, WaterWise landscape rebates, rebates for water saving repairs or upgrades of irrigation systems, reduced price rainbarrels and rainbarrel rebates, and rainwater harvesting system rebates.

The Conservation Program also offers a number of free services and incentives for industrial, commercial and institutional (ICI) customers. Programs designed to reduce indoor consumption by ICI customers include helping them modify special equipment and processes to reduce water use or reuse water internally, as well as free water-efficient toilets and toilet rebates, free water-efficient showerheads and aerators, high efficiency clothes washer rebates, medical dry vacuum pump rebates, and free pre-rinse spray valves for food service establishments. Programs designed to reduce outdoor water consumption by ICI customers include free irrigation system audits, free whole system water audits, rebates for water saving repairs or upgrades of irrigation systems, and rebates of up to $40,000 for large water saving projects. The City of Austin also offers awards and recognition to ICI customers for achievements in water conservation.

The Conservation Program also administers several water conservation education programs. There are two programs designed to educate school children about water conservation: the Dowser Dan Assembly

Program for kindergarten through 4th grades; and the 5th and 6th grade Water in Our World programs administered in partnership with the Austin Independent School District. Other educational efforts include conservation brochures, booklets, videos, radio, television and newspaper ads, an electronic newsletter, and the water conservation web page. In addition, the Program organizes rainwater harvesting and WaterWise landscape tours, produces an ICI water conservation newsletter, and offers a WaterWise training course for professional irrigators and ICI workshops. During the summer months, a substantial effort is made each year to educate customers about efficient water use in the landscape.

Regulatory measures include the water waste ordinance, which prohibits water waste year round and has several watering stages for the summer under which water use is further restricted, and building codes that require separate metering of duplexes, triplexes and fourplexes, as well as the installation of plumbing that would accommodate the installation of submeters on larger multifamily properties.

6.3.3 STP Nuclear Operating Company Water Conservation Plan

STP Nuclear Operating Company has developed an industrial Water Conservation Plan for the South Texas Electric Generating Station. Water is an essential component of electricity production. The South Texas Project uses both groundwater and surface water for station purposes. Most of the water used by the South Texas Project is needed to condense steam and provide cooling for plant generating system. The main consumptive use of water is forced and natural evaporation from the Main Cooling Reservoir and Essential Cooling Pond.

Numerous water conservation measures have been put in place at the generating station. These include maintaining water quality in the Main Cooling Reservoir by selective diversion from the Colorado River during excess flow conditions, conjunctive use of groundwater for maintaining quality and level in the Essential Cooling Pond, and reuse of treated wastewater, HVAC condensate, and storm water. The water right for the South Texas Project includes a special provision to limit diversion from the Colorado River to 55 percent of the flow over 300 cubic feet per second, to protect environmental flows during low river flow conditions. In addition, a guideline has been developed for water management during drought conditions, where reservoir water quality is sacrificed to maintain reservoir level during drought conditions. A reduction goal for stored water of 5 percent has also been established consistent with LCRA's Drought Contingency Plan, based on the combined storage of lakes Travis and Buchanan on January 1 of each year.

STP Nuclear Operating Company is committed to operating the South Texas Project in a safe, reliable, economical, and environmentally sound manner. Water conservation is a part of that commitment. In reviewing water conservation measures, the ability to conserve water is most often a function of the design of the installed equipment and therefore there is limited potential to conserve additional water after a system is installed. Including water conservation, and its associated economic benefit, as one of the considerations used when comparing new project alternatives may ultimately have the greatest impact on water use at the generating station in the future.

APPENDIX 6A

Model Water Conservation Plan Template

Model Water Conservation Plan Template
Municipal Uses

Model Water Conservation Plan Template – Municipal Uses
Introduction and Background

Brief introduction describing WUG, its provided services, and general information.

1. Purpose

Purpose is to identify and establish principles, practices, and standards to effectively conserve and efficiently use available water supplies and water distribution system capacity.

Possibly provide historical annual average residential water demands and the goals for reductions in municipal demand included in the plan.

2. Location

General location of WUG and its service area

3. Customer Data

Population and Service Area Data

- Provide CCN certificate (if applicable) from TCEQ and service area map.
- Provide service area size in square miles.
- Provide current population of service area.
- Provide current population served by utility (water, wastewater, etc.).
- Provide population served by utility for previous 5 years.
- Provide projected population for service area for 2010, 2020, 2030, 2040, and 2050.
- Provide source/method of calculating current and projected populations.

Active Connections

- Provide current number of active connections by user type and whether they are metered or not-metered (Metered Residential, Not-metered Residential, Metered Commercial, Not-metered Commercial, Metered Industrial, Not-metered Industrial, Metered Public, Not-metered Public, Metered Other, Not-metered Other).
- Provide net number of new connections/year for most recent 3 years by user type.

High Volume Customers

- Provide annual water use for five highest volume retail and wholesale customers indicating if treated or raw water delivery.

4. Water Use Data

Water Accounting Data

- Provide amount of water use monthly for previous 5 years in 1,000 gallons and indicate whether the water is raw water diverted or treated water distributed.
- Provide source/method of obtaining monthly water use for previous 5 years.
- Provide amount of water in 1,000 gallons delivered as recorded by user type (residential, commercial, industrial, wholesale, other).
- Provide previous 5 year records for unaccounted for water use.
- Provide previous 5 year records for annual peak-to-average daily use ratio.
- Provide municipal per capita water use for previous 5 years.
- Provide seasonal water use for previous 5 years (gpd).

Projected Water Demands

- Provide total water demand estimates for utility's planning horizon indicating data sources/methods for determining water demand.
- Discuss conservation measures already implemented, if any, including impacts of measures and methods of determination of impacts.

5. Water Supply System

Water Supply Sources

- Provide current water supply sources and amounts available for surface water, groundwater, contracts, and other.

Treatment and Distribution System

- Provide design daily system capacity.
- Provide storage capacity (elevated and ground).
- Provide description of water system including number of treatment plants, wells, storage tanks along with sketch of system.
- Provide estimates of time before additional facilities for supply, storage, and pumping will be needed without conservation measures.

6. Wastewater Utility System

Wastewater System Data

- Provide design capacity of wastewater treatment plant.
- Provide description of wastewater system in service area including TCEQ name, number of treatment plants, operator, owner, receiving stream of discharge if applicable.
- Provide sketch of plant and discharge point locations

Wastewater Data for Service Area

- Provide percent of water service area served by wastewater system.
- Provide monthly volume treated for previous 3 years.
- Provide quality information on treatment plant effluent for reuse applications.
- Determine ratio between treated water pumped and wastewater flow.

7. Utility Operating Data

Water and wastewater rates/ rate structure for all classes – provide list of rates

(Rates should be cost-based so that they do not promote the excessive use of water)

Other relevant data

8. Water Conservation Goals

Goals for municipal utilities established to maintain/reduce consumption measured in:

- Gallons per capita per day used
- Unaccounted for water uses
- Peak day to average day ratio
- Increase in reuse or recycling of water

TCEQ/TWDB will assess conservation goals based on whether the following is addressed:

- Identification of a water/wastewater problem
- Completion of utility profile
- Selection of goals based on technical potential to save water as in utility profile
- Performance of cost-benefit analysis of strategies

Complete following (in gpcd) to quantify conservation goals for utility's service area:

Estimation for reducing per capita water use:

- Reduction in unaccounted-for uses
- Reduction in indoor water use due to water-conserving plumbing fixtures
- Reduction in seasonal use
- Reduction in water use due to public education program

Planning goal (Specific quantified 5 and 10 year targets for water savings to include goals for water loss programs and goals for municipal use, in gallons per capita day)

A schedule for implementing the plan to achieve the applicant's targets and goals

Needed reduction in per capita to meet planning goal

9. Water Conservation Plan Elements – Other Programs/BMPs That Should be Part of the Conservation Plan

Supplier:

A method for tracking the implementation and effectiveness of the plan

Metering Program

- A master meter(s) to measure and account for the amount of water diverted from the source of supply

- A program for universal metering of both customer and public uses of water, for meter testing and repair, and for periodic meter replacement)

Measures to Determine and Control Unaccounted for Water

- Measures to determine and control unaccounted-for uses of water (e.g., periodic visual inspections along distribution lines; annual or monthly audit of the water system to determine illegal connections, abandoned services, etc.)

Leak Detection and Repair (a program for leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system in order to control unaccounted-for uses of water)

Reservoir System Operating Plan

Customer:

Education Programs

- Media Campaign
- School Programs
- Public Exhibitions

Water Rate Structure

Examples of programs/BMPs that could be considered
Supplier:

- Plumbing and Landscape Ordinances
- Toilet Replacement/Rebates
- Clothes Washer Replacement/Rebates
- Hot-on-demand Rebate – circulating pumps installed to reduce water waste while waiting for the water to get warm
- Refrigerated Air Conditioning Cash Rebate
- Rain Barrel Rebate
- Rainwater Harvesting Program
- Efficient Irrigation Rebate

Customer:

- Reuse and Recycling of Wastewater and Graywater

10. Regional Water Planning and Coordination

11. Authority and Adoption

- Means of implementation and enforcement

Model Water Conservation Plan Template
Industrial and Mining Uses

Model Water Conservation Plan Template – Industrial and Mining Uses
Introduction and Background

Brief introduction describing WUG, its provided services, and general information.

1. Purpose

Purpose is to identify and establish principles, practices, and standards to effectively conserve and efficiently use available water supplies and water distribution system capacity.

Possibly provide historical annual average Industrial or Mining water demands and the goals for industrial or mining water demand reduction included in the plan. (The water conservation plan 5- and 10-year targets should be discussed in *Section 1.4 – Water Conservation Plan Goals*).

2. Location

General location of WUG and its service area

3. Water Use Data

Water Accounting Data

- Description of the use of the water in the production process, including how the water is diverted and transported from the source(s) of supply, how the water is utilized in the production process, and estimated quantity of water consumed in the production process and therefore unavailable for reuse, discharge, or other means of disposal.

Projected Water Demands

- Provide total water demand estimates for utility's planning horizon indicating data sources/methods for determining water demand.
- Discuss conservation measures already implemented, if any, including impacts of measures and methods of determination of impacts.

4. Water Conservation Goals

Planning goal (Specific quantified 5 and 10 year targets for water savings to include goals for water loss programs and goals for industrial and mining uses).

A schedule for implementing the plan to achieve the applicant's targets and goals.

Needed reduction in gallons per day (gpd) to meet planning goal.

5. Water Conservation Plan Elements –Other Programs/BMPs that should be part of the conservation plan

A method for tracking the implementation and effectiveness of the plan

Metering Program

- A master meter(s) (accurate to within plus or minus 5 percent) to measure and account for the amount of water diverted from the supply source

Measures to Determine and Control Unaccounted for Water

- Measures to determine and control unaccounted-for uses of water (e.g., periodic visual inspections along distribution lines; annual or monthly audit of the water system to determine illegal connections, abandoned services, etc.)

Leak Detection and Repair (a program for leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system in order to control unaccounted-for uses of water)

List any application of state-of-the-art equipment and/or process modifications to improve water use efficiency

Examples of programs/BMPs that could be considered in achieving the conservation goals:

- Industrial Water Audit
- Industrial Water Waste Reduction
- Industrial Submetering
- Cooling Towers
- Cooling Systems (other than cooling towers)
- Industrial Alternative Sources and Reuse of Process Water
- Rinsing/Cleaning
- Water Treatment
- Boiler and Steam Systems
- Refrigeration (including chilled water)
- Once through Cooling
- Management and Employee Programs
- Industrial Landscape
- Industrial Site Specific Conservation

6. Regional Water Planning and Coordination

Beginning May 1, 2005, an industrial or mining water user 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 industrial or mining water user shall review and update the plan with the next revision of this water conservation plan coinciding with the Lower Colorado regional water planning process.

Model Water Conservation Plan Template
Agricultural Uses

Model Water Conservation Plan Template – Agricultural Uses
Introduction and Background

Brief introduction describing WUG, its provided services, and general information

1. Purpose

Purpose is to identify and establish principles, practices, and standards to effectively conserve and efficiently use available water supplies and water distribution system capacity.

Possibly provide historical annual average agricultural water demands and the goals for reduction in agricultural water demand included in the plan.

2. Location and General Information

General location of WUG and its service area

System Providing Agricultural Water to More Than One User

- System Inventory for the Suppliers facilities including water storage, conveyance, and delivery structures. Also discuss the operating practices and rules as well as water pricing policy. Accounting practices for the water should be briefly discussed.

- User profile including square miles of the service area, the number of customers taking delivery of water by the system, the types of crops, the types of irrigation systems, the types of drainage systems, and total acreage under irrigation, both historical and projected.

3. Water Use Data

Water Accounting Data

Agricultural User Other than Irrigation

- Description of the use of the water in the production process, including how the water diverted and transported from the source(s) of supply, how the water is utilized in the production process, and estimated quantity of water consumed in the production process and therefore unavailable for reuse, discharge, or other means of disposal.

Individual Irrigation User

- Description of the irrigation production process, including type of crops to be irrigated, monthly irrigation diversions, any seasonal or annual crop rotation, and soil types of the land to be irrigated.

- A description of the irrigation method or delivery system and equipment including pumps, flow rates, plans, and/or schematics of the system layout.

All Agricultural Users

Projected Water Demands

- Provide total water demand estimates for utility's planning horizon indicating data sources/methods for determining water demand

- Discuss conservation measures already implemented, if any, including impacts of measures and methods for determination of impacts.

4. Water Conservation Goals

All Agricultural Users

- Planning goal (Specific, quantified five-year and ten-year targets for water savings including, where appropriate, quantitative goals for irrigation/agricultural water use efficiency and a pollution abatement and prevention plan. The targets established by a water user under this section are not enforceable.

5. Water Conservation Plan Elements –Other Programs/BMPs That Should be Part of the Conservation Plan

All Agricultural Users

- A method for tracking the implementation and effectiveness of the plan
- Metering Program
    - A master meter(s) or other **device/method** (accurate to within +/- 5 percent) to measure and account for the amount of water diverted from the source of supply.

- Measures to Determine and Control Unaccounted for Water
    - Measures to determine and control unaccounted-for uses of water (e.g., periodic visual inspections along distribution lines and canals; annual or monthly audit of the water system to determine illegal connections, abandoned services, etc.)

- Leak Detection and Repair (a program for leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system in order to control unaccounted-for uses of water)

Agricultural User Other than Irrigation

- List any application of state-of-the-art equipment and/or process modifications to improve water use efficiency

- Any other water conservation practice, method, or technique which the user shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

Individual Irrigation User

- Water-conserving irrigation equipment and application system or method including surge irrigation, low-pressure sprinkler, lining of on-farm irrigation ditches, and non-leaking pipe are a few examples of equipment to aid in conservation. List all conservation measures utilized to conserve water.

- Scheduling the timing and/or measuring the amount of water applied (e.g., soil moisture monitoring, etc.)

- Land improvements for retaining or reducing runoff, and increasing the infiltration of rain and irrigation water including, but not limited to, land leveling, furrow diking, terracing, and weed control

- Tail water recovery and reuse

- Any other water conservation practice, method, or technique which the user shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

System Providing Agricultural Water to more than one User

- Monitoring and record management program of water deliveries, sales, and loses.

- A program to assist customers in the development of on-farm water conservation and pollution prevention plans and/or measures.

- Any other water conservation practice, method, or technique which the user shows to be appropriate for achieving the stated goal or goals of the water conservation plan. Lining of district irrigation canals and replacement of canals with pipelines are a few examples of measures to aid in conservation.

- The customers of the agricultural water provider should also develop a water conservation plan or implement water conservation measures.

6. Regional Water Planning and Coordination

System Providing Agricultural Water to more than one User

- Beginning May 1, 2005, an agricultural water user 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 industrial or mining water user shall review and update the plan with the next revision of this water conservation plan coinciding with the regional water planning process.

7. Adoption of Plan

Official adoption of the water conservation plan and goals, by ordinance, rule, resolution, or tariff, indicating that the plan reflects official policy.

A review and update of this plan should occur in conjunction with the regional water planning groups update of the Lower Colorado Regional Water Plan and the five and ten-year targets should be modified as necessary.

Model Water Conservation Plan Template

Wholesale Water Providers

Model Water Conservation Plan Template – Wholesale Water Providers
Introduction and Background

Brief introduction describing WWP, its provided services, and general information.

1. Purpose

Purpose is to identify and establish principles, practices, and standards to effectively conserve and efficiently use available water supplies and water distribution system capacity.

Possibly provide historical annual average residential water demands and the goals for reduction in water demands included in the plan.

2. Location

General location of WWP and its service area

3. Customer Data

Population and Service Area Data

- Provide CCN certificate from TCEQ and service area map
- Provide service area size in square miles
- Provide current population of service area
- Provide current population served by utility (water, wastewater, etc.)
- Provide population served by utility for previous 5 years
- Provide projected population for service area for 2010, 2020, 2030, 2040, 2050
- Provide source/method of calculating current and projected populations

Active Connections

- Provide current number of active connections by user type and whether they are metered or not-metered (Metered Residential, Not-metered Residential, Metered Commercial, Not-metered Commercial, Metered Industrial, Not-metered Industrial, Metered Public, Not-metered Public, Metered Other, Not-metered Other)
- Provide net number of new connections/year for most recent 3 years by user type

High Volume Customers

- Provide annual water use for five highest volume retail and wholesale customers indicating if treated or raw water delivery

4. Water Use Data

Water Accounting Data

- Provide amount of water use monthly for previous 5 years in 1,000 gallons and indicate whether the water is raw water diverted or treated water distributed
- Provide source/method of obtaining monthly water use for previous 5 years
- Provide amount of water in 1,000 gallons delivered as recorded by user type (residential, commercial, industrial, wholesale, other)
- Provide previous 5 year records for unaccounted for water use
- Provide previous 5 year records for annual peak-to-average daily use ratio
- Provide municipal per capita water use for previous 5 years
- Provide seasonal water use for previous 5 years (gpd)

Projected Water Demands

- Provide total water demand estimates for utility's planning horizon indicating data sources/methods for determining water demand
- Discuss conservation measures already implemented, if any, including impacts of measures and methods of determination of impacts.

5. Water Supply System

Water Supply Sources

- Provide current water supply sources and amounts available for surface water, groundwater, contracts, and other

Treatment and Distribution System

- Provide design daily system capacity
- Provide storage capacity (elevated and ground)
- Provide description of water system including number of treatment plants, wells, storage tanks along with sketch of system
- Provide estimates of time before additional facilities for supply, storage, and pumping will be needed without conservation measures.

6. Wastewater Utility System

Wastewater System Data

- Provide design capacity of wastewater treatment plant
- Provide description of wastewater system in service area including TCEQ name, number of treatment plants, operator, owner, receiving stream of discharge if applicable.
- Provide sketch of plant and discharge point locations

Wastewater Data for Service Area

- Provide percent of water service area served by wastewater system
- Provide monthly volume treated for previous 3 years
- Provide quality information on treatment plant effluent for reuse applications
- Determine ratio between treated water pumped and wastewater flow

7. Utility Operating Data

Water and wastewater rates/ rate structure for all classes – provide list of rates
(Rates should be cost-based so that they do not promote the excessive use of water)
Other relevant data

8. Water Conservation Goals

Goals for WWPs established to maintain/reduce consumption measured in

- Gallons per capita per day used
- Unaccounted for water uses
- Peak day to average day ratio
- Increase in reuse or recycling of water

TCEQ/TWDB will assess conservation goals based on whether the following is addressed:

- Identification of a water/wastewater problem
- Completion of utility profile
- Selection of goals based on technical potential to save water as in utility profile
- Performance of cost-benefit analysis of strategies

Complete following (in gpcd) to quantify conservation goals for WWP's service area:

- Estimation for reducing per capita water use:
    - Reduction in unaccounted-for uses
    - Reduction in indoor water use due to water-conserving plumbing fixtures
    - Reduction in seasonal use
    - Reduction in water use due to public education program
- Planning goal (Specific quantified 5 and 10 year targets for water savings to include goals for water loss programs and goals for municipal use, in gallons per capita day)
- A schedule for implementing the plan to achieve the applicant's targets and goals
- Needed reduction in per capita to meet planning goal

9. Water Conservation Plan Elements – Other Programs/BMPs That Should be Part of the Conservation Plan

Supplier:

- A method for tracking the implementation and effectiveness of the plan
- Metering Program
    - A master meter(s) to measure and account for the amount of water diverted from the source of supply
- Measures to Determine and Control Unaccounted for Water
    - Measures to determine and control unaccounted-for uses of water (e.g., periodic visual inspections along distribution lines; annual or monthly audit of the water system to determine illegal connections, abandoned services, etc.)
- Leak Detection and Repair (a program for leak detection, repair, and water loss accounting for the water storage, delivery, and distribution system in order to control unaccounted-for uses of water)
- Reservoir System Operating Plan
    - Water Rate Structure (should be conservation oriented)

- Program to assist agricultural customers in the development of conservation pollution prevention and abatement plans.

- Program for Reuse and Recycling of Wastewater and Graywater (if not feasible explain why)

- Any other conservation measure which the WWP shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

10. Regional Water Planning and Coordination

11. Authority and Adoption

Means of implementation and enforcement

APPENDIX 6B

Model Drought Contingency Plan Template

Model Drought Contingency Plan Template
Utility/Water Supplier

Model Drought Contingency Plan Template (Utility / Water Supplier)
Brief Introduction and Background

Include information such as

- Name of Utility
- Address, City, Zip Code
- CCN#
- PWS #s

Section 1 Declaration of Policy, Purpose, and Intent

In cases of extreme drought, periods of abnormally high usage, system contamination, or extended reduction in ability to supply water due to equipment failure, temporary restrictions may be instituted to limit nonessential water usage. The purpose of the Drought Contingency Plan (Plan) is to encourage customer conservation in order to maintain supply, storage, or pressure or to comply with the requirements of a court, government agency or other authority.

Water uses regulated or prohibited under this Drought Contingency 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 6* of this plan.

(**Please note:** Water restriction is not a legitimate alternative if a water system does not meet the Texas Commission on Environmental Quality (TCEQ) capacity requirements under normal conditions **or** if the utility fails to take all immediate and necessary steps to replace or repair malfunctioning equipment.)

Section 2 Public Involvement

Opportunity for the public to provide input into the preparation of the Plan was provided by the _____________ (name of utility/water supplier) by means of __________________ (describe methods used to inform the public about the preparation of the plan and provide opportunities for input; see below for examples)

- *Scheduling and providing public notice of a public meeting to accept input on the Plan*

  The meeting took place at:
  Date: ________________
  Time: _____________
  Location: __________________________

- *Mailed survey with summary of results* **(attach survey and results*)***
- *Bill insert inviting comment* **(attach bill insert)**
- *Other method* ____

Section 3 Public Education

______________________________ (*name of utility/name of 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.

Drought plan information will be provided by:
(Check at least one of the following)

- q *Public meeting*
- q *Press releases*
- q *Utility bill inserts*
- q *Other* ____

Section 4 Coordination with Regional Water Planning Groups

The service area of the ______________________________ (*name of your utility/water supplier*) is located within the Lower Colorado Region. ____________________________ (*name of your utility/water supplier*) has mailed a copy of this Plan to the Lower Colorado Regional Water Planning Group.

Section 5 Notice Requirements

Written notice will be provided to each customer **prior to implementation or termination of each stage of the water restriction program**. Mailed notice must be given to each customer 72 hours prior to the start of water restriction. If notice is hand delivered, the utility cannot enforce the provisions of the plan for 24 hours after notice is provided. The written notice to customers will contain the following information:

the date restrictions will begin,

the circumstances that triggered the restrictions,

the stages of response and explanation of the restrictions to be implemented, and,

an explanation of the consequences for violations.

The utility must notify the TCEQ by telephone at (512) 239-4691, or electronic mail at *watermon@tceq.state.tx.us* prior to implementing Stage III and <u>must notify in writing the Public Drinking Water Section at MC - 155, P.O. Box 13087, Austin, Texas 78711-3087 within five (5) working days</u> of implementation including a copy of the utility's restriction notice. The utility must file a status report of its restriction program with the TCEQ at the initiation and termination of mandatory water use restrictions (i.e., Stages III and IV).

Section 6 Violations

First violation - The customer will be notified by written notice of their specific violation.

Subsequent violations:

After written notice, the utility may install a flow restricting device in the line to limit the amount of water which will pass through the meter in a 24-hour period. The utility may charge the customer for the actual cost of installing and removing the flow restricting device, not to exceed $50.00.

After written notice, the utility may discontinue service at the meter for a period of seven (7) days, or until the end of the calendar month, whichever is LESS. The normal reconnect fee of the utility will apply for restoration of service.

Section 7 Exemptions or Variances

The utility may grant any customer an exemption or variance from the drought contingency plan for good cause **upon written request**. A customer who is refused an exemption or variance may appeal such action of the utility in writing to the Texas Commission on Environmental Quality. The utility will treat all customers equally concerning exemptions and variances, and shall not discriminate in granting exemptions and variances. No exemption or variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance.

Section 8 Response Stages

Unless there is an immediate and extreme reduction in water production, or other absolute necessity to declare an emergency or severe condition, the utility will initially declare Stage I restrictions. If, after a reasonable period of time, demand is not reduced enough to alleviate outages, reduce the risk of outages, or comply with restrictions required by a court, government agency or other authority, Stage II may be implemented with Stage III to follow if necessary.

STAGE I - CUSTOMER AWARENESS

Stage I will begin:

Every April 1st, the utility will mail a public announcement to its customers. No notice to TCEQ required.

Stage I will end:

Every September 30th, the utility will mail a public announcement to its customers. No notice to TCEQ required.

Utility Measures:

This announcement will be designed to increase customer awareness of water conservation and encourage the most efficient use of water. A copy of the current public announcement on water conservation awareness shall be kept on file available for inspection by the TCEQ.

Voluntary Water Use Restrictions:

Water customers are requested to voluntarily limit the use of water for nonessential purposes and to practice water conservation.

STAGE II - VOLUNTARY WATER CONSERVATION:

Target: Achieve a ______ percent reduction in __________ (example: total water use, daily water demand, etc.)

The water utility will implement Stage II when any one of the selected triggers is reached:

Supply-Based Triggers: (check at least one and fill in the appropriate value)

- o Well level reaches __________ ft. mean sea level (m.s.l.)
- o Overnight recovery rate reaches __________ ft.
- o Reservoir elevation reaches __________ ft. (m.s.l.)
- o Stream flow reaches __________ cfs at USGS gage # _________
- o Wholesale supplier's drought Stage II _____________________________________
- o Annual water use equals _______ % of well permit/Water Right/purchased water contract amount
- o Other ____

Demand- or Capacity-Based Triggers: (check at least one and fill in the appropriate value)

- o Drinking water treatment as % of capacity __________ %
- o Total daily demand as % of pumping capacity __________ %
- o Total daily demand as % of storage capacity __________ %
- o Pump hours per day __________ hrs.
- o Production or distribution limitations
- o Other ____

Upon initiation and termination of Stage II, the utility will mail a public announcement to its customers. No notice to TCEQ required.

Requirements for Termination:

Stage II of the Plan may end when all of the conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days. Upon termination of Stage II, Stage I becomes operative.

Utility Measures:

Visually inspect lines and repair leaks on a daily basis. Monthly review of customer use records and follow-up on any that have unusually high usage.

Describe additional measures, if any, to be implemented directly by the utility 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.

The second water source for ______________________________ (*name of utility*) is:
(check one)

- o Other well
- o Inter-connection with other system
- o Purchased water
- o Other ____

Voluntary Water Use Restrictions:

Restricted Hours: Outside watering is allowed daily, but only during periods specifically described in the customer notice; between 10:00 p.m. and 5:00 a.m. for example;

Restricted Days/Hours: Water customers are requested to voluntarily limit the irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems. Customers are requested to limit outdoor water use to **Mondays for water customers with a street address ending with the numbers 1, 2, or 3, Wednesdays for water customers with a street address ending with the numbers 4, 5, or 6, and Fridays for water customers with a street address ending with the numbers 7, 8, 9, or 0.** 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; or
Other uses that waste water such as water running down the gutter.

STAGE III - MANDATORY WATER USE RESTRICTIONS:

Target: Achieve a ______ percent reduction in __________ (example: total water use, daily water demand, etc.)

The water utility will implement Stage III when any one of the selected triggers is reached:

Supply-Based Triggers: (check at least one and fill in the appropriate value)

- o Well level reaches ___________ ft. (m.s.l.)
- o Overnight recovery rate reaches ___________ ft.
- o Reservoir elevation reaches ___________ ft. (m.s.l.)
- o Stream flow reaches ___________ cfs at USGS gage # __________
- o Wholesale supplier's drought Stage III

  ____

- o Annual water use equals _______ % of well permit/Water Right/purchased water contract amount
- o Other ____

Demand- or Capacity-Based Triggers: (check at least one and fill in the appropriate value)

- o Drinking water treatment as % of capacity ___________ %
- o Total daily demand as % of pumping capacity ___________ %
- o Total daily demand as % of storage capacity ___________ %
- o Pump hours per day ___________ hrs.
- o Production or distribution limitations
- o Other ____

Upon initiation and termination of Stage III, the utility will mail a public announcement to its customers. Notice to TCEQ required.

Requirements for Termination:

Stage III of the Plan may end when all of the conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days. Upon termination of Stage III, Stage II becomes operative.

Utility Measures:

Visually inspect lines and repair leaks on a regular basis. Flushing is prohibited except for dead end mains.

Describe additional measures, if any, to be implemented directly by the utility to manage limited water supplies and/or reduce water demand. Examples include: activation and use of an alternative supply source(s); use of reclaimed water for non-potable purposes; offering low-flow fixtures and water restrictors.

Mandatory Water Use Restrictions:

The following water use restrictions shall apply to all customers.

1. Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems **shall be limited to Mondays for water customers with a street address ending with the numbers 1, 2, or 3, Wednesdays for water customers with a street address ending with the numbers 4, 5, or 6, and Fridays for water customers with a street address ending with the numbers 7, 8, 9, or 0.** 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.

2. 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 rinses. 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 are contingent upon frequent vehicle cleansing, such as garbage trucks and vehicles used to transport food and perishables.

3. Use of water to fill, refill, or add to any indoor or outdoor swimming pools, wading pools, or "jacuzzi" type pool 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.

4. 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.

5. Use of water from hydrants or flush valves shall be limited to maintaining public health, safety, and welfare.

6. Use of water for the irrigation of golf courses, parks, and green belt area is prohibited except by hand-held hose and only on designated watering days between the hours 12:00 midnight and 10:00 a.m. and between 8:00 p.m. and 12:00 midnight.

7. The following uses of water are defined as nonessential and are prohibited:

   a. wash down of any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas;

b. use of water to wash down buildings or structures for purposes other than immediate fire protection;

c. use of water for dust control;

d. flushing gutters or permitting water to run or accumulate in any gutter or street;

e. failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s); and

f. any waste of water.

STAGE IV - CRITICAL WATER USE RESTRICTIONS:

Target: Achieve a ______ percent reduction in __________ (example: total water use, daily water demand, etc.)

The water utility will implement Stage IV when any one of the selected triggers is reached:

Supply-Based Triggers: (check at least one and fill in the appropriate value)

- o Well level reaches __________ ft. (m.s.l.)
- o Overnight recovery rate reaches __________ ft.
- o Reservoir elevation reaches __________ ft. (m.s.l.)
- o Stream flow reaches __________ cfs at USGS gage # _________
- o Wholesale supplier’s drought Stage IV ____
- o Annual water use equals _______ % of well permit/Water Right/purchased water contract amount
- o Supply contamination
- o Other ____

Demand- or Capacity-Based Triggers: (check at least one and fill in the appropriate value)

- o Drinking water treatment as % of capacity __________ %
- o Total daily demand as % of pumping capacity __________ %
- o Total daily demand as % of storage capacity __________ %
- o Pump hours per day __________ hrs.
- o Production or distribution limitations
- o System outage
- o Other ____

Upon initiation and termination of Stage IV, the utility will mail a public announcement to its customers. Notice to TCEQ required.

Requirements for Termination:

Stage IV of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days. Upon termination of Stage IV, Stage III becomes operative.

Operational Measures:

The utility shall visually inspect lines and repair leaks on a daily basis. Flushing is prohibited except for dead end mains and only between the hours of 9:00 p.m. and 3:00 a.m. Emergency interconnects or alternative supply arrangements shall be initiated. All meters shall be read as often as necessary to insure compliance with this program for the benefit of all the customers. *Describe additional measures, if any, to be implemented directly to manage limited water supplies and/or reduce water demand.*

Mandatory Water Use Restrictions: (all outdoor use of water is prohibited)

1. Irrigation of landscaped areas is absolutely prohibited.
2. Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle is absolutely prohibited.

SYSTEM OUTAGE or SUPPLY CONTAMINATION

Notify TCEQ Regional Office immediately.

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 are 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 "A" 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

Model Drought Contingency Plan Template

Irrigation Uses

Model Drought Contingency Plan Template (Irrigation Uses)

DROUGHT CONTINGENCY PLAN
FOR
(Name of irrigation district)
(Date)

Section 1: 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 2: 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 3: 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 4: 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 5: Application

The provisions for 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 6: 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 7: 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 8: 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 9: 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 10: 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 11: 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 12: 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 13: 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 14: 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

Model Drought Contingency Plan Template
Wholesale Water Providers

Model Drought Contingency Plan Template (**Wholesale Public Water Suppliers**)

DROUGHT CONTINGENCY PLAN
FOR THE
(Name of wholesale water supplier)
(Date)

Section 1: 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 water supplier) adopts the following Drought Contingency Plan (the Plan).

Section 2: Public Involvement
Opportunity for the public and wholesale water customers to provide input into the preparation of the Plan was provided by _____________ (name of 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 3: Wholesale Water Customer Education
The ____________ (name of 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 4: Coordination with Regional Water Planning Groups
The water service area of the ______________ (name of water supplier) is located within the _______________ (name of regional water planning area or areas) and the _____________ (name of water supplier) has provided a copy of the Plan to the ____________ (name of regional water planning group or groups).

Section 5: 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 6: Application
The provisions of this Plan shall apply to all customers utilizing water provided by the __________________ (name of supplier). The terms "person" and "customer" as used in the plan include individuals, corporations, partnerships, associations, and all other legal entities.

Section 7: Triggering 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).

(a) Stage 1 - Mild Water Shortage Conditions
Requirements for initiation – The _____________ (name of 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.

(b) Stage 2 - Moderate Water Shortage Conditions
Requirements for initiation – The _____________ (name of 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 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.

(c) Stage 3 - Severe Water Shortage Conditions
Requirements for initiation – The _____________ (name of water supplier) will recognize that a severe water shortage condition exists when______________(describe triggering criteria).

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 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.

(d) Stage 4 – Emergency Water Shortage Conditions
Requirements for initiation - The _____________ (name of water supplier) will recognize that an emergency water shortage condition exists when______________(describe triggering criteria).

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 water supplier) will notify its wholesale customers and the media of the termination of stage 4.

Section 8: 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 - 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 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 - 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 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 - Severe 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 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 – 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 9: 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 10: 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 11: 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 12: Severability
It is hereby declared to be the intention of the ________________ (governing body of 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 the water supplier) without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

EXAMPLE ORDINANCE FOR ADOPTION OF A DROUGHT CONTINGENCY PLAN
ORDINANCE NO. __________

AN ORDINANCE OF THE CITY OF ____________________, TEXAS, ADOPTING A DROUGHT CONTINGENCY PLAN; ESTABLISHING CRITERIA FOR THE INITIATION AND TERMINATION OF DROUGHT RESPONSE STAGES; ESTABLISHING RESTRICTIONS ON CERTAIN WATER USES; ESTABLISHING PENALTIES FOR THE VIOLATION OF AND PROVISIONS FOR ENFORCEMENT OF THESE RESTRICTIONS; ESTABLISHING PROCEDURES FOR GRANTING VARIANCES; AND PROVIDING SEVERABILITY AND AN EFFECTIVE DATE. WHEREAS, the City of _________________, Texas recognizes that the amount of water available to the City and its water utility customers is limited and subject to depletion during periods of extended drought; WHEREAS, the City 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 citizens of_____________, Texas, the ________________ (governing body) 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 ORDAINED BY THE CITY OF ____________, TEXAS:

SECTION 1. That the City of ____________, Texas Drought Contingency Plan attached hereto as Exhibit “A” and made part hereof for all purposes be, and the same is hereby, adopted as the official policy of the City.

SECTION 2. That all ordinances that are in conflict with the provisions of this ordinance are, and the same are hereby, repealed and all other ordinances of the City not in conflict with the provisions of this ordinance shall remain in full force and effect.

SECTION 3. Should any paragraph, sentence, subdivision, clause, phrase, or section of this ordinance be adjudged or held to be unconstitutional, illegal or invalid, the same shall not affect the validity of this ordinance as a whole or any part or provision thereof, other than the part so declared to be invalid, illegal or unconstitutional. SECTION 4. This ordinance shall take effect immediately from and after its passage and the publication of the caption, as the law in such cases provides. DULY PASSED BY THE CITY OF _______________, TEXAS, on the ___________ day of ______________, 20__.

APPROVED:

____
MAYOR

ATTESTED TO:

____
CITY SECRETARY

APPROVED AS TO FORM:

____
CITY ATTORNEY

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

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CHAPTER 7.0: REGIONAL PLAN CONSISTENCY WITH STATE'S LONG-TERM RESOURCE PROTECTION GOALS

A major goal of the regional water planning process is the protection of the State's water, agricultural, and natural resources. This focus has been considered throughout the planning process by the Lower Colorado Regional Water Planning Group (LCRWPG) when selecting strategies to meet water needs for the future. Conservation has been recommended as a first strategy for meeting shortages. Impacts on the State's resources have been thoroughly considered before recommending other strategies.

The effects of the recommended water management strategies on specific resources are discussed in further detail within this chapter.

7.1 WATER RESOURCES WITHIN THE LOWER COLORADO REGIONAL WATER PLANNING AREA (LCRWPA)

Water resources available by basin within the LCRWPA are discussed in further detail below.

7.1.1 Brazos River Basin

Portions of Bastrop, Burnet, Fayette, Mills, Travis, and Williamson Counties are within the Brazos River Basin. Local supplies are the only surface water sources originating from the Brazos River Basin in the LCRWPA. The portion of Williamson County within the LCRWPA is within the service boundary of the City of Austin (COA) and the Lower Colorado River Authority and is served by their water supplies in the Colorado River Basin. Groundwater supplies in the Brazos River Basin are obtained primarily from the Carrizo-Wilcox, Hickory, and Trinity aquifers. Groundwater is also available in lesser quantities from the Edwards-Balcones Fault Zone (BFZ), Ellenburger-San Saba, Gulf Coast, Marble Falls, Queen City, Sparta, and other unnamed aquifers.

Municipal conservation measures recommended by the Plan may have the effect of elevating the level of contaminants introduced to streams in the Brazos River Basin from wastewater treatment facilities if treatment standards are insufficient to meet total daily maximum loading limitations. Areas that are supplied from groundwater in the Brazos River Basin would be expected to discharge less water from treatment plants after implementing conservation measures. As wastewater effluent is often an important portion of instream flows, especially during dry periods, conservation measures may result in reduced streamflows. Expanding the use of groundwater will generally increase the amount of return flows to streams, though the possibility of introducing low quality groundwater, particularly from the Hickory aquifer, to surface systems may have an unfavorable effect on surface water quality. The implementation of House Bill (HB) 1437 may somewhat increase the instream flows in the Brazos River Basin absent significant reuse. However, with this additional supply comes additional usage and resulting contaminants that may pose water quality concerns unless treated to appropriate water quality standards.

7.1.2 Brazos-Colorado Coastal River Basin

The Brazos-Colorado Coastal River Basin includes portions of Colorado, Matagorda, and Wharton Counties. The only surface water source for this basin in the LCRWPA that is not a local supply is a run-of-river (ROR) right from the San Bernard River. However, large amounts of surface water originating in the Colorado River Basin is transferred to the Brazos-Colorado Coastal River Basin for agricultural use and is subsequently released to streams in the process of rice production. The entirety of the Brazos-Colorado River Basin within the LCRWPA is served by the Gulf Coast aquifer.

As in the other basins of the LCRWPA, increased groundwater usage may have potential impacts on water quantity in stream channels but possible adverse effects on water quality in some cases. Conservation programs implemented through the Lower Colorado River Authority-San Antonio Water System (LCRA-SAWS) Water Project may decrease streamflows during dry periods and introduce less water from the Colorado River Basin for irrigation use. Conjunctive use of groundwater and surface water supplies will decrease aquifer levels

7.1.3 Colorado River Basin

Because the LCRWPA is centered around the Colorado River Basin, nearly every recommended management strategy has the potential to impact water quantity and quality in the basin.

The Colorado River Basin constitutes the largest portion of the LCRWPA as well as the single largest source of water for the region. The Highland Lakes System, operated by the Lower Colorado River Authority (LCRA), provides firm surface water supplies throughout the basin. An even larger amount of water is available from ROR supplies in the basin. Other reservoirs in the system provide small yields or receive their water through the Highland Lakes System or a ROR right. The largest amounts of groundwater in the Colorado River Basin are available from the Gulf Coast, Carrizo-Wilcox, Hickory, and Ellenburger-San Saba aquifers. These four aquifers represent approximately 60 percent of the available groundwater supply with various other aquifers providing the remaining 40 percent.

Currently, the use of COA effluent discharges downstream to increase the reliability of existing diversion rights maintains flow rates from Austin to the downstream point of diversion until the COA Reclaimed Water Initiative becomes comprehensive enough to reduce these total flows considerably in later decades. Contract renewals, reallocation of surplus supplies, and contract increases may also decrease total flow and concentrate chemical constituents in certain areas during low flow periods.

The direct transfer of raw water from the Guadalupe River to the Colorado River may result in issues arising from the mixing of water from two sources.

The construction of a structure along Onion Creek to promote recharge to the Edwards aquifer in the BFZ may impact the water quality of the Edwards-BFZ by significantly increasing the portion of recharge coming from this stream segment. As Onion Creek does not have any listed water quality concerns and is designated for use as a public water supply and for contact recreation, these impacts may not be significant. However, future developments may elevate the potential for groundwater contamination.

Several strategies are recommended for the Goldthwaite and Llano Reservoirs. Construction of new impoundments at the sites will slightly reduce instream flows by capturing interruptible flows under normal conditions. During drought, the reservoirs would allow water to pass downstream to provide water to firm right holders. Water quality will benefit from the settling action of the reservoirs that will allow suspended materials to settle out within the new reservoirs. Construction of an off-channel reservoir at the Goldthwaite Reservoir will allow for slow releases of water over time from return flows and will reduce peak flows when the reservoir is filling. The same settling that would increase water quality in the on-channel reservoirs would also occur in this off-channel basin.

Operation of the Highland Lakes System to allow interruptible water supplies to be supplemented with available firm water during drought periods will be beneficial to instream flows during these periods, although the use of these stored water supplies will reduce the amount of water available in the Colorado River. Conservation practices implemented as part of the LCRA-SAWS Water Project will result in reduced streamflow, although sediment and nutrient loads from irrigation tail water would be reduced, as well. As noted above, conjunctive use of groundwater and surface water will decrease aquifer levels in the Colorado-Lavaca Coastal River Basin.

Portions of Matagorda and Wharton Counties are within the Colorado-Lavaca Coastal River Basin. All surface water sources in these areas are associated with local supplies. However, as in the Brazos-Colorado Coastal River Basin, water from the Colorado River Basin is discharged into streams following its use in rice production, and all groundwater supplies are obtained from the Gulf Coast aquifer.

As in the other basins of the LCRWPA, increased groundwater usage may have potential positive impacts on water quantity in stream channels but possible adverse effects on water quality in some cases. Again, conservation programs implemented through the LCRA-SAWS Water Project may decrease streamflows during dry periods and introduce less water from the Colorado River Basin for irrigation use.

7.1.4 Lavaca River Basin

The western portions of Colorado and Fayette Counties are located in the Lavaca River Basin. There are no firm surface water rights available from the Lavaca River Basin within these two counties. Additionally, the only reservoir in this basin, Lake Texana, is not located in the LCRWPA, and no surface water contracts serve water user groups (WUGs) in the region from Lavaca River Basin supplies. All surface water supplies in the basin are obtained from local supplies. The primary source of groundwater for the Lavaca River Basin in the LCRWPA is the Gulf Coast aquifer.

As in the Brazos and Colorado River Basins, municipal conservation could possibly impair water quality. However, areas served by groundwater would experience some benefit from increased streamflows from additional pumpage, although groundwater quality issues may introduce additional problems to stream water quality in certain instances. As in the other basins expected to benefit from the LCRA-SAWS Water Project, conservation programs implemented through the program may decrease streamflows during dry periods and introduce less water from the Colorado River Basin for irrigation use. As in the other basins subject to the LCRA-SAWS Water Project, conjunctive use of groundwater and surface water supplies will increase aquifer levels when irrigators use available surface supplies rather than groundwater.

7.1.5 Guadalupe River Basin

The Guadalupe River Basin includes portions of Bastrop, Blanco, Fayette, Hays, and Travis Counties within the LCRWPA. No major reservoirs exist within the LCRWPA section of the Guadalupe River Basin, and the only firm surface water source is provided by two minor reservoirs operated by the City of Blanco. Other surface water sources are obtained from local supplies. The Carrizo-Wilcox and Ellenburger-San Saba aquifers are the major groundwater sources for the Guadalupe River Basin. Other smaller groundwater sources include the Edwards-BFZ, Edwards-Trinity, Gulf Coast, Queen City, Sparta, and Trinity aquifers.

As in the other basins, expanded groundwater usage is expected to increase streamflows with a possibility of negatively impacting water quality from additional discharges and groundwater quality issues. The transfer of water from the Canyon Lake Water Supply to the City of Blanco will not remove water from the Guadalupe River Basin, but that water will not be returned to the Guadalupe River until the confluence with the Blanco River near Gonzales and will, therefore, bypass Canyon Lake. The transmission of water to the Colorado River Basin will involve a transfer between basins and will cause a small amount of water to leave the Guadalupe River Basin which will reduce instream flows downstream.

7.2 AGRICULTURAL RESOURCES WITHIN THE LCRWPA

Rice production in the lower counties of the LCRWPA is the agricultural resource most dependent upon a reliable, extensive water supply. Water rights in these counties used for rice farming are some of the most senior rights within the entire Colorado River Basin. However, as a result of the "No Call" assumptions made when determining supplies within the Colorado River, these users do not have a reliable supply of water under drought-of-record (DOR) conditions without the implementation of one or more future water management strategies.

The management strategies introduced in Chapter 4 of this Plan were created to meet the needs of all WUGs including agricultural needs. Primarily, the unmet agricultural needs in the LCRWPA are related to rice irrigation in the lower counties of Colorado, Wharton, and Matagorda. These needs have been met with sufficient new strategies to overcome the predicted shortages, including strategies to convert agricultural rights to firm water rights for municipal or other demands. The use of interruptible water supplies and return flows from the COA in the near future will eventually give way to conservation programs through an LCRA-SAWS agreement to reduce overall irrigation demands with on-farm conservation, conveyance improvements, conjunctive use of groundwater, and the development of more efficient rice varieties.

7.3 NATURAL RESOURCES WITHIN THE LCRWPA

The water management strategies recommended for the LCRWPA in this Plan are intended to protect natural resources while still meeting the projected water needs of the region. The impacts of recommended strategies on specific resources are discussed below.

7.3.1 Threatened and Endangered Species

The LCRWPA contains an array of habitats for a variety of wildlife species. A number of these species are listed as threatened or endangered by federal or state authorities, proposed as candidates to be listed, or are otherwise rare but unlisted species. A comprehensive list of these species can be found in *Appendix 1A* of this Plan.

The quantitative environmental impacts as a result of the water management strategies discussed in Chapter 4 were determined to be minimal. A discussion of the environmental impacts can be found in Chapter 4. The potential impacts to threatened and endangered species are expected to be limited. The construction of infrastructure related to these strategies may potentially impact one or more of the species identified in *Appendix 1A*.

The environmental impacts of expanded use of the Edward-BFZ aquifer are in question at the time of this report completion. Water availability for this aquifer was based on modeling performed by the Barton Springs Edwards Aquifer Conservation District and documented in a report released late in the planning cycle. The final modeling performed indicates that springflows may be temporarily reduced to approximately 1 cubic foot per second (cfs) during the worst period of a repeat of the DOR if all of the permits that have been issued by the District are fully utilized. The 1 cfs spring flow may not be sufficient to support endangered species in the areas downstream of Barton Springs, and potential negative environmental impacts could be high. As a result of this finding, the District is considering making all future permits conditional, so no additional firm yield would be available from the aquifer. While there was not time to provide an alternative strategy in this planning cycle, this will be a high priority in the next planning cycle.

7.3.2 Parks and Public Lands

As described in Chapter 1, over 28,000 acres of state parks are within the boundaries of the LCRWPA. These 14 state facilities host a variety of outdoor recreational opportunities for visitors from around the state of Texas. None of the recommended water management strategies are expected to have impacts on public lands. In addition, there are no foreseen impacts to stream segments traversing public lands. Additional information concerning impacts from each strategy can be found in Chapter 4.

7.3.3 Impacts of Water Management Strategies on Matagorda Bay System

The Matagorda Bay system represents a significant ecological resource to the LCRWPA and provides habitat for a number of species while supporting recreation and industry. As the second largest estuary system in Texas, it represents a major priority in protecting the state's natural resources.

Matagorda Bay receives inflows from the Colorado and Lavaca Rivers as well as a coastal contributing area. The target and critical freshwater inflow needs were estimated in a study conducted in 1997 by the LCRA, TNRCC, TWDB, and TPWD and for the Matagorda Bay system from the Colorado River Basin are included in the *Water Management Plan for the Lower Colorado River Basin* (1999) *Table 7.1*. The target inflow is described as the necessary long-term inflows that produce 98 percent of the maximum normalized population biomass for nine key estuarine species while maintaining certain criteria for salinity, population density, and nutrient inflow. The minimum inflow for critical needs represents the amount of water required for bay and estuary inflows to keep salinity at the mouth of the Colorado River to a level of 25 parts per thousand or less. This condition is expected to provide for fish habitat during extreme drought conditions without impacting the long-term ecology of Matagorda Bay.

Table 7.1 Target and Critical Freshwater Inflow Needs for the Matagorda Bay System From the Colorado River

Month	Target Needs (1,000 ac-ft)	Critical Needs (1,000 ac-ft)
January	44.1	14.26
February	45.3	14.26
March	129.1	14.26
April	150.7	14.26
May	162.2	14.26
June	159.3	14.26
July	107.0	14.26
August	59.4	14.26
September	38.8	14.26
October	47.4	14.26
November	44.4	14.26
December	45.2	14.26
TOTAL	**1,034.9**	**171.12**

Source: 1997 Freshwater Inflow Needs Study

The freshwater inflow values presented in *Table 7.1* were developed following the methodology presented in "Characteristics of an Ecologically Sound Environment for the Guadalupe Estuary" by Boyd and Green, presented in *Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs* by TPWD, dated 1994. The process of determining freshwater inflow needs was carried out in three distinct phases:

Phase 1: Develop statistical relationships between freshwater inflows and key indicators such as salinity, species productivity, and nutrient inflows.

Phase 2: Use the developed statistical functions to compute optimal monthly and seasonal freshwater needs using the Texas Estuarine Mathematical Programming (TXEMP) Model developed by TWDB.

Phase 3: Simulate salinity conditions throughout the estuary using the TxBLEND model developed by TWDB and LCRA.

Phases 2 and 3 were carried out in an iterative process that compared simulated and desired salinity levels throughout the estuary. If the modeled salinity levels were outside of the ranges desired, the TXEMP model was adjusted accordingly. Additional information concerning the development of the target and critical freshwater inflows to the Matagorda Bay system can be found in *Freshwater Inflow Needs of the Matagorda Bay System* (LCRA 1997).

Additional data collection since the development of the inflows in *Table 7.1* show that trends in salinity levels in Matagorda Bay have not corresponded to the projections made by the model, and changes may have to be made to the target and critical inflows presented here. In particular, the critical monthly inflow rate may have to be increased to maintain a salinity level of 25 parts per thousand. This process is being carried out as an ongoing project by LCRA in conjunction with TPWD, TWDB, and TCEQ. The Final Study is expected to be completed by the end of 2006.

The impacts of water management strategies on bay and estuary freshwater inflows were modeled in Chapter 4. The most significant impacts were associated with the reuse of municipal effluent from the COA. This strategy reduced compliance with target and critical freshwater needs in the year 2060 by 1.88 and 3.33 percent, respectively.

The transfer of water anticipated under HB 1437 would constitute an inter-basin transfer to the Brazos River Basin. With this distinction comes the potential for environmental impacts from the introduction of invasive species and issues resulting from mixing water supplies from multiple sources. The greatest potential impacts on the Colorado River Basin would result from the reduced streamflow resulting from the transfer. It is difficult to quantify the impacts of this strategy on environmental conditions at this planning stage. A diversion point to the Brazos River Basin will have to be determined, as well as the specific strategies of the Ag Fund for creating no net loss in surface water, before these impacts can be modeled. However, it can be assumed that there would be a reduction in instream flows downstream from the point of diversion to the Brazos River Basin to the point at which the Ag Fund strategies are implemented. However, LCRA will continue to meet the environmental flow requirements as specified in its WMP. The magnitude of these effects will have to be determined once these details become available.

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APPENDICES

CHAPTER 8.0: ADDITIONAL RECOMMENDATIONS (INCLUDING UNIQUE ECOLOGICAL STREAM SEGMENTS AND RESERVOIR SITES, LEGISLATIVE ISSUES, AND REGIONAL POLICY ISSUES)

8.1 SUMMARY OF TWDB RULES

8.1.1 Policy Recommendation Rules

Texas Water Development Board (TWDB) rules for SB 1 regional water planning [31 TAC Chapter 357.7(a) (9)] provide that the regional water planning groups (RWPG) may include in their regional water plans:

> …regulatory, administrative, or legislative recommendations the regional water planning group believes are needed and desirable to: facilitate the orderly development, management, and conservation of water resources and preparation for and response to drought conditions in order that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare; further economic development; and protect the agricultural and natural resources of the state and regional water planning area. The regional water planning group may develop information as to the potential impact once proposed changes in law are enacted.

The 77th Texas Legislature clarified that the designation of unique stream segments (USS) solely means that a state agency or political subdivision of the State may not finance the actual construction of a reservoir in a designated stream segment of unique ecological value. It does not affect the analysis to be made by RWPGs. To recommend all or parts of stream segments of unique ecological value to the Legislature, RWPG is required to develop a recommendation package that includes a physical description of the location, maps, photographs, and site characterization documented by supporting literature and data.

The approved scope-of-work for the development of the SB 1 water plan for the Lower Colorado Region included a subtask to "prepare possible legislative, regulatory, and administrative recommendations." In this regard, the Lower Colorado Regional Water Planning Group (LCRWPG) established a Policy Committee and charged it with the responsibility for coordinating a three-step process to:

1. Identify, define, and screen policy issues
2. Evaluate issues and policy options
3. Develop recommendations for consideration by the LCRWPG

During the current planning cycle, the recommendation process has been applied to the following ten water policy issue areas:

- Management of surface water resources
- Environmental Flows – instream flows and freshwater inflows to bays and estuaries
- Environmental – sustainable growth, including impacts of growth
- Groundwater
- Protection of agricultural and rural water supplies
- Agricultural water conservation
- Reuse

- Public involvement
- Education; and
- Brush control

In addition, the LCRWPG has adopted policy recommendations on various issues either by resolution or motion. These recommendations are incorporated into the policy issue briefs or otherwise included below. Finally, the LCRWPG has identified a number of areas in which the SB 1/SB 2 regional water planning process might be improved for subsequent regional water plan updates. These recommendations are also presented.

8.1.2 Unique Ecological Stream Segment Recommendation Rules

In accordance with the Texas Administrative Code 31 §357.8, RWPGs:

> …may include in adopted regional water plans recommendations for all or parts of river and stream segments of unique ecological value located within the regional water planning area by preparing a recommendation package consisting of a physical description giving the location of the stream segment, maps, and photographs of the stream segment, and a site characterization of the stream segment documented by supporting literature and data.

The following criteria are to be used when identifying a river or stream segment as being of unique ecological value:

- <u>Biological Function:</u> Segments that display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats
- <u>Hydrologic Function:</u> Segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge
- <u>Riparian Conservation Areas:</u> Segments that are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes under a governmentally approved conservation plan
- <u>High Water Quality/Exceptional Aquatic Life/High Aesthetic Value:</u> Segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality
- <u>Threatened or Endangered Species/Unique Communities:</u> Sites along segments where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along segments that are significant due to the presence of unique, exemplary, or unusually extensive natural communities

If a RWPG decides to recommend a stream segment for designation as ecologically unique, TAC §357.8 (a) directs that the recommendation package be forwarded to the Texas Parks and Wildlife Department (TPWD) for review. The TPWD has 30 days to complete a written evaluation of the recommendation. The adopted regional water plan shall include, if available, TPWD's written evaluation. Based on the regional water plans, the State Water Plan shall identify ecologically unique stream segments that the

TWDB recommends for protection under Texas Water Code §16.051. Ultimately, the Legislature has the authority to designate a river or stream segment of unique ecological value. As per TWC §16.051 (f), this designation solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature as ecologically unique.

8.1.3 Unique Reservoir Site Selection Rules

In accordance with the Texas Administrative Code 31 §357.9, RWPGs:

> …may recommend sites of unique value for construction of reservoirs by including descriptions of the sites, reasons for the unique designation, and expected beneficiaries of the water supply to be developed at the site.

The following criteria are to be used when identifying a site that is unique for reservoir construction:

- The site-specific reservoir development is recommended as a specific water management strategy or in an alternative long-term scenario in an adopted regional water plan
- The location, hydrologic, geologic, topographic, water availability, water quality, environmental, cultural, and current development characteristics, or other pertinent factors make the site uniquely suited for a reservoir development
    - to provide water supply for the current planning period
    - that might reasonably be needed to meet water supply needs beyond 2050.

8.2 SUMMARY OF POLICY RECOMMENDATIONS

8.2.1 Management of Surface Water Resources: Inter-Basin Transfers, Model Linking, and Conjunctive Use

8.2.1.1 Background Information

As water marketing pressures intensify to meet demands in more arid portions of the State, the potential increases for harm to the environment and the economies in areas from which water is extracted.

Proposed inter-basin transfers (IBTs), including the Lower Colorado River Authority-San Antonio Water System (LCRA-SAWS) Water Project, and other water uses external to a basin must be managed carefully relative to impairment of existing water rights, consistency with the public welfare including the need for water, consistency with state and regional water supply planning, and environmental and water quality issues.

Multiple major water right permit applications are currently pending in the Colorado River Basin, which result in competing interests within and external to the basin. For permits related to inter-basin transfers, the inclusion of special provisions to ensure the protection of the economic and public welfare interests in the basin of origin is imperative. Business, industry, agriculture and other economically important water users developed originally as a result of water availability. Without some means of protecting these users, water transfers could leave them priced out of the market, adversely affecting the economy of the entire region in order to benefit another area of the State.

Some identified strategies for dealing with water supply shortages may impact sustainability of groundwater, when development of surface water supplies could be utilized instead. This approach could result in long-term adverse consequences for the region.

Subsequent to the completion of the first planning cycle, LCRA and SAWS entered into a long-term water supply contract, which includes a potential IBT of up to 150,000 ac-ft/yr of water from the Colorado River Basin. A feasibility study is underway to determine whether the long-term water needs of the Lower Colorado Regional Water Planning Area can be met by water conservation and development strategies in the Lower Colorado River Basin. This study is funded by entities in the SCTRWPG in exchange for the IBT of water to the South Central Region consistent with the restrictions imposed by HB 1629 (2001).

8.2.1.2 Policy Statements

8.2.1.2.1 Inter-Basin Transfers

It is essential that current water supplies for agricultural, industrial, municipal, and environmental uses be protected and preserved even in the midst of developing new supplies for growing industries and populations in urban areas. Inter-basin transfers (IBTs) should follow principles established by LCRWPG in the first planning cycle, and revised in the current planning cycle, for transporting water outside of the region:

The LCRWPG has adopted a resolution (*Appendix 8A*) supporting the following nine-point policy that identifies the conceptual elements and guidelines for transporting water outside of the Lower Colorado River Basin:

1. A cooperative regional water solution shall benefit each region.
2. Lower Colorado Regional Water Planning Area's (LCRWPA) water shortages shall be substantially reduced if there is an exchange for an equitable contribution from LCRWPA to meet the municipal water shortages in the South Central Texas Region (or similar transfers to other regions of the State).
3. Proposed actions for inter-regional water transfers shall have minimal detrimental water quality, environmental, social, economic, and cultural impacts.
4. Regional water plans with exports of significant water resources shall provide for the improvement of lake recreation and tourism in the Colorado River Basin over what would occur without water exports.
5. Each region shall determine its own water management strategies to meet internal water shortages when those strategies involve internal water supplies and/or water demand management.
6. Cooperative regional solutions shall include consideration of alternatives to resolve conflicts over groundwater availability.
7. Any water export from the Colorado River would not be guaranteed on a permanent basis.
8. Any water export from the Colorado River shall make maximum use of flood or excess inflows below Austin, but only after in-basin demands are met in the lower basin. Provisions and supporting

technical reviews included in a draft permit to support this principle shall be reviewed by the Regional Water Planning Group to assure consistency with the planning process.

9. Any water export from the Colorado River shall comply with the LCRA's inter-basin water transfer policy.

These nine elements are fundamental considerations for any out-of-basin transfers. This policy specifically addresses potential transfers to the South Central Texas Regional Water Planning Group (SCTRWPG), but would be similarly applied to any request made for a transfer to any other region of the State.

8.2.1.2.2 Linking Groundwater and Surface Water Models (Also See Groundwater)

Groundwater and surface water model development should include the ability to link the models to better integrate the effects of changes in the uses or availability of either groundwater or surface water on each other in varying conditions such as flood or drought. Such models may be more appropriate for specific areas where groundwater and surface water are closely related, such as concentrations of base-flow springs or stream-based recharge. Develop the methodology to utilize available empirical data from public and private sectors to calibrate both groundwater and surface water models.

8.2.1.2.3 Conjunctive Use of Groundwater and Surface Water (Also See Groundwater)

Surface water resources should be managed to minimize the need for pumping of groundwater, if such pumping results in degradation of the aquifer capacity or quality. Aquifers should be managed for sustainability when surface water is available. Strategies which increase surface water availability to offset shortages in a region should receive higher priority than strategies which reduce the sustainability of groundwater. The use of multiple sources of water that are available to meet local and/or regional needs is supported by LCRWPG.

LCRWPG further supports conjunctive use within LCRWPG to promote sustainability and to meet the identified needs of the regional water plan. Conjunctive use of water is defined as the use of multiple sources of water that are available to meet local and/or regional needs.

8.2.1.3 Actions Needed

Texas Legislature – The LCRWPG encourages the Legislature to:

1. Maintain and strengthen water policies designed to protect basins of origin in the event of inter-basin transfers. These policies should consider the nine points presented above.
2. Support State funding for the exploration of the feasibility of linking groundwater and surface water by TWDB during the next generation of water models Groundwater Availability Models/Water Availability Models (GAMs/WAMs) with a priority for specific areas where groundwater and surface water are closely related, such as concentrations of base-flow springs or stream-based recharge. Encourage the validation and calibration of models with data and technical reviews available from the public and private sectors.
3. Strengthen water policies to encourage and prioritize strategies which increase surface water availability to offset shortages in a region in lieu of strategies which could negatively impact the sustainability of groundwater.

Texas Commission on Environmental Quality (TCEQ) – The LCRWPG encourages TCEQ to:

1. Include provisions in water right permits related to inter-basin transfers that protect the basin of origin. Obtain concurrence that draft permits are consistent with the regional water planning process.

2. Provide the Regional Water Planning Groups with technical review summaries including WAM runs for pending permits affecting the region to ensure consistency with the regional planning process.

Lower Colorado River Authority – Diligently complete the LCRA-SAWS Study Plan in such a way as to demonstrate the degree to which each of the points in the LCRWPG's nine-point guidelines for transporting water out of the basin are met.

8.2.2 Environmental Flows – Instream Flows and Freshwater Inflows to Bays and Estuaries

8.2.2.1 Background Information

Texas' myriad of fish and wildlife resources and outdoor recreational opportunities deserve preservation and, in some cases, restoration. Fortunately, a large percentage of surface water rights in Texas are currently underutilized, thereby resulting in sufficient natural flows to provide for critical environmental needs during drought conditions. However, increasing utilization of existing water rights coupled with new water rights potentially threaten the availability of these critical environmental flows.

Total authorizations for consumptive use are approximately 22 million acre-feet of water per year and the vast majority of those authorizations were issued prior to 1985 without conditions to protect environmental flows. The total amount of surface water available on a reliable basis during drought conditions is estimated at 14.9 million acre-feet per year (Vol. 1, *2002 State Water Plan*, Figure 5-17). As of 1999, surface water use was estimated at slightly less than 7 million acre-feet per year (Vol. 1, *2002 State Water Plan*, p. 47).

8.2.2.2 Policy Statement

The LCRWPG supports the protection of instream flows and bay and estuary inflows at levels sufficient to protect native species throughout extended periods of drought at population levels that would enable the species to fully recover upon the return of normal weather conditions. During normal weather conditions, target flows sufficient to ensure a healthy habitat for fish and wildlife should be assured. This requires addressing the specific water quality, flow rates and timing that are required to sustain a healthy and productive riparian ecosystem as well as the physical form of the river such as deep pools, riffles, bluffs, terraces, and its vegetation, springs, and tributaries.

The LCRWPG recommends that the Legislature accomplish environmental flow protection through the surface water permitting process by:

1. In areas where permitting additional quantities of water could threaten critical flow conditions, permits should be issued with thorough mitigation plans that would assure the maintenance of appropriate environmental flows. In addition, the state should aggressively seek the conversion of existing water rights to environmental uses through programs such as the voluntary sale or lease of under-utilized water rights back to the state as a means of regaining adequate flow conditions. These water rights should then be set aside to provide for environmental flow protection.

2. Where unpermitted surface water is available, the state should set aside quantities sufficient to assure critical flows and include provisions in all new permits that would further protect these flows.

It is critical that the issue of environmental flow protection be addressed in a responsible, comprehensive way as expediently as possible. Where sufficient scientific data is unavailable, interim data should be extrapolated from similar watersheds and appropriate studies undertaken to gain adequate site-specific data. Lack of data should not lead to the over-appropriation of rivers and streams.

8.2.2.3 Actions Needed

Texas Legislature – Provide mechanism and/or direction to protect instream/freshwater inflows; Refine TCEQ's surface water permitting process.

8.2.2.4 Timing and/or Conflicts

This issue should be addressed in the 2005 Legislative session.

8.2.3 Environmental – Sustainable Growth, Including Impacts of Growth

8.2.3.1 Background Information

Sacrifices and trade-offs are often seen as necessary to meet a greater common good, and this seems particularly true of water planning. With finite water resources available, such sacrifices are inevitable. Water planning in this state has always assumed that certain demands can and should be met.

The State of Texas has yet to take a comprehensive look at whether meeting predicted water demands would simply and inevitably generate even higher demands in the future. Will these current planning efforts embrace water supply strategies that cannot be sustained? How many sacrifices should be made to support unsustainable growth in a particular region or to provide for unsustainable growth in another region? If aquifers are mined and the viability of the region's ecosystems are reduced to minimal survival levels, how can assurance be given that the next step will not be destruction of those ecosystems in order to simply support a little more growth?

Business, industry, agriculture, and other economically important water users developed originally as a result of water availability and its likely sustainability. Without some means of protecting these users, water transfers could leave them priced out of the market, adversely affecting the economy of the entire region in order to benefit another area of the State.

8.2.3.2 Policy Statement

The LCRWPG recognizes the complexities and the seemingly insurmountable political obstacles that prevent the adoption of growth management plans. Therefore, it is the LCRWPG's recommendation that the issue of sustainable growth be addressed primarily through educational efforts. The LCRWPG strongly supports the proposed state-wide Water IQ public education campaign and encourages that this campaign be saturated with information regarding the finite nature of water resources and the inescapable trade-offs that inevitably must occur when water use in a given geographic area or economic sector increases. Care must be taken in such a program to highlight the need for a balance to be sought among competing water uses that would ensure the maintenance of:

- Healthy riparian, riverine, estuarine, and hardwood bottomland ecosystems
- Historic cultural resources
- Regional economic opportunities
- Agricultural development
- Preservation of rural communities

8.2.3.3 Actions Needed

Texas Legislature – The LCRWPG encourages the Legislature to fully fund the Water IQ public education program directing its administering staff to include educational efforts regarding sustainability as presented in the above policy statement.

8.2.3.4 Timing and/or Conflicts

This is for immediate action by the Texas Legislature.

8.2.4 Groundwater

8.2.4.1 Background Information

Groundwater resources vary greatly across the state and regions, both in quantity and quality. The difficulties and problems inherent in managing these diverse resources have been delegated by the State of Texas to locally organized Groundwater Conservation Districts (GCDs). These local governmental entities are responsible for management, conservation, preservation, protection, and enhancement of groundwater resources in their individual jurisdictions. Groundwater Conservation Districts vary from small, one or two person offices in single county districts to larger agencies covering multiple counties and employing a staff of twenty or more.

Groundwater Conservation Districts have been an integral part of the regional planning process and have provided valuable input on local aquifer characteristics, usage, and availability. This input has resulted in a clearer picture of the importance of groundwater in the State's future.

Groundwater is a major source of water in large parts of Texas. Planning efforts must ensure that this water supply will remain a long-term, viable option for consumption by local residents, agriculture, commercial, and other users. Parts of Texas where demand for water exceeds, or is expected to exceed, its local supply, are increasingly looking to strategies that include importing water from less populated areas.

While local growth may result in site-specific water quantity or quality concerns, such growth is generally not of any major consequence. Recently however, proposals have been made by private business interests to develop groundwater resources in areas where groundwater supply is plentiful and little used. Such proposals have been very controversial and have underscored the need for more inclusive and coordinated planning efforts on the State, regional, and local levels in order to avoid long-term adverse consequences at either end of the supply line.

Region K has reviewed a variety of groundwater policy issues. Some have been incorporated into other sections of this policy document. Five other issues and policy statements are discussed below.

8.2.4.2 Policy Statements

8.2.4.2.1 Groundwater Management by GCDs and the Rule of Capture

Region K supports local management of groundwater by GCDs. GCDs, be they partial, single, or multi-county, have been managing and regulating groundwater since the early 1950s and are the state's preferred method of groundwater management and regulation. Texas groundwater law is based on the Rule of Capture. The Rule of Capture allows the owner of the overlying property to pump or capture any amount he can put to beneficial use. GCDs may modify the Rule of Capture by means of rule-making authority described in Texas Water Code Chapter 36. Region K policy is to continue its support of GCDs and their ability to modify the Rule of Capture when and where appropriate.

Absent a GCD, Region K will support the creation of a GCD, either partial, single, or multi-county, that is determined locally to be reasonable, practical, effective, and achievable. New GCDs should continue to be delineated, established, and confirmed by local elections. Region K will continue to support the Rule of Capture in areas where no GCD has been established. Region K notes that GCDs are local governments that are confirmed by local elections, and it is Region K policy that any attempts or proposals of dissolution, annexation, consolidation, or other organization of GCDs must be referred to the local election process for validation or rejection.

8.2.4.2.2 Sustainability

Region K supports a sustainable approach to groundwater management in regions where such an approach is reasonably achievable. Sustainability is defined as balancing groundwater withdrawals with natural recharge and replenishment to maintain long-term stability in regional or local groundwater supplies. It is Region K policy to look to GCDs to use the "best available science" in developing groundwater availability numbers for areas that lie within these districts.

8.2.4.2.3 Water Marketing (e.g. Water Rights Leases, Sales, Transfers)

Region K policy is to establish coordination between water marketing proposals with local GCDs and RWPGs and to require state agencies to comply with all local GCD rules and state-certified groundwater management plans and all state and regional water plans.

8.2.4.2.4 Groundwater Export and Potential Equity Issues

Region K policy is to require all groundwater export or water marketing projects to coordinate with local GCDs and RWPGs.

8.2.4.2.5 Improving Groundwater Availability Data

Region K policy is to encourage new funding sources for GCDs specific to data collection and encourage data storage methods that emphasize convenience and ease of use. Region K policy is to support the funding needs of the TWDB in order to continue maintaining state-wide databases.

8.2.4.3 Actions Needed

Texas Legislature – LCRWPG encourages the Texas Legislature to sufficiently fund TWDB programs specifically related to groundwater conservation, protection, enhancement, GAM (including development/review/updating/recalibration), and database management.

Texas Water Development Board – LCRWPG encourages TWDB to (1) seek adequate funding for groundwater related programs, GAM needs, and digitization of known well data; and (2) to continue assisting GCDs in their management planning, groundwater quantity and quality research, water conservation programs, and interagency cooperative database management efforts (such as the Texas Water Information Network).

Regional Planning Groups – LCRWPG recommends that all regional planning groups should encourage and incorporate GCDs in their regional planning efforts and to rely on GCDs to provide the most current aquifer data. Regional planning groups should support legislative initiatives that are supportive of GCDs.

Groundwater Conservation Districts – LCRWPG encourages groundwater districts to work cooperatively with regional planning efforts. GCDs should continue to expand or develop groundwater research and database efforts in order to be the primary resource for groundwater data in their jurisdiction.

8.2.4.4 Timing and/or Conflicts

The Texas Legislature session will meet in 2005 and will be setting the budget for the next two years which will have direct impacts on funding programs needed by the TWDB, GCDs, and RWPGs.

Ongoing water marketing proposals are currently front-page news and are expected to maintain a high profile during the 2005 Legislative Session. Water marketing and its relationships with the State, GCDs, and RWPGs is an issue that will need to be addressed by the Legislature this session if water planning in Texas is to maintain some semblance of order.

8.2.5 Protection of Agricultural and Rural Water Supplies

8.2.5.1 Background Information

The potential for harm to rural economies and rural culture grows along with the growing development of water marketing and the planned transfers of water from rural areas to urban population centers. As Texas Agriculture Commissioner Susan Combs has said, “We can’t afford to dewater or leave behind rural Texas.”

Those who would oversimplify solutions to the State’s water woes would have the citizenry believe that water marketing is the solution. Water marketing facilitates the movement of water based on the ability to pay. Unfettered water marketing would result in those segments of our culture and our economy least able to pay being left behind.

In the case of agriculture, irrigators are often third party users of water rights that are subject to being bought and sold by an entity beyond their control. If availability of water to these users is not protected by some means, the resource will go to a higher bidder.

Rural communities find themselves in similar situations where both groundwater aquifers over which they lie and surface waters that flow in nearby streams are threatened by water transfers to entities with the financial and political backing sufficient to make them happen.

Without some means of protecting rural and agricultural water uses, water transfers could leave these users priced out of the market. There has already been a move by some regions to leave future needs for agriculture partially unmet and to recommend water transfers from rural Texas with no plan for mitigating adverse consequences. Since agriculture and rural Texas cannot afford water at the prices that cities and industry will pay, some vehicle must be established to provide parity in water markets for these users.

8.2.5.2 Policy Statement

It is essential that current water supplies for agriculture and rural communities be protected and preserved even in the midst of developing new supplies for growing industries and populations in urban areas. Care must be taken that water transfers of either surface or groundwater be undertaken only after sufficient study and care have been utilized in protecting and preserving any local rural supplies that could be adversely affected. Care must be taken to sustain present and future income, employment, and population growth potential for all water donor areas. The LCRWPG is concerned that unfettered market-driven water transfers could have dire, long-term consequences for unprotected donor areas.

8.2.5.3 Actions Needed

Texas Legislature – The LCRWPG encourages the Legislature to:

1. Strengthen groundwater conservation districts' abilities to protect and preserve groundwater supplies for both present and future uses local to their districts.

2. Develop water policy that enables agriculture and rural Texas to achieve parity with other water users in the water market and water planning arenas.

3. Maintain and strengthen water policies designed to protect basins of origin in the event of inter-basin transfers.

Texas Commission on Environmental Quality – The LCRWPG encourages the TCEQ to provide pertinent technical reviews and draft permits to impacted regional water planning groups for confirmation of consistency with regional water plans.

8.2.5.4 Timing and/or Conflicts

These recommendations should be implemented in during the 79th Legislative session.

8.2.6 Agricultural Water Conservation

8.2.6.1 Background Information

With finite water resources available to a growing Texas populace, it is necessary that all possible means of stretching those finite resources be explored and implemented. Agriculture, being the single largest water user group, represents the area where conservation may offer the most hope for freeing up substantial water supplies.

The economy of irrigated agriculture seldom is such that it would allow producers to invest in major water conservation measures. The Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture administers a number of conservation programs that could be utilized and further optimized to enhance the likelihood of irrigators implementing water conserving practices.

The NRCS Environmental Quality Incentives Program (EQIP) is the NRCS' most likely platform for encouraging water conservation. Water quantity is a national priority of EQIP. The Texas State Conservationist, Dr. Larry Butler and the Texas State Technical Committee have also recognized the high priority that water conservation deserves in the allocation of Texas' share of EQIP funding. However, EQIP funding is continually subject to Congressional appropriations that determine the program's viability on an annual basis. In addition, the cost sharing incentives are generally limited to 50 percent of total project costs, still falling short of what would be required to assure widespread implementation of some of the more costly, more effective water conservation practices.

The LCRA-SAWS Water Project (LSWP), though still in its infancy, offers a responsible template for attaining agricultural water conservation while using conserved water to meet growing metropolitan demands. The plan calls for major agricultural water conservation practices to be funded by metropolitan users in exchange for metropolitan users reaping the benefit of a portion of the conserved water.

8.2.6.2 Policy Statement

The LCRWPG encourages agricultural water conservation as a method of stretching existing supplies by reducing agricultural demands in order to increase water availability to meet new and existing water demands. The LCRWPG further recognizes the need for public and private partnerships with irrigators to fund existing, proven water conservation technology and to develop new, innovative water conservation technology.

8.2.6.3 Actions Needed

United States Congress – The LCRWPG encourages that Congress sufficiently fund NRCS programs aimed at implementing known water conservation technology and at developing promising, new technology for water conservation.

Texas Water Development Board – The LCRWPG encourages TWDB to aid the NRCS State Conservationist in targeting water conservation program funding to projects that offer the most water conservation benefit for the state. The TWDB should also offer expert testimony to the Agriculture Committees of both the Senate and the House regarding the need and effectiveness of water conservation accomplished through EQIP in order to highlight the ongoing need for adequate EQIP funding.

Regional Planning Groups – The LCRWPG encourages all planning groups to adopt water plans that capitalize on the potential for partnering between water user groups to accomplish much needed water conservation in ways that share both the burdens and the benefits between water user groups.

8.2.6.4 Timing and/or Conflicts

Creative funding and implementation of water conservation is an ongoing responsibility for all water users groups and their constituents.

8.2.7 Reuse (including basin-specific assessment of reuse potential and impacts)

8.2.7.1 Background Information

Water reuse typically can be divided into two types, direct and indirect. Direct reuse is when reclaimed water or treated effluent is pumped directly to a place of use. The TCEQ administers water quality requirements for direct reuse through the Chapter 210 rules. Indirect reuse is a method by which discharged effluent is conveyed to a downstream point of use via the bed and banks of a watercourse.

Under most surface water rights, the full amount of water may be used and reused for the purposes and location of use provided for in the underlying water right without additional authorization. However, once this water is discharged to a stream, it becomes waters of the state, available for appropriation by others. Specific authorization for indirect reuse must be obtained to convey discharged effluent for reuse at a downstream point of use.

In addition to the traditional protections against carriage losses, indirect reuse authorizations are subject to special conditions to protect downstream water rights that may have been granted in reliance on the flows remaining in the watercourse or to protect the environment.

Water reuse is an important water management strategy. There is considerable debate and disagreement, however, over which entities should have the right to reuse water and to what extent.

A TCEQ staff memorandum to the Commission, dated February 25, 2005, summarizes the status of these reuse issues as follows:

> "As municipalities have increasingly looked to their effluent as an additional water resource, the Commission and the Legislature have endeavored to specify and interpret the law related to reuse. Challenges arise, in part, because in the past the Commission has issued some permits based on the existence of return flows being in the river. In the adjudication process, some claims were established based on return flows being in the stream. Also in the past, some bed and banks authorizations (to allow use of the river to transport water for reuse) were issued with a priority date and some were not.
>
> In 1997, the Legislature enacted Senate Bill 1, which amended Section 11.042 and Section 11.046 of the Texas Water Code. These amendments resolved some issues, such as providing for the Commission to protect existing water rights and the environment in permitting reuse. However, not all issues were resolved. Since the passage of SB 1, new issues have developed related to how the Commission should permit the use of a watercourse to transport water for reuse.
>
> A major issue is the conflict between Tex. Water Code §§ 11.042 and 11.046. Section 11.046(c) states that once surface water diverted under a permit is returned to the stream, absent any provisions in a water right to the contrary, it becomes state water again subject to appropriation by others. However, Section 11.042(b) and (c), allow the owner of the groundwater-based return flows, or the water right holder or discharger of surface-water-based return flows, to obtain a bed and banks permit to transport this water to a place of reuse. Thus conflicts between appropriators and those who wish to indirectly reuse effluent are inevitable."

8.2.7.2 Policy Statement

LCRWPG supports reuse as a water management strategy, in accordance with State Law and SB 1. The Group recognizes that there are potentially complex issues associated with reuse. Therefore, LCRWPG will continue to examine reuse as a water management strategy in an effort to better understand potential long-term impacts. LCRWPG will continue to monitor legislative developments regarding reuse, and will incorporate those developments into its deliberations and planning.

8.2.7.3 Actions Needed

Texas Commission on Environmental Quality – LCRWPG encourages TCEQ to continue its thorough review and approval processes for indirect reuse applications. It is through this application process that potential impacts, including environmental and water rights impacts, should be addressed.

Regional Water Planning Groups – Continue to monitor legislative developments regarding reuse.

8.2.7.4 Timing and/or Conflicts

Consideration of reuse should be an integral part of the ongoing regional water planning process.

8.2.8 Public Involvement

8.2.8.1 Background Information

From its inception through the legislative process of writing, refining, and passage, and of writing the rules to implement the legislation, SB 1 was intended to create a grass-roots, bottom-up water planning process. Prior to SB 1**,** state water plans were written and implemented from the top down.

The new process empowered local jurisdictions and regional groups to write water plans that would be melded to produce a State plan. In creating RWPGs to oversee the creation of these plans, the legislation called for representation of a number of diverse groups on the regional groups. Both the inclusion of diverse interests and the focus on local and regional groups brought about a new method of writing the State water plan. Public involvement is key to the success of this new process.

8.2.8.2 Policy Statement

The LCRWPG believes that better decisions are reached and carried out when the public is actively involved in those decisions. Members are committed to conducting public outreach as part of their duties as LCRWPG members.

Regional Planning Group members shall continue to make a major effort to reach out to interest groups, civic leaders, small water utilities, and the public at large throughout the region. The LCRWPG:

- Encourages public attendance and participation at regular meetings
- Holds open meetings of the LCRWPG
- Holds regular monthly meetings in locations throughout the region
- Publicizes basin-wide meetings through invitations and news releases

- Provides the opportunity for the public to participate in the planning process at each meeting by scheduling time for public comment
- Uses a comment/participation card at each meeting
- Maintains a web page
- Publishes an e-newsletter
- Uses contributed funds to supplement the project's public involvement budget
- Utilizes focus groups when necessary
- Participates on the LCRA-SAWS Working Group
- Holds public meetings and public hearings to gain public input on the Plan

All of these efforts make information and updates on the regional water planning process available to thousands of people throughout the region.

8.2.8.3 Actions Needed

This public process was initiated in the production of the first water plan and shall continue as the 5-year update is conducted and submitted to the State. Since this public involvement process is contained in SB 1 and the implementing rules, no legislative action is required. The LCRWPG should be vigilant that no weakening of the public process occurs.

8.2.8.4 Timing and/or Conflicts

These recommendations should be included in the final report submitted to the Texas Water Development Board along with a description of the public involvement activities carried out by the LCRWPG.

8.2.9 Education

8.2.9.1 Background Information

Population growth in Region K brings together residents who are unfamiliar with the regional water planning process. Longtime residents need to stay abreast of planning developments. People move from one part of the state to another. Also people get interested in different issues at different times. Each of these factors calls for continuing education on the water planning process. Education is a necessary part of the grassroots regional water planning process as envisaged by SB 1**.**

8.2.9.2 Policy Statement

The LCRWPG is committed to public education as one of the Group and individual member's ongoing responsibilities. Published reports and materials, presentations at regular meetings, and group member presentations to civic and community groups all serve as an education vehicle. Public education strengthens public understanding of regional water planning which is essential to these efforts to plan for water for Texas' future. The LCRWPG commits to participate in future legislative efforts to create public awareness of the importance of water conservation.

The LCRWPG will:

- Work to increase participation and attendance at regular meetings
- Increase multimedia efforts through radio and television talk shows and newspapers to inform the public
- Find ways to increase the distribution of the e-newsletter that is used to update planning group activities and focus on issues of interest in the basin
- Publicize the website as an important source of information
- Continue to emphasize presentations at regular meetings that inform the public about critical issues such as water reuse, the health of the bays and estuaries, irrigation conservation strategies, the LCRA-SAWS Water Project, and potential water management strategies
- Increase contacts with civic and interest groups
- Update the Region K-LCRWPG Fact Sheet

8.2.9.3 Actions Needed

Public education was initiated in the production of the first water plan and shall continue as the 5-year update is conducted and submitted to the State.

In addition, the LCRWPG shall support the recommendations of the Water Conservation Implementation Task Force to the Legislature to establish a statewide awareness, and education campaign to raise the citizen's awareness and knowledge of the importance of water conservation to the State and its future water supplies.

8.2.9.4 Timing and/or Conflict

These should be adopted during the 2005 79th Legislative Session.

8.2.10 Brush Control

The LCRWPG adopted the following motion regarding the potential water supply benefits of brush management for the purpose of enhancing water supplies:

> The LCRWPG recommends and endorses ***studies of brush control projects on a voluntary basis for the Lower Colorado Region, especially west of Interstate Highway 35, and recommends that state and/or federal funds be made available for landowner assistance on a pro-rata basis as needed or requested.***

8.2.11 Recommended Improvements to the Regional Planning Process (SB 1 - 75th Legislature)

The following six recommendations have been developed by the LCRWPG in order to improve the ongoing SB 1/SB 2 regional water planning process:

1. ***The LCRWPG continues to support action by the State to provide for the integration of water quantity (supply) and water quality planning. The TWDB, and the TCEQ should work to***

coordinate the SB 1/SB 2 planning process with the Texas Clean Rivers Program, which is a partnership that uses a watershed management approach to identify and evaluate water quality issues. The RWPGs are considering water quality issues during this revision to the plan and continued coordination with the Texas Clean Rivers Program is desirable.

2. ***The LCRWPG supports action by the State to continue to fund programs for the collection of water data and groundwater availability information, which remains a critical need in the planning process. The State should provide adequate, continuous funding in order to improve the collection, development, monitoring, and dissemination of such water data.***

3. ***The LCRWPG continues to support action by the State to provide assistance to the RWPGs with public information materials and administrative support. This will be particularly important as the RWPGs approach the end of the second planning cycle and enter the third planning phase.***

4. ***The LCRWPG continues to support action by the State to provide for the opportunity to have improved representation of women and minorities on the RWPGs to ensure a true diversity of interests.***

5. ***The LCRWPG supports action by the state to structure the planning process to include environmental needs in order to get a clear picture of the amount of available water resources for all users. Environmental needs and water supply strategies should be planned for just like Agricultural, Municipal, Industrial and other uses in the state.***

6. ***The LCRWPG supports adequate and timely state funding for the SB 1/SB 2 regional water planning process. This funding is critical for the development of long-term, sustainable, environmentally protective and conservation-effective water management strategies as well as the collection of water data and groundwater availability information, including the refinement of modeling data, public information materials, and administrative assistance.***

8.2.12 Other Policy Recommendations

8.2.12.1 Radionuclides in the Hickory and Marble Falls Aquifers

The ***Region "K" Water Supply Plan for the Lower Colorado Regional Water Planning Group, Volume I, December 2000*** provided background information and a policy recommendation on the issues surrounding radionuclides in the Hickory and Marble Falls aquifers. This is an update of the issues and policy recommendation.

EPA (U.S. Environmental Protection Agency) revised the federal radionuclides regulations, which had been in effect since 1977, effective in 2003. Radionuclides emit ionizing radiation, which can cause various kinds of cancers, depending on the type and concentration of radionuclide a person is exposed to via drinking water. These rules cover man-made and naturally occurring radionuclides in drinking water and include a first-time standard for uranium. EPA revised this regulation in accordance with the requirements of the 1986 Amendments to the SDWA (Safe Drinking Water Act) and the 1996 Amendments to SDWA. The statute calls for regulation of radionuclides and a review of regulations every six years. Additionally, according to the SDWA Amendments, the EPA must maintain or provide for greater protection of the health of persons when revising regulations. The EPA reviewed the most current health, occurrence, treatment, and analytical methods in revising these regulations to ensure that safe drinking water is protective of public health.

The TCEQ received an extension from EPA and then adopted the provisions of the Radionuclides Rule into the Texas Administrative Code in December 2004.

The concentration of radionuclide contaminants in the water entering the distribution system shall not exceed the following maximum contaminant levels: combined radium (radium isotopes No. 226 and No. 228) cannot exceed 5 picoCuries/liter (pCI/l); gross alpha-radiation emitters cannot exceed 15 pCI/l (not including radon and uranium); and effective December 8, 2003, 30 micrograms per liter (g/L) for uranium. The Texas rules states that MCLs (maximum contaminant levels) for beta particle and photon radioactivity from man-made radionuclides in drinking water in community water systems are equivalent to the MCLs under 40 Code of Federal Regulations (CFR) §141.66(d) as amended and adopted in the CFR through December 7, 2000, which was adopted by reference. The Texas Rule contains applicability, monitoring, reporting, and public notification requirements, and analytical requirements for radionuclide contaminants and compliance determination.

There are several water utilities currently providing water to the public from the Hickory and Marble Falls aquifers where radionuclide contaminates occur. These include San Saba County, within the Lower Colorado Region, as well as seven counties in Region F, Mason, Brown, Coleman, Concho, McCulloch, Menard, and Kimble. Safe drinking water is a concern of these utilities. With Commission approval, utilities may be able to continue to use the water and/or bottled water on a temporary basis while they seek a long-term solution. Efforts are underway to investigate the development of alternative water sources or effective treatment and radioactive waste disposal. These small towns and water utilities have limited financial resources with which to treat the groundwater for municipal uses.

The LCRWPG recommends ***the State should provide adequate funding for water treatment and radioactive waste disposal for those rural communities that may lose their water supply if such financial support is lacking. In addition, State agencies should develop disposal procedures to provide for the safe handling of the radioactive wastes derived from the treatment processes.***

8.3 SUMMARY OF UNIQUE STREAM SEGMENT RECOMMENDATIONS

This section provides background information on the ***ten streams in the Lower Colorado Region identified and recommended by the Subcommittee as warranting further study for consideration of designation as ecologically unique*** (*Table 8.1*). A listing of source documents for this section is contained in *Appendix 8C*. Additional information resources have also been provided by the TPWD in *Appendix 8D*.

Table 8.1 Stream Segments Identified for Further Study for Potential Designation as Ecologically Unique

Stream Segment	Location
Barton Springs segment of the Edwards Aquifer	Recharge stretches of Barton, Bear, Little Bear, Onion, Slaughter, and Williamson Creeks in Travis and Hays Counties
Bull Creek	From the confluence with Lake Austin upstream to its headwaters in Travis County
Colorado River	Within TCEQ classified Segments 1409 and 1410 including Gorman Creek in Burnet, Lampasas, and Mills Counties
Colorado River	TCEQ classified Segments 1428 and 1434 in Travis, Bastrop, and Fayette Counties
Colorado River	TCEQ classified Segment 1402 including Shaws Bend in Fayette, Colorado, Wharton, and Matagorda Counties
Cummins Creek	From the confluence with the Colorado River upstream to FM 159 in Fayette County
Llano River	TCEQ classified Segment 1415 from the confluence with Johnson Creek to CR 2768 near Castell in Llano County
Pedernales River	TCEQ classified Segment 1414 in Kimball, Gillespie, Blanco, and Travis Counties
Rocky Creek	From the confluence with the Lampasas River upstream to the union of North Rocky Creek and South Rocky Creek in Burnet County.
Hamilton Creek	From the outflow of Hamilton Springs to the confluence with the Colorado River.

8.3.1 Barton Creek Within the TCEQ Classified Stream Segment 1430 From the Confluence With Town Lake in Travis County to FM 12 in Hays County

Barton Creek is the TCEQ classified stream Segment 1430 and extends from the confluence with Town Lake in Travis County to FM 12 in Hays County. The creek is in the Central Texas Plateau ecoregion and the watershed lies within the live oak-ashe juniper woods vegetation association. Water quality is generally good to exceptional, although coliform levels are occasionally elevated after storm events. Nitrite levels can also be high due to the influence of groundwater. Substrate is typically limestone bedrock with rubble, boulders, and gravel. The upper portions of the streams are generally intermittent, except in spring-fed reaches, which limits aquatic habitat. A comprehensive list of literature about the Barton Springs portion of the Edwards aquifer was prepared by the City of Austin in collaboration with the Austin History Center, and is available at http://www.ci.austin.tx.us/aquifer/. Barton Creek meets the following criteria for designation as ecologically unique:

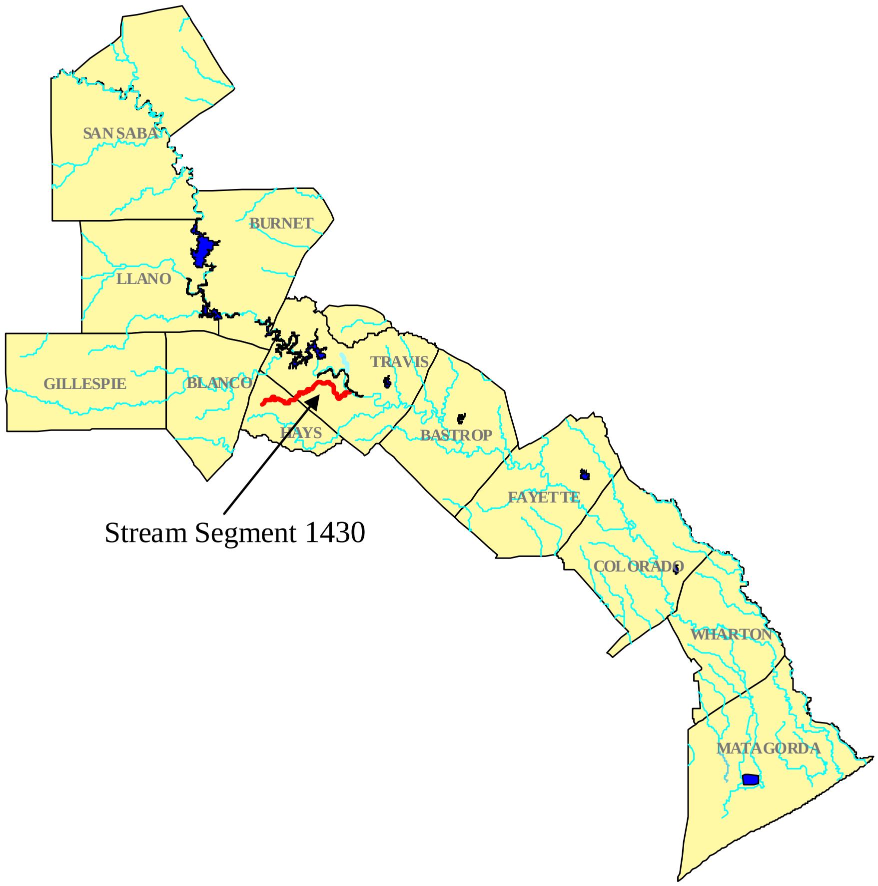
- Riparian Conservation Area: the lower end of the stream is in the City of Austin's Zilker Park
- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: the stream was selected as an ecoregion stream based on its physical attributes, water quality, and biological assemblages; the stream exhibits high dissolved oxygen (DO) concentrations and a diverse and complex benthic macroinvertebrate community
- Endangered/Threatened Species: the stream contains the only known population of the Barton Springs salamander (*Eurycea sosorum*), a federally listed endangered species

8.3.2 Bull Creek From the Confluence With Lake Austin Upstream to its Headwaters

Bull Creek lies wholly within Travis County in the northwest portion of the City of Austin (*Figure 8.2*). The watershed for the stream is approximately 32 square miles in a rapidly developing area. The watershed is located on the eastern edge of the Texas Hill Country and immediately west of the Balcones Fault Zone. Numerous seeps and springs provide baseflow to Bull Creek. Water quality is generally good, although some degradation has occurred due to development. The Bull Creek watershed contains suitable habitat for a variety of rare and endangered species including the Golden-Cheeked Warbler (*Dendroica chrysoparia*), Black-Capped Vireo (*Vireo atricapillus*), Tooth Cave spider (*Neoleptoneta myopica*), Tooth Cave pseudoscorpion (*Tartarocreagris texana*), Bee Creek Cave harvestman (*Texella redelli*), Bone Cave harvestman (*Texella redelli*), Tooth Cave ground beetle (*Rhadine persephone*), Kretshcmarr Cave mold beetle (*Texamaurops reddeli*), and Jollyville Plateau salamander (*Eurycea* sp.). In addition, the watershed contains a very diverse flora. Bull Creek meets the following criteria for designation as ecologically unique:

- Biologic Function: nearly pristine stream with a largely intact riparian area
- Hydrologic Function: pervious cover and intact riparian zone reduce downstream flooding
- Riparian Conservation Area: Bull Creek Preserve
- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: overall pristine nature gives the stream a high aesthetic value; stream has a diverse and complex benthic macroinvertebrate community, and an abundance and diversity of amphibians
- Endangered/Threatened Species: the stream contains a population of the Jollyville Plateau salamander (*Eurycea* sp.), a federally listed endangered species

Figure 8.1: Location and Map of Barton Creek Stream Segment 1430



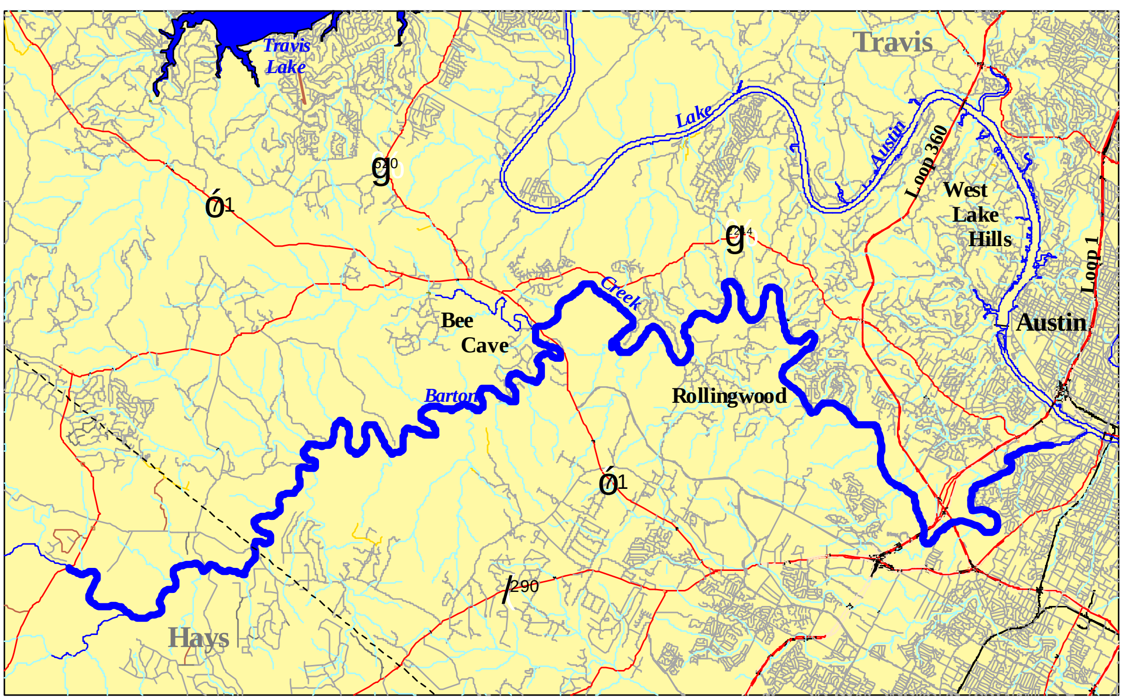
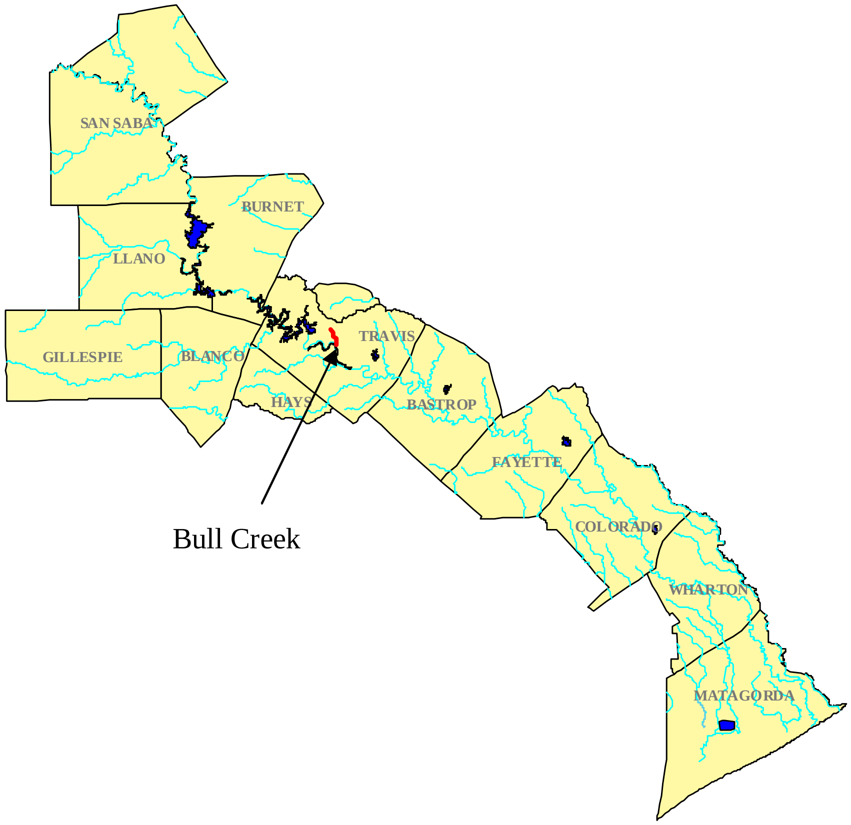
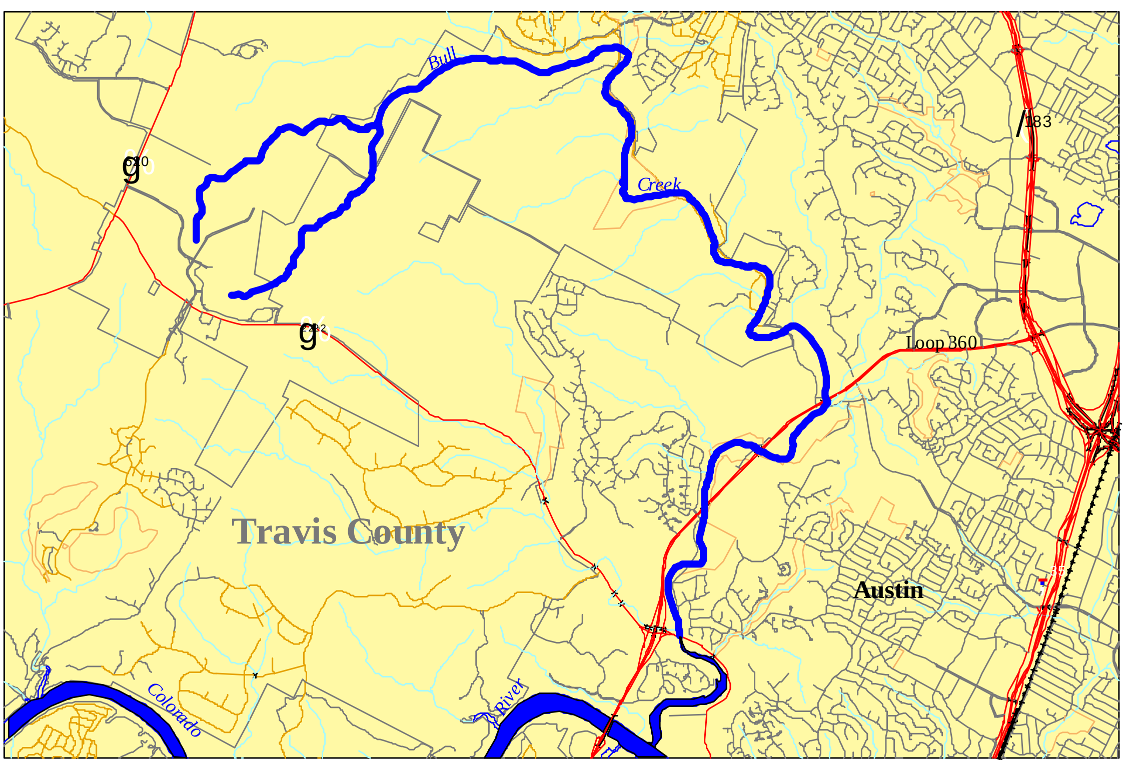


Figure 8.2: Location of Bull Creek





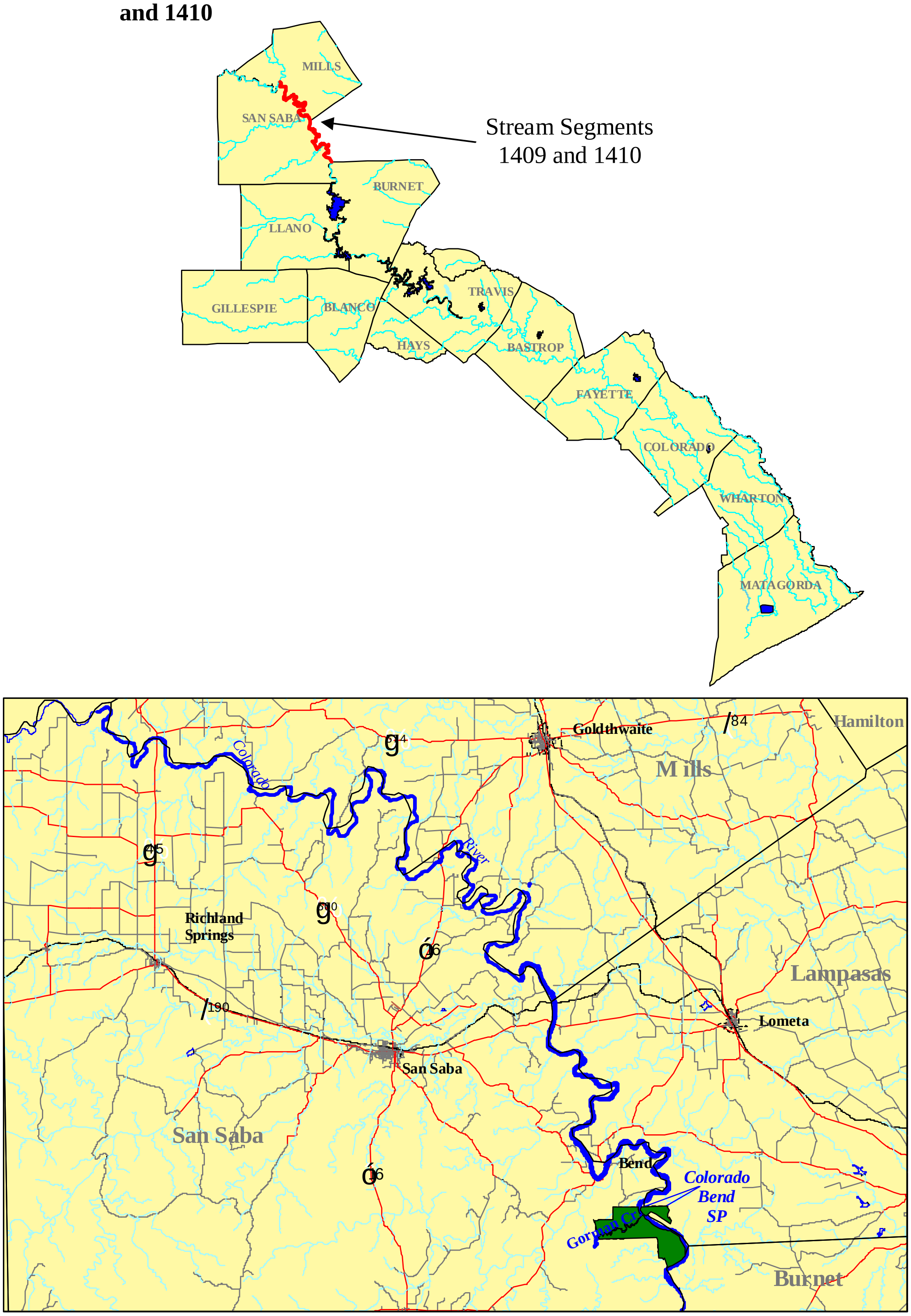
8.3.3 Colorado River Within TCEQ Classified Stream Segments 1409 and 1410 Including Gorman Creek in Burnet, Lampasas, and Mills Counties

This segment consists primarily of the Colorado River upstream of Lake Buchanan to the Brown/San Saba/Mills county line, but also includes the Gorman Creek tributary (*Figure 8.3*). The stream segment is within the Central Texas Plateau ecoregion. Vegetation types common along the stream are mostly live oak-juniper parks. The river itself is wide and relatively shallow, flowing over a bed of limestone and gravel. A few stretches of small rapids exist on the upper part of this section down to the point where the backwaters of Lake Buchanan deepen the river and slow its flow.

Among the segment's scenic attributes are high limestone bluffs, vistas of rugged cedar-covered hills, and the existence of one of the most spectacular waterfalls in Texas. Gorman Falls is formed at the point where Gorman Creek tumbles into the Colorado River over a 75-foot-tall limestone bluff. The water coming from the creek is clear and cold, and many ferns and mosses grow on the slippery rocks and travertine deposits below the falls. The TCEQ identifies the segment as having a high aquatic life use. The National Park Service identified the segment for inclusion in the National Rivers Inventory based on the degree to which the river is free-flowing, the degree to which the river and corridor is undeveloped, and the outstanding natural and cultural characteristics of the river and its immediate environment. The segment meets the following criteria for designation as ecologically unique:

- Biologic Function: white bass spawning area
- Riparian Conservation Area: Colorado Bend State Park
- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: exceptional aesthetic value
- Endangered/Threatened Species: Concho water snake (Nerodia paucimaculata), a federal and state listed endangered species, as well as the rare and endemic mollusks, Texas fawnfoot and Texas pimpleback

Figure 8.3: Location of the Colorado River Within TCEQ Classified Stream Segments 1409 and 1410

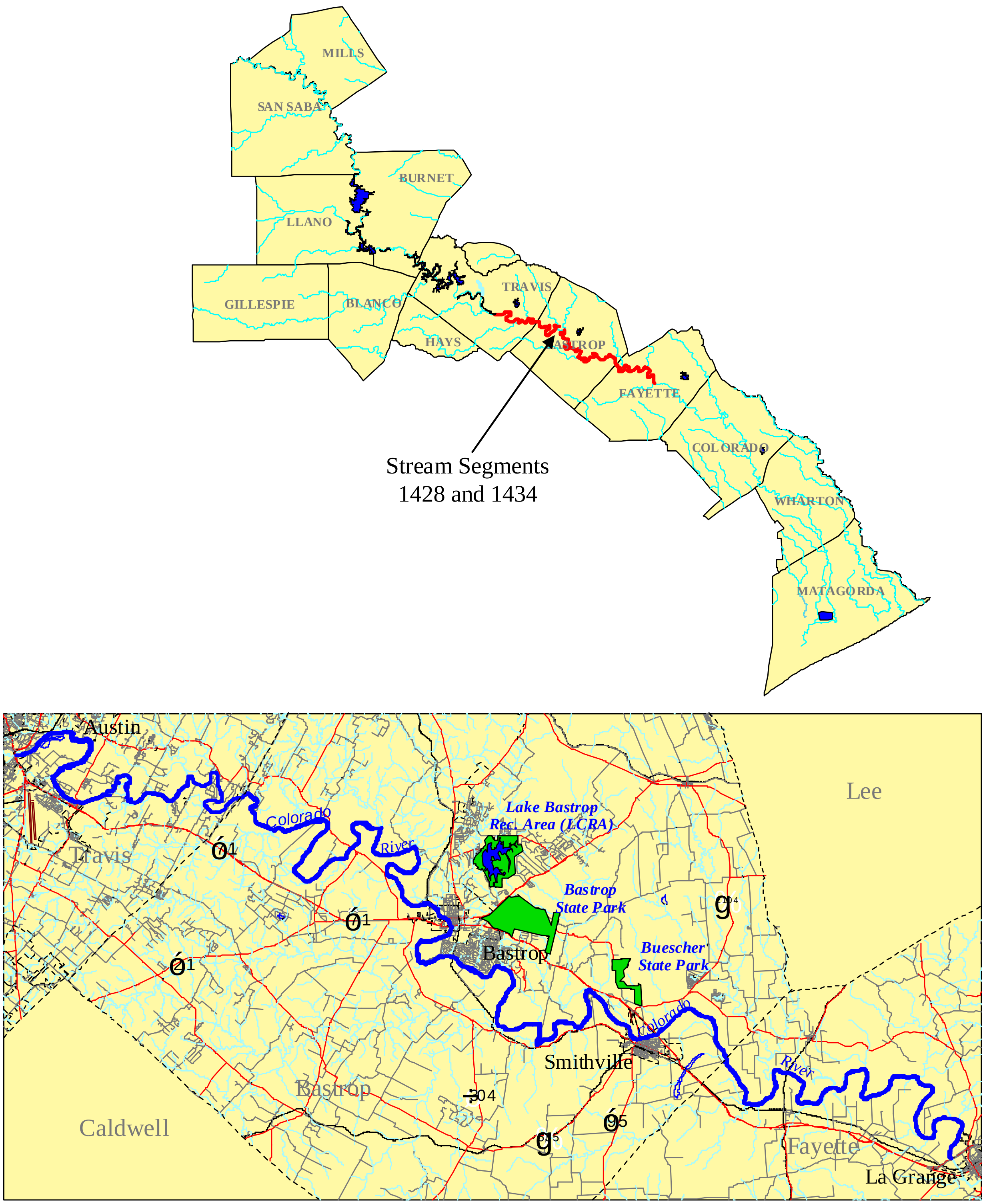


8.3.4 Colorado River Within TCEQ Classified Stream Segments 1428 and 1434 in Travis, Bastrop, and Fayette Counties

The segment includes the Colorado River from a point 100 meters downstream of SH 71 in La Grange to Longhorn Dam in Austin and portions of Wilbarger, Big Sandy, Alum, and Cedar Creeks in Bastrop County (*Figure 8.4*). Extensive information about the segment in Bastrop County, submitted by the Bastrop County Environmental Network (BCEN), is presented in *Appendix 8B*. In general, water levels in the Colorado River are controlled by releases from Lake Travis and Lake Buchanan. The occurrences of low instream flows often depend on the discharge rate of return flows from the City of Austin. Instream flows in the smaller creeks within Bastrop County originate from diffuse surface water runoff, groundwater contributions, and springs. The segment lies within the Texas Blackland Prairies ecoregion. Substrate in the streams is typically sand and/or gravel. Several reaches of the segment are characterized by rubble and boulder fields. The TCEQ has classified the mainstem river as supportive of exceptional aquatic life uses. Water quality is generally good although nutrient levels are often elevated. Water quality in the creeks is typically good but influenced by flow levels, land use patterns, and wastewater discharges. Cedar Creek contains an exceptional macroinvertebrate community and, based on the ichthyofauna, a high Index of Biotic Integrity rating. This portion of the Colorado River has a diverse fish community, including the state listed threatened blue sucker (*Cycleptus elongatus*). In addition, the state and federally listed endangered Houston toad (*Bufo houstonensis*) occurs in the area. The segment meets the following criteria for designation as ecologically unique:

- Biologic Function: undeveloped riverine habitat, part of the Central Flyway of migratory birds
- Hydrologic Function: extensive riparian zone attenuates flooding and improves water quality via filtration and soil stabilization; riparian and stream channels hydrologically connected to an alluvial aquifer and the Carrizo-Wilcox aquifer
- Riparian Conservation Area: McKinney Roughs Environmental Learning Center
- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: exceptional aquatic life use
- Endangered/Threatened Species: blue sucker (*Cycleptus elongatus*), a state listed endangered species and the federal and state listed endangered Houston toad (*Bufo houstonensis)*

Figure 8.4: Location of the Colorado River Within TCEQ Classified Stream Segments 1428 and 1434



8.3.5 Colorado River Within the TCEQ Classified Stream Segment 1402 Including Shaws Bend in Fayette, Colorado, Wharton, and Matagorda Counties

The segment extends from just downstream of the Missouri-Pacific Railroad trestle in Matagorda County to a point 100 meters downstream of SH 71 in La Grange, a distance of 150 miles (*Figure 8.5*). The segment lies within the Texas Blackland Prairies ecoregion and flows into the East Central Texas Plains ecoregion. Substrate varies from primarily gravel in the upper reaches of the segment to gravel/cobble riffles and extensive sand-dominated reaches downstream. Instream flow is largely dependent on upstream releases for rice irrigation but also receives contributions from the intervening watershed. The water quality of the segment is typically good and supports a high aquatic life use designation. Nutrient levels are elevated, but DO concentrations are typically higher than the minimum required to maintain a high aquatic life use designation. The fish community is generally diverse and includes the blue sucker (*Cycleptus elongatus*), a state listed endangered species. Although not contained in this report, additional information about the segment is available in feasibility studies performed by ECS Technical Services for the U.S. Department of the Interior, which includes the Shaw's Bend Reservoir site. The segment meets the following criteria for designation as ecologically unique:

- <u>Biologic Function</u>: undeveloped riverine habitat, part of the Central Flyway of migratory birds
- <u>Endangered/Threatened Species</u>: blue sucker (*Cycleptus elongatus*), a state listed endangered species

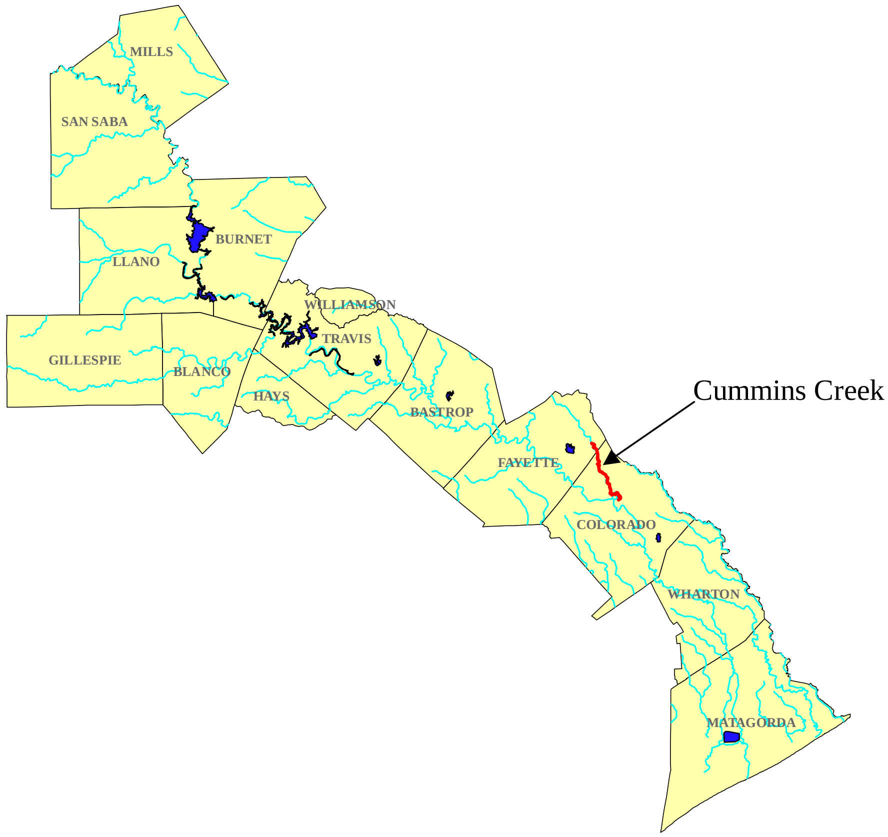
8.3.6 Cummins Creek From the Confluence With the Colorado River in Colorado County Upstream to FM 159 in Fayette County

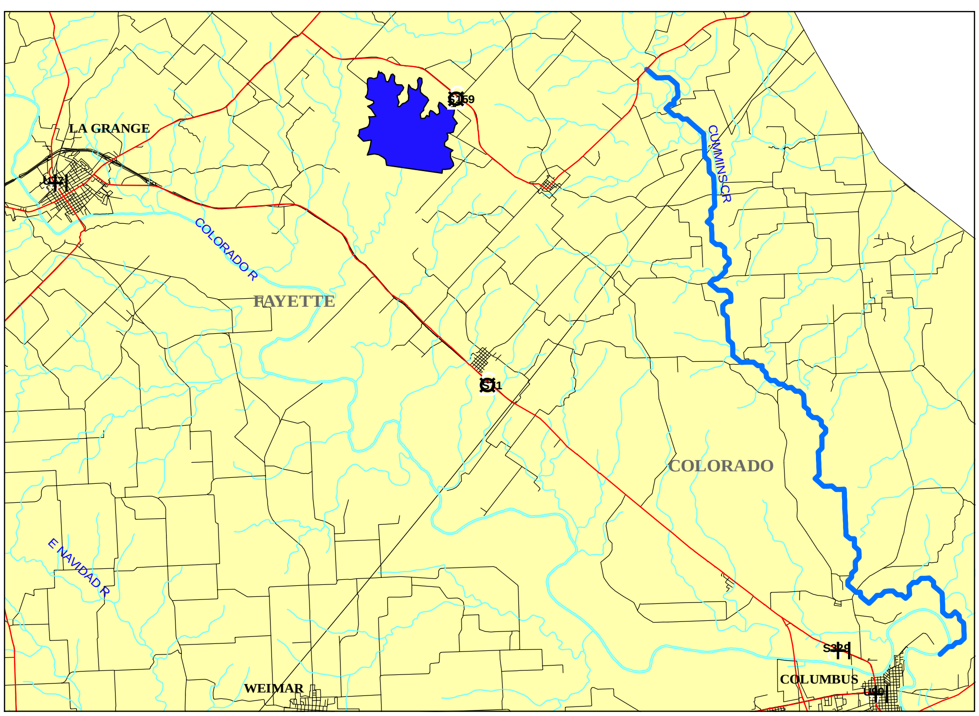
Cummins Creek lies within the Texas Blacklands Prairie ecoregion in Colorado and Fayette Counties (*Figure 8.6*). The stream is characterized by shallow to moderately deep pools, riffles, and occasional shallow runs. Substrate is predominantly fine sands with gravel and rubble in riffles and runs. Cummins Creek is within the post oak savannah vegetation region. The surrounding land use is mostly agricultural. Water quality is generally good, and the stream supports diverse macroinvertebrate and fish communities. The LCRA rated the creek, which has at least 27 species of fish as suitable for a high aquatic life use for fish. Among the fish species that have been collected in the stream is the Guadalupe bass (*Micropterus treculi*). Cummins Creek supports at least 28 species of aquatic macroinvertebrates. Several varieties of mayflies and caddisflies, which are considered intolerant of pollution, are present. Cummins Creek was rated an excellent aquatic life use category for macroinvertebrates based on work by the LCRA. The segment meets the following criteria for designation as ecologically unique:

- <u>High Water Quality/Exceptional Aquatic Life/High Aesthetic Value</u>: the stream was selected as an ecoregion stream based on its physical attributes, water quality, and biological assemblages the stream
- <u>Exhibits High Dissolved Oxygen Concentrations and a diverse and complex benthic macroinvertebrate community</u>

Figure 8.5: Location of the Colorado River Within the TCEQ Classified Stream Segment 1402

Figure 8.6: Location of Cummins Creek





8.3.7 Llano River Within the TCEQ Classified Stream Segment 1415 From the Confluence With Johnson Creek to County Road 2768 Near Castell in Llano County

The Llano River between the confluence with Johnson Creek and County Road (CR) 2768 in Llano County is part of TCEQ classified stream Segment 1415 (*Figure 8.7*). The Llano River is a spring-fed stream of the Edwards Plateau and is widely known for its scenic beauty. It is in the Central Texas Plateau ecoregion and is characterized by the live oak-mesquite parks vegetation type. Riparian vegetation includes elm, willow, sycamore, and salt-cedar. The stream has designated water uses for contact recreation, as a public water supply, and for high aquatic life uses. Among the fish found in the stream is the Guadalupe bass (*Micropterus treculi*). The substrate is composed of limestone bedrock and gravel. In addition, large boulders and slabs of granite and gneiss occur in the river. This section of the Llano River is widely known for the one-billion-year-old igneous and metamorphic rocks, which form the riverbed. The area is a part of the Llano Uplift, which is one of the most unique geologic features in Texas. Land use along the stream is generally rural and includes ranching and agriculture. The segment meets the following criteria for designation as ecologically unique:

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: exceptional aesthetic value

8.3.8 Pedernales River Within the TCEQ Classified Stream Segment 1414 in Kimball, Gillespie, Blanco, and Travis Counties

The Pedernales River from a point immediately upstream of the confluence of Fall Creek in Travis County upstream to FM 385 in Kimble County makes up the TCEQ classified stream Segment 1415 (*Figure 8.8*). Most of this segment lies within the LCRWPA. The Pedernales River in general has high water quality and supports a high aquatic life use. The stream is within the Central Texas Plateau ecoregion. Surrounding vegetation is characteristic of the live oak-ashe juniper parks and live oak-mesquite-ashe juniper parks vegetation regions. The river is spring-fed and free flowing, with many limestone outcroppings. The National Park Service identified the segment for inclusion in the National Rivers Inventory based on the degree to which the river is free flowing, the degree to which the river and corridor is undeveloped, and the outstanding natural and cultural characteristics of the river and its immediate environment. Bald cypress, red columbine, and native orchids are found adjacent to the river. Among the fish species that occur in the stream is the Guadalupe bass (*Micropterus treculi*). Other aquatic species typical of Hill Country spring-fed streams also inhabit the Pedernales River. Along the river are several state and national parks including Pedernales Falls State Park, LBJ State Park, and LBJ National Park. The segment meets the following criteria for designation as ecologically unique:

- Biologic Function: significant natural area
- Riparian Conservation Area: Pedernales Falls State Park, LBJ State Park, LBJ National Park, and Stonewall Park
- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: exceptional aesthetic value

Figure 8.7: Location of the Llano River From Johnson Creek Confluence to CR 2768

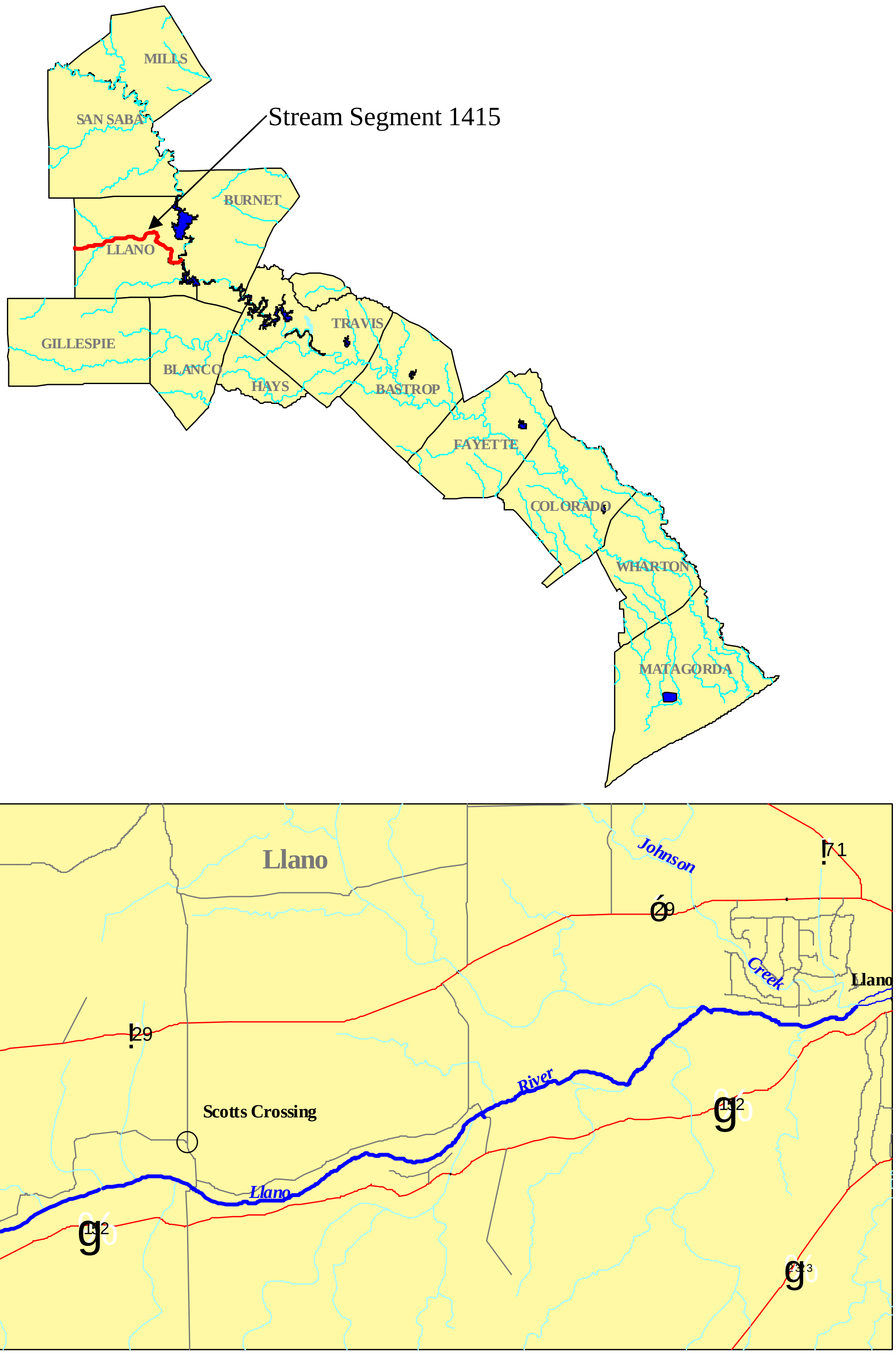
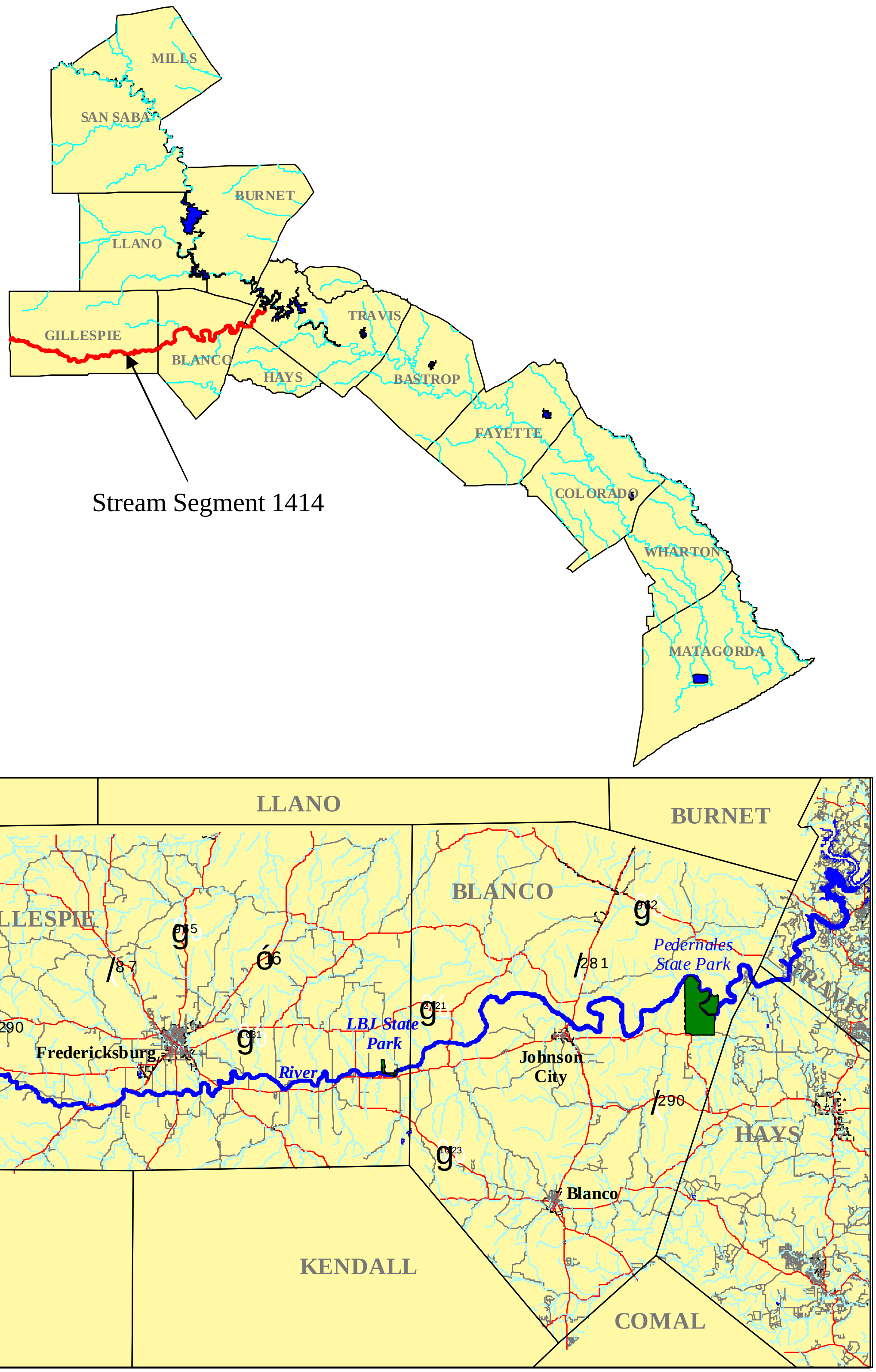


Figure 8.8: Location of the Pedernales River Within the LCRWPA



8.3.9 Rocky Creek From the Confluence With the Lampasas River Upstream to the Union of North Rocky Creek and South Rocky Creek in Burnet County

Rocky Creek lies within the Brazos River Basin in northeast Burnet County (*Figure 8.9*). The stream is approximately 6 miles long with a drainage area of 94 square miles. The stream is in the Central Texas Plateau ecoregion and within the oak-mesquite-juniper parks/woods vegetation association. The upper reach flows through the live oak-ashe juniper parks association. Long deep runs with numerous short riffles and occasional deep glides characterize the creek morphology. Limestone bedrock, gravel, and rubble are the dominant substrate types. In sampling for the Texas Aquatic Ecoregion Project, 54 species of aquatic invertebrates and 15 species of fish were collected. The segment meets the following criteria for designation as ecologically unique:

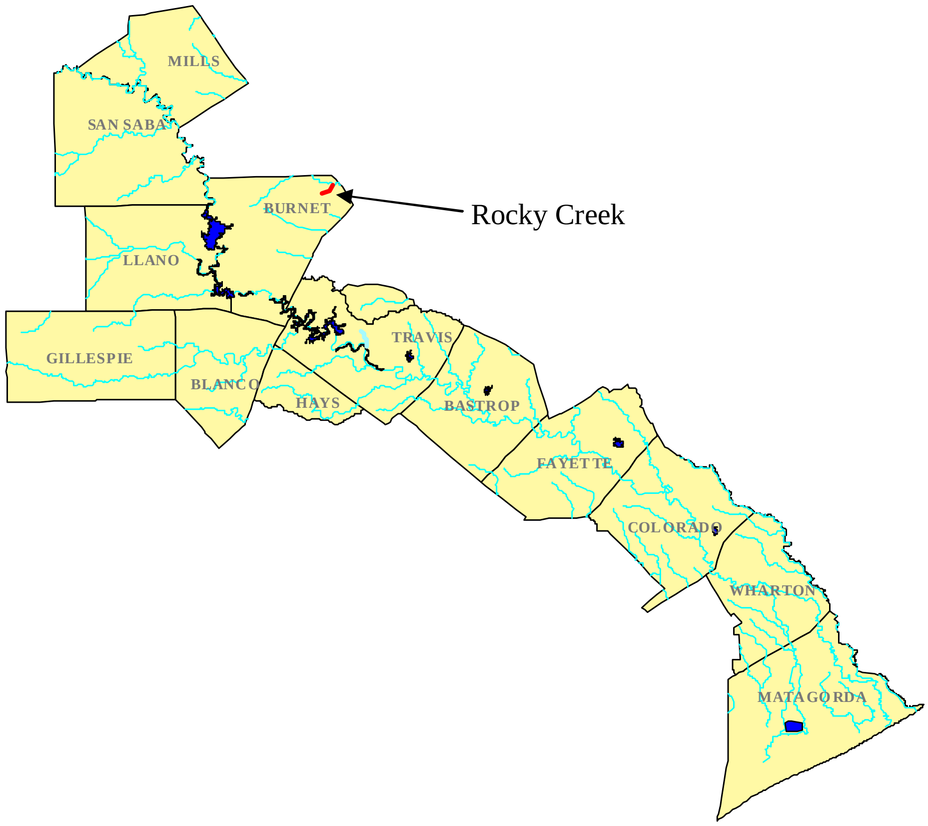
- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: the stream was selected as an ecoregion stream based on its physical attributes, water quality, and biological assemblages; the stream exhibits high DO concentrations and a diverse and complex fish and benthic macroinvertebrate community.

8.3.10 Hamilton Creek From the Confluence With the Colorado River Upstream to the Outflow of Hamilton Springs in Burnet County

Hamilton Creek originates at Hamilton Springs in south central Burnet County 5 miles northwest of Burnet and flows south for 22 miles to its confluence with the Colorado River in TCEQ classified stream segment 1404 (*Figure 8.10*). The upper reaches of Hamilton Creek are intermittent with flow increasing downstream due to municipal discharges from the City of Burnet and other sources. The stream flows through the Edwards Plateau ecoregion, a region of limestone outcrops and a mixture of granitic and sandy soils. Throughout the Edwards Plateau live oak, shinnery oak, mesquite and juniper dominate the woody vegetation. There is a limited riparian cover adjacent to the stream. TCEQ identifies Hamilton Creek as Segment 1404A with water body uses for contact recreation and fish consumption with an intermediate aquatic life use.

Following the adoption of the Region K Water Supply Plan, the LCRWPG was made aware of a proposed open pit mine being considered in Burnet County adjacent to Hamilton Creek. Local residents in the area around Hamilton Creek came to the RWPG indicating that the pristine nature of the creek was unique and worthy of consideration as a Unique Steam Segment (USS). The hope was that such a designation would protect the creek from potential adverse impacts due to the proposed mining operation. The RWPG, on December 11, 2002, took action on this request by authorizing the issuance of a letter from the RWPG to the TCEQ and the LCRA expressing concerns about excessive water mining and non-point source pollution damage to the creek. At the February, 12, 2003, RWPG meeting, the group approved the recommendation that Hamilton Creek, from the outflow of Hamilton Springs to the Colorado River, be designated as a USS and that the recommendation be submitted to a local legislator for consideration during the 78th Legislative Session. The designation of Hamilton Creek as a USS was not passed during the 78th Texas Legislative Sessions.

Figure 8.9: Location of Rocky Creek in Burnet County



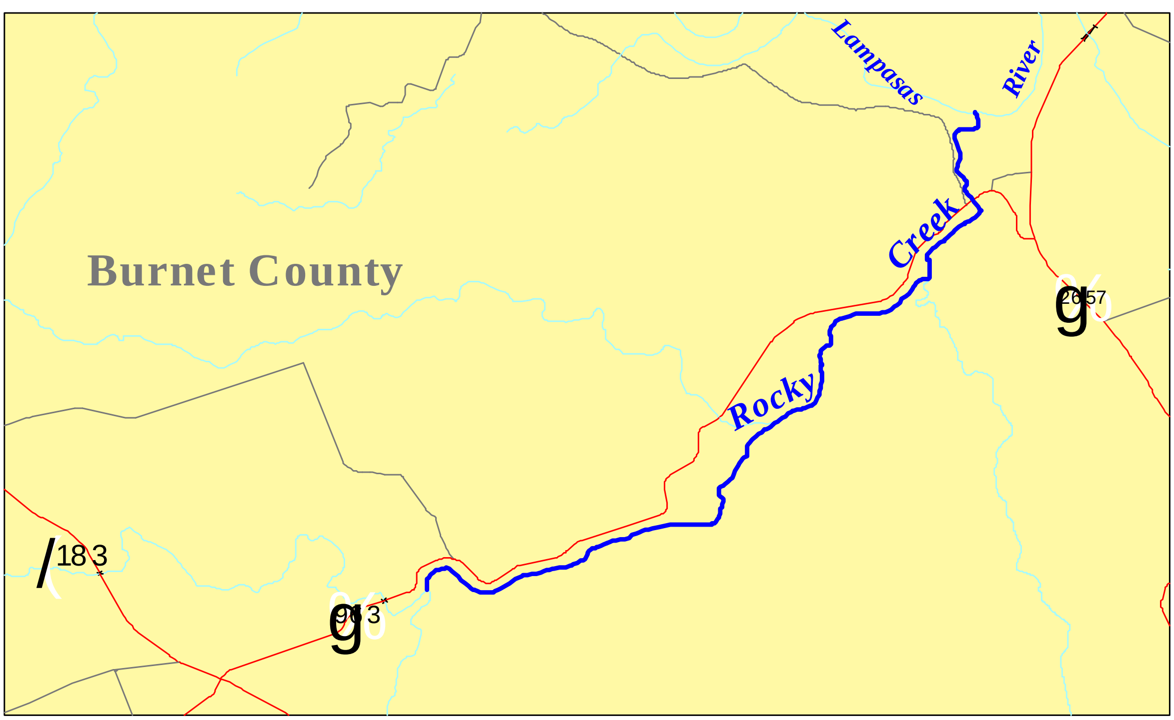
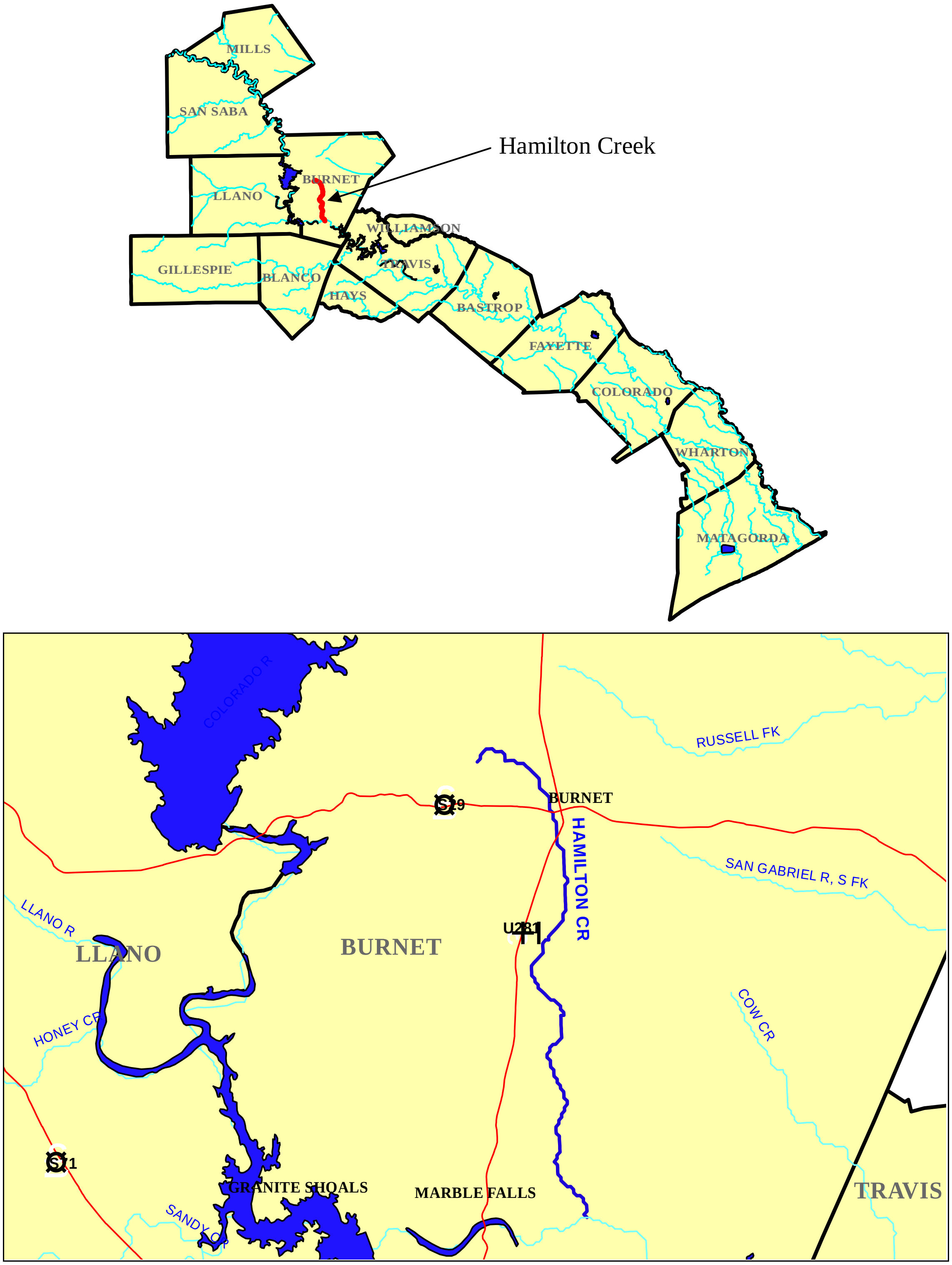


Figure 8.10: Location of Hamilton Creek in Burnet County



8.3.11 Conclusions and Recommendations

The protection intended to be provided by the designation of a river or stream segment as ecologically unique is to preclude a state agency or political subdivision of the state from financing the actual construction of a reservoir in a specific river or stream segment designated by the legislature as ecologically unique. In addition numerous programs presently exist to protect areas of special ecological significance. Since the LCRWPG currently has not recommended strategies for state financed reservoirs on any of the ten identified stream segments, and in the absence of additional environmental data, the LCRWPG takes no action at this time to designate these stream segments as ecologically unique. However, further study may be warranted in future Lower Colorado Regional Water Plans.

8.4 SUMMARY OF POTENTIAL SITES UNIQUELY SUITED FOR RESERVOIRS

This section provides background information and recommendations on eight specific reservoir sites, one specific reservoir enhancement project, and several non-specific reservoir sites in the Lower Colorado Region considered by the USS/RS Subcommittee as possible candidates for designation as reservoir sites. The recommendations include support of certain potential projects, opposition to certain potential reservoir sites, and support for further study of certain projects. It should be noted that the TWDB guidelines state that public support and acceptance can be considered under "other criteria" for evaluating water supply management strategies.

8.4.1 Mills County Potential Reservoir Projects

For the 2001 Regional Plan, the LCRWPG passed a resolution *"supporting the efforts of residents in Mills County and adjoining areas to construct water supply projects involving dams and reservoirs for water supply and the construction of pipelines and other facilities related thereto"* (*Appendix 8A*). There are three projects under development by the Fox Crossing Water District and the DGRA. These sites include off-channel reservoir alternatives for Pompey Creek and Bennett Creek, and an in-channel reservoir alternative on the Colorado River. To date, there are no engineering technical reports evaluating these locations other than a site map created by the Natural Resources Conservation Service (NRCS). The 2001 Regional Plan states that Mills County has projected municipal and irrigation water supply needs for every decade from 2000 through 2050. *Table 8.2* below contains the preliminary data currently available from the DGRA on the two off-channel and the one on-channel reservoir sites. Please note this information is extremely preliminary.

Table 8.2 Projected Cost for Selected Mills County Surface Water Reservoir Projects

Reservoir Alternative	Reservoir Area (ac)	Average Reservoir Depth (ft)	Reservoir Conservation Pool (ac-ft)	Drainage Area (sq mi)	Reservoir Yield (mgd)	Creek Elevation at Dam (ft msl)	Dam Top Elevation (ft msl)
Pompey Creek	240	42	10,080	53	0.4 - 0.75	1,245	1,350
Bennett Creek	525	16	8,400	100	0.8 - 1	1,260	1,300
Colorado River		10 or 16	510 or 3,400			1,130	
Reservoir Alternative	**Dam Height (f)**	**Dam Length (ft)**	**Estimated Cost ($)**	**Annual Debt Service* ($)**	**Annual O&M Cost ($)**	**Total Projected Annual Cost ($)**	**Unit Water Cost ($/1,000 gal)**
Pompey Creek	105	1,500	3,938,000	343,333	30,000	373,333	1.78
Bennett Creek	40	5,000	5,188,333	452,343	100,000	552,343	1.68
Colorado River	20		3.5-6.9 million				

* Annual debt service is calculated at 6% for 20 years

8.4.2 Shaws Bend Potential Reservoir Project

Reservoir Project Opposition is recommended for the potential Shaws Bend Reservoir site in Colorado and Fayette Counties. This potential reservoir site has been explored in the past by the SCTRWPG. This site is within the boundaries of the LCRWPA and would involve an in-channel dam on the Colorado River approximately five miles west of the City of Columbus. Large local opposition to this project was demonstrated at the various LCRWPG public meetings and in correspondence during the 2001 LCRWPG plan preparation. In addition, this site has many attributes that may qualify it to be considered for designation as a USS (see *Section 8.3.5*). However, to date, no USS recommendations have been made by the LCRWPG.

A U.S. Bureau of Reclamation Environmental Inventory and Impact Assessment Study was conducted on the Colorado Coastal Plains, which includes the Shaws Bend Reservoir site, and the results and analyses were compiled in an April 1985 report. This report states that construction and conservation pool operations (220 feet mean sea level [msl]) would adversely impact various natural and man-made resources. The reservoir would inundate 12,400 acres and directly impact a total of 12,913 acres of forest, pasture, cultivated, and other lands. Impacts from 100- and 500-year flood events would be even greater. Vegetation resources impacted would include pecan orchards, woodlands, bottomland forests, riverine habitat, pastures, and native grasslands/prairies. Five threatened or endangered species could possibly be located within the Shaws Bend Reservoir area. Five unique areas have been identified within the 210,000-acre project area, and it has been determined that three of them would definitely be adversely affected. Unique areas are defined as sites that provide an unusual setting with regard to vegetation resources or habitat, or are of social, historical, recreational, or aesthetic value. A 1.4-mile stretch up-channel containing pristine bottomlands with pools and riffles at Harvey Creek Woodlands would be inundated by approximately 10 feet of water. Approximately 70 percent of Horseshoe Bend Woodlands would be inundated under normal conservation pool operations, and during flood events the entire woodland would be inundated. The third site with vegetative/habitat value is the Fern Hollows and Bluffs, which contain secluded canopies of large trees, natural springs, and unusual hydrophilic plant species. Most of the historical Burnam's Ferry Crossing would be inundated by conservation pool reservoir waters, and it has already been determined that mitigation would be required if the reservoir were constructed. This area was part of the La Bahia Road from southwestern Louisiana to San Antonio and is currently privately owned and used annually by the Boy Scouts for camping. Camp Lone Star is located near La Grange and its 125 acres of dense upland forest is of recreational value for camping year-round. In addition, preliminary identification of many potential archeological sites has been made in the Shaws Bend Reservoir project area. Man-made resources that would be adversely affected include roadways, electrical line right-of-ways, oil/gas wells, and petroleum pipelines.

8.4.3 Cummins Creek Potential Reservoir Project

Reservoir Project Opposition is recommended for the potential Cummins Creek Reservoir site in Colorado County. This potential reservoir site was considered as a water supply option under consideration by the SCTRWPG in their 2001 Regional Plan. This site is within the boundaries of the Lower Colorado Region near the City of Columbus and the confluence with the Colorado River and would involve an off-channel dam on Cummins Creek. This reservoir would utilize flows from Cummins Creek plus diversion of unappropriated Colorado River flows. Large local opposition to this project was demonstrated at the various LCRWPG public meetings and in correspondence during the 2001 Plan Meetings. Cummins Creek has a WCID which covers only Fayette County, and there are already 15 dams along the creek. There are more than 7,200 acres of bottomland along the creek within the proposed reservoir project area as well as spring-fed sections of the creek. It has already been determined by the SCTRWPG that mitigation would be required for inundation of 6,600 acres, which includes riparian woodlands. Portions of the Colorado River and Cummins Creek that would be affected by the reservoir project have been listed as “ecologically significant” stream segments by the TPWD.

8.4.4 Potential Llano County Small In-Channel Check Dams Project

Support is recommended for further study and potential development of small in-channel check dams within existing floodplains in Llano County. Specific locations need to be identified and further analyses are needed for these projects. The USS/RS Subcommittee is interested in gauging local public support and determining actual need for this project before the recommendation process moves forward. The Subcommittee needs additional information for this project.

8.4.5 Potential Llano County Diversion of the Llano River to the Lake Buchanan Project

Support is recommended for further study of the Llano County diversion of the Llano River to Lake Buchanan. Benefits of this reservoir enhancement project include the potential enhancement of lake levels in the Highland Lakes System and potential flood control in Llano County. The original study conducted in the 1950s (which was updated in the early 1990s) indicated this project would not be cost effective. However, recent engineering technology improvements (specifically mentioned were the methods to excavate dolomite) and decreasing the pipeline path length can improve the unit cost of this option. Specific information on local support is also needed for the consideration of this option. The LCRA provided the LCRWPG with a technical memorandum**,** which describes the LCRA’s 1999 Water Management Plan evaluation of increased Highland Lakes water supply available with diversion of water from the Llano River to Lake Buchanan. In this plan, the LCRA determined the firm maximum annual water supply from Highland Lakes (combined firm yield or CFY) during a repeat of the drought of record to be 445,266 ac-ft/yr. The impact of the proposed Llano River diversion canal was determined by recalculating the CFY, as well as the economic merits of the diversion that largely depend on how much additional water supply is made available. However, this analysis did not consider potential water supply improvements. The new CFY of Highland Lakes, incorporating the Llano River diversion, was determined to be 444,695 ac-ft/yr, which is an annual decrease of 571 acre feet (ac-ft). The net loss of water due to the diversion canal occurs in Lake Buchanan because this lake has more evaporative surface area than Lake Travis, where all of the Llano River water would have been stored without the diversion canal.

8.4.6 Clear Creek Potential Reservoir Project

Reservoir Project Opposition is recommended for the potential Clear Creek Reservoir site in Fayette County. Clear Creek is an approximately 8-mile-long tributary of Cummins Creek and is a few miles north of Lake Fayette. There are no official reservoir projects currently under consideration for this creek. However, there has been large local opposition to any reservoir projects in this area at the various LCRWPG public meetings and in correspondence.

8.4.7 Further Study and Potential Development of LCRA Off-Channel Flood Storage Facilities

Support is recommended for further study and potential development of the LCRA off-channel flood storage facilities. Specific locations need to be identified and further analysis is needed, especially regarding impacts to recommended upstream reservoir projects.

8.5 UNRESOLVED ISSUES

While the LCRWPG has been able to reach consensus on a number of strategies and related issues regarding future water supplies for the Lower Colorado Region (Region K), not all issues have been able to be resolved. Other issues have certainly not yet been identified and many more cannot be identified, which are all expected occurrences at this stage of the planning process. Many new issues will come to light during the planning, permitting, construction, and operational phases of the identified water management strategies and resulting projects for Region K. Most of these issues will need to be resolved between the various parties responsible for the development and implementation of selected strategies and affected interests.

The following have been identified as unresolved issues by the LCRWPG:

- There is the possibility that policies and or strategies regarding groundwater in adjacent regions could lead to dewatering portions of the aquifers residing in Region K. The portion of the Carrizo-Wilcox aquifer lying under Bastrop County in Region K and Lee County in Region G has the potential for such a conflict. Excess pumpage in Lee County or Bastrop County could lead to dewatering of the aquifer in Region K, if such pumpage is permitted.
- Region G included a demand of 16,000 acre-feet for Williamson County from Region K in the 2001 Region G Regional Plan. According to HB 1437 of the 76th Texas Legislative Session, no transfer of water may occur unless there is “no net loss” of water to the Colorado River Basin. If Region L fully implements Region K’s regional cooperation plan, all of the available savings from conservation of water in rice irrigation will be allocated to the Region L project. Therefore, to the extent that the “no net loss” is satisfied through conservation of water in the rice irrigation districts, alternative means for satisfying this “no net loss” requirement will need to be identified since the conservation savings will no longer be available for the Region G project. Further work is needed to resolve this potential deficit.

- Much emphasis has been placed on groundwater modeling as the source for reliable data on groundwater availability in the next few years. However, the models have suffered from significant delays and some level of inaccuracy that is being attended to currently. In any event, it will require significant additional effort over a period of years to refine the models and strengthen their capability for evaluating local area issues. Many of the issues identified are of concern on a more local basis, and the localized impacts of groundwater pumpage on existing wells from future production are undeterminable at this time.
- The TWDB Scope of Work initially required TCB to use the Water Availability Model (WAM) Run 3 for this round of regional planning. TWDB later allowed Region K to use a modified version of the WAM Run 3 to model the "No Call" scenario proposed by Region F. The late release of the model by the TCEQ in November 2004 and the subsequent allowed revisions to the WAM allowed by the TWDB impacted not only the initial budget for the planning cycle but also significantly reduced the amount of time that the regional planning group members had to develop a thorough understanding of the modeling effort. While many stakeholders involved in the process expended additional resources in an attempt to verify that the model accurately represented their water usage, this effort was limited by time constraints. The group also recognizes that several technical issues remain unresolved with the underlying WAM that, if resolved, could have impacted the planning process, these issues are discussed in more detail in sections 3.2.1.2.6 and 3.2.1.2.7 in Chapter 3. Examples of issues include but are not limited to the following:

  1. The WAM's representation of a zero firm yield for several reservoirs in the basin
  2. The WAM's approach to modeling environmental flow restrictions on water rights
  3. The naturalized flows used in the WAM
  4. The WAM's incorporation of channel gains and losses
  5. The WAM's treatment (or lack thereof) of "futile call" issues
  6. The WAM's incorporation of existing subordination agreements
  7. The WAM's backup of Austin's steam electric water rights with LCRA stored water
  8. Other technical issues to numerous to elaborate on here
  9. Inconsistencies with how interregional strategies are addressed in the planning cycle relative to application of WAM Run 3

  The Regional Planning Group is also generally concerned that the requirement of a Run 3 WAM is unreasonably restrictive in a 50-year water planning context. Use of this version of model requires full and simultaneous exercise of all water rights in the basin and zero return flows, creating an artificial picture of the anticipated condition of the river basin over the planning period, in particular in the early decades when we know that water rights are not likely to be fully exercised and that return flows will continue to be discharged to the river in significant quantities. This approach then results in artificial shortages for water users and the environment to be identified in the process for which water supply strategies then have to be developed.

  Finally, the complexity of the WAM model is such that it can only be understood by experienced hydrologists and others with a strong technical background related to modeling. Generally, the model does not provide an output format that can be easily understood or visualized by the average regional water planning group member. No calibration curves or other standard hydrology modeling techniques to verify accuracy were provided to the Planning Group to improve confidence. In essence, the strict application of the WAM and the complex nature of its code necessarily require a heavy reliance by the members of the planning group on technical consultants and others with water rights expertise. This has frustrated some planning members who do not feel well enough equipped to challenge the veracity of the technical analysis provided.

- The planning process as it is currently structured does not have a mechanism to plan for and provide water for environmental uses/needs. Healthy bays and flowing rivers are important components of Texas' natural heritage and economy. We should plan for environmental water needs just as we do for municipal, agricultural, industrial and other needs in our state.
- The environmental impacts that developing additional new Colorado River water supplies in the basin will have on the reductions of instream flows and freshwater inflows to the bays and estuaries may be significant. Methods for mitigating and avoiding these impacts on the estuarine and riparian habitats within the Lower Colorado River Basin will be a fundamental consideration for determining the feasibility of such projects prior to their development and implementation. Initial studies are underway to better define these impacts as a part of the LCRA-SAWS agreement, but are not yet complete.
- Another unknown that could potentially add balance to the impacts on the bay and estuarine is the contribution of rice irrigation flood-culture runoff to freshwater inflows to the bay and estuary system. This concept needs additional work and quantification with at least three components to be considered: (1) runoff from flooded fields during rain events, (2) irrigation water drained from flooded fields prior to harvest, and (3) leakage from irrigation delivery systems.
- Concerns have also been expressed regarding the Plan's dependency on conservation to make up much of the available supplies in the future. Region K is dependent upon the success of the implementation of many of the conservation activities that are, in turn, dependent upon funds being made available from the sale of the developed new water supplies. These funds would be used to pay for implementation of additional on-farm and canal system improvements and water-use efficiencies, as well as research aimed at developing rice varieties that use less water and improve yield relative to water use.

APPENDIX 8A

RESOLUTIONS ADOPTED BY THE LCRWPG

RESOLUTIONS ADOPTED BY THE LCRWPG FOR THE 2001 PLAN

These resolutions are included for historical reference.

LOWER COLORADO REGIONAL PLANNING GROUP
RESOLUTION
September 22, 1999

WHEREAS, Senate Bill 1 provides, in part: "Nothing in the initial planning effort shall prevent development of a management plan or project where local or regional needs require action prior to completion of the initial regional plan…";

WHEREAS, many local communities, cities, and utilities have planned for their local water needs for up to a 50-year period and in a manner consistent with accepted water-planning criteria;

WHEREAS, local communities should move forward with meeting and supplying their future water supply needs consistent with the goals of Senate Bill 1;

WHEREAS, local water planning efforts are to be applauded and encouraged by the regional planning group;

BE IT RESOLVED, THEREFORE, that the Lower Colorado Regional Water Planning Group (LCRWPG) confirms that the City of Austin and any other local community should be commended for its planning efforts in securing future water supplies for at least 50 years, and such planning is consistent with the goals of the Senate Bill 1 regional planning process in that local communities are encouraged to plan ahead for their water needs.

9-27-99

John E. Burke, P.E. Chairman — Date
Lower Colorado Regional Water Planning Group

RESOLUTION

WHEREAS, water is a precious commodity; and

WHEREAS, the people of Fayette County have always conserved, managed and protected water with a great deal of respect and feel that conservation of water should be the primary scope of any water plan; and

WHEREAS, the Commissioners Court of Fayette County is opposed of transferring water from Fayette County; and

WHEREAS, we are greatly concerned about the possibility of San Antonio and other cities coming into our region to obtain water or water rights; and

WHEREAS, we are equally appalled by any municipality building a dam or reservoir in Fayette County; and

WHEREAS, the building of such a reservoir would displace many people, decrease the quality of life and diminish our tax base; and

WHEREAS, the people of Fayette County are known for their generosity, but also feel that cities should conserve and look at other areas of water supplies in their own regions before coming to Fayette County; and

WHEREAS, the Commissioners Court is asking the Lower Colorado Regional Water Planning Group to kindly consider this resolution when creating your final water plan for this region.

Passed and approved this 30th day of November, 1999.

Edward F. Janecka, County Judge

Lawrence Adamcik,
Commissioner, Precinct 1

Wilbert Gross
Commissioner, Precinct 3

Gary Weishuhn
Commissioner, Precinct 2

Tom Muras
Commissioner, Precinct 4

ATTEST:

Carolyn Kubos Roberts
Fayette County Clerk

HARLEN BARKER
COUNTY JUDGE

KIM WELLS
DISTRICT AND COUNTY CLERK

ROGER CROCKETT
COMMISSIONER PRECINCT 1

RICKEY LUSTY
COMMISSIONER PRECINCT 2

WAYLAND PERRY
COMMISSIONER PRECINCT 3

ROGER McGEHEE
COMMISSIONER PRECINCT 4

JOHN BENNER
SHERIFF TAX ASSESSOR-COLLECTOR

[illegible] WILLIAMS
[illegible]Y ATTORNEY

COUNTY OF SAN SABA
SAN SABA, TEXAS 76877

GAYLA HAWKINS
COUNTY TREASURER

ROY WALSTON
COUNTY AGENT

CAROLYN McDOWELL
FAMILY & CONSUMER SCIENC

TOM DEAN
JUSTICE OF THE PEACE

GUILFORD L. JONES III
DISTRICT JUDGE

SAM OATMAN
DISTRICT ATTORNEY

JOHN EARL McPHERSON
VETERANS SERVICE OFFICE

RESOLUTION

WHEREAS, water is a precious commodity, the means to sustain life and to enable economic development; and

WHEREAS, the waters of the Colorado River Basin have always been carefully conserved, managed, and protected by the inhabitants of the basin, who have strong opinion and belief that conservation of water should be the primary scope of any water plan; and

WHEREAS, the undersigned Commissioners' Court of San Saba County, which is one of the counties in the Colorado River Basin, is opposed to transferring water from the counties to areas outside of the basin, which effectively transfers our economic opportunity to others; and

WHEREAS, the said Commissioners' Court is concerned about major municipalities outside of the basin coming into the Colorado River Basin to obtain surface and groundwater to the detriment of the inhabitants of the basin when those municipalities have made inadequate efforts to institute water conservation practices to extend the life of their own water supplies or resorted to water projects in their own areas to meet their water needs; and

WHEREAS, the said Commissioners' Court is equally concerned about major outside basin municipalities coming into the Colorado River Basin to construct dams and creating reservoirs to meet their water supply needs; and

WHEREAS, the said Commissioners' Court is concerned about dam and reservoir projects, the construction of which would displace our population, decrease our quality of life, diminish our tax bases, and reduce our economic opportunity, all to the detriment of the citizens of this basin, unless said dams and reservoir projects are done with the support and concurrence of the respective Commissioners' Court; and

BE IT RESOLVED BY THE UNDERSIGNED COMMISSIONERS' COURT that the Lower Colorado Regional Water Planning Group consider this resolution when creating a final water plan for this region, consider the effect of activities that would impact our populations and tax bases, and oppose the construction of water supply projects involving dams and reservoirs for water supply of distant municipalities outside of the basin.

PASSED AND APPROVED this the 10th day of January, 2000.

Harlen Barker
Harlen Barker, County Judge

Roger Crockett
Roger Crockett
Commissioner, Precinct #1

Wayland Perry
Wayland Perry
Commissioner, Precinct #3

Rickey Lusty
Rickey Lusty
Commissioner, Precinct #2

Roger McGehee
Roger McGehee
Commissioner, Precinct #4

Attest: K. Wells
Kim Wells, County Clerk

MILLS COUNTY
JUDGE RANDY WRIGHT
GOLDTHWAITE, TEXAS
PHONE: 915-648-2222
FAX: 915-648-2806

MILLS COUNTY RESOLUTION

WHEREAS, WATER IS A PRECIOUS COMMODITY, THE MEANS TO SUSTAIN LIFE AND TO ENABLE ECONOMIC DEVELOPMENT;

WHEREAS, THE WATERS OF THE COLORADO RIVER BASIN HAVE ALWAYS BEEN CAREFULLY CONSERVED, MANAGED AND PROTECTED BY THE INHABITANTS OF THE BASIN, WHO HAVE STRONG OPINION AND BELIEF THAT CONSERVATION OF WATER SHOULD BE THE PRIMARY SCOPE OF ANY WATER PLAN;

WHEREAS, THE UNDERSIGNED COMMISSIONERS' COURT OF COUNTIES IN THE COLORADO RIVER BASIN ARE OPPOSED TO TRANSFERRING WATER FROM THE COUNTIES TO AREAS OUTSIDE OF THE BASIN, WHICH EFFECTIVELY TRANSFERS OUR ECONOMIC OPPORTUNITY TO OTHERS;

WHEREAS; THE SAID COMMISSIONERS' COURT ARE CONCERNED ABOUT MAJOR MUNICIPALITIES OUTSIDE OF THE BASIN COMING INTO THE COLORADO RIVER BASIN TO OBTAIN SURFACE AND GROUNDWATER TO THE DETRIMENT OF THE INHABITANTS OF THE BASIN WHEN THOSE MUNICIPALITIES HAVE MADE INADEQUATE EFFORTS TO INSTITUTE WATER CONSERVATION PRACTICES TO EXTEND THE LIFE OF THEIR OWN WATER SUPPLIES OF RESORTED TO WATER PROJECTS IN THEIR OWN AREAS TO MEET THEIR WATER NEEDS;

WHEREAS, THE SAID COMMISSIONERS' COURT ARE EQUALLY CONCERNED ABOUT MAJOR OUTSIDE BASIN MUNICIPALITIES COMING INTO THE COLORADO RIVER BASIN TO CONSTRUCT DAMS AND CREATING RESERVOIRS TO MEET THEIR WATER SUPPLY NEEDS;

WHEREAS; THE SAID COMMISSIONERS' COURT ARE CONCERNED ABOUT DAM AND RESERVOIR PROJECTS, THE CONSTRUCTION OF WHICH WOULD DISPLACE OUR POPULATION, DECREASE OUR QUALITY OF LIFE, DIMINISH OUR TAX BASES, AND REDUCE OUR ECONOMIC OPPORTUNITY, ALL TO THE DETRIMENT OF THE CITIZENS OF THIS BASIN, UNLESS SAID DAMS AND RESERVOIR PROJECTS ARE DONE WITH THE SUPPORT AND CONCURRENCE OF THE RESPECTIVE COMMISSIONERS' COURT;

BE IT RESOLVED BT THE UNDERSIGNED COMMISSIONERS' COURTS THAT THE LOWER COLORADO REGIONAL WATER PLANNING GROUP CONSIDER THIS RESOLUTION WHEN CREATING A FINAL WATER PLAN FOR THIS REGION, CONSIDER THE EFFECT OF ACTIVITIES THAT WOULD IMPACT OUR POPULATIONS AND TAX BASES, AND OPPOSE THE CONSTRUCTION OF WATER SUPPLY PROJECTS INVOLVING DAMS AND RESERVOIRS FOR WATER SUPPLY OF DISTANT MUNICIPALITIES OUTSIDE OF THE BASIN.

PASSED AND APPROVED this 10 day of January 2000, by the Commissioners' Court of Mills, Goldthwaite. Beulah Roberts, Mills County Clerk Beulah L Roberts.

COMMISSIONERS COURT MILLS COUNTY

Mills County Judge RANDY WRIGHT Randy Wright	Commissioner Precinct 1 JOE KARNES Joe Karnes	Commissioner Precinct 2 CARROLL BUNTING Carroll Bunting
	Commissioner Precinct 3 Dale Henry Dale Henry	Commissioner Precinct 4 James Miller James R Miller

RESOLUTION

WHEREAS,water is a precious commodity, the means to sustain life and to enable economic deveolpment; and

WHEREAS, the waters of the Colorado River Basin have always been carefully conserved, managed and protected by the inhabitants of the basin, who have strong opinion and belief that conservation of water should be the primary scope of any water plan; and

WHEREAS, the Burnet County Commissioners' Court is opposed to transferring water from the counties to areas outside of the basin, which effectively transfers our economic opportunity to others; and

WHEREAS, Burnet County is concerned about major municipalities outside of the basin coming into the Colorado River Basin to obtain surface and groundwater to the detriment of the inhabitants of the basin when those municipalities have made inadequate efforts to institute water conservation practices to extend the life of their own water supplies or resorted to water projects in their own areas to meet their water needs; and

WHEREAS, THE Burnet County Commissioners' Court is equally concerned about major municipalities outside of the basin coming into the Colorado River Basin to construct dams and creating reservoirs to meet their water supply needs; and

WHEREAS, the said Burnet County Commissioners; Court is concerned about dam and reservoir projects, the construction of which would displace our population, decrease our quality of life, diminish our tax bases, and reduce our economic opportunity, all to the detriment of the citizens of this basin.

BE IT RESOLVED BY THE BURNET COUNTY COMMISSIONERS' COURT that the Lower Colorado Regional Water Planning Group consider this resolution when creating a final water plan for this region, consider the effect of activities that would impact our populations and tax bases, and oppose the construction of water supply projects involving dams and reservoirs for water supply of distant municipalities outside of the basin.

PASSED AND APPROVED this 24th day of January, 2000, by the Burnet County Commissioners' Court.

Martin McLean

Martin McLean
Burnet County Judge

James Holbrook

James Holbrook
Commissioner, Precinct 1

Homer Feild

Homer (Buddy) Feild
Commissioner, Precinct 2

George DeSpain

George DeSpain
Commissioner, Precinct 3

James Oakley

James Oakley
Commissioner, Precinct 4

ATTEST:

Janet Parker

Janet Parker
Burnet County Clerk

City of Goldthwaite Utilities

1218 FISHER STREET – P. O. BOX 450
GOLDTHWAITE, TEXAS 76844
915-648-3186
Electric — Water — Wastewater

City of Goldthwaite Resolution

Whereas, water is a precious commodity, the means to sustain life and to enable economic development;

Whereas, the waters of the Colorado River Basin have always been carefully conserved, managed and protected by the inhabitants of the basin, who have strong opinion and belief that conservation of water should be the primary scope of any water plan;

Whereas, the undersigned City Council of the City of Goldthwaite in the Colorado River Basin are opposed to transferring water from the counties to areas outside of the basin, which effectively transfers our economic opportunity to others;

Whereas, the said City of Goldthwaite/City Council are concerned about major municipalities outside of the basin coming into the Colorado River Basin to obtain surface and groundwater to the detriment of the inhabitants of the basin when those municipalities have made inadequate efforts to institute water conservation practices to extend the life of their own water supplies or resorted to water projects in their own areas to meet their water needs;

Whereas, the said City of Goldthwaite/City Council are equally concerned about major outside basin municipalities coming into the Colorado River Basin to construct dams and creating reservoirs to meet their water supply needs;

Whereas, the said City of Goldthwaite/City Council are concerned about dam and reservoir projects, the construction of which would displace our population, decrease our quality of life, diminish our tax bases, and reduce our economic opportunity, all to the detriment of the citizens of this basin, unless said dams and reservoir projects are done with the support and concurrence of the respective City of Goldthwaite/City Council.

Be it resolved by the undersigned City of Goldthwaite/City Council that the Lower Colorado Regional Water Planning Group consider the resolution when creating a final water plan for this region, consider the effects of activities that would impact our populations and tax bases, and oppose the construction of water supply projects involving dams and reservoirs for water supply of distant municipalities outside of the basin.

PASSED AND APPROVED this 3rd day of February, 2000, by the City Council of the City of Goldthwaite, Richard Poss, Mayor

Mayor Richard Poss	Alderperson Judy Beavers	Alderperson Ramona Flores	Alderperson Jim Landry
Richard Poss	Judy P Beavers	Ramona Flores	Jim Landry
	Alderperson Craig Smith	Alderperson Darrell Wilson	
	Craig Smith	Darrell	

A RESOLUTION OF THE
LOWER COLORADO REGIONAL WATER PLANNING GROUP
REGARDING MINING OF GROUNDWATER

WHEREAS, the Lower Colorado Regional Water Planning Group (hereinafter referred to as "LCRWPG") was appointed and recognized by the Texas Water Development Board in February and March of 1998 as part of the implementation of Senate Bill 1 passed by the Legislature in 1997;

WHEREAS, the LCRWPG is concerned with water resources in the Lower Colorado Region which consists of all or part of fourteen counties in central and south central Texas; and

WHEREAS, resource sustainability is a major concern of the LCRWPG and resource sustainability is also a key factor in the LCRWPG's selection of appropriate water supply strategies; and

WHEREAS, the LCRWPG is concerned regarding the over-utilization of groundwater within its region at rates which could lead to eventual harm in the possible forms of subsidence, drying up of wells, saltwater encroachment, instream flow losses to alluvial aquifers, and cessation of springflows; and

WHEREAS, the LCRWPG has determined that it will not support the over-utilization of groundwater within its region at rates which could lead to eventual harm as discussed above; and

WHEREAS, the LCRWPG has determined that one form of over-utilization which it will not support is the mining of groundwater except during limited periods of extreme drought conditions; and

WHEREAS, for purposes of this Resolution, mining of groundwater is defined as the withdrawal of groundwater from within each aquifer in Region K at an annualized rate exceeding the annualized average recharge rates for each aquifer where the recharge rate can be scientifically derived with reasonable accuracy; and

WHEREAS, the LCRWPG has determined that establishing its position on the mining of groundwater is in the best interest of the LCRWPG; and

NOW THEREFORE, BE IT RESOLVED BY THE LOWER COLORADO REGIONAL WATER PLANNING GROUP THAT:

The above recitals are true and correct; and

The LCRWPG and its consultants will henceforth pursue only those water supply strategies that are consistent with the above recitals thus promoting resource sustainability and the minimization of the mining of groundwater.

PASSED AND APPROVED this 9th day of February, 2000.

John E. Burke, Chairman

ATTEST:

Randy Goss, Secretary

LCRWPG BRUSH CONTROL SUPPORT RESOLUTION

The LCRWPG recommends and endorses studies of brush control projects on a voluntary basis especially west of Interstate 35 for Region "K"; and recommends that State/Federal funds be available for landowner assistance on a pro-rata basis as needed or requested.

Resolution for Lower Colorado Regional Water Planning Group Regarding Local Groundwater Conservation Districts

Whereas, projected population growth in our region indicates that all water resources will need to be efficiently and effectively utilized to provide for the projected demands; and

Whereas, projections of future water supplies from our rivers and lakes can be fairly accurately predicted, but only approximate estimates are available on potential groundwater supplies; and

Whereas, current efforts are being made to investigate potential groundwater supplies, including rates of recharge, effects of mining on the depth of the water table, potential for subsidence, economic consequences of withdrawals and other impacts of exploitation of groundwater supplies; and

Whereas, the full results of these investigations and their validity will not be available in the near term even though they might be useful in the planning process, and while there must be provisions to immediately begin the process of conserving our precious groundwater supplies that are both fair and equitable to all parties; and,

Whereas, the policy of the State of Texas as indicated in previous State Water Plans and reiterated in Senate Bill 1, as well as incorporated into the Texas Water Code, states that local Groundwater Conservation Districts are "... the preferred method of groundwater management."

Whereas, the creation and confirmation of Groundwater Conservation Districts effectively modifies the Rule of Capture Doctrine in Groundwater Conservation Districts and more clearly defines the rights of landowners and production rights of groundwater as a private property right while fostering good stewardship of groundwater resources;

Therefore, the Lower Colorado Regional Water Planning Group resolves to recommend the creation of Groundwater Conservation Districts as soon as possible giving consideration to developing multi county districts, or single county districts with shared management and costs and with consideration to adjacent hydrological impacts, consistent with local control and local political considerations in order that they may provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater and to prevent and control subsidence in their areas of the State consistent with the objectives of Section 59, Article XVI, Texas Constitution, or single county districts with shared management and with consideration to adjacent hydrological impacts.

PASSED AND APPROVED this 9 day of February, 2000.

John Burke, Chairman

Randy Goss, Secretary

Resolution for The Lower Colorado Regional Water Planning Group Regarding Construction of Dams and Reservoirs Upstream from the Highland Lakes (Mills County Resolution)

WHEREAS, water is essential to the residents of Mills County to sustain life, agriculture, and enable economic development.

WHEREAS, this water is not presently available to residents, it is the opinion and belief that surface water collected in the streams from run-off from pastures and fields in Mills County should be detained and stored behind dams in reservoirs built on said streams in Mills County

WHEREAS, the residents of Mills County in their water planning and efforts to provide adequate water for the present and future have determined that ground water is not available or only available in small quantities in a large portion of the county, and whereas several streams and tributaries are located in Mills County, in the Colorado River basin, and with construction of reservoirs and dams, would provide adequate storage of water and economic development for the county and flood control for areas downstream.

WHEREAS, the Lower Colorado Regional Water Planning Group of Senate Bill I, of the 75th Legislature is equally concerned that residents of Mills County and the surrounding area make adequate efforts to extend the life of their own water supplies by construction of dams on streams and creating reservoirs to meet their water supply needs;

Be it resolved by the Lower Colorado Regional Water Planning Group, that this resolution be considered in developing the final water plan for this region and that the Lower Colorado Regional Water Planning Group supports the efforts of the residents of Mills County and adjoining areas to construct water supply projects involving dams and reservoirs for water supply and the construction of pipelines and other facilities related thereto:

PASSED AND APPROVED this 9 day of Feb 2000, by the Lower Colorado Regional Water Planning Group.

John Burke, Chairman

Randy Goss, Secretary

A RESOLUTION of the Lower Colorado Regional Water Planning Group supporting the water appropriation application of the Lower Colorado River Authority to appropriate water of the Colorado River

WHEREAS, the Lower Colorado River Authority has applied to the Texas Natural Resource Conservation Commission for a permit to appropriate any remaining unappropriated flows ("excess flows") of the Lower Colorado River;

WHEREAS, the Lower Colorado River Authority has applied to the Texas Natural Resource Conservation Commission for rights to all unappropriated flood flows of the Lower Colorado River;

WHEREAS, the water appropriated to Lower Colorado River Authority should be designated for use in the Lower Colorado River Authority service area;

WHEREAS, indications are that water supplies in Region K are insufficient to meet all the projected water supply needs of the area;

WHEREAS, the water sought to be appropriated by Lower Colorado River Authority should be available for use in the Lower Colorado River Authority service area to meet those projected needs;

NOW, THEREFORE, BE IT RESOLVED BY THE LOWER COLORADO REGIONAL WATER PLANNING GROUP that:

the Lower Colorado Regional Water Planning Group supports the "excess flows" permit application of the Lower Colorado River Authority;

urges that the Texas Natural Resource Conservation Commission grant the application; and,

the water be designated for use in the Lower Colorado River Authority service area.

PASSED AND APPROVED this 20th day of MARCH, 2000.

LOWER COLORADO REGIONAL WATER PLANNING GROUP

John Burke, Chairman

ATTEST:

Secretary

A RESOLUTION of the Lower Colorado Regional Water Planning Group identifying the guidelines for potential cooperation agreements with the South Central Regional Water Planning Group to provide mutually beneficial solutions to regional water problems

WHEREAS, the Lower Colorado Regional Water Planning Group has identified significant future water shortages within our region,

WHEREAS, it may not be economically feasible for present water users within the region to eliminate the projected future water shortages,

WHEREAS, the South Central Regional Water Planning Group has expressed interest in water supplies from the Lower Colorado Region,

WHEREAS, a cooperative water plan between the Lower Colorado and South Central regions may be beneficial to the citizens of both regions,

WHEREAS, the Lower Colorado and South Central regions have agreed to explore possible cooperative regional water solutions,

NOW, THEREFORE, BE IT RESOLVED BY THE LOWER COLORADO REGIONAL WATER PLANNING GROUP that:

the Lower Colorado Regional Water Planning Group adopts the attached nine conceptual elements as the minimum basis for negotiations with the South Central Regional Water Planning Group concerning potential cooperation agreements to provide mutually beneficial solutions to regional water problems.

PASSED AND APPROVED this the 12th day of April, 2000.

Lower Colorado Regional Water Planning Group

John E. Burke, Chairman

CONCEPTUAL ELEMENTS OF A REGIONAL WATER SOLUTION WITH THE SOUTH CENTRAL REGIONAL WATER PLANNING GROUP

4/12/00

The items noted below are fundamental considerations in any cooperative arrangement between the Lower Colorado Regional Water Planning Group (LCRWPG) and the South Central Regional Water Planning Group (SCRWPG).

I. A cooperative regional water solution shall benefit each region.

Whatever plan is developed for multi-regional cooperation must be more beneficial to each region than would have been the solutions determined independently by each regional planning group for its own region. However, the LCRWPG's first priority is to protect the water resources of the Lower Colorado Regional Planning Area (LCRPA).

II. Lower Colorado Regional Planning Area's (LCRPA) water shortages shall be substantially reduced in exchange for an equitable contribution from the LCRPA to meet the municipal water shortages in the South Central Region.

Sufficient water demand reduction and/or water supply strategies shall be provided to substantially reduce water shortages in the LCRPA. The LCRPA shall make a reasonable contribution toward meeting the South Central Region's municipal water shortages.

III. Proposed actions for interregional water transfers shall have minimal detrimental environmental, social, economic and cultural impacts.

The elements in each regional plan involving export to another region shall have minimal detrimental environmental, social, economic and cultural impacts on both regions. Major on-channel or tributary reservoirs used for export would be considered major detrimental environmental impacts.

IV. Regional water plans with exports of significant water resources shall provide for the improvement of lake recreation and tourism in the Colorado River basin over what would occur without water exports.

Although not a water demand in the regional water plan, lake recreation and tourism is an important economic water use within the LCRPA. If a cooperative multi-regional water plan is developed, it shall result in improved lake recreation and tourism conditions over what would have occurred without water exports to other regions.

V. Each region shall determine its own water management strategies to meet internal water shortages when those strategies involve internal water supplies and/or water demand management.

In any cooperative multiple regional plan, each region shall determine its own combination of water strategies from internal regional sources and/or conservation to meet projected internal water shortages. The decision of what internal resources to use or conservation practices to impose would not be subject to approval by other regions that may be either exporting or importing water from that region.

For example, assume the SCRWPG agreed to recommend a regional water plan that funds strategies for solving irrigation water shortages in order to receive surface water from the Colorado River. It would be at the sole discretion of the LCRWPG to recommend management strategies in the Lower Colorado Regional plan to meet those water shortages. Of course, the LCRWPG decision would be known to the SCRWPG prior to finalizing any cooperative agreement.

VI. Cooperative regional solutions shall include consideration of alternatives to resolve conflicts over groundwater availability.

The LCRWPG has adopted the policy that groundwater availability is limited in Region K to the average annual recharge except either during periods of extreme drought when mining may be allowed or when that recharge cannot be accurately measured. Where recharge is not accurately measured, the LCRWPG has determined that groundwater availability is limited to the maximum projected future local water needs.

In conflict with that policy, the San Antonio Water System (SAWS) has entered into a contract with Alcoa to receive up to 30,000 acre-feet annually from the Simsboro aquifer in Bastrop County. The LCRWPG has determined there is not sufficient groundwater availability to meet Bastrop County year 2050 water needs and the maximum contract amount specified in the SAWS-Alcoa contract.

Several additional considerations complicate the resolution of this conflict. The TWDB rules require all regional plans to comply with water contracts (Section 357.5 (e)(3)). However, hydrogeologic studies indicate that there would be dramatic declines in the local water table if the full 30,000 acre-feet annually is taken from the Bastrop County mine site over the life of the SAWS-Alcoa contract. Recently, SAWS reported that 15,000 acre-feet annually may be a more reasonable amount to withdraw from the CPS site. This amount appears to be more than the annual recharge to the Simsboro Formation used in the Bureau of Economic Geology Report of Investigations No. 256 published in 1999.

This area of conflict needs to be discussed to determine if some agreement is possible that is mutually beneficial to both regional groups. For example, it may be economically feasible to combine the groundwater development in Bastrop County with a larger regional water solution involving surface water. If this occurs then the possibility is open to conjunctively use the groundwater with Colorado River water so that overdrafting of groundwater would occur only during drought years. Such management might still provide the total water needed in the San Antonio region but do so in a manner consistent with the policy adopted by the LCRWPG.

VII. Any water from the Colorado River would not be guaranteed on a permanent basis.

There shall be no permanent sale of Colorado River water outside the basin, including the sale of surface water rights. Potential interbasin surface water transfers from the Colorado River shall be limited to a finite contractual period. Presently the LCRA standard water sale contracts are for 30 years. These contracts may be renewed upon agreement by both parties. Special agreements, such as the recent LCRA-City of Austin water sale, may be for longer periods with renewal options. However, LCRA does not grant permanent water sales to any party. There would be no guarantee that LCRA water would be permanently available to the South Central Region.

Water not provided by the LCRA could be committed for purposes of the LCRWPG regional plan for a period up to the 50 year planning horizon.

VIII. Any water from the Colorado River shall make maximum use of inflows below Austin.

Under current water rights, the LCRA must make maximum use of inflows downstream of the Highland Lakes prior to using stored water from the Lakes. Similarly, any diversion of Colorado River waters should be done as close to the mouth of the river as possible to maximize the use of uncontrolled flood flows. Using these flood flows will minimize use of stored water. Stored water, in the long-term, is needed to meet the future municipal and industrial water demands in the basin, particularly in the Austin area and the Highland Lakes region.

IX. Any water export from the Colorado River shall comply with the LCRA interbasin water transfer policy.

The LCRA Board of Directors has adopted a policy on interbasin water transfers (Policy 501 - Water Resources Management, Section 501.40). This section reads:

501.40 INTERBASIN TRANSFERS

The LCRA opposes any sale of surface water rights for use outside LCRA's water service area. In addition, the LCRA opposes any interbasin transfer of surface water outside the Colorado River basin, unless:

(a) the interbasin transfer is within LCRA's water service area; or

(b) it is demonstrated to the satisfaction of the Board that: (i) the interbasin transfer will not detrimentally affect the public welfare or the interests of LCRA's water service area; (ii) the receiving basin is prudently using and conserving its existing water resources and has aggressively planned and attempted to develop local sources of supply to meet current and future demand with no success; and (iii) the interbasin transfer is not permanent, but is made through a temporary water sales agreement.

The determination of whether an interbasin transfer will detrimentally affect the public welfare or the interests of LCRA's water service area must include, but need not be limited to, consideration of the direct and indirect impacts of the interbasin transfer on the following, both at the time the interbasin transfer is initiated and in the future:

(a) existing water rights and obligations.

(b) LCRA's contractual commitments.

(c) water supplies for environmental purposes and economic activities, including instream flows, inflows to the bays and estuaries, municipal and industrial uses, irrigation, recreation, and tourism.

(d) water quality and aquatic ecosystems in the Highland Lakes, the lower Colorado River basin and associated bays and estuaries, and LCRA's water service area.

Wastewater originating as surface water diverted from the Colorado River basin pursuant to an LCRA water right shall not be reused outside of the Colorado River basin except pursuant to an interbasin transfer permit that expressly authorizes such reuse outside the Colorado River basin.

The LCRWPG is charged with preparing the regional water plan. However, that plan does not obligate political subdivisions to implement its provisions. In fact, Section 357.7(b) of the TWDB rules for SB1 planning prohibits the LCRWPG from recommending water management strategies for political subdivisions if those subdivisions object to the strategies. Any cooperative agreement between LCRWPG and SCRWPG shall recognize that potential cooperation by the LCRA will be contingent on meeting the LCRA interbasin transfer policy.

Resolution by the Lower Colorado Regional Water Planning Group
Acknowledging Austin's Right to Reuse 100 Percent of its Effluent
May 10, 2000

Whereas, the City of Austin was granted rights to use water from the Colorado River for municipal purposes, and those rights do not require the City to return any flow to the River;

Whereas, the City of Austin has developed an integrated water supply plan that depends heavily on increased conservation and use of reclaimed wastewater, and is therefore expanding its Water Reuse Program to help meet projected needs;

Whereas, the Texas Natural Resource Conservation Commission has required the City to engage in water conservation measures including increasing the recycling and reuse of water so that a water supply is made available for future or alternative uses;

Whereas, the Lower Colorado Regional Water Planning Group (LCRWPG) is required to update the Lower Colorado Regional Water Plan every five years and can make appropriate adjustments to Austin's return flow percentage and demand projection accordingly to align the regional plan with local plans;

Whereas, for the purposes of determining the amount of interruptible water available downstream of Austin, the LCRWPG is using the results of the Lower Colorado River Authority's (LCRA's) Response model in which a water balance approach matching water supply and demand is used over a 50-year period;

Be it resolved that the Lower Colorado Regional Water Planning Group acknowledges:

(1) That the assumptions and results of the LCRA's Response Model as used in the Lower Colorado Regional Water Plan are intended for the purposes of projecting interruptible water downstream during the time period of the plan;
(2) That the Model and Plan are not intended to define the water rights of any holder of a certificate of adjudication;
(3) That the model used in the Lower Colorado Regional Water Plan is a dynamic model, and as the City's uses change in the future, the model should reflect the changes in return flow to the Colorado River;
(4) That the Lower Colorado Regional Water Plan and the Response Model reflect the fact that the City of Austin's right to use its full municipal water rights under certificate of adjudication 14-5471A does not require the City to return any amount of water to the Colorado River as long as it is beneficially using that water.

5/10/00

JOHN BURKE, P.E., CHAIRMAN DATE
Lower Colorado Regional Water Planning Group

ATTEST:

Secretary

CITY OF GOLDTHWAITE

RESOLUTION

WHEREAS, the City Council of the City of Goldthwaite desires to be included in the State of Texas Fifty-Year Water Plan, as mandated by Senate Bill 1, and

WHEREAS, the City Council of the City of Goldthwaite recognizes the need for a long-term water plan, statewide, as well as locally, to address future water needs, and

WHEREAS, the City Council of the City of Goldthwaite has reviewed and deliberated the City of Goldthwaite Fifty-Year Water Plan, as prepared by the City Administration, and

WHEREAS, the City of Goldthwaite Fifty-Year Water Plan focuses on the City's needs; it also considers the interests of the Mills County residents, and

WHEREAS, the City Council of the City of Goldthwaite approves and supports the City of Goldthwaite Fifty-Year Water Plan.

THEREFORE, BE IT RESOLVED that the City Council of the City of Goldthwaite does hereby request the City of Goldthwaite Fifty-Year Water Plan be approved by the Lower Colorado Regional Planning Group, Region K, and be submitted as a part of its final water plan recommendation for this region.

PASSED AND APPROVED this 6th day of July, 2000, by the City Council of the City of Goldthwaite, Richard Poss, Mayor.

Richard Poss / Judy Beavers / Frank Bridges

Mayor, Richard Poss — Alderperson, Judy Beavers — Alderperson, Frank Bridges

Ramona Flores / Jim Landry / Darrell

Alderperson, Ramona Flores — Alderperson, Jim Landry — Alderperson, Darrell Wilson

STATE OF TEXAS §
§ **RESOLUTION #071300-01**
COUNTY OF TRAVIS §

BARTON SPRINGS/EDWARDS AQUIFER CONSERVATION DISTRICT RESOLUTION ADDRESSING MANAGEMENT STRATEGIES FOR INCLUSION IN THE LOWER COLORADO REGIONAL WATER PLAN

WHEREAS, the Lower Colorado Regional Water Planning Group's (Region K) planning area includes those portions of Travis and Hays Counties within the Colorado River basin; and,

WHEREAS, Region K has the responsibility to identify water management strategies in the Regional Water Plan to address unmet water needs within their planning area through the 50-year Senate Bill 1 planning horizon until the year 2050; and,

WHEREAS, Region K has identified a 3,594 acre-foot deficit for that portion of Hays County in the rural areas outside of Buda and Dripping Springs' jurisdiction within the Colorado River basin; and,

WHEREAS, that portion of rural Hays County includes the watershed basins of Barton and Onion Creeks which comprise the Contributing Zone and Recharge Zone of the Barton Springs segment of the Edwards Aquifer (BSEA) and portions of the Extended Service Area of the Barton Springs/Edwards Aquifer Conservation District (District); and,

WHEREAS, the District's mandate is to conserve, protect, and enhance the groundwater resources of the BSEA and other groundwater resources located within the District's boundaries and to prevent the waste of groundwater; and,

WHEREAS, the District has the statutory authority to protect rights of owners of interest in groundwater and for the sustainability of this resource as the sole source of drinking water for about 45,000 people, as well as water for agriculture, industry, commerce, and recreation and for the habitat of endangered species; and,

WHEREAS, the District does not support mining of the BSEA. Groundwater models have indicated that current levels of total pumpage can result in dewatering of some areas currently reliant on groundwater and drying of Barton Springs during periods of drought. The District will establish the methodology to be used to determine the carrying capacity and sustainable yield of the BSEA to set a cap on the amount of groundwater that will be permitted to be withdrawn in the future. The District will not permit any additional regulated pumpage withdrawals from the BSEA that when combined with the existing permitted non-exempt pumpage, the estimated withdrawals from exempt pumpage, and the minimum historic springflow that would exceed these pumpage limits; and,

WHEREAS, the BSEA has long been recognized as the Texas drinking water aquifer that is the most vulnerable to contamination. The health of the BSEA depends on the quantity and quality of the water that recharges it, most of which falls inside the Contributing Zone, outside the District boundaries. While the District has no authority over zoning or the subdivision or use of land, inside or outside of its jurisdiction, the District will defend the aquifer against any actions or conditions that might imperil its continued use for these purposes -- including development that occurs in the Contributing and Recharge Zones; and,

WHEREAS, recent scientific studies have confirmed that the aquifer is susceptible to depletion due to drought or overpumping. The District recognizes the adverse impact this may have on exempt and non-exempt well owners, on the base flow of the Colorado River, on the movement of the bad water zone, and on springflow. The District will implement all available management strategies in an effort to preserve groundwater to meet the needs of the well owners and to preserve at least the historic minimum springflow at Barton Springs to retain local control of the groundwater resource and avoid state or federal intervention to enforce the Endangered Species Act. The District also realizes that in times of extreme drought there may be a cessation of springflow even under current accepted management practices. In cases of such extreme nature, groundwater from the aquifer may be used when and to the extent it is necessary to prevent danger to public health, safety, or welfare, and to maintain a subsistence level of water use for agriculture, industry, and commerce utilizing management concepts such as interruptible supply and the prioritization of beneficial groundwater use; and,

NOW THEREFORE, WE, the Board of Directors of the District do hereby resolve that Region K should include the following recommendations as management strategies to meet the identified water shortages in northern Hays County in order to be prepared for drought and to avoid depleting the BSEA, with consideration given to their proactive approach, ease of implementation, and economic feasibility:

1. The District will work cooperatively with the providers of surface water in northern Hays County to make conjunctive sources of water available to those who are otherwise dependent on groundwater. But, the District will oppose extending surface water into sensitive areas where development fostered by this service provision could threaten the continued use of the BSEA as a drinking water source without development controls being established that will cause no measurable or predicted degradation of the water quality from the harmful effects of urban and suburban growth and other land use practices. In general, development east of the Recharge Zone would not be likely to degrade the quality of the BSEA.

   The District supports the Guadalupe-Blanco River Authority I-35 water line from the San Marcos treatment plant to serve areas within northern Hays County east of the Recharge Zone. If this surface water were to be extended onto the Contributing or Recharge Zones, the District would require development controls.

   The District acknowledges the Lower Colorado River Authority's intentions to serve the existing population in those areas of northern Hays County in Dripping Springs currently dependent upon the Trinity aquifer. The District will not support the provision of additional surface water to new developments in the Recharge and Contributing Zones until nondegredation development controls are established following the completion of an Environmental Impact Statement that accurately identifies potential degradation and conservatively evaluates all potential means to mitigate or eliminate potential water quality and source water problems.

Both of these projects are discussed in the District's 1997 Alternative Regional Water Supply Plan.

2. The District supports the increase of recharge of the BSEA in an environmentally and fiscally sound manner. Recharge enhancement projects should be investigated on all of the recharge creeks within the BSEA. Projects on Onion Creek have been studied in the past. These projects can be designed to provide flood mitigation of downstream landowners, could make surface water available in the Contributing Zone and on the western edge of the Recharge Zone -- including the Dripping Springs area, and provide for the increase in the amount of groundwater recharged into the BSEA. Similar development controls would be required by the District for use of any combination surface water/recharge supply project to provide water to new development on the Contributing and Recharge Zones.

   The opportunity exists to create partnerships with private entities and local, state and federal governments to accomplish these projects. Prior to choosing project sites and implementing any recharge enhancement structures, sufficient site assessment must be completed to ensure that the dynamics of the BSEA are understood on that particular site -- prior to the construction of these projects. Flow loss measurements must be determined to calculate the recharge characteristics of the site and groundwater tracing must be done to determine the travel time and direction of enhanced recharge.

   The District supports the study of the feasibility of the proposed Driftwood Dam and Reservoir, or some variation thereof resulting from additional research efforts. Specifically, with the recent acquisition of the Sky Ranch by the City of Austin, the possibility exists to pursue this project in partnership with other interested parties. This project would be constructed west of the Recharge Zone and could serve the multiple purposes described above – flood mitigation, surface water reservoir and recharge enhancement.

   Additionally, the District supports the development of a series of check dams on Onion Creek. These structures would be low profile dams and would be designed to capture storm flows on the Recharge Zone; thereby providing direct recharge into the BSEA.

   Both of these projects were studied in some detail in the District's 1990 Regional Water Plan.

3. The District supports the pursuit of aggressive Education, Conservation, and Planning programs. The District currently has an excellent Education program that explores a variety of outlets to inform the public of vital issues. Avenues including, but not limited to, publications, presentations, community events, and school programs provide meaningful outlets for the District's messages, though the accumulated benefits of these activities are difficult to quantify. This program should be supported to continue its current activities and encouraged to expand into conservation and planning programs. Planning programs seek to establish two-way communication between the District and the community in order to more effectively allocate District resources towards the best management of the resource. Conservation programs seek to implement activities that produce more immediately quantifiable results including, but not limited to, rebates for plumbing retrofits, incentives for drought-tolerant landscaping, and commercial, municipal, and domestic water use audits.

District resources towards the best management of the resource. Conservation programs seek to implement activities that produce more immediately quantifiable results including, but not limited to, rebates for plumbing retrofits, incentives for drought-tolerant landscaping, and commercial, municipal, and domestic water use audits.

4. The District supports the pursuit of the reuse of treated wastewater, if proven safe, to replace the dependency on potable groundwater. The District's primary consideration is that groundwater quality would be protected as treated effluent was used in environmentally sensitive areas. Treated effluent standards identified and recommended by the District -- especially pertaining to inherent viruses, bacteria, nutrients, organic constituents from household chemicals, chlorides, sulfates, dissolved oxygen and the accumulation of heavy metals must be developed. The District should pursue research studies that are designed to develop a true understanding of the ramifications and potential problems associated with treated wastewater reuse. During specific project development, the District would provide expertise and on-site hydrogeologic assessments to ensure that critical recharge features were identified and protected during construction, and in the long-term maintenance of the reuse project. The developer would be encouraged to contribute funding and other in-kind services for the research. Specific research should include timely analysis of the quality of the treated effluent, dye trace studies injected on the site of the project and the collection of baseline water quality data from nearby wells to the reuse site that may potentially be impacted by the project.

5. The District supports the further study of the recirculation of groundwater that was originally examined in the 1997 Alternative Regional Water Supply Plan.

6. The District supports the initiation of a study to examine the feasibility of springflow augmentation as a management strategy to be implemented to preserve minimum springflow during times of extreme drought.

The motion passed with 3 ayes, 0 nays, and 1 abstentions.

PASSED AND APPROVED THIS 13th DAY OF July, 2000.

Craig Smith

Craig Smith, President

ATTESTED BY:

Don Turner

Don Turner, Secretary

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DEC-11-2000 MON 05:02 PM ALAN PLUMMER ASSOCIATES FAX NO. 5124522325 P. 02

Aug-03-00 09:05A C1*v' of Pflugerville 51 ~31 8525 P.02

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF PFLUGERVILLE, TEXAS SUPPORTING PROPOSED LONG-TERM WATER PROJECTS

WHEREAS, The Lower Colorado River Water Planning Group (LCRWPG) is responsible for preparing the regional water plan for Region K as required by Senate Bill 1 of the 1997 Texas Legislature; and

WHEREAS, the LCRWPG requests input from all water providers in the region regarding the providers' long-term water plans; and

WHEREAS, the City of Pflugerville has previously and is currently studying several options to provide water to the households and businesses on the City of Pflugerville water system; NOW THEREFORE

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF PFLUGERVILLE, TEXAS:

That the City Council hereby requests that the following projects being studied are included in the Region K Water Plan.

- Transmitting groundwater from the Carizzo –Wilcox Aquifer,
- Purchasing treated water, off-peak, from the City of Austin and storing it in an aquifer storage and recovery system before distribution, and
- Purchasing surface water from the Colorado River, transmitting it, storing it, and treating it.

APPROVED this 25th of July, 2000

CITY OF PFLUGERVILLE, TEXAS

By:
DOYLE BRIDGEFARMER, MAYOR

ATTEST:

Karen Thompson
KAREN THOMPSON, CITY SECRETARY

07/20/00

RESOLUTION 2000-08-01

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LLANO, TEXAS ADOPTING THE FUTURE WATER COMMITTEE REPORT OF AUGUST 7, 2000 AND THANKING THE COMMITTEE FOR THEIR COMMITMENT TO THIS PROJECT.

NOW, THEREFORE BE IT RESOLVED by the City Council of the City of Llano:

WHEREAS, the future water committee was appointed by the Llano City Council in February of 2000, to explore the facts in order to determine the future water needs of the city; and

WHEREAS, the committee met numerous times to confer with experts to discuss the relevant issues and to produce a report to City Council; and

WHEREAS, this three (3) part report give the City Council and the Regional water Planning Group insight into our local water needs;

NOW THEREFOR BE IT RESOLVED BY THE LLANO CITY COUNCIL that the "Water for the Future Committee Report" of August 7, 2000 is hereby adopted for future reference and that the committee of Richard Arellano, Henry Buttery, Roger Pinckney, Bill Stewart, Taylor Virdell, Sr. and Mark Virdell are heartily thanked for their service to the City. The City Council also acknowledges the assistance of Mike Reagor, Philip Cook and Mark Sherley in developing the report.

PASSED AND APPROVED this the 21st day of August, 2000.

T. Hutto

Terry Hutto, Mayor

ATTEST:

Martha Box

Martha Box, City Secretary

RESOLUTION NO. 2000-17

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a Regional Plan that would become pan of a comprehensive Texas Water Plan; and,

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, the Lower Colorado Regional Water Planning Group (LCRWPG) sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, after almost three years of research and study, the LCPWPG adopted those strategies so as to provide for the region's future water and will forward their Regional Water Plan to the Texas Water Development Board for consideration to be included in the Texas Water Plan;

Now Therefore, be it resolved by the City Council of the City of Burnet, Texas, approves this plan which has been designed to fairly and equitably provide for the future water needs of our area and of the region, and that we support acceptance of the Regional Water Plan by the Texas Water Development Board.

PASSED AND APPROVED this the 28th day of September, 2000.

CITY OF BURNET, TEXAS

Howard R Benton

Howard R. Benton, Mayor

ATTEST:

Joyce Laudenschlager

Joyce Laudenschlager, City Secretary

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

WHEREAS, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

WHEREAS, Region K was designated as one of the sixteen regions mandated to create a Regional Plan that would become part of a comprehensive Texas Water Plan; and,

WHEREAS, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

WHEREAS, the Lower Colorado Regional Water Planning Group (LCRWPG) sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

WHEREAS, after almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their Regional Water Plan to the Texas Water Development Board for consideration to be included in the Texas Water Plan;

NOW, THEREFORE, be it resolved by the Commissioners Court of Fayette County that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the Regional Water Plan by the Texas Water Development Board.

Adopted this 29th day of September, 2000.

Edward F. Janecka
Fayette County Judge

ABSENT
Lawrence Adamcik
Commissioner, Precinct 1

Gary Weishuhn
Commissioner, Precinct 2

Wilbert Gross
Wilbert Gross
Commissioner, Precinct 3

Tom Muras
Commissioner, Precinct 4

RESOLUTION IN SUPPORT OF THE
LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and,

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, The **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, After almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan;**

Whereas, the LCRWPG conclusions with regard to export of water from the basin, particularly the 5,450 acre-feet per year of groundwater from Bastrop County, are just and reasonable, and supported by technical data;

Now Therefore, be it resolved by the Commissioners' Court of the County of Bastrop that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board.

PASSED AND APPROVED this 23rd day of October, 2000, by the Commissioners' Court of the County of Bastrop.

Ronnie McDonald
Ronnie McDonald
Bastrop County Judge

John A. Sanders
John A. Sanders, Commissioner Pct. 1

Charles McKeown, Commissioner Pct. 2

G. L. Hanna
G. L. Hanna, Commissioner Pct. 3

Lee Dildy, Commissioner Pct. 4

ATTEST:

Shirley Wilhelm
Shirley Wilhelm
County Clerk

RESOLUTION NO. 2000-11-02

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan;** and

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, the **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, After almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan;**

Whereas, the LCRWPG conclusions with regard to export of water from the basin, particularly the 5,450 acre-feet per year of groundwater from Bastrop County, are just and reasonable, and supported by technical data;

Now Therefore, be it resolved by the City Council of the City of Elgin that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board.

PASSED and APPROVED this 7th day of November, 2000, by the City Council of the City of Elgin, Texas.

Eric W. Carlson

ERIC W. CARLSON, MAYOR
City of Elgin, Texas

ATTEST:

Shirley Garvel

SHIRLEY GARVEL, City Secretary

RESOLUTION IN SUPPORT OF THE
LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th Legislature passed Senate Bill I in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan;** and,

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Group and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, the **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, after almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Water Development Board for consideration to be included in the **Texas Water Plan;**

Now Therefore, be it resolved by the Commissioners Court of Mills County, Texas, that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board.

PASSED AND APPROVED this 10th day of October 2000, by the Mills County Commissioners' Court.

Randy Wright
Randy Wright, Mills County Judge

FILED FOR RECORD
At 11 O'clock A M
OCT 10 2000 BLR
BUELAH L. ROBERTS
County and District Clerk
Mills County, Texas
By__________Deputy

Joe Karnes, Commissioner Precinct 1

Carroll Bunting
Carroll Bunting, Commissioner Precinct 2

Dale Henry
Dale Henry, Commissioner Precinct 3

James R Miller
James Miller, Commissioner Precinct 4

STATE OF TEXAS §
§ **RESOLUTION #111600-01**
COUNTY OF TRAVIS §

BARTON SPRINGS/EDWARDS AQUIFER CONSERVATION DISTRICTS RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and,

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, the **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, After almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan;**

Now therefore, be it resolved by the Barton Springs/Edwards Aquifer Conservation District, whose jurisdiction includes parts of Travis, Hays, Bastrop and Caldwell Counties, that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board. The District recommends that Region K consider sustainability as the driving criteria for preparing future water plans for Region K.

The motion passed with 4 ayes, and 0 nays.

PASSED AND APPROVED THIS 16th DAY OF Nov, 2000.

Craig Smith
CRAIG SMITH, President

ATTESTED BY:
Don Turner
DON TURNER, Secretary

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

WHEREAS, the 75th Legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

WHEREAS, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and,

WHEREAS, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and

WHEREAS, the **Lower Colorado Regional Water Planning Group** (LCRWPG) sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

WHEREAS, after almost three years of research and study, the **LCRWPG** adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan**;

NOW THEREFORE, be it resolved by the Commissioners Court of Colorado County that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board.

A. G. Jamison
A. G. Jamison, County Judge

Richard Seifert
Richard Seifert, Prct. No. 1

Herbie Helmcamp
Herbie Helmcamp, Prct. No. 2

Tommy Hahn
Tommy Hahn, Prct. No. 3

Darrell Gertson
Darrell Gertson, Prct. No. 4

ATTEST:

Darlene Hayek
Darlene Hayek, County Clerk

AARO

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

WHEREAS, the Austin Area Research Organization (AARO) believes that the region needs a long-term adequate affordable water supply to satisfy municipal, farming and ranching, mining, manufacturing and steam electric demands; and,

WHEREAS, satisfaction of the region's water needs should not deteriorate, but possibly improve the region's ecology; and,

WHEREAS, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

WHEREAS, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and,

WHEREAS, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

WHEREAS, the **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

WHEREAS, after almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan**;

NOW THEREFORE, be it resolved by the Austin Area Research Organization, that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that the members of AARO support acceptance of the **Regional Water Plan** by the Texas Water Development Board.

PASSED AND APPROVED this 13th day of November 2000, by the Austin Area Research Organization.

W. Neal Kocurek

W. Neal Kocurek
President
AARO

AUSTIN AREA RESEARCH ORGANIZATION, INC.
221 WEST SIXTH STREET SUITE 1240, AUSTIN, TEXAS 78701 TELEPHONE 477-4000 FAX 477-5366

CITY OF LAGO VISTA, TEXAS

RESOLUTION 00-975

A RESOLUTION BY THE CITY COUNCIL OF THE CITY OF LAGO VISTA SUPPORTING THE LOWER COLORADO REGIONAL WATER PLAN.

WHEREAS, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years, and,

WHEREAS, Region K was designated as one of the sixteen regions mandated to create a Regional Plan that would become part of a comprehensive Texas Water Plan, and,

WHEREAS, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the lower Colorado River basin, and,

WHEREAS, the Lower Colorado Regional Water Planning Group (LCRWPG) sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply, and,

WHEREAS, after almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their Regional Water Plan to the Texas Water Department Board for consideration to be included in the Texas Water Plan.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LAGO VISTA, TEXAS:

THAT, the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that the City Council the City of Lago Vista, Texas supports acceptance of the Regional Water Plan by the Texas Water Development Board.

AND, IT IS SO RESOLVED.

On a motion by Alderman *Fred Harless*, second by Alderman *Jo Anne Malloy* the above and foregoing resolution was passed and approved this *9th* day of *November* 2000.

Dennis Jones
Dennis Jones, Mayor

ATTEST:

Joyce W. Stapleton
Joyce W. Stapleton, City Secretary

City of Lakeway
Resolution No. 2000-10-16-2

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LAKEWAY SUPPORTING THE LOWER COLORADO REGIONAL WATER PLAN BY THE TEXAS WATER DEVELOPMENT BOARD

WHEREAS, the 75[th] legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years, and;

WHEREAS, Region K was designated as one of the sixteen regions mandated to create a Regional Plan that would become part of a comprehensive Texas Water Plan; and

WHEREAS, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the lower Colorado River basin; and

WHEREAS, the Lower Colorado Regional Water Planning Group (LCRWPG) sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and

WHEREAS, after almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their Regional Water Plan to the Texas Water Development Board for consideration to be included in the Texas Water Plan.

NOW THEREFORE BE IT RESOLVED by the City Council of the City of Lakeway, Travis County, Texas, that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that **we the undersigned support acceptance of the Regional Water Plan by the Texas Water Development Board.**

APPROVED THIS 16[TH] day of OCTOBER, 2000.

Charles A. Edwards, Mayor

CITY OF LAKEWAY SEAL STATE OF TEXAS

Attest:

Cynthia A. Evans

Cynthia A. Evans, City Secretary

NO. R-2000-30

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and,

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, The **Lower Colorado Regional Water Planning Group (LCRWPG)**sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, After almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan;**

Whereas, the LCRWPG conclusions with regard to export of water from the basin, particularly the 5,450 acre-feet per year of groundwater from Bastrop County, are just and reasonable, and supported by technical data;

Now Therefore, be it resolved by the City Council of the City of Bastrop that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board.

PASSED AND APPROVED this 14th day of Nov., 2000, by the City Council of the City of Bastrop Texas.

Tom Scott

Tom Scott
Mayor of Bastrop

ATTEST:

Teresa Miertschin

Teresa Miertschin
Secretary

RESOLUTION

A RESOLUTION of the Lower Colorado Regional Water Planning Group, Region K, stating support for funding for study and evaluation of a proposed desalination project by the Lavaca Regional Water Planning Group, Region P

Whereas, Senate Bill 1 mandates that regional water planning efforts determine the water demands and supplies of each region for the next thirty and fifty years, and develop strategies to address any indicated shortages, and

Whereas, Region L has listed possible sources of needed water supplies in Region K to make up for their anticipated shortage, and

Whereas, Projections for Region K do not indicate surplus future water supplies, and

Whereas, Water from a proposed desalination project in Region P should greatly alleviate the anticipated water shortage in Region L without adversely affecting current water supplies in other regions, Now

Therefore, Be it resolved by the Lower Colorado Regional Water Planning Group that support be indicated for funding by the Texas Water Development Board for a study and evaluation of the proposed Joslin Power Plant to determine the feasibility of providing quantities of desalinated water to San Antonio and/or Corpus Christi.

John Burke, Chairman

Attest: Teresa Lutes, Secretary

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

Whereas, *the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and*

Whereas, *Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and*

Whereas, *Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and*

Whereas, *the **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and*

Whereas, *After almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan;***

Now therefore be it resolved by the Commissioners' Court of Matagorda County *that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board, provided that environmental concerns (i.e.: fresh water inflows into Matagorda Bay are maintained).*

Attest:

Gail Denn, County Clerk

Approved:

Greg B. Westmoreland, County Judge

Mike Pruett, Commissioner Pct. #1

George Deshotels, Commissioner Pct. #2

Leonard Lamar, Commissioner Pct. #3

Percy Carroll, Commissioner Pct. #4

THE COUNTY OF LLANO
LLANO, TEXAS

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and,

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, the **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, after almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan;**

Now Therefore, be it resolved by the Commissioners Court of Llano County, Texas, that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned

PASSED AND APPROVED this 13th day of November, 2000, by the Llano County Commissioners' Court.

J.P. Dodgen, Llano County Judge

Bill Kinney, Commissioner, Precinct 1

Keith Faulkner, Commissioner, Precinct 2

Duane Stueven, Commissioner, Precinct 3

Leon Tucker, Commissioner, Precinct 4

ATTEST:

Bette Sue Hoy, Llano County Clerk

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGION WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and

Whereas, the Lower Colorado Regional Water Planning Group (LCRWPG) sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, after almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan**;

Now Therefore, be it resolved by the Wharton County Commissioners Court of Wharton County that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board..

Signed this 23rd day of October, 2000.

Lawrence E. Naiser
County Judge

Mickey Reynolds
Commissioner, Precinct 1

Philip Miller
Commissioner, Precinct 3

D. C. "Chris" King
Commissioner, Precinct 2

James Kainer
Commissioner, Precinct 4

ATTEST:

Sandra K. Sanders

COMMISSIONERS COURT ★ WHARTON COUNTY ★ S T A X E

RESOLUTION IN SUPPORT OF THE LOWER COLORADO REGIONAL WATER PLAN

Whereas, the 75th legislature passed Senate Bill 1 in 1997 to address the water needs for Texas for the next 50 years; and,

Whereas, Region K was designated as one of the sixteen regions mandated to create a **Regional Plan** that would become part of a comprehensive **Texas Water Plan**; and,

Whereas, Region K was subsequently titled the Lower Colorado Regional Water Planning Area and encompasses all or portions of fourteen counties in the Colorado River Basin; and,

Whereas, The **Lower Colorado Regional Water Planning Group (LCRWPG)** sought and retained expert counsel and authorities to determine the future water needs of the region and to recommend strategies to address possible deficiencies in the water supply; and,

Whereas, After almost three years of research and study, the LCRWPG adopted those strategies so as to provide for the region's future water needs and will forward their **Regional Water Plan** to the Texas Water Development Board for consideration to be included in the **Texas Water Plan;**

Whereas, the LCRWPG conclusions with regard to export of water from the basin, particularly the 5,450 acre-feet per year of groundwater from Bastrop County, are just and reasonable, and supported by technical data;

Now Therefore, be it resolved by the City Council of the City of Smithville that the Plan is designed to fairly and equitably provide for the future water needs of our area and of the region and that we the undersigned support acceptance of the **Regional Water Plan** by the Texas Water Development Board.

PASSED AND APPROVED this 13th day of November, 2000, by the City Council of the City of Smithville, Texas.

Renee D Blaschke

Renee Blaschke
Mayor of Smithville

ATTEST:

Brenda C. Page

Brenda C. Page
Secretary

<u>The Lower Colorado Regional Water Planning Group adopts the following language in the Regional Water Plan:</u>

The proposed four off-channel reservoirs are projected to supply at least 150,000 acre-feet annually when operated under existing, under-utilized LCRA irrigation water rights. This water supply is reduced to 131,000 acre-feet when the diversion restrictions from the Consensus Water Planning Environmental Criteria are applied. It is uncertain whether either of these annual volumes will ultimately be available until permits for the use of these reservoirs can be obtained. Only then will it be known to what extent the use of LCRA's existing under-utilized water rights will be allowed, how much water can be obtained, and to what extent additional mitigation and environmental protection will impact the annual volume of water, which can be made available, if at all.

LCRA has applied to TNRCC for a permit for all remaining unappropriated flows in the lower Colorado River. If LCRA is successful in obtaining a permit for additional, unappropriated water from the lower Colorado River, this water may become part of the supply offered to Region L. Any such new permit would also be subject to mitigation and environmental protection requirements.

The LCRWPG takes the position that any adverse environmental impacts should be identified and mitigated to the extent practicable. To that end, the LCRA and Texas Parks and Wildlife Department are cooperating to determine environmental flow requirements for the lower Colorado and the extent that those requirements can be satisfied through: (1) modification of the LCRA Water Management Plan, (2) special conditions in any new permit obtained, (3) construction and operation of mitigation projects, or (4) by other methods. Further evaluations will be needed to determine appropriate mitigation for the four off-channel reservoirs.

The LCRWPG approves water transfers of up to 150,000 acre-feet to Region L, subject to the supply ultimately determined to be available as a result of developing the four off-channel reservoirs, as well as other permitting, mitigation, and environmental protection requirements yet to be determined.

[This language was adopted by the LCRWPG at the December 13, 2000 board meeting]

RESOLUTIONS ADOPTED BY THE LCRWPG
FOR THIS PLANNING CYCLE (2006 PLAN)

RESOLUTION OF

LOWER COLORADO REGIONAL WATER PLANNING GROUP

SUPPORTING

THE UTILIZATION OF THE REGIONAL AND LOCAL WATER PLANNING PROCESSES BY THE TEXAS GENERAL LAND OFFICE

WHEREAS, the Texas Legislature and the State of Texas have defined a water planning process wherein all water users in the state work with the regional water planning groups and the local groundwater districts to develop plans for the use of the water supplies in the state; and

WHEREAS, Regional Water Planning Groups are organized to: address diverse interest groups; represent all water users; consider best available data; coordinate water availability, water demands, population projections, and water management strategies; and prepare a regional water plan based on a fifty year planning horizon; and

WHEREAS local groundwater districts are the state's preferred method for addressing the planning, protection, and management of groundwater resources in the state as defined in Chapter 36 Texas Water Code and the enabling legislation of the individual Districts; and

WHEREAS, the Legislature of the State of Texas, 75th Session, mandated that all water use strategies affecting the water resources of each region must be considered by the Regional Water Planning Groups in developing a water plan; and

WHEREAS, water use strategies considered by the Regional Water Planning Groups to be viable and appropriate for the region must be incorporated in the regional water plan; and

WHEREAS, a proposal has been made by a group or entity calling itself "Rio Nuevo" to pump groundwater into the Rio Grande or into a pipeline for export or for use somewhere other than the local area; and

WHEREAS, other water marketing entities are considering comparable activities within various Texas Water Planning Regions; and

WHEREAS, the Texas General Land Office is considering the lease or sale of water from lands owned by the people of the State of Texas to one or more water marketing entities who propose to serve market demands and population centers inside and outside of the local Water Planning Regions; and

WHEREAS, it is unclear to what extent the Texas General Land Office has considered the short and long term impacts of the proposed sale or lease on the economy, people, or environment as provided through Regional Water Planning Process; and

WHEREAS, proposals by the Texas General Land Office to lease or sell groundwater from lands owned by the people of the State of Texas have not been adequately presented to local Regional Water Planning Group(s) for consideration and possible incorporation into the Regional Water Plan(s).

NOW, THEREFORE, BE IT RESOLVED that the **LOWER COLORADO REGIONAL WATER PLANNING GROUP** opposes any effort by the Texas General Land Office to lease or sell any groundwater from lands owned by the people of the State of Texas to any entity unless a water use strategy proposing such use of groundwater is first presented to and reviewed by the affected Local Regional Water Planning Group(s) and is subsequently accepted, included, and adopted as part of the local regional water plan(s).

BE IT FURTHER RESOLVED that the General Land Office shall comply with all local groundwater district rules and state-certified groundwater management plans; and

BE IT FURTHER RESOLVED that the responsibility of the Texas General Land Office to the school children of the state of Texas is an important state interest, but that responsibility does not allow the Texas General Land Office to disregard the rights and best interests of other Texans who would be affected by the proposed sale or lease of water.

BE IT FURTHER RESOLVED that all negotiations regarding the sale or lease of water from lands owned by the people of the State of Texas must be conducted in public, with public input and knowledge, and use the competitive bidding process.

BE IT FUTHER RESOLVED that The Honorable Rick Perry, Governor of State of Texas; The Honorable David Dewhurst, Lt. Governor of State of Texas; The Honorable Tom Craddick, Speaker of the House of Representatives are urged to intervene and ask The Honorable Jerry Patterson, Commissioner of the General Land Office to delay further negotiations with any group or entity regarding the sale or lease of water from lands owned by the people of the State of Texas until a thorough study of the impacts of selling or leasing water under lands owned by the people of the State of Texas and controlled by the Texas General Land Office has been conducted.

BE IT FINALLY RESOLVED that the study of the impacts of selling or leasing water should focus on how the pumping, exportation, and importation would affect (1) the environment, (2) the value and use of private lands, (3) the value and use of federal, state, and local public lands, including the lands from which the groundwater is proposed to be withdrawn, (4) ad valorem tax bases, (5) aquifer conditions, depletion, subsidence, and sustainability, (6) local spring flows and well levels, (7) local economies and demographics, (8) cost/benefit analyses for both the importing and exporting Water Planning Regions during the period for which water is proposed to be sold or leased, (10) the availability of feasible and practicable alternative water supplies to the proposed sale or lease, (11) the amount, term, and proposed use of the groundwater proposed to be sold.

Adopted and Resolved by vote of the **Lower Colorado Regional Water Planning Group** on the 28th day of January, 2004.

John Burke, Chairman

Attest: Teresa Lutes, Secretary

RESOLUTION OF THE LOWER COLORADO REGIONAL WATER PLANNING GROUP ASKING THE LOWER COLORADO RIVER AUTHORITY AND SAN ANTONIO WATER SYSTEM TO INCLUDE THE CONJUNCTIVE USE OF GROUNDWATER WITH SURFACE WATER AND STUDYING THE EFFECTS OF THE PROPOSED JOINT SHARING PLAN

WHEREAS, the Lower Colorado River Authority (LCRA) and the San Antonio Water System (SAWS) have entered into a contract to study the environmental and other effects of a plan to transport water from the Colorado River Basin to San Antonio for its municipal uses; and,

WHEREAS, such proposal is known as the Joint Sharing Plan; and,

WHEREAS, the Joint Sharing Plan contemplates that the LCRA will construct a series of off channel storage reservoirs near the Gulf of Mexico in the Colorado River Basin; and,

WHEREAS, the water from the Colorado River will be pumped into the off channel reservoirs under certain flow conditions in the river in order to have water available for San Antonio's use; and,

WHEREAS, the LCRA and SAWS have agreed to study various alternatives to implement the Joint Sharing Plan in a way as to minimize its impacts on the environment of the Colorado River, including the bays and estuaries of the Gulf of Mexico at the mouth of the Colorado River; and,

WHEREAS, one option to implement the Joint Sharing Plan is to conjunctively use groundwater and surface water to maximize in-stream flows in the Colorado River and to maintain the inflow of fresh water into the bays and estuaries in an attempt to minimize the environmental effects of the plan; and,

WHEREAS, an available alternative to help accomplish this goal is for ALCOA to discharge the water it produces from its proposed Three Oaks Mining Project into the Colorado River; and,

WHEREAS, the LCRA has produced a report at the request of the LCRWPG, a copy of which is attached, that summarily examines the conditions under which fresh water inflows into the bays will drop below the Critical Estuarine Inflow (CEI) if the Joint Sharing Plan is implemented; and,

WHEREAS, the number of times that the flow to the estuary drops below the CEI is reduced by over 35% when the ALCOA water is discharged into the river and allowed to flow to the bays and estuaries; and,

WHEREAS, a more detailed study of the conjunctive use of ALCOA produced groundwater and the Colorado River surface water is in the best interest of the region; and, WHEREAS, the Lower Colorado Regional Water Planning Group believes that the LCRA and SAWS study should include an analysis of the conjunctive use of the ALCOA water and the surface water flowing into the bays as a feasible way to implement the Joint Sharing Plan in the most environmentally responsible manner.

NOW, THEREFORE BE IT RESOLVED BY THE LOWER COLORADO REGIONAL PLANNING GROUP THAT:

1. The LCRA and SAWS are hereby asked to include the option of discharging groundwater produced by the proposed ALCOA Three Oaks Mining Project into the Colorado River in order to conjunctively use groundwater and surface water as a means to maximize the in-stream flows of the Colorado River and to minimize the number of times that the flows into the bays and estuaries drops below the Critical Esturine Inflow if the Joint Sharing Plan is implemented.

2. The Chairman of the Lower Colorado Regional Water Planning Group is instructed to send copies of this resolution to the Lower Colorado River Authority, the San Antonio Water System, ALCOA, Inc., and the South Central Texas Regional Water Planning Group (Region L).

PASSED AND APPROVED THIS 14th day of May, 2003.

John Burke, Chair

ATTEST:

Secretary

RESOLUTION OF THE LOWER COLORADO REGIONAL WATER PLANNING GROUP IN SUPPORT OF A GROUND WATER DISTRICT IN BURNET COUNTY

Whereas, Burnet County is located in the Lower Colorado Regional Water Planning Group study area; and,

Where as, there is not presently a ground water district that covers all of Burnet County; and,

Whereas, there exists a need for the existence of a groundwater district that covers the major and minor aquifers of Burnet County; and,

Whereas, there is strong local support for the creation of such a district with Burnet County; and,

Whereas, the members of the Lower Colorado Regional Water Planning Group are in favor of such a district in Burnet County; and,

Whereas, legislation was passed in the 79th legislative session of the Texas legislature which created the Central Texas Groundwater Conservation District;

NOW, THEREFORE, BE IT RESOLVED BY THE MEMBERS OF THE LOWER COLORADO REGIONAL WATER PLANNING GROUP THAT:

1. The Lower Colorado Regional Water Planning Group endorses and supports the creation of a groundwater district that will include all of Burnet County.

2. The chairman of The Lower Colorado Regional water Planning Group is directed to publish this resolution, as necessary or helpful in creation such a district.

PASSED AND APPROVED this 8th day of June, 2005.

John E. Burke, Chairman

ATTEST:

Teresa Lutes, Secretary

LOWER COLORADO REGIONAL WATER PLANNING GROUP

RESOLUTION

Requesting Participation by the Texas Water Development Board in the Groundwater Study for the LCRA/SAWS Water Project

WHEREAS, In 1997 with Senate Bill 1 (SB1) the Texas Legislature recognized the essential need for long range water planning to sustain social and economic viability for Texas by creating basic planning elements, and

WHEREAS, The responsibility for enacting and establishing procedures for this unique "Grass Roots" planning effort was delegated to the Texas Water Development Board (TWDB), and

WHEREAS, To accomplish the letter and spirit of SB1 the TWDB embarked on an unprecedented statewide mission to ascertain the opinions and attitudes of all Texas citizens regarding this planning for our future water supplies, and

WHEREAS, This consummate approach resulted in the establishment of sixteen (16) Regional Planning Groups (RPG) each of which were to address the water issues within their geographic regions with individual water plans, and

WHEREAS, The resulting sixteen (16) Regional Water Plans would then be coordinated and coalesced into a Texas State Water Plan that would assess and address the water needs of the State of Texas and assess and address the strategies needed to accomplish providing for these needs, and

WHEREAS, The projections and strategies formulated in the initial five (5) year planning cycle are now being updated and refined preparatory to being considered for the upcoming 2007 State Water Plan, and

WHEREAS, The Lower Colorado Regional Water Planning Group (Region K) established its distinctive "Nine Points" strategy to provide for Region K future water needs while also augmenting water supplies for the neighboring Region L Water Planning Region, and

WHEREAS, The Lower Colorado River Authority (LCRA) and the San Antonio Water System (SAWS) have subsequently contracted to implement the strategies adopted by both regions provided that the implementation can be accomplished while protecting and benefiting agricultural, environmental, municipal, industrial and other interests in the Colorado River watershed, and

WHEREAS, To determine what effects the project may incur on these interests, individual studies have been initiated, one of which will include the impact on developing certain groundwater resources of the Gulf Coast Aquifer to be available to agricultural interests when sufficient surface water is not available during times of drought, and

WHEREAS, It is essential that the groundwater study accurately and reliably project the consequences of the development and utilization of these water resources on the aquifer water table, on existing wells, on sustainability of future water supplies and on water quality, and

WHEREAS, Detrimental projections can affect whether the project should be undertaken or can indicate the degree of mitigation necessary to respond to harmful effects, and

WHEREAS, Due to the singular importance of the outcome of the Groundwater Study to the LCRA/SAWS Project and consequently to the implementation of the plan, and

WHEREAS, The Texas Water Development Board does have responsibility for an accurate, thorough and, especially, an objective outcome for the study

NOW THEREFORE, BE IT RESOLVED, that the Lower Colorado Regional Water Planning Group respectfully requests that the Texas Water Development Board provide ongoing technical review and feedback of the Gulf Coast Aquifer Groundwater Availability Model being developed for the LCRA/SAWS project. The Goals of such TWDB review and feedback should be to assure the reliability and accuracy of data and methodologies used in the model development as well as to assess the resulting model's sufficiency and predictability for use in future water planning efforts.

BE IT FURTHER RESOLVED, that a copy of this resolution be spread upon the Minutes of the Lower Colorado Regional Water Planning Group as public acknowledgment of this resolution.

PASSED IN REGULAR MEETING, this the 28th day of September, 2005

Attest:

Teresa Lutes, Secretary LCRWPG

Approved:

John Burke, Chairman

Haskell L. Simon, Vice Chairman

APPENDIX 8B

INFORMATION PROVIDED BY THE TPWD, LCRA, BCEN, AND REGION G FOR THE IDENTIFICATION OF ECOLOGICALLY UNIQUE STREAM SEGMENTS IN THE LOWER COLORADO REGIONAL WATER PLANNING AREA

TPWD List of Ecologically Significant Stream Segments

Lower Colorado Regional Water Planning Area (Region K)

Ecologically Unique River and Stream Segments

As a result of the passage of Senate Bill 1 in 1997, water planning in Texas became the domain of regional planning groups rather than the Texas Water Development Board (TWDB). For the Lower Colorado River basin, which extends from Mills County to Matagorda County, the Lower Colorado Regional Water Planning Group (LCRWPG) was established to plan for the next 50 years of water needs within the region. As a part of the planning process, the LCRWPG may include in the adopted regional water plan recommendations for the designation of ecologically unique river and stream segments within the region. In accordance with the TWDB's rules, the following criteria are to be used when recommending a river or stream segment as being of unique ecological value:

- Biological Function: Segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats.

- Hydrologic Function: Segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge;

- Riparian Conservation Areas: Segments which are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes under a governmentally approved conservation plan;

- High Water Quality/Exceptional Aquatic Life/High Aesthetic Value: Segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality; or

- Threatened or Endangered Species/Unique Communities: Sites along segments where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along segments that are significant due to the presence of unique, exemplary, or unusually extensive natural communities.

The Texas legislature can officially designate stream segments as being of unique ecological value following nomination of stream segment by a regional planning group. By so doing, a state agency or political subdivision may not obtain a fee title or an easement that would destroy the unique ecological value of a designated stream. It should be noted that these stream segments do not have to correspond to classified water quality segments.

The Texas Parks and Wildlife Department identified several river and stream segments within the Lower Colorado River basin that are ecologically significant based upon the aforementioned criteria. The following list and tables are streams that satisfy at least one of the criteria defined in Senate Bill 1 (1997) for ecologically unique river and stream segments. An * indicates those segments considered of highest importance by TPWD biologists.

Ecologically Significant River and Stream Segments in the Lower Colorado Regional Water Planning Area

***Barton Creek** - From the confluence with Town Lake in Austin in Travis County upstream to FM 12 in Hays County (TNRCC stream segment 1430)
R. Cons. Area: Zilker Park
Aq. Life: Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
End/Threat: Only known location of Barton Springs salamander[14,17]

Blanco River - From the Blanco/Hays County line to the Blanco/Kendall County line (within TNRCC stream segment 1813)
R. Cons. Area: Blanco State Park
Aq. Life: Overall use[4]

***Bull Creek** - From the confluence with Lake Austin in Austin in Travis County upstream to its headwaters west of Jollyville in north central Travis County
Biol. Function: Nearly pristine stream with a largely intact riparian area
Hydr. Function: Largely intact riparian area functions to reduce downstream flooding
R. Cons. Area: Bull Creek Preserve
Aq. Life: Overall pristine nature lends it a particularly high aesthetic value; Benthic macroinvertebrates[19]; Amphibians[19]
End/Threat: Jollyville Plateau salamander[19]

Cedar Lake Creek (Matagorda County)
R. Cons. Area: San Bernard National Wildlife Refuge; Part of the Great Texas Coastal Birding Trail
End/Threat: Reddish egret, Wood stork, Brown pelican, White-faced ibis[36]

Colorado River - From the Lampasas/San Saba/Mills County line upstream to the Brown/Mills/San Saba County line (within TNRCC stream segments 1409 and 1410)
Biol. Function: Texas Natural Rivers System nominee[10]; White bass spawning area[14]
R. Cons. Area: Colorado Bend State Park
Aq. Life: Exceptional aesthetic value[10]
End/Threat: Concho water snake[13]; Very rare, endemic Texas fawnfoot and one of only four known remaining populations of endemic Texas pimpleback [41]

***Colorado River** - From La Grange in Fayette County upstream to Longhorn Dam in Travis County (TNRCC stream segments 1434 and 1428)
Aq. Life: Overall use[4]
End/Threat: Blue sucker[16]

Colorado River - From a point 1.3 miles downstream of the Missouri-Pacific Railroad in Matagorda County upstream to La Grange in Fayette County (TNRCC stream segment 1402)
    End/Threat: Blue sucker[16]

Colorado River - From the confluence with the Gulf of Mexico in Matagorda County to a point 1 3 miles downstream of the Missouri-Pacific Railroad in Matagorda County (TNRCC stream segment 1401)
    Biol. Function: Unique habitat-Extensive freshwater wetland habitat[14]

Cummins Creek - From the confluence with the Colorado River in Colorado County upstream to SH 159 in Fayette County
    Aq. Life: Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]; Fish[1,3]

Gorman Creek (San Saba County)
    R. Cons. Area: Colorado Bend State Park

Little Barton Creek - From the confluence with Barton Creek three miles southeast of Bee Caves in Travis County upstream to its headwaters four miles east of Shingle Hills in west Travis County
    Aq. Life: Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]

Little Blanco River - From the Blanco/Comal County line upstream to its headwaters near Twin Sisters in the southern part of Blanco County
    Aq. Life: Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]

Oatmeal Creek - From the confluence with the San Gabriel River three miles southeast of Bertram in Burnet County upstream to its headwaters located 6.5 miles southeast of Burnet in east Burnet County
    Aq. Life: Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]

Onion Creek - From the confluence with the Colorado River in Travis County to the most upstream crossing of FM 165 in Blanco County (TNRCC stream segment 1427)
    R. Cons. Area: McKinney Falls State Park
    Aq. Life: Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]

***Pedernales River** - From a point immediately upstream of the confluence of Fall Creek in Travis County to FM 385 in Kimble County (TNRCC stream segment 1414)
    Biol. Function: National Wild and Scenic Rivers System nominee, Significant natural area[10]
    R. Cons. Area: Pedernales Falls State Park; Stonewall Park; LBJ State Park; LBJ National Park
    Aq. Life: Exceptional aesthetic value[10]

***Rocky Creek** - From the confluence with the Lampasas River 0.5 mile northeast of Oakalla in Burnet County upstream to the union of North and South Rocky creeks 4.5 miles southwest of Oakalla in the northeastern corner of Burnet County
    Aq. Life: Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]; Fish[1,3]

Table 3. Streams that meet the riparian conservation area criteria (31 TAC 357.8 (b) (3)).

River or Stream Segment	County	Conservation Area
Barton Creek	Travis	Zilker Park
Blanco River	Blanco	Blanco State Park
Bull Creek	Travis	Bull Creek Preserve
Cedar Lake Creek	Matagorda	San Bernard National Wildlife Refuge; Part of the Great Texas Coastal Birding Trail
Colorado River	San Saba	Colorado Bend State Park
Gorman Creek	San Saba	Colorado Bend State Park
Onion Creek	Travis	McKinney Falls State Park
Pedernales River	Gillespie	Pedernales Falls State Park; Stonewall Park; LBJ State Park; LBJ National Park
San Bernard River	Wharton	Attwater Prairie Chicken NWR

Table 4. Streams that meet the high water quality/exceptional aquatic life/high aesthetic value criteria (31 TAC 357.8 (b) (4)).

River or Stream Segment	County	Significance
Barton Creek	Travis	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Blanco River	Blanco	Overall use[4]
Blanco River	Hays	Overall use[4]
Bull Creek	Travis	Benthic macroinvertebrates[19]; Amphibians[19]; High aesthetic value
Colorado River	San Saba	Exceptional aesthetic value[10]
Colorado River	Mills	Exceptional aesthetic value[10]
Colorado River	Fayette	Overall use[4]
Cummins Creek	Colorado	Ecoregion Stream[1], Benthic macroinvertebrates[1,2], Fish[1,3]
Cummins Creek	Fayette	Ecoregion Stream[1], Benthic macroinvertebrates[1,2], Fish[1,3]
Little Barton Creek	Travis	Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]
Little Blanco River	Blanco	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Oatmeal Creek	Burnet	Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]
Onion Creek	Travis	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Onion Creek	Blanco	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Pedernales River	Travis	Exceptional aesthetic value[10]
Pedernales River	Blanco	Exceptional aesthetic value[10]

Table 3. Streams that meet the riparian conservation area criteria (31 TAC 357.8 (b) (3)).

River or Stream Segment	County	Conservation Area
Barton Creek	Travis	Zilker Park
Blanco River	Blanco	Blanco State Park
Bull Creek	Travis	Bull Creek Preserve
Cedar Lake Creek	Matagorda	San Bernard National Wildlife Refuge; Part of the Great Texas Coastal Birding Trail
Colorado River	San Saba	Colorado Bend State Park
Gorman Creek	San Saba	Colorado Bend State Park
Onion Creek	Travis	McKinney Falls State Park
Pedernales River	Gillespie	Pedernales Falls State Park; Stonewall Park; LBJ State Park; LBJ National Park
San Bernard River	Wharton	Attwater Prairie Chicken NWR

Table 4. Streams that meet the high water quality/exceptional aquatic life/high aesthetic value criteria (31 TAC 357.8 (b) (4)).

River or Stream Segment	County	Significance
Barton Creek	Travis	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Blanco River	Blanco	Overall use[4]
Blanco River	Hays	Overall use[4]
Bull Creek	Travis	Benthic macroinvertebrates[19]; Amphibians[19]; High aesthetic value
Colorado River	San Saba	Exceptional aesthetic value[10]
Colorado River	Mills	Exceptional aesthetic value[10]
Colorado River	Fayette	Overall use[4]
Cummins Creek	Colorado	Ecoregion Stream[1], Benthic macroinvertebrates[1,2], Fish[1,3]
Cummins Creek	Fayette	Ecoregion Stream[1], Benthic macroinvertebrates[1,2], Fish[1,3]
Little Barton Creek	Travis	Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]
Little Blanco River	Blanco	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Oatmeal Creek	Burnet	Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]
Onion Creek	Travis	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Onion Creek	Blanco	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]
Pedernales River	Travis	Exceptional aesthetic value[10]
Pedernales River	Blanco	Exceptional aesthetic value[10]

Pedernales River	Gillespie	Exceptional aesthetic value[10]
Rocky Creek	Burnet	Ecoregion Stream, Dissolved oxygen[1]; Benthic macroinvertebrates[1,2]; Fish[1,3]
Tres Palacios Creek Tidal	Matagorda	Overall use[4]
West Bernard Creek	Wharton	Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]; Fish[1,3]

Table 5. Streams that meet the threatened or endangered species/unique community criteria (31 TAC 357.8 (b) (5)).

River or Stream Segment	County	Significance
Barton Creek	Travis	Only known location of Barton Springs salamander[14,17]
Bull Creek	Travis	Jollyville Plateau salamander[19]
Cedar Lake Creek	Matagorda	Reddish egret, Wood stork, Brown pelican, White-faced ibis[36]
Colorado River	San Saba	Concho water snake[13]; Texas fawnfoot[41]; Texas pimpleback[41]
Colorado River	Mills	Concho water snake[13];Texas fawnfoot[41]; Texas pimpleback[41]
Colorado River	Fayette	Blue sucker[16]
Colorado River	Matagorda	Blue sucker[16]
Colorado River	Fayette	Blue sucker[16]
San Bernard River	Wharton	Unique community-Live Oak-Water Oak-Pecan bottomlands[14]

San Bernard River - From the Wharton/Brazoria County line upstream to the point where the river crosses into Austin County south of New Ulm (within TNRCC stream segment 1302)
R. Cons. Area: Attwater Prairie Chicken National Wildlife Refuge
End/Threat: Unique community-Live Oak-Water Oak-Pecan bottomlands[14]

Tres Palacios Creek Tidal - From the confluence with Tres Palacios Bay in Matagorda County to a point one mile upstream of the confluence of Wilson Creek in Matagorda County (TNRCC stream segment 1501)
Aq. Life: Overall use[4]

West Bernard Creek - From the confluence with the San Bernard River in Wharton County upstream to the FM 2764 crossing in Wharton County
Aq. Life: Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]; Fish[1,3]

Table 1. Lower Colorado River Basin stream segments that meet the biological function criteria (31 TAC 357.8 (b) (1)).

River or Stream Segment	County	Function
Bull Creek	Travis	Nearly pristine stream with a largely intact riparian area
Colorado River	San Saba	Texas Natural Rivers System nominee[10]; White bass spawning area[14]
Colorado River	Mills	Texas Natural Rivers System nominee[10]; White bass spawning area[14]
Pedernales River	Travis	National Wild and Scenic Rivers System nominee. Significant natural area[10]
Pedernales River	Blanco	National Wild and Scenic Rivers System nominee, Significant natural area[10]
Pedernales River	Gillespie	National Wild and Scenic Rivers System nominee. Significant natural area[10]

Table 2. Streams that meet the hydrologic function criteria (31 TAC 357.8 (b) (2)).

River or Stream Segment	County	Function
Bull Creek	Travis	Largely intact riparian area reduces downstream flooding
Colorado River	Matagorda	Unique habitat-Extensive freshwater wetland habitat[14]

San Bernard River - From the Wharton/Brazoria County line upstream to the point where the river crosses into Austin County south of New Ulm (within TNRCC stream segment 1302)
R. Cons. Area: Attwater Prairie Chicken National Wildlife Refuge
End/Threat: Unique community-Live Oak-Water Oak-Pecan bottomlands[14]

Tres Palacios Creek Tidal - From the confluence with Tres Palacios Bay in Matagorda County to a point one mile upstream of the confluence of Wilson Creek in Matagorda County (TNRCC stream segment 1501)
Aq. Life: Overall use[4]

West Bernard Creek - From the confluence with the San Bernard River in Wharton County upstream to the FM 2764 crossing in Wharton County
Aq. Life: Ecoregion Stream[1]; Benthic macroinvertebrates[1,2]; Fish[1,3]

Table 1. Lower Colorado River Basin stream segments that meet the biological function criteria (31 TAC 357.8 (b) (1)).

River or Stream Segment	County	Function
Bull Creek	Travis	Nearly pristine stream with a largely intact riparian area
Colorado River	San Saba	Texas Natural Rivers System nominee[10]; White bass spawning area[14]
Colorado River	Mills	Texas Natural Rivers System nominee[10]; White bass spawning area[14]
Pedernales River	Travis	National Wild and Scenic Rivers System nominee. Significant natural area[10]
Pedernales River	Blanco	National Wild and Scenic Rivers System nominee, Significant natural area[10]
Pedernales River	Gillespie	National Wild and Scenic Rivers System nominee. Significant natural area[10]

Table 2. Streams that meet the hydrologic function criteria (31 TAC 357.8 (b) (2)).

River or Stream Segment	County	Function
Bull Creek	Travis	Largely intact riparian area reduces downstream flooding
Colorado River	Matagorda	Unique habitat-Extensive freshwater wetland habitat[14]

Table 6. Summary table of ecologically significant stream segments in the Lower Colorado River Water Planning Area and the selection criteria

STREAM	COUNTY	BIO FX	HYDRO FX	R CONS AREA	AQ LIFE	THREAT/END
Barton Creek	Travis			X	X	X
Blanco River	Blanco			X	X	
Bull Creek	Travis	X	X	X	X	X
Colorado River	Bastrop				X	
Colorado River	Burnet	X			X	
Colorado River	Fayette				X	
Colorado River	Matagorda	X	X			
Colorado River	Mills					X
Colorado River	San Saba	X		X	X	X
Colorado River	Travis				X	
Cummins Creek	Colorado				X	
Lake Creek	Matagorda			X		
Little Barton Creek	Travis				X	
Little Blanco River	Blanco				X	
Oatmeal Creek	Burnet				X	
Onion Creek	Hays				X	
Pedernales River	Blanco	X		X	X	
Pedernales River	Gillespie	X		X	X	
Pedernales River	Hays	X			X	
Pedernales River	Travis	X			X	
Rocky Creek	Burnet				X	
San Bernard River	Colorado			X		
Tres Palacios Creek Tidal	Matagorda				X	
West Bernard Creek	Wharton				X	

JAN.31.2000 10:52AM LCRA WATER RESOURCES NO.571 P.2/3

THE POWER TO MAKE A DIFFERENCE.

RECEIVED
DEC 1 5 1999
AQUA WATER SUPPLY CORP.

December 14, 1999

Mr. John Burke, P.E.
General Manager
Aqua WSC
P.O. Drawer P
Bastrop, TX 78602

Dear John:

Over the past six months, the Lower Colorado Regional Water Planning Group (LCRWPG) has been soliciting recommendations for stream segments in the LCRWPG planning area which have unique ecological characteristics or would provide unique reservoir sites for future water supplies. The LCRA has reviewed all the stream segments in the lower Colorado River basin to determine if they would be appropriate candidates for such designations. Five stream segments have been identified as being of particular ecological importance:

1. **Cummins Creek** – Unclassified stream segment; from the confluence in Segment 1402 (Colorado River below La Grange) upstream to FM 159,

2. **Colorado River above Lake Buchanan** – TNRCC Segment 1409; from the confluence of Yancey Creek in Burnet/San Saba/Lampasas County upstream to the confluence of the San Saba River in San Saba County,

3. **Llano River** – TNRCC Segment 1415; from the confluence of Johnson Creek in Llano County to County Road 2768 near Castell,

4. **Pedernales River** – TNRCC Segment 1414; from the confluence of Fall Creek in Travis County upstream to Stonewall in Gillespie County, and

5. **Colorado River above La Grange** – TNRCC Segment 1434; from La Grange in Fayette County upstream to FM 969 (Utley) in Bastrop County.

As an element in our evaluations, the LCRA has also considered the consequences of a stream being designated by the LCRWPG as ecologically unique or a unique reservoir site. At this time, the LCRA cannot determine either: (1) the true level of protection that would be afforded by such a designation or (2) the impacts on local property rights.

Our power is distributed to you through our partnership with the following cities and rural electric cooperatives:
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P.O. Box 220 • Austin, TX 78767-0220 • (512) 473-3200 • (512) 473-3298 FAX

Because of these uncertainties, the LCRA will not recommend to the LCRWPG the designation of any stream segment as either ecologically unique or uniquely suited to reservoir development.

It would be erroneous to assume that this recommendation means that the LCRA consider the above five streams or any others not to be ecologically unique and worth protecting. The LCRA considers all parts of the Colorado River and its tributaries as valued riverine ecosystems that should be preserved. Protecting water quality has been one ofLCRA's primary duties since its creation in 1934 and is explicitly part of its legislative mandate. The LCRA will continue its extensive efforts to monitor water quality conditions and actively seek to protect all streams from existing and potential pollution problems.

If I can provide any additional information, please feel free to contact me at 1-800-776-5272, ext. 4064.

Sincerely,

Quentin W. Martin, Ph.D., P.E.
Chief Water Resources Planner

LOWER COLORADO RIVER AUTHORITY

Mar-02-00 15:52 P.01

HICKS COMPANY

ENVIRONMENTAL
ARCHEOLOGICAL
AND PLANNING
CONSULTANTS

FAX Transmittal

DATE: March 2, 2000

TIME:

MESSAGE TO: Jim Barho, 512-756-8591

FIRM:

FAX NO.: 512-756-0247

MESSAGE FROM:

TRANSMITTED BY: Roy Frye

NUMBER OF PAGES INCLUDING COVER PAGE: 3

COMMENTS:

Mr. Barho: This information is transmitted at the behest of Denis Qualls, of the Brazos River Authority. It relates to a section of the Colorado River that is the boundary of Water Planning Regions K and G. This section has been identified as a potential unique stream segment (among 18 others in the Brazos G Region). If you have questions, please call me at 512-478-0858.

1504 West 5th Street, Austin, TX 78703
512-478-0858
FAX 512-474-1849

3.2.5 Colorado River – Lampasas County

This designated river segment begins immediately upstream of the confluence of Yancey Creek in Lampasas County, and proceeds upstream to the Lampasas/Mills County line (See Figures 3-15 and 3-16). This segment is within TNRCC stream segment # 1409, and is approximately 30 river miles in length. This portion of the Colorado River exhibits exceptional beauty, traversing through rolling hills and rugged topography of the Edwards Plateau ecological region[7]. Vegetation adjacent to the river is comprised principally of live oak-juniper parks. Stream corridor vegetation includes pecan, cottonwood, sycamore, elm, hackberry, live oak, greenbriar and poison ivy. Age of vegetation varies from mature to old growth; however the riparian corridor is generally narrow and frequently fragmented and disturbed. Over 150 species of birds have been observed at Colorado Bend State Park, located on the west side of the Colorado River within this segment. Gorman Falls, located on the western bank of the Colorado River, approximately 10 miles above Lake Buchanan, is a 60-foot high waterfall with travertine formations. Water quality within this segment is good. The river channel is diverse with alternating flat water, riffles, pools, and sandbars.

Evaluation Criteria

1) *Biological Function:* Texas Natural Rivers System nominee, white bass spawning area (TPWD[4,5]).

2) *Hydrologic Function:* Insufficient information to confirm significance.

3) *Riparian Conservation Area:* None designated (Note: Although Colorado Bend State Park would qualify, the park is on the west side of the Colorado River and not within the Brazos G RWPA).

4) *High Water Quality/Exceptional Aquatic life/high Aesthetic Value:* Exhibits exceptional beauty and aesthetic value(TPWD[4,5]).

5) *Threatened or Endangered Species/Unique Communities:* Confirmed occurrence of the Concho River water snake which is Federally listed as threatened (TPWD[4,5]).

Mar-02-00 15:52 P.03

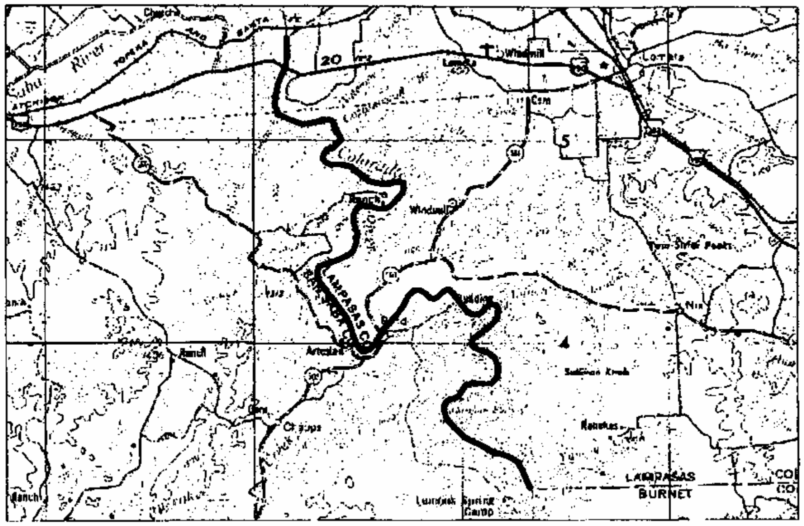

Figure 3-15. Map Location of Colorado River

Figure 3-16. Colorado River

Wednesday, February 16, 2000

To: John Barho
Chairman
Unique Streams Segment Committee
LCRWPG

From: Bob Pickens
Alternate
LCRWPG
Colorado County

Subject: Recommendation for Shaw's Bend Reservoir Site

I would like to recommend the site of Region L's option C-18, Shaw's Bend Reservoir, be recognized as having the following unique sites under our selection criteria of Reparian Conservation, Unique Communities, High Aesthetic Value, and Biologic Function:

1. Fern Hollows and Bluffs
2. Horseshoe Bend Woodland
3. Harvey Creek Woodland

Additionally, this area has numerous pre-historic sites and one historic site, Burnham's Ferry Crossing.

Supporting material for this recommendation is attached and has been excerpted from
"Colorado Coastal Plains Project, Texas
Environmental Inventory and Impact Assessment"
For: U. S. Department of Interior, Bureau of Reclamation, Southwest Region
By: ECS Technical Services, Fort Worth, Texas
April 1985

My apologies for not submitting this sooner, but until Region L grew ominous, it did not seem too relevant since Region K had not focused on it. Therefore, I feel that I would be remiss in my obligation to the landowners at the site if I did not make an attempt to get this information into the records.

Thank you for considering this recommendation.

COLORADO COASTAL PLAINS PROJECT, TEXAS

Environmental Inventory

and

Impact Assessment

(Contract No. 3-CS-50-01650)

Prepared for:

U.S. Department of the Interior
Bureau of Reclamation
Southwest Region

Prepared by:

ECS Technical Services
Fort Worth, Texas

APRIL 1985

George R. High
Project Coordinator

R. John Taylor, Ph.D.
Principal Investigator

William F. Mahler, Ph.D.
Threatened & Endangered
Species Botanist

Elton R. Prewitt
Archeological Research

PROJECT OVERVIEW

The Colorado Coastal Plains Environmental Resources Investigation and Impact Assessment consists of a compilation of data pertaining to vegetation resources, physical features, unique areas, and land use analyses. The report also includes the results of archeological research conducted within a portion of the project area. Project lands include approximately 452,762 acres (707 square miles) within south central Texas. Approximately 210,092 acres lie within proposed reservoir sites from Columbus to Austin. 233,000 acres are within Wharton and Matagorda counties and comprise the Wharton-Matagorda County Land Use Assessment area. Approximately 10,900 acres consist of riverine and first terrace areas along the Colorado River, portions of which are within proposed reservoir sites and the Wharton-Matagorda County Land Use Analysis area.

Investigations of proposed reservoir site lands are organized to address resources which may be impacted by construction and operation of two alternative reservoir systems. Scenarios referred to in text consist of construction of a single dam at Shaws Bend with a conservation pool elevation of 220 feet msl. and a multi-reservoir system consisting of in-channel impoundments extending from Shaws Bend to Austin. Conservation pool elevations of the multi-reservoir system would be 10 to 15 feet above the existing river level.

The report is compiled in the following 10 sections:

1. Introduction and Project Summary
2. Summary of Impacts
3. Regional Setting
4. Vegetation Analyses—Reservoir Site Locations
5. Threatened and Endangered Species Research
6. Vegetation Analyses—Riverine and First Terrace Areas
7. Unique Areas Identification
8. Physical Features and Land Use Analyses
9. Archeological and Historical Sites Analysis
10. Wharton-Matagorda County Land Use Analysis

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SECTION 1

INTRODUCTION

Colorado Coastal Plains Project, Texas

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SECTION 1

1.0 INTRODUCTION AND PROJECT SUMMARY

ECS Technical Services, Inc. has conducted a series of studies to identify and evaluate environmental resources within the Colorado Coastal Plains Project Area, Texas. The study was performed to determine impacts which would result from construction of a single reservoir between Columbus and La Grange and a series of six in-channel reservoirs between Columbus to the vicinity of Austin.

1.1 Project Background

The Bureau of Reclamation is in the preliminary phases of investigation and planning for municipal and industrial (M&I) water supply sources within Texas. The investigation has been conducted as part of a series of steps which originated during the early 1950's and resulted in the preparation of a report entitled: "Water Supply and the Texas Economy". As a result of a favorable reception given to the document, the Agency was requested to initiate studies of all river basins entering the Gulf of Mexico. The results of the investigations, collectively designated as the Texas Basins Project, were reported in February 1965. Subsequently, the 93rd Congress appropriated the necessary funds to initiate the Colorado Coastal Plains investigation. Phase I of the study concluded in 1981 with a status report that recommended more detailed investigations of a dam and reservoir between Columbus and La Grange.

Phase II investigations set into motion steps necessary to: (1) further evaluate and quantify water needs projections, (2) determine if a dam in the La Grange-Columbus vicinity should be recommended for construction, and (3) identify and quantify environmental impacts which could result from construction and operation of such a reservoir.

The Colorado Coastal Plains Environmental Resources Assessment was originally based on the assumption that a single reservoir would be constructed between La Grange and Columbus with the intended dam site to be in the vicinity of Shaws Bend. Based on this assumption, initial studies were conducted to evaluate relative impacts from operation of a conservation pool at 220 feet msl. Work to be performed included analyses of reservoir pool, dam site and surrounding lands to provide detailed analyses of vegetation resources, physical features, unique

Field team members identified areas considered to be unique to the region in terms of social, historic, and ecological significance. The evaluation of unique areas included their relative importance to the region and possible impacts to the area which may result from reservoir construction and operation.

Extensive evaluations were conducted to identify and quantify physical features within alternative reservoir sites and adjacent project lands. Principal land uses were also included as part of the physical features analysis.

Investigations were conducted to determine the vegetation and other resources within the Lower Colorado River Basin from Mansfield Dam to the Gulf of Mexico. The primary objective of the study was to quantify expected impacts which would result from construction and operation of a single reservoir between Columbus and La Grange and construction and operation of a series of six in-channel impoundments from Columbus to near Austin. In-channel reservoirs which were evaluated were: Shaws Bend, La Grange, Wilco, Hills Prairie, Reed Bend, and Webberville. Data were compiled for each reservoir site based on five-foot elevation increments within the following elevations:

Reservoir Scenario	Elevation Parameters (ft. m.s.l.)
Single Impoundment Scenario	
Shaws Bend Dam Site	215 - 240
Multiple Reservoir Scenario	
Shaws Bend Dam Site	200 - 225
La Grange Dam Site	255 - 275
Wilco Dam Site	290 - 315
Hills Prairie Dam Site	330 - 350
Reed Bend Dam Site	350 - 375
Webberville Dam Site	390 - 410

Impacts to vegetation, physical features and land use resources within the project area were quantified based on inundation due to conservation pool operations as well as inundation during 100-year and 500-year flood events. Based on the size and configuration of the Shaws Bend (single impoundment) reservoir, back water effects of flooding were evaluated for 100-year and 500-year events. Backwater effects evaluations for each of the in-channel reservoirs were not considered due to their relative sizes. The following identifies reservoir elevations used for

Each section contains a table of contents and references applicable to the section contents and an abstract delineating the principal findings addressed in the section. The principal investigator (or investigators) responsible for section contents is identified on appropriate section title pages.

1.4 Methodologies and Data Analysis

Methodologies used in the analyses of vegetation resources, physical features, land uses, and archeological investigations included extensive field survey and sampling techniques in conjunction with low altitude and high altitude false-color infrared aerial photography. When possible and appropriate, data were supplemented by published information. Specific methods used in the research are identified in appropriate sections.

Results of field investigations and aerial photography evaluations were used to prepare mylar overlays to 1:24,000 scale U.S.G.S. Topographic Sheets. The overlays were prepared in sets to identify area vegetation communities, physical features, and elevations by five-foot increments within the reservoir study areas; elevations used for 100-year and 500-year flood event analyses for the Shaws Bend single reservoir scenario; riverine and first terrace vegetation resources; and land uses within the Wharton-Matagorda County Land Use Study Area. A listing indicating overlays and corresponding topographic sheets used in project mapping is provided in Appendix B.

The overlays and corresponding topographic maps are provided in Volume II.

SECTION 2

SUMMARY OF IMPACTS

Colorado Coastal Plains Project, Texas

George R. High
Principal Investigator

ABSTRACT

SUMMARY OF IMPACTS

Analyses have been made to determine probable impacts to area vegetation, unique areas, physical features and land uses relative to the construction and operation of a single impoundment at Shaws Bend and a series of in-channel impoundments from Shaws Bend to the vicinity of Austin. The data were compiled by reservoir based on conservation pool operations and flooding resulting from a 100-year and 500-year event.

(Construction and conservation pool operations of a single reservoir at Shaws Bend would create a direct impact to approximately 12,910 acres of forest, pasture, cultivated, and other lands. Construction and operation of a series of in-channel impoundments would create an immediate impact to approximately 6,600 acres of similar lands and approximately 140 acres used for residential purposes.

Construction of a single reservoir at Shaws Bend would inundate (under conservation pool operations) approximately 4,700 acres of bottomland forest and riverine habitat. Impacts expected from a series of reservoirs would total approximately 2,780 acres. Similarly, impacts to tame pasturelands are expected to total more than 3,500 acres under a single reservoir operational concept whereas operation of a series of reservoirs would affect approximately 1,500 acres. No impacts to lands used for residential/urban purposes are expected based on operation of a single reservoir. If a series of reservoirs were constructed, approximately 150 acres would be lost in the vicinity of Webberville. Impacts to other vegetation types and land uses would be relatively similar, regardless of construction scenario.

Additional analyses were performed relative to probable secondary impacts to native and improved pecan orchards. Data indicate maintenance of a water surface above the existing levels will result in an increased ground water table which will kill mature trees. Based on these data, construction of a single reservoir would result in the loss of approximately 2,180 acres of pecan orchard. Construction of a series of reservoirs would destroy approximiately 880 acres of orchards.

Analyses pertaining to unique areas indicate construction and operation of a single reservoir at Shaws Bend would adversely impact Harvey Creek and Horseshoe Bends

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SECTION 2

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2.0 SUMMARY OF IMPACTS

Construction and operation of a reservoir or series of reservoirs within the Colorado Coastal Plains Project area would result in adverse impacts to various natural and man-made resources within the region. The severity of impacts would be contingent on the size of reservoir constructed and lands flooded. Therefore, the following summary of impacts has been developed to address the effects of construction of a single reservoir at Shaws Bend or a series of six in-channel impoundments extending from Shaws Bend to the vicinity of Austin. Anticipated impacts have been tabulated based on reservoir waters at the following elevations:

Shaws Reservoir Scenario:

	Elevations msl		
	Conservation Pool	100-year Flood	500-year Flood
Shaws Bend	220	222-295*	223-297*

Multi-Reservoir Scenario:

Reservoir	Conservation Pool	100-year Flood	500-year Flood
Shaws Bend	200	210	225
La Grange	255	265	275
Wilco	290	300	315
Hills Prairie	330	340	350
Reed Bend	350	360	375
Webberville	390	400	410

* Variable, due to backwater effect (preliminary analysis)

Acreage totals used in the summary have been tabulated to identify lands (and resources) effected under each operational concept for the single reservoir scenario at Shaws Bend as well as a composite of reservoirs for the multi-reservoir scenario. Total water surface acreages for both scenarios are as follows:

TABLE 2-1

VEGETATION COMMUNITY ACREAGES BY H.E.P. COVER TYPE CATEGORY

Direct Impacts Based on Operation of a Single Reservoir at Shaws Bend
Colorado Coastal Plains Project, Texas

Map Unit	H.E.P. Cover Type/ Community	Conservation Pool Acres	%	100-yr Flood Event Acres	%	500-yr Flood Event Acres	%
	Pecan, Cottonwood, Sycamore, Elm, Willow						
50	Improved Variety Pecan Orchard	287	6.1	430	4.9	444	4.9
51	Native Pecan Orchard	1,273	27.1	1,339	15.2	1,358	14.9
52	Planted Fruit Orchard	0	0	0	0	0	0
60	Cottonwood Bottomlands	757	16.1	757	8.6	758	8.3
61	Elm-Ash-Hackberry	1,707	36.3	5,079	57.6	5,307	58.3
63	Willow Bottomlands	557	11.9	943	10.7	959	10.5
67	Elm Woodlands	112	2.4	268	3.0	280	3.1
69	Sycamore Bottomlands	4	0.1	4	< 0.1	4	< 0.1
	Total H.E.P. Cover Type	4,697		8,820		9,110	
	Live Oak, Post Oak, Water Oak, Yaupon, Pine						
62	Oak-Juniper Forest	170	92.4	213	55.6	231	54.8
65	Oak-Yaupon Forest	0	0	83	21.7	84	20.0
66	Oak-Hickory Forest	14	7.6	25	6.5	26	6.2
74	Yaupon Thickets	0	0	23	6.0	24	5.7
80	Pine Forest	0	0	0	0	0	0
81	Pine-Oak Forest	0	0	39	10.2	56	13.3
	Total H.E.P. Cover Type	184		383		421	
	Savannah						
41	Pasture with Trees	1,170	100.0	4,000	100.0	4,246	100.0
	Native Grassland						
71	Native Prairie	0	0	0	0	0	0

TABLE 2-2

VEGETATION COMMUNITY ACREAGES BY H.E.P. COVER TYPE CATEGORY

Direct Impacts Based on Operation of a Multiple Reservoir System
Colorado Coastal Plains Project, Texas

Map Unit	H.E.P. Cover Type/ Community	Conservation Pool Acres	Conservation Pool %	100-yr Flood Event Acres	100-yr Flood Event %	500-yr Flood Event Acres	500-yr Flood Event %
	Pecan, Cottonwood, Sycamore, Elm, Willow						
50	Improved Variety Pecan Orchard	57	2.0	167	3.5	1,701	13.9
51	Native Pecan Orchard	94	3.4	712	14.7	2,588	21.1
52	Planted Fruit Orchard	0	0	0	0	0	0
60	Cottonwood Bottomlands	137	4.9	354	7.3	793	6.5
61	Elm-Ash-Hackberry	1,816	65.2	2,675	55.2	5,798	47.3
63	Willow Bottomlands	665	23.9	913	18.9	1,220	9.9
67	Elm Forest	16	0.6	21	0.4	151	1.2
69	Sycamore Bottomlands	0	0	0	0	8	0.1
	Total H.E.P. Cover Type	2,785		4,842		12,259	
	Live Oak, Post Oak, Water Oak, Yaupon, Pine						
62	Oak-Juniper Forest	22	46.8	31	45.5	309	62.5
65	Oak-Yaupon Forest	25	53.2	27	37.9	51	10.3
66	Oak-Hickory Forest	0	0	9	13.6	67	13.5
74	Yaupon Thickets	0	0	0	0	0	0
80	Pine Forest	0	0	0	0	0	0
81	Pine-Oak Forest	< 1	0	2	3.0	68	13.7
	Total H.E.P. Cover Type	47		69		495	
	Savannah						
41	Pasture with Trees	1,161	100.0	3,148	100.0	8,756	100.00
	Native Grassland						
71	Native Prairie	0	0	0	0	0	0

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tabulated by five-foot increment for each reservoir and are provided in Appendix C. All vegetation categories have been organized by Habitat Evaluation Procedure (H.E.P.) cover type.

2.1.1 Conservation Pool Impacts

Data indicate normal conservation pool operations of a single impoundment at Shaws Bend would be more detrimental to wooded bottomland communities than those of a multi-reservoir system. Overall impacts to the pecan, cottonwood, sycamore, elm, and willow Cover Type would result in the inundation of approximately 4,700 acres if a single impoundment were constructed. Impacts resulting from a multi-reservoir impoundment would result in the loss of approximately 2,780 acres of habitat. Similarly, construction and operation of a single reservoir at Shaws Bend would directly impact approximately 3,590 acres of tame pasture, whereas, the multi-reservoir impacts would total approximately 1,520 acres. Although impacts to upland vegetation communities would be minimal regardless of reservoir alternative, approximately four times as much oak, yaupon, juniper habitat would be taken as a result of single reservoir conservation pool operations. Impacts to area agricultural (cultivated) lands have been evaluated to determine expected losses under both construction alternative. Data indicate approximately 2,840 acres of cultivated land would be lost due to conservation pool operations at Shaws Bend. Anticipated impacts to cultivated lands under the multiple reservoir scenario would be approximately 590 acres. Significant impacts to urban and built-up lands would be incurred as a result of construction and operation of a series of reservoirs within the project area. Based on conservation pool operations of a series of reservoirs, approximately 147 acres of lands, primarily used for residential purposes, would be inundated. Principal impacts would be in the vicinity of Webberville where relatively light density housing is located within the proposed dam construction site. Impacts to other lands within the proposed reservoir sites would be similar, regardless of construction alternative.

TABLE 2-3

VEGETATION COMMUNITY IMPACTS
(in acres)

Resulting from Conservation Pool Operations
Single and Multiple Reservoir Alternatives
Colorado Coastal Plains Project, Texas

HEP/Community	Map Unit	Reservoir Alternative Single	Multiple
Pecan, Cottonwood, Sycamore, Elm, Willow			
Improved Variety Pecan Orchards	50	287	57
Native Pecan Orchards	51	1,273	94
Fruit Orchards	52	0	0
Cottonwood Bottomlands	60	757	137
Elm-Ash-Hackberry Forest	61	1,707	1,816
Willow Bottomlands	63	557	665
Elm Bottomlands	67	112	16
Sycamore Bottomlands	69	4	0
Total Cover Type		4,697	2,785
Live Oak, Post Oak, Water Oak, Yaupon, Pine			
Oak-Juniper Forest	62	170	22
Oak-Yaupon Forest	65	0	25
Oak-Hickory Forest	66	14	0
Yaupon Thickets	74	0	0
Pine Forest	80	0	0
Pine-Oak Forest	81	0	< 1
Total Cover Type		184	47
Savannah			
Pasture with Scattered Trees	41	1,170	1,161
Native Grassland			
Native Tall-grass Prairie	71	0	0
Tame Pasture			
Tame Pasture (maintained)	40	3,106	904
Pasture with Shrubs	42	330	287
Pasture with Forbs	44	155	330
Total Cover Type		3,591	1,521

The following estimates have been made based on direct and secondary impacts expected from conservation pool operations. Secondary impacts represent acreages located five feet and below conservation pool operations.

Direct and Secondary Impacts to
Pecan Orchards (in acres)

Single Reservoir Alternative (Shaws Bend):

Immediate Impacts	Secondary Impacts	Total
1,560	581	2,141

Multiple Reservoir Alternative:

Immediate Impacts	Secondary Impacts	Total
151	319	470

The analysis of secondary impacts has been based on data provided in Appendix C and does not differentiate recently planted orchards (of immature trees) from mature improved variety orchards. The lack of differentiation is based on the assumption that all identified orchards will reach maturity during or prior to reservoir completion.

Construction of either reservoir scenario would prove beneficial to regional ecological resources. Much of the area designated as reservoir land is relatively flat and water depths during conservation pool operations would be less than five feet. As a result, much of the project area would become a littoral environment with large near-shore areas of shallow water. Similarily, wetland habitat within remnant ox-bow lakes and other low areas would be flooded as backwater sloughs. Construction of a single impoundment at Shaws Bend would create approximately 118 miles of shoreline during conservation pool operations. Conservation pool operations for the multi-reservoir scenario would create approximately 280 miles of shoreline.

Additional beneficial impacts would result from inundation of numerous acres of nonproductive (barren) soils located along the river. River margin

2.2 Threatened and Endangered Species

Investigations have been conducted to determine the presence of endangered and threatened plant species which could be impacted by reservoir construction or operation. Herbaria and literature data indicate the following taxa to possibly be within the Colorado Coastal Plains Reservoir areas:

Amsonia repens Shinners
Eleocharis austrotexana Johnston
Hymenoxys texana (Coulter & Rose) Cockerell
Spiranthes parksii Correll
Thalictrum texanum (Gray) Small

Field investigations, conducted for Spiranthes parksii and Thalictrum texanum, provided negative results. Based on habitat within known populations of S. parksii, project lands were found to be edaphically different from those required to support the species. Soils within known populations are generally absent of limestone substrata, common throughout upland areas of the project site.

Although field studies were conducted to determine the presence of T. texauum, lack of information pertaining to habitat requirements, range and distribution and the presence of viable populations elsewhere, resulted in inconclusive findings pertaining to the possible presence in the project area. Recent collection records and herbaria data indicate the species to be adapted to either a prairie environment or an oak forest habitat with an understory of shrubs and grasses. Based on available habitat descriptions, the species may be located within areas along floodplain margins or within oak woodlands. Therefore, it is recommended that thorough field investigations be conducted following selection of reservoir construction alternative. If a single reservoir were to be constructed at Shaws Bend, detailed investigations should be performed at the proposed dam site (including adjacent upland areas which would be impacted) and within lands which would be impacted by conservation pool operations. If the multiple reservoir scenario is selected, investigations should be conducted at each proposed dam location. Based on previously completed field investigations and vegetation/habitat mapping, 4,945 acres of oak forest and prairie environments are within the Shaws

Impacts due to extreme flooding under each reservoir alternative would be inconsequential. Analyses performed by Prewitt & Associates (consulting archeologists) indicate mitigative actions would be warranted, should reservoir construction be initiated.

Other unique areas within the region would be uneffected by reservoir construction as both Camp Lone Star and the Red Bluffs are above maximum flood elevations. Some undeveloped river frontage owned by Camp Lone Star would be inundated if reservoir levels reached 230 to 240 feet during flood conditions.

2.4 Physical Features and Land Use

Construction and operation of a single reservoir at Shaws Bend or a series of reservoirs from Shaws Bend to the vicinity of Austin will effect physical features within the region. The degree of severity of impacts is largely contingent upon location relative to proposed dam sites and areas which would be inundated under conservation pool and flood conditions. Physical features and land uses which have been identified within the project area are:

- Electrical Facilities
    - High Voltage Electrical Lines
    - Utility Trunk Lines
    - Utility End Users
- Oil and Gas Wells (including proposed well locations)
- Transportation Network
    - Public Roads and Highways
    - Private Roads and Trails
    - Railroads
    - Petroleum Pipelines

TABLE 2-4

PHYSICAL FEATURES IMPACT ANALYSIS

Direct Impacts Based on Operation of a Single Reservoir at Shaws Bend
Colorado Coastal Plains Project, Texas

	Conservation Pool	100-year Flood Event	500-year Flood Event
Land Use Analyses (acres)			
Upland Agricultural	738	5,141	5,526
Bottomland Agricultural	12,065	33,804	39,011
Urban/Residential	0	12	20
Commercial/Industrial	0	0	0
Gravel Excavation (active)	110	485	533
Gravel Excavation (inactive)	0	50	72
Total Acres	12,913	39,492	45,162
Oil and Gas Production (wells)			
Proposed Well Location	0	17	18
Abandoned Well Location	1	1	1
Dry Hole	0	10	10
Oil Well (producing)	0	49	55
Gas Well (producing)	0	0	0
Abandoned Oil Well	0	2	4
Transportation Network (miles)			
Public Roads and Highways	0.20	12.43	16.37
Private Roads and Trails	75.20	139.59	157.21
Railroads	0	2.20	2.64
Petroleum Pipelines	0.86	20.37	25.25
Electrical Facilities			
High Voltage Lines (miles)	0.20	5.19	6.97
Utility Trunk Lines (miles)	8.50	43.38	53.10
End Users	9	164	203
Structures			
Residential	6	63	65
Non-residential	21	226	251
Total	27	289	316

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2.4.1 Electrical Facilities

Construction and operation of a dam at the proposed Shaws Bend location would result in adverse impacts to two high voltage lines. The severity of impact would be dependant upon the intended conservation pool elevation selected for operations. Construction and operation of a reservoir at Shaws Bend with a conservation pool elevation at 220 feet msl would result in minimal impacts to the right-of-way of the 345 kv LCRA line which crosses the river near Mullins Prairie. Operation of a series of reservoirs from Shaws Bend to the vicinity of Austin would impact a total of 0.92 miles of right-of-way, most of which consists of existing river surface.

Impacts during flood conditions would be substantially greater under the single reservoir scenario than would occur as a result of construction of a series of reservoirs during a 100-year flood event and nearly equal during a 500-year flood event. Lines which would receive the greatest impact during flood conditions are associated with a single reservoir at Shaws Bend are the 345 kv line through Mullins Prairie and the 138 kv line which serves the LCRA pump station near Ellinger. Impacts to the LCRA pump station would be minimal. Potential impacts to line rights-of-way have been evaluated based on 100-year and 500-year flood events. Construction of an impoundment at La Grange would inundate as much as 10,250 linear feet of 69 kv line right-of-way northwest of the city (based on 500-year flood elevations). During normal conservation pool operations, approximately 1,625 feet of right-of-way would be inundated.

Operations of the Wilco Reservoir at Smithville would result in the maximum inundation of approximately 11,000 linear feet of 69 kv line rights-of-way north of the city. Additionally, the BBEC substation at the site could be adversely effected as the elevation at the site is approximately 312 feet msl. During normal conservation pool elevations, approximately 1,200 linear feet of rights-of-way would be inundated and the substation would not be effected.

greater if a multiple reservoir system were constructed than would occur under a single reservoir alternative.

2.4.3 Transportation Network

Data indicate reservoir construction and operation would have a minimal effect on roads crossing the Colorado River, regardless of construction alternative. River bridges at Columbus, La Grange, Smithville, Utley and Del Valle are of sufficient height to preclude flooding by conservation pool operations.

Construction and operation of a large dam at the proposed Shaws Bend location would inundate a minimum of 75.20 miles of private roads and trails if the water surface were at 220 feet elevation (conservation pool elevation). Construction of a series of reservoirs would impact approximately four miles of private roads and trails. Comparison of data relative to flood conditions indicates a 100-year flood will have a substantially greater impact under the single reservoir alternative than would occur under the multiple reservoir concept. Conversely, a 500-year flood would create greater impacts under the multiple reservoir scenario.

Data indicate area railroads would be generally uneffected by reservoir construction and operation with the possible exception of the Missouri-Kansas-Texas Railroad which crosses Hills Prairie near Bastrop. Conservation pool operations of a single reservoir at Shaws Bend would not impact area railroads. If a multiple reservoir system were constructed, 0.31 miles of right-of-way would be impacted. During flood conditions, backwater effects from the Shaws Bend Dam (single reservoir alternative) would impact as much as 2.64 miles of right-of-way. Impacts under similar conditions for the multiple reservoir system would be less than two miles.

Construction and operation of a dam at the Shaws Bend location would require the relocation of numerous pipelines within the project site and within the general project area. Lines which cross the proposed reservoir site or those which would be directly effected by construction would during a 500-year flood event. Reservoir operations at other elevations would have little or no effect on the lines. Under maximum flood conditions, approximately two linear miles of a 16-inch Phillips gas line would be inundated by the La Grange Reservoir.

Construction of the La Grange Reservoir would similarly inundate portions of a 16-inch Intertex line during 100-year and 500-year flood events. Inundation would be minimal and would impact less than two linear miles of right-of-way.

Construction and operation of the Wilco Dam would result in the inundation of as much as 4,000 linear feet of Valero Marketing Company gas lines during extreme flood conditions. The line is located northeast of Smithville. A 12-inch Valero Marketing Company gas line which crosses the river between Utley and Webberville. During 500-year flood event conditions, approximately 800 linear feet of line right-of-way would be inundated.

Reservoir construction or operations would not significantly effect other pipeline rights-of-way.

2.4.4 Land Use

Gross analyses of land uses indicate construction and conservation pool operations of a single reservoir at Shaws Bend will impact approximately twice as much agricultural bottomland area as would be impacted by a multiple reservoir system. Impacts to upland agricultural uses under the single reservoir concept would be almost four times those of the multiple reservoir system. Severe impacts to residential/urban land uses would result from construction of a multiple reservoir system. Major areas affected are associated with the Webberville Reservoir in which dam construction and operations would take approximately 110 acres.

Flood condition evaluations for a 100-year event indicate substantially higher impacts would be expected to agricultural bottomland and

TABLE 2-6

RELATIVE IMPACT SEVERITY BY CONSTRUCTION SCENARIO

	Conservation Pool		100-year Flood		500-year Flood	
	Single Reservoir	Multiple Reservoir	Single Reservoir	Multiple Reservoir	Single Reservoir	Multiple Reservoir
HEP Cover Type						
Bottomland Forest	6	4	6	4	4	6
Upland Forest	8	2	8	2	5	5
Savannah	5	5	6	4	3	7
Native Grasslands	0	0	0	0	0	0
Maintained Pasture	7	3	7	3	5	5
Cultivated (cropland)	8	2	7	3	5	5
Mesquite-Huisache Grassland	9	1	8	2	6	4
Urban, Built-up Areas	0	10	1	9	1	9
Nonclassified Lands	4	6	5	5	3	7
Cover Type Summary	47	33	48	32	32	48
Land Use and Principal Physical Features						
Land Use						
Upland Agricultural	8	2	9	1	7	3
Bottomland Agricultural	7	3	7	3	4	6
Urban/Residential	0	10	1	9	1	9
Commercial/Industrial	0	0	0	10	0	10
Gravel Excavation Sites	4	6	5	5	3	7
Land Use Summary	19	21	22	28	15	35
Oil and Gas Production	0	10	8	2	7	3

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if a single reservoir were constructed. Conversely, greater impacts to commercial/industrial and residential lands would be expected if a multiple reservoir system were in place. All other land use categories and physical features would be impacted to a relatively similar degree, regardless of reservoir scenario.

SECTION 5

THREATENED AND ENDANGERED SPECIES RESEARCH

Colorado Coastal Plains Project, Texas

William F. Mahler, Ph.D.
Principal Investigator

ABSTRACT

THREATENED AND ENDANGERED SPECIES RESEARCH

Investigations were conducted to determine the presence of endangered or threatened plant species within the area. As a result of herbaria and literature analyses, five taxa were identified as potentially within project areas which would be impacted by construction and operation of reservoirs between Columbus and Austin. Those taxa included in the analysis were:

Amsonia repens Shinners
Eleocharis austrotexana Johnson
Hymenoxys texana (Coulter & Rose) Cockerell
Spiranthes parksii Correll
Thalicutrum texanum (Gray) Small

Initial data indicated suitable habitat appeared to be available to support S. parksii and T. texanum and field investigations were conducted to provide additional data. Based on herbaria records and literature, the project area is not suitable to support the other species.

Spiranthes parksii is an endangered species, endemic to open oak and juniper woodlands and populations have been found in the vicinity of Bryan, Texas and elsewhere. Little is known regarding the required habitat of T. texanum and herbaria records contain conflicting data. Furthermore, only one population of the taxa has been found since 1970. Therefore, the taxon has been proposed by the U.S. Fish and Wildlife Service for listing as either threatened or endangered.

Field investigations were conducted during the fall 1983 to evaluate habitat suitability for S. parksii and during the spring 1984 to evaluate habitat suitability for T. texanum. Although extensive studies were conducted to locate populations of both taxa, investigative results proved negative. Based on field studies conducted for S. parksii, project lands are edaphically different from those of known populations; field studies conducted for T. taxanum resulted in inconclusive findings pertaining to habitat suitability.

Therefore, it has been concluded that none of the researched species are within project site impact areas with the possible exception of T. texanum. Based on inconclusive results of herbaria, literature and field research, additional field investigation are warranted, following selection of construction alternative and refinement of construction plans.

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5.0 THREATENED AND ENDANGERED SPECIES RESEARCH

Evaluations were made to determine the potential for the occurrence of threatened or endangered plant species within the project area. Although the evaluations principally included species which are listed by the U.S. Fish and Wildlife Service as threatened, endangered, or as potentially threatened or endangered (Federal Register, 1980), they also considered species included by the Texas Organization for Endangered Species (TOES) as threatened, endangered or rare endemics (TOES, 1984).

Investigations were conducted using herbaria and literature research to determine species distribution, records of previous collections, and habitat preference for each species. Field investigations were made to evaluate habitat suitability within the area and, as appropriate, field team members investigated the possible occurrance of specific species.

Literature and herbaria data indicate five species to possibly occur within the project area. One species is listed as endangered, two species has been proposed for listing as endangered and two species have been deleted from the listing of proposed species. Those species which were investigated are:

Amsonia repens Shinners
Eleocharis austrotexana Johnston
Hymenoxys texana (Coulter & Rose) Cockerell
Spiranthes parksii Correll
Thalicutrum texanum (Gray) Small

Appendix H provides taxonomic, collection, distribution, habitat and other information pertinent to each species. A descriptive summary of each species is provided in the following text.

5.1 Amsonia repens

Amsonia repens was first described in 1951 by L. H. Shinners from the type specimen collected by V. L. Cory in Wharton County (Cory 55089, 29 March 1948

(SMU)). Specimens were subsequently collected in Austin and Wood counties. Amsonia repens is a semi-aquatic species which occurs within wet areas along roadsides and depressions of prairies as well as around lakes and ponds in wooded areas. Areas of similar habitat may infrequently exist within upland project site locations.

The U.S. Fish and Wildlife Service has dropped the species from further consideration as either threatened or endangered.

5.2 Eleocharis austrotexana

Eleocharis austrotexana was first collected by L. H. Shinners in Atascosa County in 1955 (Shinners 19709 (SMU)) and described in 1964 by M. C. Johnson. Subsequently, speciments have been collected in Kleberg, Liberty, and San Patricio counties. Habitat preference of the species is limited to sandy clay soils of forests and localized areas of sandy clays in the Gulf Prairie. Such soils are not in the project area.

The species has been dropped by the U.S. Fish and Wildlife Service as under review for potential listing as either threatened or endangered based on the wide spread distribution.

5.3 Hymenoxys texana

Hymenoxys texana has been officially listed (proposed) as threatened or endangered. The species was first collected near Hockley, Texas (Harris County) in 1889 and 1890 by F. W. Thurow. During 1891, the species was taxonomically described and classified by Coulter and Rose as Actinella texana. In 1898, E. L. Green transferred the species to Picradenia which was subsequently transferred, in 1904, by T. D. A. Cockerell to the genus Hymenoxys.

During the period 1890 through 1981, no collections were made and the species was believed to be extinct. In March 1981, collections were made from an area north of Cypress, Texas (Harris County) by J. W. Kessler and at Hockley, Texas by W. F. Mahler (Mahler, 1983).

Hymenoxys texana occupies a specific habitat which is described as open, barren, clay hardpans within a prairie vegetation type. The habitat type and location of known populations are similar to that of Choloris texensis and Machaeranthera aurea, both of which are rare Texas endemics. Field observations indicate that the project area does not provide suitable habitat for the species.

Recommendations have been made to list the species as endangered (Mahler, 1983) and it should be officially listed as such during 1985. The Texas Organization for Endangered Species (TOES) recognizes the taxon as a "Watch List Species" which indicates that it is neither increasing nor decreasing in range but should be monitored to assure its survival (TOES, 1984).

5.4 Spiranthes parksii

Spiranthes parksii is the only species which was reviewed as potentially occurring within the project area which is listed by the U.S. Fish and Wildlife Service and TOES as endangered. The species was first discovered in 1945 in the vicinity of Bryan, Texas by H. B. Parks. During 1945 through 1978, populations could not be found until, in 1978, it was rediscovered by P. M. Catling and K. L. McIntosh (Catling and McIntosh, 1979) in oak forest near the Brazos River. Until recent months, the only known populations of the species were limited to three small locations near Bryan, Texas (Brazos County). During early November 1983, additional populations were found in Grimes, Burleson and Robertson counties which surround the original population.

Sprianthes parksii occupies upland areas within open oak and juniper forest. Recent data acquired by the Species Recovery Team (personal conversation with Dr. H. Wilson, Texas A&M University) indicate it to be associated with gravelly, sandy soils on well drained ridges. Field investigations were conducted during the Fall 1983 to evaluate habitat suitability and the possible presence of S. parksii within portions of the project area. Although much of the work was restricted to upland ares in proximity to the proposed Shaws Bend dam site, investigation also included upland areas of Oak-Juniper forest upstream from the site.

Results of field investigations indicate that although soils types within the project area are similar to those found at known populations in Bryan County, project area lands are edaphically different from known population sites. Soils within the project area are generally underlain with limestone whereas soils associated with known populations are absent of limestone substrata. Therefore, construction of a reservoir, or series of reservoirs, within the Colorado Coastal Plains Project area will not impact the species.

5.5 Thalictrum texanum

Thalictrum texanum was first collected in the late 1800's by E. Hall and reported in his publication entitled "Plantae Texanae". The collection was subsequently included as a variety of T. debile in B. L. Robinson's section of the "Synoptic Flora of North America". In 1903, J. K. Small elevated the taxon to the rank of species, where it is currently recognized.

The original collection of T. texanum was made in Harris County, in the vicinity of Houston. During 1970, an additional population was found in Brazos County in habitat similar to that of Sprianthes parksii.

Thalictrum texanum is presently proposed by the U.S. Fish and Wildlife Service as threatened or endangered and the taxon is currently under review pending additional information pertaining to its vulnerability to threats (Federal Register, 1983).

Based on 1970 collections, habitat preference of the taxon appears to be that of oak forest with an understory of shrubs and grasses; however, herbaria research (from collection labels) indicates that collections were made in Harris County in a prairie environment. Presently, there is only one population known to exist. The species is limited to a grassy roadside park area in Waller County, approximately 0.5 miles west of Brookshire, Texas (Brown 8492, 10 March 1985, (SMU)). The Brookshire population is approximately 50 miles east of the proposed Shaws Bend Dam site. Although suitable habitat may exist within the project area to support the species, field investigations conducted during the spring 1984 failed to locate populations.

Therefore, based on conflicting habitat descriptions and the possibility that suitable habitat may exist within the project area, the possible presence of the species within the project lands cannot be conclusively determined. Therefore, it is recommended that thorough field investigations be conducted following selection of reservoir construction alternative. If a single reservoir were to be constructed at Shaws Bend, detailed investigations should be performed at the proposed dam site (including adjacent upland areas which would be impacted) and within lands which would be impacted by conservation pool operations. If the multiple reservoir scenario is selected, investigations should be conducted at each proposed dam location. Based on previously completed field investigations and vegetation/habitat mapping, 4,945 acres of oak forest and prairie environments are within the Shaws Bend Reservoir; 2,729 acres are within multiple reservoir areas. Additional lands which may require further investigations would be dependent upon proposed barrow sites, construction sites and access roads. Scheduling for such investigations should be conducted during the spring of two consecutive years; a total of two field trips.

REFERENCES

SECTION 5

Catling, P. M. and K. L. McIntosh, 1979. Rediscovery of Sprianthes parksii Correll. Sida 8(2): 188:193.

Federal Register, December 15, 1980. Department of the Interior, Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species. Part IV. 82480-82569.

Federal Register, November 28, 1983. Department of the Interior, Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Supplement to Review of Plant Taxa for Listing; Proposed Rule. Part II. 53640-53670.

Mahler, W. F., 1983. Rediscovery of Hymenoxys texana and Notes on Two Other Texas Endemics. Sida 10(1) 87:91.

Texas Organization for Endangered Species (TOES), 1984. Endangered, Threatened and Watch Lists of Plants of Texas (unpublished draft).

SECTION 5

THREATENED AND ENDANGERED SPECIES RESEARCH

Colorado Coastal Plains Project, Texas

William F. Mahler, Ph.D.
Principal Investigator

ABSTRACT

UNIQUE AREAS IDENTIFICATION

Field investigations have resulted in the identification of six areas as unique to the region. Five sites are located within the Shaws Bend Reservoir area; one site is in the vicinity of Bastrop. Unique areas have been defined as sites which provide an unusual (atypical) setting to the area in terms of vegetation resources or habitat or are of social, historical, recreation, or aesthetic value. Those sites which are of interest due to vegetation or habitat value are: Fern Hollows and Bluffs, Horseshoe Bend Woodlands and Harvey Creek Woodlands. Sites which are of recreation, social, historic or aesthetic value are: Burnam's Ferry Crossing, Camp Lone Star, and Red Bluffs.

Horseshoe Bend Woodlands and the Harvey Creek Woodlands, contain mature elm, ash, hackberry and oak and have remained undisturbed for a considerable length of time. Additionally, the Horseshoe Bend Woodlands provide a unique habitat within a portion of the project site which is primarily comprised of open fields and cultivated lands.

A few locations within the south central Shaws Bend Project area contain Fern Hollows and Bluffs which provide a habitat unique to the area. The areas are relatively secluded and large trees provide good canopy cover and, natural springs provide a continuous water supply to the area. As a result, the areas support palmetto (Sabal minor), resurrection fern (Polypodium polypodioides), Ombligo de Venus (Hydrocotyle umbellata) and other unusual taxa.

Burnam's Ferry Crossing is located in the south central portion of the Shaws Bend Reservoir site. The area is of historic interest as it was along the La Bahia Road linking southwestern Louisiana and San Antonio. Presently, the site is privately owned and used annually by the Boy Scouts for camping.

Camp Lone Star is located south of the river approximately two miles from La Grange. It occupies approximately 125 acres and lies within dense upland forest. The site is of recreational interest and is in continuous operation throughout the year. During 1983, Camp Lone Star provided facilities for 15,000 camper-day usage.

The Red Bluffs unique area is located along the Colorado River near Bastrop and are of aesthetic interest due to their elevation above the river and surrounding floodplain lands. Upland areas are vegetated in dense pine and oak woodlands and portions of the bluffs have remained relatively undisturbed and pristine.

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7.0 UNIQUE AREAS IDENTIFICATION

The investigation and identification of unique areas was conducted by field team members as part of vegetation sampling and resources analyses. Criteria used in the evaluation were based on locations with unusual vegetation composition, unusual land forms, areas of scenic or aesthetic value, and locations of specific social and cultural interest.

Information used for the identification of unique areas was acquired as a result of work conducted during vegetation sampling. Input to the identification of potential unique areas was acquired through review of area topographic sheets, with specific attention to land forms, creeks and streams and through detailed evaluations of sterioscopic false-color infrared aerial photographs. Input was also solicited from area residents which proved exceptionally beneficial in the identification of areas which could be considered unique.

Intensive field investigations have resulted in the identification of six sites which were considered unique to the central Texas region. Three sites are unique in terms of environmental and ecological significance, two sites are of historical and recreational significance, and one site was identified as unique due to unusual land form and aesthetic value.

Due to subjectivity used in judging some areas, the relative importance of each site must be evaluated with respect to importance to any one or a combination of several of the criteria used in the evaluation. Those sites identified as unique to the area are:

Fern Hollows and Bluffs
Horseshoe Bend Woodlands
Harvey Creek Woodlands
Burnam's Crossing
Camp Lone Star
Red Bluffs

7.1 Fern Hollows and Bluffs

Several areas within the central portion of the Shaws Bend Reservoir Site provide unique habitat for hydrophyllic vegetation. Upland areas, south of the river are frequently cut by deep ravines and, within a limited area, bluffs are located near the river edge.

Ravines and bluffs within the area are heavily vegetated in understory and relatively mature trees provide good canopy. Additionally, many of the areas are continuously moist as a result of springs which provide a reliable water source to the area.

The combination of ample and reliable water supply and dense canopy has resulted in excellent habitat for ferns, mosses and other hydrophyllic plants infrequently found within the project area. Unusual species observed during field investigation include: Palmetto (Sabal minor), resurrection fern (Polypodium polypodioides), inland sea oats (Chasmanthium sp.), Ombligo de Venus (Hydrocotyle umbellata), meadow spikegrass (Selaginella apoda), and buckeye (Aesculus pavia).

Field investigations, review of aerial photography, and use of topographic sheets indicate Fern Hollows and Bluffs occupy approximately 30 acres within the Shaws Bend project site. Although similar habitat may exist within other river reaches, none were found during field investigations. Figure 7-1 identifies the general locality of the unique area, Exhibit 7-A, taken within the habitat, shows the proliference and diversity of vegetation within the area.

7.2 Horseshoe Bend Woodlands

The Horseshoe Bend Woodlands consist of a pristine area which has remained relatively undisturbed during the past 30 years. The area occupies approximately 100 acres within the central portion of a remnant ox-bow lake which was cut off from the river during the 1940's. Other area ox-bow lakes have been generally cleared for agricultural purposes.

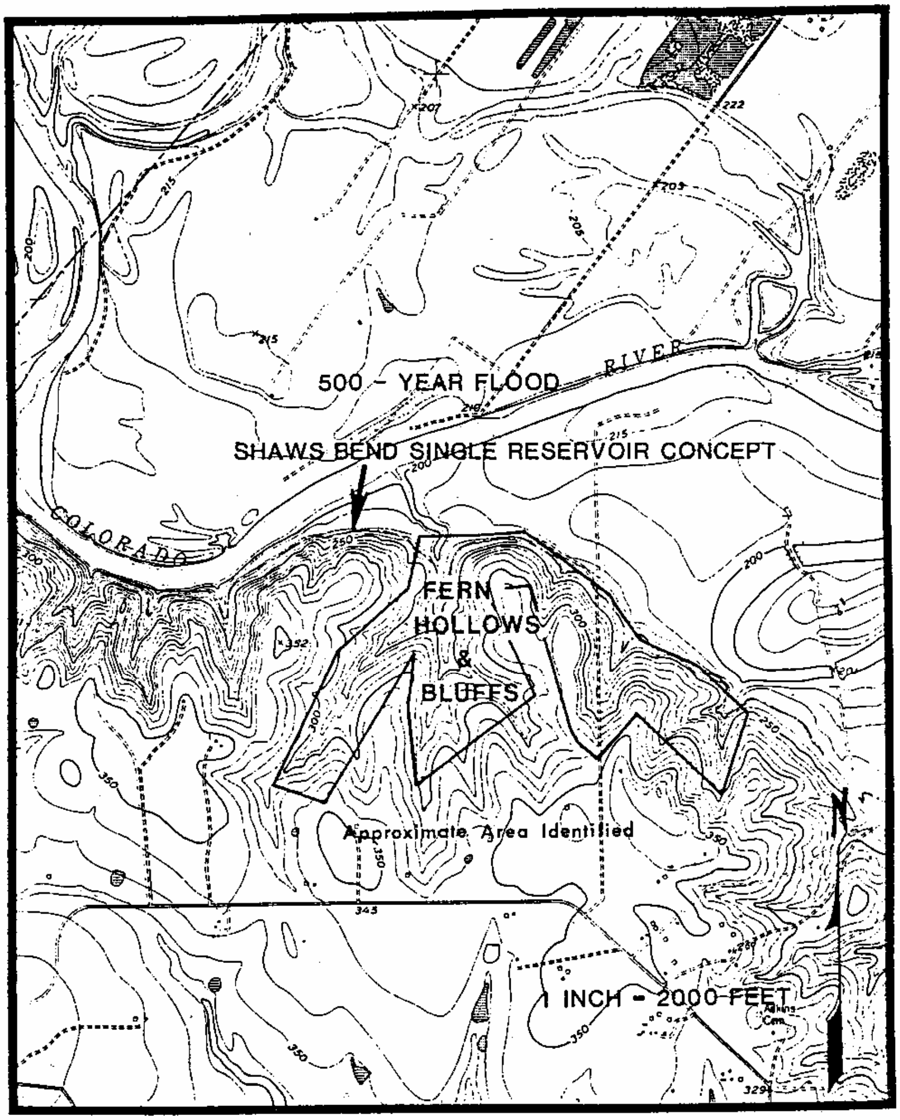

FIGURE 7-1

FERN HOLLOWS AND BLUFFS

Unique Area

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Vegetation of the Horseshoe Bend Woodlands is dominated by the Elm-Ash-Hackberry Community; however, relatively homogeneous stands of mature cottonwood, hackberry, and other species have become established in various scattered locations.

In addition to the relatively undisturbed nature of the woodlands, the area provides unique habitat for area wildlife. Surrounding lands, on the north side of the river, are generally maintained in pasture and cultivation. The presence of a major woodland area provides valuable habitat for area wildlife. The Horseshoe Bend Woodlands location is identified on Figure 7-2.

7.3 Harvey Creek Woodlands

The Harvey Creek Woodlands (Figure 7-3) total approximately 30 acres and are comprised of relatively undisturbed, mature oaks, elms, and hackberry. In addition, the creek provides a continuous water supply to the area and numerous pools and riffles are located along a reach above the confluence with the Colorado River. The area provides valuable bottomland habitat for many avian and mammalian species.

Harvey Creek Woodlands and surrounding areas are shown on Exhibit 7-B. Uplands surrounding the Harvey Creek area have been of archeological interest as the locality was extensively used as Indian encampments. Local residents frequently visit the woodlands and surrounding areas in search of Indian artifacts and for solitude. During the late 1800's the vicinity of Harvey Creek was the site of a Black Community and the Pleasant Hill Church and Cemetary are located in the woodlands, south of the creek. The cemetary is not maintained, however, the church was recently repaired and remains in relatively good condition.

Detailed investigations throughout the project area indicate the Harvey Creek Woodlands to be significantly different from other similar habitats. Although numerous heavily wooded areas are present within other project site areas, none were found to be in a relatively undisturbed condition as those of Harvey Creek. Furthermore, Harvey Creek flows freely throughout much of the year whereas

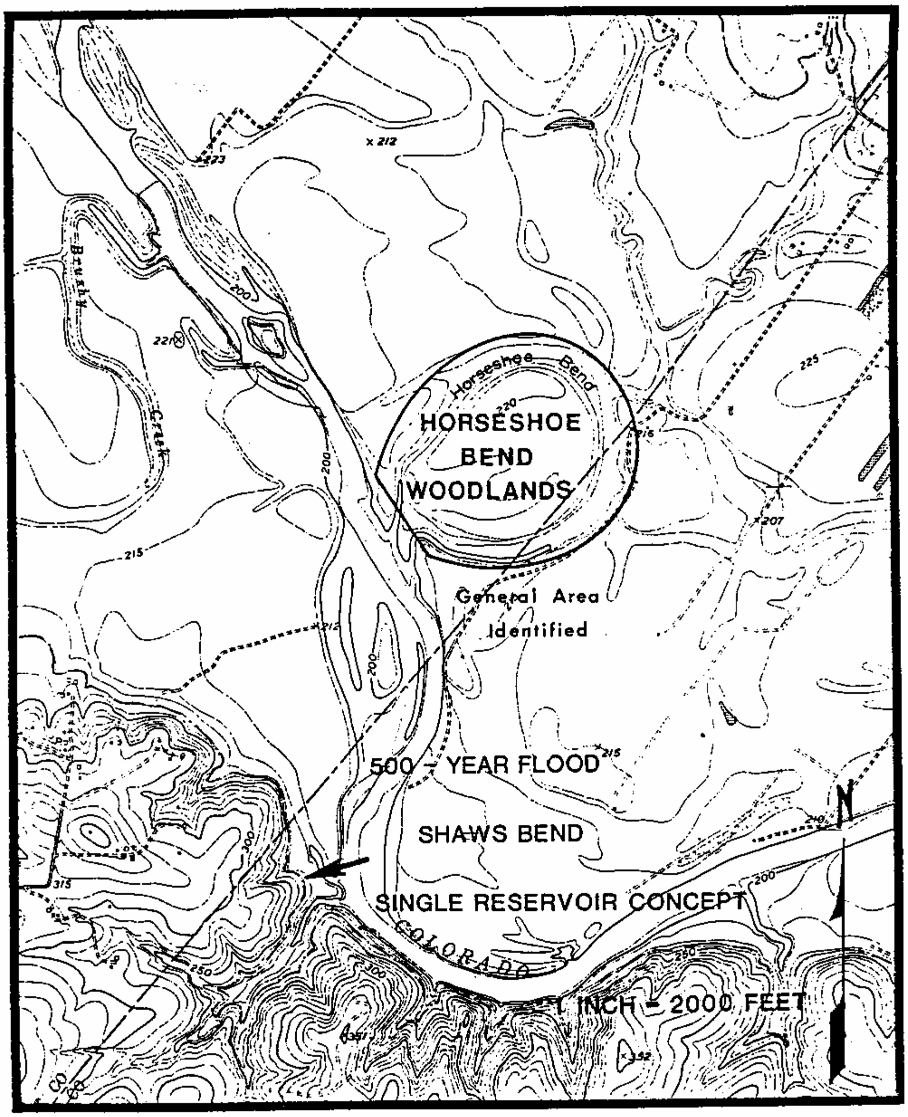

FIGURE 7-2
HORSESHOE BEND WOODLANDS
Unique Area

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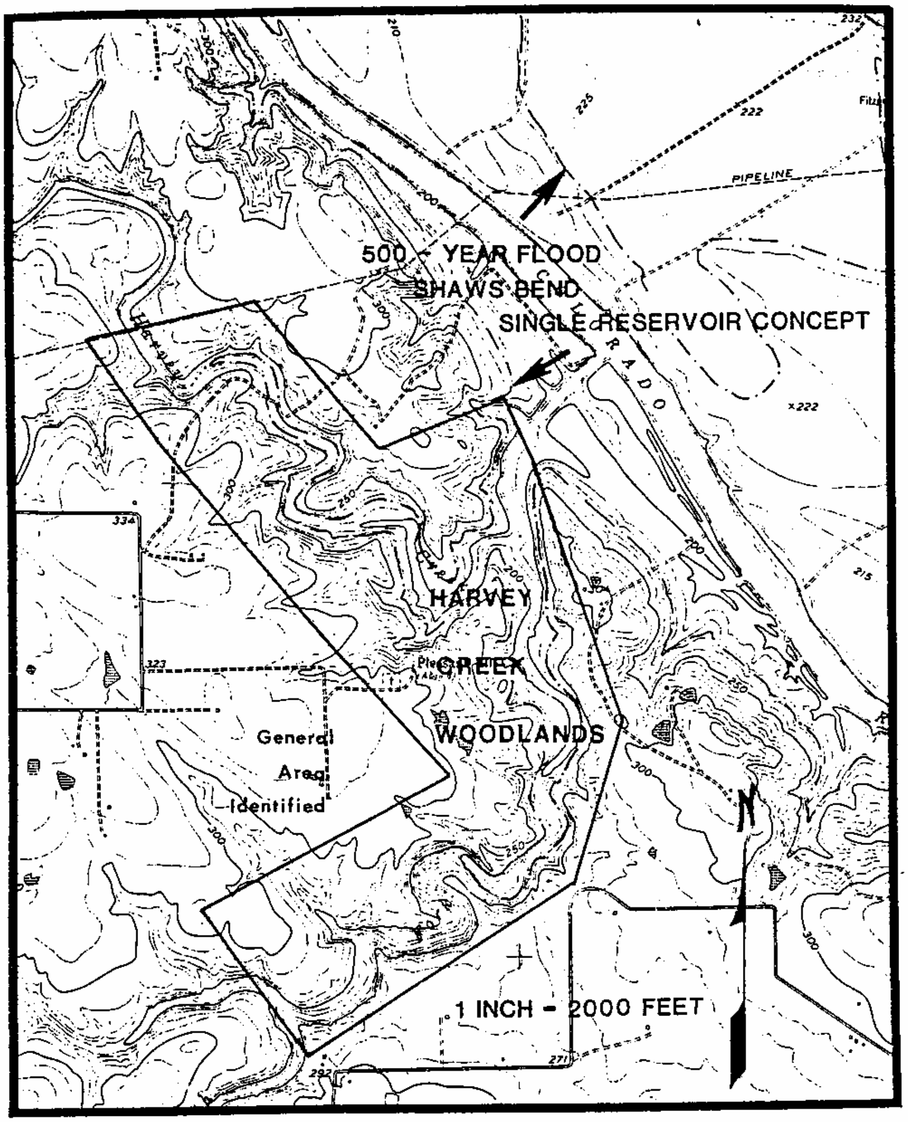

FIGURE 7-3
HARVEY CREEK WOODLANDS
Unique Area

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many streams within the project area are ephemeral, flowing only as a result of immediate runoff.

7.4 Burnam's Crossing

The historic site of Burnam's Crossing is located approximately 12 miles upstream from Columbus in Colorado County. During the 1820's a ferry was established by Jessie Burnam at the site of the La Bahia Road linking southwestern Louisiana and San Antonio. During 1836, the ferry was used by General Sam Houston in his retreat from Gonzales to San Jacinto and was destroyed to prevent use by the Mexican Army. Access to the site was made across the broad floodplain north of the river, south of the river the area consists of a relatively large first terrace surrounded by bluffs. The road to the uplands remains in relatively good condition and is used by local landowners and others.

During recent years, a concrete boat ramp has been constructed for private use; no other modifications to the site have been made. The site remains of local interest as it is used annually by Boy Scouts as a camp site. The relative importance of Burnam's Crossing as a recreational site is insignificant with respect to other suitable locations along the river. Although the site is infrequently used by the Boy Scouts, and the area is ideal as a camp site, other privately held lands can probably be made available for use.

Burnam's Crossing was the site of extensive trading activities during the late 18th through early 20th century. Although superficial evidence of its previous importance no longer exists, archeological research at the site should provide valuable insight regarding the early inhabitants of the area. If the location becomes inundated by reservoir waters, potentially valuable resource of archeological significance would be lost. Construction of a dam at Shaws Bend would require site mitigation.

Figure 7-4 identifies the Burnam's Ferry Crossing site.

7.5 Camp Lone Star

Camp Lone Star, located on the south side of the river approximately two miles southeast from La Grange, is owned and operated by Texas Outdoors Ministry of the Lutheran Church, Missouri Synod. The camp occupies approximately 125 acres, primarily within upland forest and has a 2,000 foot frontage on the Colorado River. All water and sanitary facilities are maintained on the premises and the facility is in year-around operation. During 1983, occupancy levels totaled at 15,000 camper days.

Lone Star Camp is identified on Figure 7-5.

7.6 Red Bluffs

The Red Bluffs unique area is located in the vicinity of Bastrop (Figure 7-6) overlooking the Colorado River at an elevation of approximately 100 feet (above river surface). Although the area is of little ecological significance except as a roost for vultures and other birds, the site is unique from an aesthetic aspect.

The Red Bluffs are of Reklaw Formation (refer to Section 3.3, Regional Geology) and contain glauconitic clay ironstone which is browinsh black, reddish brown and weathers light brown to light gray. The lower portion of the Red Bluffs is grayish-green in color and consists of quartz sand.

Upland areas are dominated by pine woods and oaks. The first terrace vegetation below the Red Bluffs has remained relatively undisturbed and dominated by large sycamores with a basal area of approximately 72 square feet per acre.

Exhibit 7-C, photograph taken from the vicinity of Red Bluffs, shows dense overstory vegetation along the Colorodo River and heavily wooded upland areas. Wooded uplands are primarily pine-oak woodlands and oak-juniper woodlands. Pasturelands across the river are maintained in Bermuda-grass; river terraces are typical of those throughout the Colorado River floodplain.

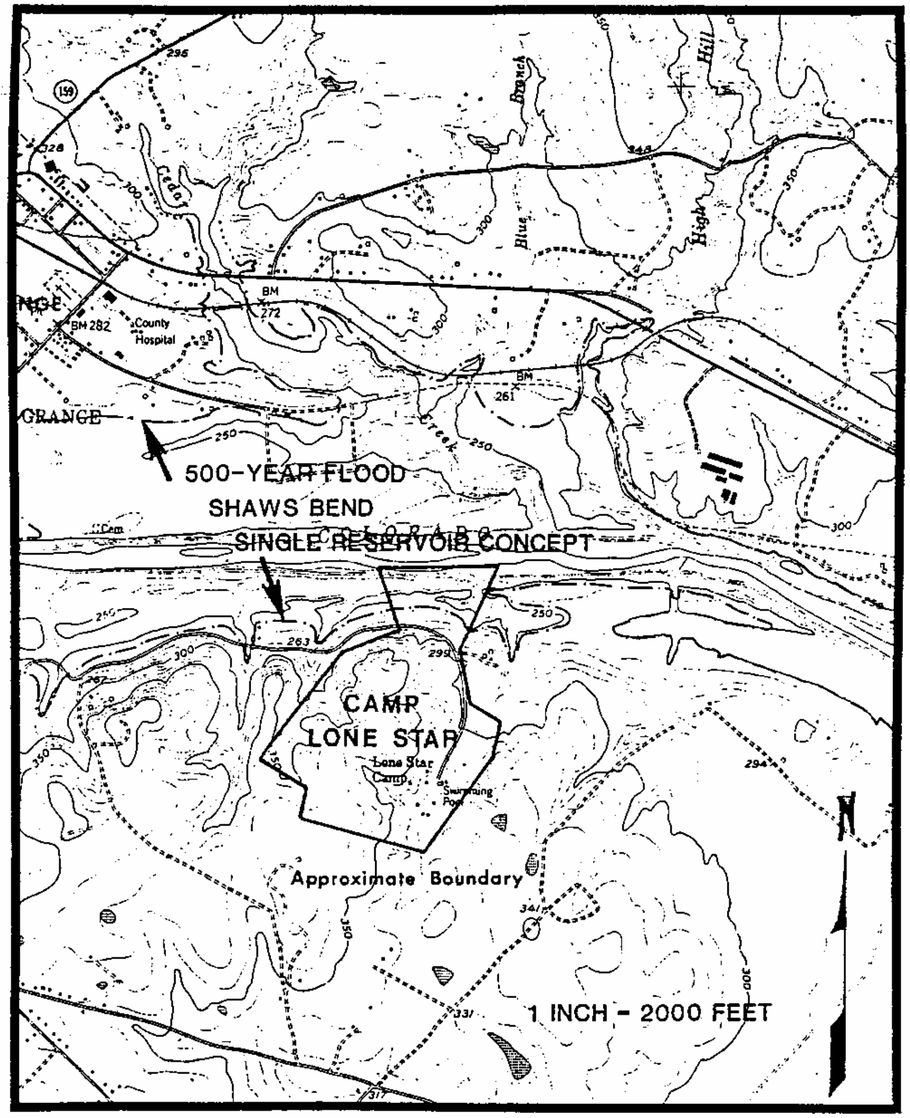

FIGURE 7-5
LONE STAR CAMP
Unique Area

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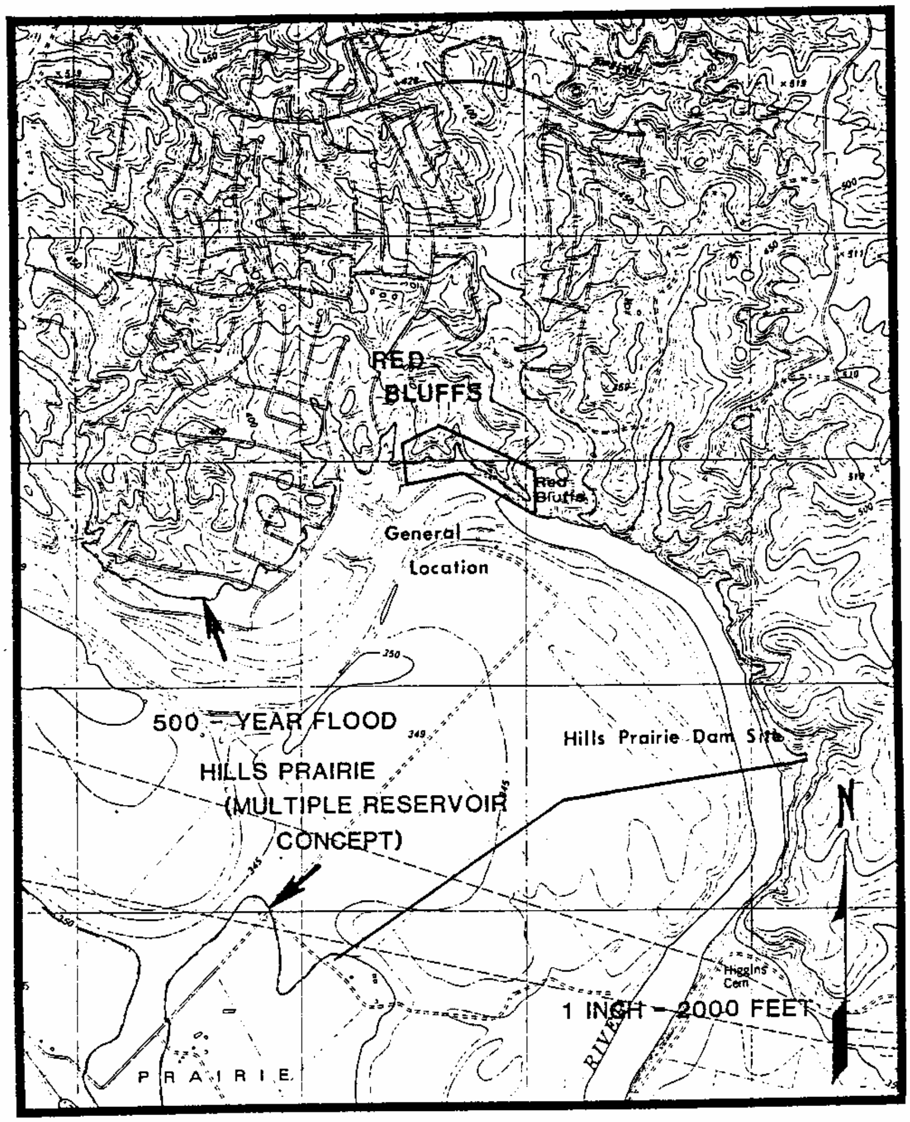

FIGURE 7-6
RED BLUFFS
Unique Area

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SECTION 9

ARCHEOLOGICAL AND HISTORICAL SITES ANALYSIS

Colorado Coastal Plains Project, Texas

Elton R. Prewitt
Principal Investigator

ABSTRACT

False-color infrared aerial photography was studied to determine the potential usefulness of this method of analysis for predicting archeological and historical site occurrences in the Colorado Coastal Plains Project. The archeological aerial photography analysis was conducted in late 1983 by Prewitt and Associates, Inc. as part of a larger study performed by ECS Technical Services, Fort Worth, Texas under a contract from the U.S. Department of the Interior, Bureau of Reclamation.

Potential sites identified from the aerial photographs include 64 prehistoric and six historic sites. Ten of the potential prehistoric sites were field checked; two were determined to be the locations of previously unrecorded sites. None of the historic sites were checked for accuracy although one coincided with a previously recorded site. Thirty-one of the 64 prehistoric site predictions were examined during the field check, a recent sampling survey conducted by New World Research, Inc., or other previous investigations. Eleven of these 31 predicted locations were found to be accurate. This yields an accuracy ratio of 35 percent.

It is concluded that this type of study is more useful for preliminary indications of overall site density rather than precise locational data. It is recommended that analysis of false-color infrared imagery for archeological site data be continued. It is further suggested that future studies not be conducted on a "blind" basis; rather, existing local or regional site location data should be analyzed first to provide a basis for greater accuracy in site predictions.

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9.0 ARCHEOLOGICAL AND HISTORICAL SITES ANALYSIS

9.1 Introduction

A predictive investigation of archeological and historical sites in the original Study Areas 1 and 2 of the Colorado Coastal Plains Project (refer to Appendix A) was conducted by Prewitt and Associates, Inc. in conjunction with the vegetation resources study undertaken by ECS Technical Services. Project location and area characteristics have been described in Section 1 and, therefore, are not repeated as part of this section.

Previous archeological studies in and near the current project area have demonstrated that a wide range of prehistoric and historic sites can be expected along the Colorado River and its tributaries (Nunley, 1963; Jackson and Skelton, 1975; Skelton and Freeman, 1979; Laurens, et al., 1979; Pevey and Van Cleve, 1981; Nightengale and Jackson, 1983). Excavations of varying intensity have provided a basic framework for chronological and functional studies extending from Paleoindian to Historic times (Hester and Collins, 1969; Carter and Ragsdale, 1976; Skelton, 1977; Fullem, 1977; Young, 1979). Based on the background data provided by these studies, it can be expected that a high density of both prehistoric and historic sites exists within the project area.

The purpose of this study is to examine stereoscopic false-color infrared aerial photographs to determine the utility of this method of study for locating archeological and historical sites in the Colorado Coastal Plains Project. While aerial photographs have been used by archeologists for many years and for varied purposes, increasing availability of false-color infrared imagery in recent years has allowed more-widespread use of this tool for archeological investigations. Particular success has been achieved in locating house ruins, irrigation and water retention features, roads, and other architectural and engineering features in the arid Southwestern United States (Lyons, 1976; Lyons and Hitchcock, 1977; Lyons and Ebert, 1978; Herrington, 1979; Lyons and Mathien, 1980). Greater difficulty has been encountered in the effective use of false-color infrared aerial photographs in semiarid regions of Texas where the activities of hunting and gathering peoples left more-subtle remains than the architectural and engineering features of the

Southwest (Prewitt, 1983). Archeological studies of aerial photographs, other than false-color infrared, have met with even greater difficulties although, to a certain degree, they have been successful (Prewitt, 1976; Holz and Prewitt, 1981; Prewitt, et al., 1983).

As previously noted, the study was limited to Areas 1 and 2 as specified by the Bureau of Reclamation. This limitation substantially restricts the effective areal coverage, particularly in the vicinity of the mouths of Williams Creek and Cedar Creek, then extending upstream along the Colorado River. The study was terminated at the U.S. Highway 77 bridge at La Grange since the proposed Shaws Bend Reservoir limits are confined to the existing river channel by the time it reaches that point. For comparative purposes, site predictions also were made for Study Area 3 even though it was not included in the ensuing analysis. The difference in total site numbers is dramatic; a total of 70 potential prehistoric and historic site locations were identified in Study Areas 1 and 2 while 212 locations were identified in Study Areas 1, 2, and 3 combined.

9.2 Analysis Methods

The study of false-color infrared aerial photographs of the Colorado Coastal Plains Project was essentially a blind test. The specific locations of known archeological sites were <u>not</u> reviewed by the photointerpreter prior to the study. However, familiarity with the project area led to an inescapable situation where a few of the site locations <u>were</u> known to the photointerpreter. This knowledge biased the interpretation process to the extent that certain landforms were identified as high potential site locations. Specifically, low rises on stream terraces adjacent to creeks, fossil channel scars, and the river were immediately recognizable as having high site occurrence potential. Consequently, the study is not a totally blind test although an attempt was made to keep the interpretations as objective as possible.

The imagery studied consisted of 9-by-9 inch format false-color infrared contact prints produced at an approximate scale of 1:12,000 (1 in. = 1000 ft). The actual scale of the nonrectified photographs is closer to 1:11,500 (1 in. = 964 ft). The stereoscopic imagery, supplied by the Bureau of Reclamation, had approximately

56 percent overlap and 40 percent sidelap. A folding pocket stereoscope was used during the analysis. Potential site locations were plotted as accurately as possible on USGS 1:24,000 scale topographic maps.

9.2.1 Prehistoric Site Signatures

The recognition characteristics for prehistoric sites were derived from previous experience in the immediate project area, from other known characteristics along the Colorado River, and from previous experience in photointerpretation along the Blanco River and the San Gabriel River. Rises or knolls on floodplains are known to be favored site locations during prehistoric times, and these were used as key identifiers in predicting site locations. Even though some previously known sites such as 41CD10 are reported to be possible burned rock middens (Nunley 1963:35-36), it was expected that vegetation cover and less-dense accumulations of burned rocks would preclude the use of blue color tones for site identifiers such as was successfully used on the Stockton Plateau in the Trans-Pecos region of Texas (Prewitt 1983).

Variations in soil and vegetation tones which occur in conjunction with floodplain rises are particularly identified as potential site locations. Where tributary streams extend beyond the limits of the Colorado River floodplain, small terrace remnants, particularly higher terrances and those with distinct rises, are identified as high site potential locations. In all situations, either river or creek floodplains, the low rises do not necessarily appear on the USGS topographic maps. Thus, the same site prediction obtained from the aerial photographs can be neither obtained from the topographic maps, nor can they be identified without stereoscopic photographs.

It must be made explicit that these landforms are generally relatively recent in the geologic history of the project area. Consequently, it must be expected that older, and potentially more deeply buried, sites will not necesssarily coincide with these surface features. The predictions, then, should reflect a bias toward later sites that were occupied after about

6000 B.P. (B.P. = years before present calculated from A.D. 1950). Even so, some earlier sites should be included in the predictions since it can be assumed that some of the modern landform expressions began developing in the late Pleistocene or early Holocene.

To this point, all discussions regarding prehistoric site locations have dealt with depositional (or accretionary) landforms. Stable or deflationary (erosional) landforms present different problems. These are upland areas where lithic resource procurement localities and ephemeral temporary campsites may be expected to occur. These types of sites are more difficult to deal with in the sense that they are not readily identifiable. All of the upland lobes overlooking the Colorado River and its major tributaries are potential site locations for either of the previously mentioned activities. These are as equally identifiable on the USGS topographic maps as they are on the photographs. Consequently, very few site predictions were made for these upland areas. Only where distinctive small rises are associated with either soil or vegetation tonal changes were predictions made for this type of site. Most of these were found to be marginal to Study Areas 1 and 2. Since they occur more frequently in Study Area 3, few are included within this analysis.

9.2.2 Historic Site Signatures

Somewhat different recognition characteristics were used to identify potential historic sites. To an extent, rises on the floodplain remain a key consideration, but other factors predominate. These are described separately for sites with standing structures and those without standing structures.

9.2.2.1 Standing Structures

These potential historic sites are identified on the basis of the shapes of houses visible on the photographs. Two styles of houses, felt to be characteristic of the late nineteenth century and early twentieth century, were readily identifiable. Both consist of an elongated (rectangular) main unit that is either one story or two stories and has a secondary add-on unit on the rear. Variations in the placement of the add-on units account for the two basic stylistic differences. The first style is a symmetrical "T" where the add-on is centered on the rear of the main unit. The second style is an assymetrical "L" where the add-on is placed near or flush with the alignment of one end of the main unit. In both styles, the rooflines form a distinct 90° angle. Occasionally, the houses also exhibit dormers on the front. Outbuildings, pens, and access roads are usually associated with the houses and form distinctive farmstead complexes. In some cases, simple square or rectangular houses are identified as potential historic sites. These are usually abandoned structures with overgrown access roads and other evidence of discontinued use. Vegetation within farmsted complexes is usually enhanced in comparison to surrounding vegetation.

9.2.2.2 No Standing Structures

This type of potential historic site is identified on the basis of enhanced vegetation that occurs in rectangular or square patterns, stock pens, and occasionally the presence of outbuildings. Houses once associated with these sites have either been moved, burned, or allowed to deteriorate into a pile of rubble and rotted lumber. Access roads are usually overgrown and appear to be abandoned. Frequently, these sites appear on the 1957 edition USGS topographic maps as occupied houses. In these cases, it can be assumed that the houses were abandoned sometime during the past 25 years.

9.3 Analysis Results

Seventy potential site locations were identified in Study Areas 1 and 2 during the analysis of the photographs. Following the airphoto analysis, records of known sites were checked to determine the locations of previously recorded sites. These two groups of sites are summarized in this section. Three gross environmental settings are used as categories for sorting and analysis. These are: uplands, bottomlands, and creek terraces in uplands. Uplands include the higher landforms outside the incised Pleistocene/Holocene valley of the Colorado River. This category includes the valley wall. Bottomlands include the modern floodplain and the Holocene and Pleistocene alluvial deposits contained within the incised valley. Creek terraces in uplands include alluvial deposits in tributary creek valleys incised into the upland landforms outside the incised river valley.

9.3.1 Site Predictions

The criteria used for identifying potential site locations have already been defined. The predicted sites are segregated into two groups based on age and cultural affiliation. These are prehistoric and historic.

9.3.1.1 Prehistoric Sites

An overwhelming majority of the potential sites identified are prehistoric in age (Table 9-1). Sixty-four (91.4 percent) sites are included in this category. Although the prehistoric sites are predicted to occur in all three of the environmental zones described earlier, there is a noticeable bias toward the bottomlands that reflects the constraints of the study area rather than real differences in site location. Fifty-seven (89 percent) of the predicted prehistoric sites are located in the bottomlands. In contrast, only three (5 percent) are located in the uplands, and four (6 percent) are on upland creek terraces. No attempt has been made to further segregate the bottomland sites although several topographic settings may be appropriate for future analyses of this sort. These include: riverbank, creekbank, oxbow lake bank, and isolated depositional or erosional knolls.

9.3.1.2 Historic Sites

Few potential sites in the study area are identified in this category (Table 9-2). Six (8.6 percent) sites are included. As with the prehistoric sites, they are unequally distributed in the three major environmental zones. However, in this case, the locational bias is probably not a direct reflection of the study area restrictions. The majority are, again,

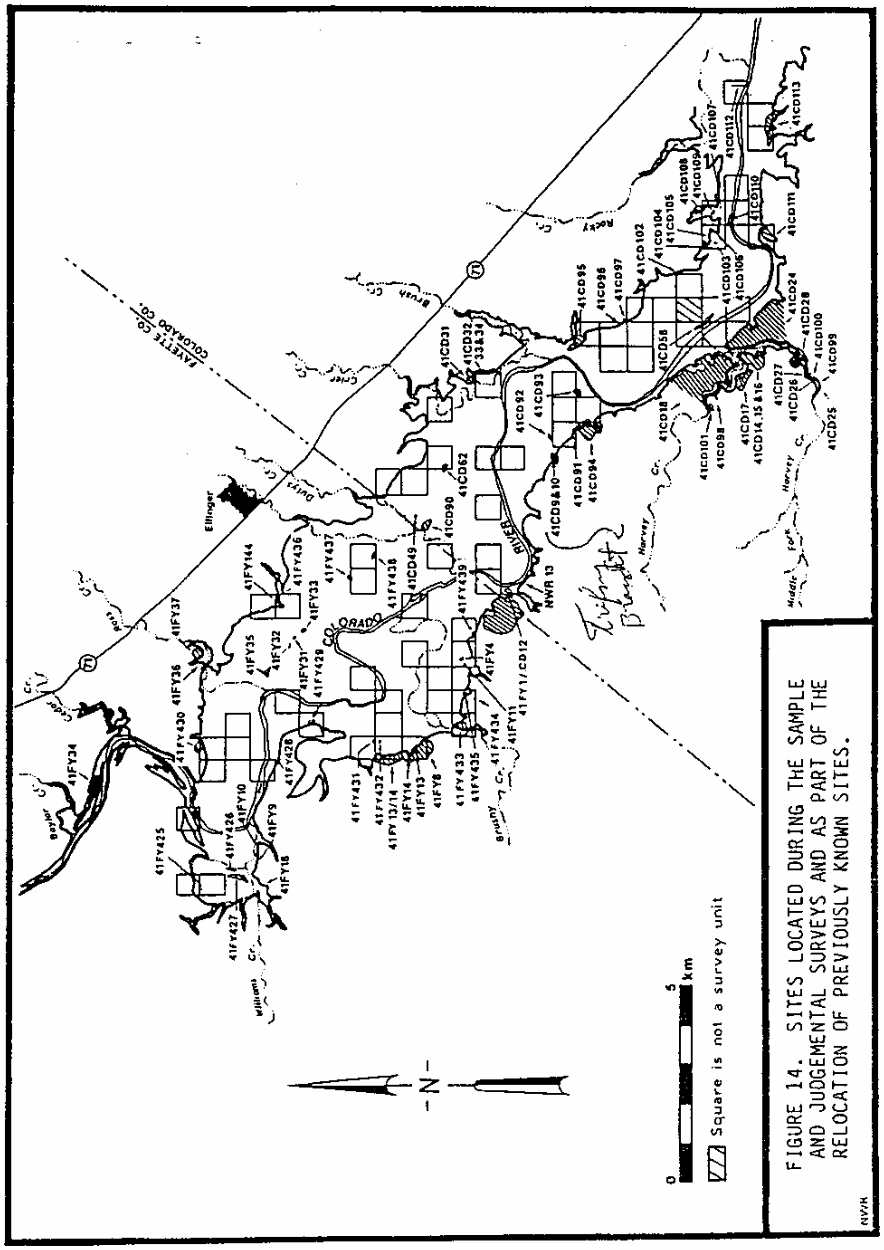

FIGURE 14. SITES LOCATED DURING THE SAMPLE AND JUDGEMENTAL SURVEYS AND AS PART OF THE RELOCATION OF PREVIOUSLY KNOWN SITES.

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MAR. 1.2000 5:27PM LCRA WATER RESOURCES NO.560 P.2/5

INTEROFFICE MEMORANDUM

DATE: February 28, 2000

TO: Lower Colorado Regional Water Planning Group

FROM: Quentin Martin Quentin Martin

SUBJECT: Evaluation of Increased Highland Lakes Water Supply Available with Diversion from Llano River to Lake Buchanan

Background

Several planning group members have proposed the concept of diverting water from the Llano River into Lake Buchanan. Such a diversion has the potential for increasing the water supply in the Highland Lakes if that water can be captured for later use.

Initial study of this concept was undertaken by Mr. Holton Cook under contract to the LCRA in 1955. He was charged to evaluate the feasibility of connecting the Llano River to Lake Buchanan so river water could be diverted for hydropower generation at Buchanan Dam. He concluded that the canal would not be cost effective to increase hydropower generation. His analysis did not consider water supply improvements. A conceptual system diagram of the Llano River - Buchanan canal is shown in Figure 1.

The economic merits of the potential canal depend largely on the additional water supply made available. The purpose of this memorandum is to report on results of a study to evaluate the water supply impacts of such a project.

Scope and Methodology

The firm water supply from the Highland Lakes is called the Combined Firm Yield (CFY). The CFY is the maximum annual water supply available from the lakes, after honoring all senior water rights, during a repetition of the critical drought period. The critical drought occurs from early1947 to early 1957.

The LCRA Water Management Plan (WMP, 1999) describes the process used to determine the CFY, which has been computed at 445,266 acre-feet annually.

To determine the impact of the Llano River diversion canal, the CFY was recomputed by Mr.

Richard Brown, of the LCRA staff, using the following assumptions:

- All procedures and assumptions used in determined the WMP CFY are also used in this analysis,
- A maximum daily Llano River diversion canal capacity of 500 cfs, and
- All daily flows in the Llano River less than 500 cfs are diverted to Lake Buchanan.

Results

The CFY using the Llano diversion was found to be 444,695 acre-feet annually - a drop of 571 acre-feet per year from the CFY without the project. There is a net loss in water supply with the diversion canal. This seems a strange result, but it is accurate.

Why did this result occur? The key consideration is the storage of Llano River water during the critical drought. Without the diversion canal, all Llano River water flows into Lake Travis after first passing through lakes LBJ and Marble Falls. During the entire critical drought, Lake Travis is never full. So the Llano River water will be captured during all months of the critical drought for later use even without moving it to Lake Buchanan.

Another critical factor to consider is the available lake storage during the first six months in 1947. This is the beginning of the critical drought period. Figure 2 shows the monthly ending storage in both lakes without the diversion canal. Note that in January through March, both lakes are full. Water in the Llano River during those months will spill from the Highland Lakes regardless of which lake it enters. There's no place to store it.

The first lake to drop from full is Lake Travis in April, 1947. Note in Figure 2 that Lake Buchanan remains full until June. Even with the Llano diversion, Lake Buchanan can't hold any more water. All the Llano River flows have to be stored in Travis, which is where they are stored without the diversion channel.

As the drought proceeds past 1947, both lakes have storage available for the Llano River flows. With the diversion canal, part of the Llano water would move into Lake Buchanan. Since Buchanan is a shallower reservoir than Lake Travis, it has more surface area in proportion to its storage. Thus, it loses more water to evaporation for every acre-foot stored than does Lake Travis. Therefore, during the drought period, putting more Llano water into Lake Buchanan increases lake evaporation losses compared to storing it all in Lake Travis. The resulting decrease in CFY with the Llano River diversion is caused by this increased evaporation loss in Buchanan.

Please advise me if you would like additional information.

CC: SB1 Consultants

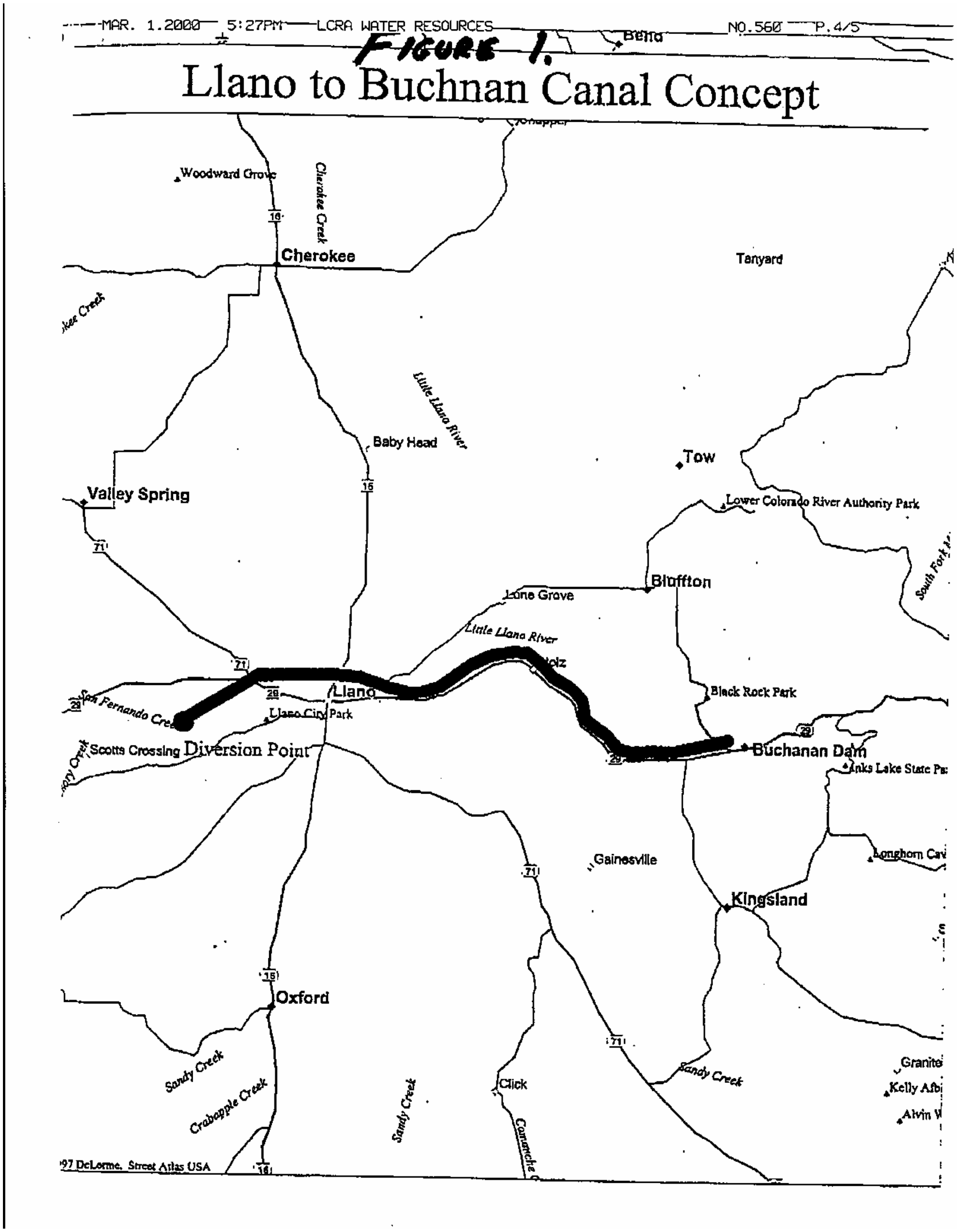
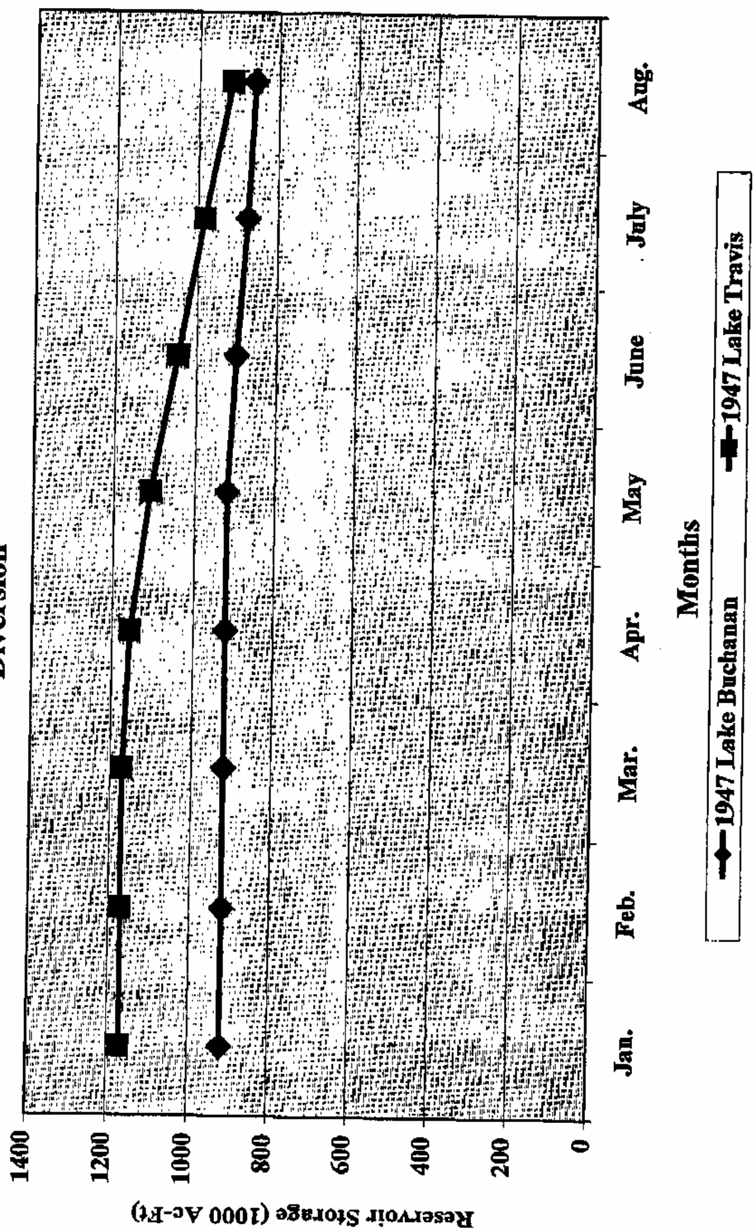

MAR. 1.2000 5:27PM LCRA WATER RESOURCES NO.560 P.4/5
FIGURE 1.
Llano to Buchnan Canal Concept
Woodward Grove
Cherokee Creek
Cherokee
Tanyard
Little Llano River
Baby Head
Tow
Valley Spring
Lower Colorado River Authority Park
South Fork
Bluffton
Lone Grove
Little Llano River
Black Rock Park
Llano
San Fernando Creek
Llano City Park
Scotts Crossing
Diversion Point
Buchanan Dam
Inks Lake State Pa
Gainesville
Longhorn Cav
Kingsland
Oxford
Sandy Creek
Crabapple Creek
Sandy Creek
Click
Sandy Creek
Granite
Kelly Afb
Alvin W
'97 DeLorme. Street Atlas USA

Figure 2. 1947 Simulated Lake Storage Without Llano River Diversion



APPENDIX 8C

SOURCE DOCUMENTS FOR SECTION 8.3

Listing of Source Documents for Section 8.3

1. Bayer, C. W., J. R. Davis, S. R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. *Texas Aquatic Ecoregion Project: An Assessment of Least Disturbed Streams (draft)*. Texas Water Commission, Austin, Texas.
2. Bauer, J., R. Frye, and B. Spain. 1991. "A Natural Resource Survey for Proposed Reservoir Sites and Selected Stream Segments in Texas." Texas Parks & Wildlife Department, Austin, Texas.
3. City of Austin. 2000. "Barton Springs Edwards Aquifer Resource Management Knowledge Base" (Available online at http://www.ci.austin.tx.us/aquifer).
4. City of Austin. 1999. *Jollyville Plateau Water Quality and Salamander Assessment.* City of Austin Watershed Protection Department, Austin, Texas.
5. City of Austin. 1993. *Cumulative Impacts of Development on Water Quality and Endangered Species in the Bull and West Bull Creek Watersheds*. City of Austin Environmental and Conservation Services Department, Austin, Texas.
6. ECS Technical Services. April 1985. Colorado Coastal Plains Project, Texas: *Environmental Inventory and Impact Assessment* (U.S. Department of the Interior, Bureau of Reclamation, Southwest Region Contract # 3-CS-50-01650).
7. Howells, B. 1999. Personal communication. Texas Parks & Wildlife Department, Ingram, Texas.
8. Lower Colorado Regional Water Planning Group. 2000. *Adopted Region "K" Water Supply Plan for the Lower Colorado Regional Water Planning Group*, Volumes I & II, December 2000, prepared for the Texas Water Development Board with assistance from Turner Collie & Braden, Inc. et. al.
9. Lower Colorado River Authority. 2000. *Aquatic Resource Characterization Report,* (Available online at http://www.lcra.org/lands/wrp/wq/wq_arcprog.htm March 2000).
10. McMahan, C. A., R. G. Frye, and K. L. Brown. 1984. T*he Vegetation Types of Texas Including Cropland.* Texas Parks & Wildlife Department, Austin, Texas.
11. Mosier, D. T. and R. T. Ray. 1992. *Instream Flows for the Lower Colorado River: Reconciling Traditional Beneficial Uses With the Ecological Requirements of the Native Aquatic Community*. Lower Colorado River Authority, Austin, Texas.
12. National Park Service. 1995. *The Nationwide Rivers Inventory*. United States Department of the Interior, Washington, D.C.
13. Texas Natural Resource Conservation Commission (now the Texas Commission on Environmental Quality). 1995. *Texas Surface Water Quality Standards.* Texas Natural Resource Conservation Commission (now the Texas Commission on Environmental Quality), Austin, Texas.
14. Texas Parks & Wildlife Department. 1979. *An Analysis of Texas Waterways.* Texas Parks and Wildlife Department, Austin, Texas.
15. Members of the local community have voiced strong opposition to giving a USS designation to Cummins Creek due to the uncertainties that exist regarding the impacts to property rights that such a designation may have. Also, there is concern in the local community that such a designation may infringe upon the Cummins Creek WCID's mandate.

APPENDIX 8D

TPWD SUPPLEMENTAL INFORMATION RESOURCES FOR SECTION 8.3

Rocky Creek:

Bayer, C. E., J. R. Davis, S. R. Twidwell, R. Kleinsasser, G. Linam, K. Mayes, and E. Hornig. 1992. Texas aquatic ecoregion report: an assessment of least disturbed streams. Draft. Texas Water Commission, Austin, Texas.

The Barton Springs Segment of the Edwards Aquifer:

A comprehensive list of literature about the Barton Springs portion of the Edwards aquifer was prepared by the City of Austin in collaboration with the Austin History Center and is available at http://www.ci.austin.tx.us/aquifer/. A partial list of existing information obtained from this website is given in Appendix C (Austin, City of 2000).

General Overview:

Abbott, P.L., and Woodruff, C.M., Jr., eds., 1986, The Balcones escarpment-geology, hydrology, ecology and social development in central Texas Geological Society of America, 200 p.

Brown, J.B., Ritch, K.D., and Yelderman, J.C., Jr., 1986, The stratigraphy, geomorphology and groundwater of the Edwards Plateau, Texas Waco, Tex., Baylor Geological Society Field Conference Guidebook, 34 p.

Cardwell, Walter, III 1988, Proceedings; San Marcos & Comal Springs symposium, San Marcos, TX, Southwest Tex. State Univ., 74 p.

Dimmock, P.E., 1986. Regional geomorphology, geology, and hydrogeology of the Edwards Limestone outcrop belt of Texas and their influence on cave formation Waco, Tex., Baylor University, B.S. thesis, 143 p.

Hill, R.T., 1901. Geography and geology of the Black and Grand Prairies of Texas, with detailed descriptions of the Cretaceous formations and special reference to artesian waters U.S. Geological Survey 21st Annual Report, pt. 7, 666 p.

Hill, R.T., and Vaughan, T.W., 1898. Geology of the Edwards Plateau and Rio Grande Plain adjacent to Austin and San Antonio, Texas, with reference to the occurrence of underground waters U.S. Geological Survey 18th Annual Report, pt. 2, p. 193-321.

Metcalf & Eddy, Inc., 1976. Bibliography-appendix to the phase one report, Edwards aquifer study San Antonio, Tex., Metcalf & Eddy, Inc., 87 p.

Trombatori, D.R., 1992. The Edwards aquifer, central Texas, Austin, Tex., University of Texas, Walter Geology Library, 7 p.

Biology and Ecology:

Albritton, E.M., 1994. The Endangered Species Act: The fountain darter teaches what the snail darter failed to teach, Ecology Law Quarterly, vol. 21, no. 4, pp. 1007-1066.

Arsuffi, T. L., 1996. Ecological structure and biodiversity of benthic communities associated with karst topographic springs of the Edwards aquifer region of central Texas and their effects on water quality assessment - in Abstracts with Programs - Geological Society of America, Boulder, CO, Geological Society of America.

Blair, W.F., 1950. The biotic provinces of Texas, Texas Journal of Science, v. 2, no. 1, p. 93-117.

Bowles, David E., Arsuffi, Thomas, L., 1993. Karst aquatic ecosystems of the Edwards Plateau region of central Texas, USA: a consideration of their importance, threats to their existence, and efforts for their conservation, Aquatic Conservation: Marine and Freshwater Ecosystems, v. 3, pp. 317-329.

Crowe, Joanna Catherine, 1994. Detailed hydrologic maps of the Comal and San Marcos Rivers for endangered species habitat definition, Austin, TX, University of Texas, M. S. Thesis, 153 p.

Edwards, R.J., Longley, Glenn, Moss, Randy, Ward, John, Matthews, Ray, and Stewart, Bruce, 1989. A classification of Texas aquatic communities with special consideration toward the conservation of endangered and threatened taxa, Texas Journal of Science, v. 41, no. 3, p. 231-240.

Karnei, H.S., 1978. A survey of the subterranean aquatic fauna of Bexar County, Texas. San Marcos, Tex., Southwest Texas State University, M.S. thesis, 118 p.

Longley, Glenn, 1981. Ecosystem of a deep confined aquifer in Texas, Eighth International Congress of Speleology (Beck, B.F., ed.), Bowling Green, Ky., July 18-24, 1981, Proceedings of the International Congress of Speleology No. 8, p. 611.

Longley, Glenn, 1981. Ecosystem studies of the central portion-Balcones Fault Zone Edwards aquifer [abs.], Geological Society of America Abstracts with Programs, v. 13, no. 5, p. 241.

Longley, Glenn, 1981. The Edwards aquifer - earth's most diverse groundwater ecosystem, International Journal of Speleology, v. 11, no. 1-2, p. 123-128. Copyright© 1981, by Biological Abstracts, Inc. (BIOSIS).

Longley, Glenn, 1991. Research needs for Texas aquatic ecosystems, Water for Texas-setting the research agenda, Nov. 18-19, Austin, Tex., Proceedings Austin, Tex., Texas Water Development Board and Texas Water Resources Institute, p. 9-15.

Longley, Glenn, 1992. The subterranean aquatic ecosystem of the Balcones Fault Zone Edwards aquifer in Texas - threats from over pumping, in Groundwater Ecology, First International Conference, Tampa, Fla., April, Proceedings Bethesda, Md., American Water Resources Association, p. 291-300.

Mathews, R. and Edwards, R., 1992. Influence of springflows on river flows and instream fisheries, NEW WAVES vol. 5, no. 3, pp. 2-3

Neck, R.W., 1986. The Balcones Fault Zone as a major zoogeographic feature, The Balcones escarpment-geology, hydrology, ecology and social development in central Texas Geological Society of America (Abbott, P.L., and Woodruff, C.M., Jr., eds.), p. 35-40.

U.S. Fish and Wildlife Service, 1984. San Marcos River recovery plan for San Marcos River endangered and threatened species - San Marcos gambusia (Gambusia georgei) (Hubbs and Peden), fountain darter (Etheostoma fonticola) (Jordan and Gilbert), San Marcos salamander (Eurycea nana) (Bishop, and The U.S. Fish and Wildlife Service), 109 p.

U.S. Soil Conservation Service, 1978. Draft watershed plan and environmental impact statement, upper San Marcos River watershed, Comal and Hays Counties, Texas U.S. Soil Conservation Service, 102 p.

Wegner, D.E., 1991. Safe play among protected species, Parks & Recreation, v. 26, no. 11, p. 42-44.

Water Resources Planning and Management:

Anon, 1992. Effectiveness of alternative systems being monitored in Kerr County, ON-SITE INSIGHTS vol. 1, no. 1, p. 3.

Berryman, Marc E., 1993. A ground water and a contamination potential analysis using a geographic information system - in American Water Resources Association, Texas Section fall meeting on Man's effect on hydrologic systems, p. 66-72 Balcones Research Center, University of Texas, Austin, TX.

Butler, K.S., 1987. Urban growth management and groundwater protection, Austin, Texas, in Planning for groundwater protection New York, Academic Press, Inc., p. 261-287.

City of Austin, 1992. Comprehensive watershed ordinance, City of Austin [variously paged].

Conti, R.D., and Smith, H.B., 1990. Comprehensive management of a sole-source aquifer in central Texas-a model for coping with urban development in hydrologically sensitive areas, in 1990 National Conference, Irrigation and Drainage Division, American Association of Civil Engineers, Durang New York, American Association of Civil Engineers, p. 395-403.

Donald G. Rauschuber & Associates, Inc., 1990. Regional water plan for the Barton Springs segment of the Edwards aquifer, Austin, Tex., Donald G. Rauschuber & Associates, Inc., 1 v. [variously paged].

Donald G. Rauschuber & Associates, Inc., 1992. Onion Creek recharge project-engineering assessment and environmental inventory issues report of artificial recharge enhancement, Austin, Tex., Barton Springs/Edwards aquifer Conservation District [variously paged].

Evans, Thomas Anders, 1995. A spatial and statistical assessment of the vulnerability of Texas groundwater to nitrate contamination, Austin, TX, University of Texas, Ph. D. dissertation, 334 p. Regional distribution of permeability in the Edwards aquifer.

Ferguson, B.K., 1991. Urban stream reclamation, Journal of Soil and Water Conservation, v. 46, no. 5, p. 324-328.

Jensen, Ric, 1990. Storing water underground-aquifer recharge projects may replenish groundwater supplies, Texas Water Resources, v. 16, no. 4, [6] p.

Lamb, B.L., and Lovrich, N.P., 1987. Strategic use of technical information in urban instream flow plans, Journal of Water Resources Planning and Management, v. 113, no. 1, p. 42-52.

Longley, Glenn, and Maler, J., 1990. San Marcos River management plan - preliminary report, phase 1 San Marcos, Tex., Southwest Texas State University, Edwards aquifer Research and Data Center Report R2-90, 56 p.

Marsh, William M. and Marsh, Nina L, 1994. Microtopography, runoff processes, sediment transport, and their implications for land-use planning in the central Texas Hill Country, Gulf Coast Association of Geological Societies and Gulf Coast Section of SEPM meeting (AAPG Gulf Coast Section); abs AAPG Bulletin vol. 78 no. 9; p. 1469.

Mays, L.W., Wanakule, Nisai, and Lasdon, L.S., 1985. Large-scale optimization models for groundwater management, in Issues in groundwater management Austin, Tex., University of Texas, Center for Research in Water Resources, Water Resources Symposium Twelve, p. 309-329.

McKinney, D.C., and Watkins, D.W., Jr., 1993. Management of the Edwards aquifer - a critical assessment, Austin, Tex., University of Texas, Center for Research in Water Resources Technical Report 244, 94 p.

McKinney, Daene C.; Lindner, P. Ray; Kam, Aaron; Kan, Lihong; Ye, Zichuan, 1995. Edwards aquifer emergency withdrawal reduction plan; a modeling analysis, First International Symposium on Water Resources Engineering, New York, NY, American Society of Civil Engineers, p. 65-70.

McReynolds, Maureen, 1985. Regulation and development of the northern Edwards aquifer, Edwards aquifer - northern segment, Travis, Williamson, and Bell Counties, Texas, Austin Geological Society Guidebook 8 (Woodruff, C.M., Jr., Snyder, F.R., De La Garza, Laura, and Slade, R.M., Jr., eds.), p. 71-86.

McReynolds, Maureen, and Slade, R.M., Jr., 1986. A case study of aquifer contamination and development of a ground-water management program, Water Pollution Control Federation Special Report, 14 p.

Musick, S.P., 1985. Edwards aquifer protection rules, Williamson County, Edwards aquifer-northern segment, Travis, Williamson, and Bell Counties, Texas, Austin Geological Society Guidebook 8 (Woodruff, C.M., Jr., Snyder, F.R., De La Garza, Laura, and Slade, R.M., Jr., eds.), p. 61-63.

Shih, C.S., Ingram, J.W., and Hogenauer, D.O., 1979. Protection of groundwater resources using multiattribute decision analysis, International Water Resources Association Third World Congress on Water Resources Mexico Papers - World Congress on Water Resources (Ponencias - Congreso Mundial sobre Approvechamientos Hidraluicos), 3 v. 5, p. 2,477-2,487.

Stein, William G., 1993. Population and well distribution for the Edwards aquifer, American Water Resources Association, Texas Section fall meeting on Man's effect on hydrologic systems, p. 17-22, Balcones Research Center, University of Texas, Austin, TX.

Streckfus, D.L., 1977. The successful involvement of a citizen group in an environmental controversy, Aquifer Protection Association, and the Edwards aquifer, San Marcos, Tex., Southwest Texas State University, M.S. thesis, 140 p.

U.S. Environmental Protection Agency, 1988. A portion of the Austin-area Edwards aquifer in parts of Hays and Travis Counties, Texas; sole source aquifer; final determination Federal Register, v. 53, no. 109, p. 20,897-20,899.

Wanakule, Nisai, 1987. A groundwater management model for the Barton Springs-Edwards aquifer [abs.], Geological Society of America Abstracts with Programs, v. 19, no. 3, p. 180.

Wanakule, Nisai, 1989. Optimal groundwater management models for the Barton Springs-Edwards aquifer, San Marcos, Tex., Southwest Texas State University, Edwards Aquifer Research and Data Center Report R1-89, 31 p.

Wanakule, Nisai, and Anaya, Roberto, 1993. A lumped parameter model for the Edwards aquifer, College Station, Tex., Texas A&M University, Texas Water Resources Institute Technical Report 163, 84 p.

Wanakule, Nisai, and Mays, L.W., 1986. Optimal management of large-scale aquifers-methodology and applications, Water Resources Research, v. 22, no. 4, p. 447-465.

Wanakule, Nisai, Mays, L.W., and Lasdon, L.S., 1985. Development and testing of a model for determining optimal pumping and recharge of large-scale aquifers, Austin, Texas, University of Texas at Austin, Center for Research in Water Resources Technical Report 217, 137 p. [Available from National Technical Information Service, Springfield, VA 22161 as NTIS report PB86-186210.]

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CHAPTER 9.0: WATER INFRASTRUCTURE FINANCING RECOMMENDATIONS

9.1 INTRODUCTION

Infrastructure financing needs have long been a key concern of the Texas Water Development Board (TWDB) as it pursues its mission of providing adequate funding to timely meet local water needs. The 77th Legislature, in Senate Bill (SB) 2, added the formal preparation of an Infrastructure Financing Report (IFR) to the regional planning process. The purpose of the IFR is to determine the amount of funding needed from outside sources to implement Region K's management strategies as recommended in the 2006 Regional Plan. The intent of this portion of Chapter 9 is to present the following:

- The total capital cost of all the improvements recommended in the management strategies portion of the Plan.
- The results of the Infrastructure Survey letters that were sent by the Regional Water Planning Group (RWPG) to each identified municipal water user group (WUG) that had a need.
- An estimate of the capital cost of the Plan improvements that cannot be funded out of local revenues and funding sources.
- A review of the funding options listed in the responses to the Infrastructure Survey letters.
- A review of the Policy Statements in Chapter 8 that the RWPG adopted that dealt with funding issues.

9.2 CAPITAL COSTS FOR THE 2006 REGION K WATER PLAN

The total capital cost of the water management strategies (WMS) proposed by the 2006 Region K Water Plan is $360 million over the 50-year planning period. This total cost includes project cost estimates for the major capital improvement strategies involving the development of new supply projects, treatment and transmission cost estimates, and capital infrastructure expenses related to irrigation conservation measures (namely, precision laser-leveling). The total cost also includes estimates associated with localized WUG costs for expansion of existing groundwater and surface water capabilities for treatment and transmission systems, additional wells, and additional storage. Costs for major capital improvement projects are estimated at $300 million. The WUG-level costs for localized expansion of groundwater costs are estimated at $60 million. *Table 9.1* summarizes the estimated costs for both the major capital improvement strategies and the WUG-level strategies for the region.

Table 9.1: Recommended Strategies Requiring Capital Expenditure

Water Management Strategy	Starting Decade [1]	Largest Firm Yield [2] (ac-ft/yr)	Total Project Cost [3] (2002 $)
Major Capital Improvement Strategies			
Construct Goldthwaite Channel Dam	2010	0	$2,495,700
City of Austin Reuse [4]	2010	47,227	$178,060,000
Desalination	2010	29,568	$96,537,700
Purchase Water From City of Austin for Hays County	2010	1,100	$2,280,200
Construct Guadalupe-Blanco River Authority Hays County Pipeline	2010	2,982	$10,451,600
Recharge Edwards Balcones Fault Zone With Onion Creek	2030	5,043	$6,808,000
HB 1437 Irrigation Conservation	2020-2060	25,000	$2,903,700
Subtotal			**$299,536,900**
Local WUG-level Strategies			
New or Expanded Use of Groundwater	2010	26,018	$58,637,200
Total			**$358,174,100**

[1] The Starting Decade is shown as 2010 for several WUGs since it is anticipated that they will start planning/ engineering work on some of the projects right away in order to have the projects constructed by the time they are needed, which could result in expenditures being spread out over the entire planning period.

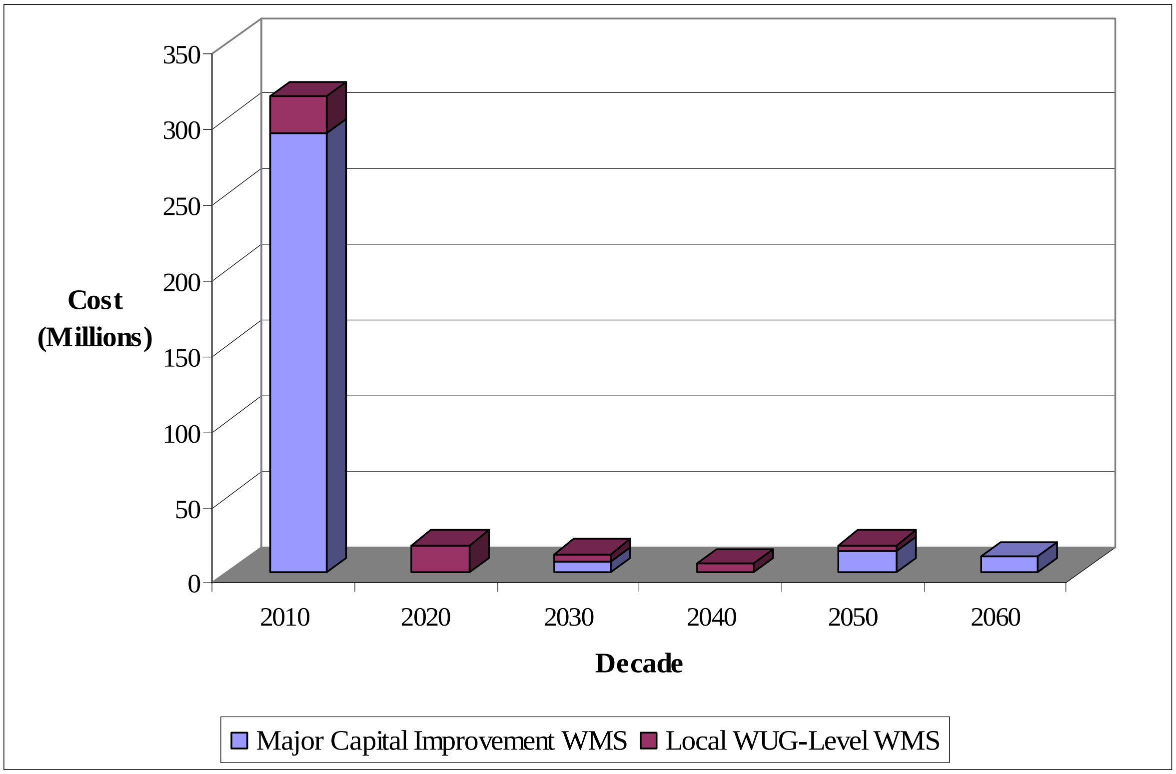
[2] The Largest Firm Yield indicated the largest annual firm yield of the project over the planning period. This value was used to calculate unit costs. Several projects will produce different amounts of water each year of the planning period, and this largest firm yield will not be available every year.

[3] Total Project Costs include capital costs (construction costs - 2nd Quarter 2002); engineering, contingencies, financial, and legal services costs (assumed percent of capital costs); land and easements costs; environmental and archeological studies and mitigation costs; interest during construction; and water right acquisition costs.

[4] Note that the City of Austin continually updates its Capital Improvements Program spending plan through its budgeting and approval process; therefore, the anticipated capital expenditures related to City of Austin water management strategies are subject to change. In addition, the City of Austin is currently conducting a comprehensive water resources planning study, the results of which may affect expected expenditures and quantities associated with reuse.

Figure 9.1 illustrates how the capital costs for both major capital improvements as well as WUG-level strategies shown above are distributed over the planning period. For simplicity, the WUG-level costs are shown as all beginning in 2010 in the above *Table 9.1*; however, several entities do not have a need until later in the planning period. Therefore, in *Figure 9.1*, the WUG-level costs for new or expanded use of groundwater are shown as occurring in the decade in which facilities are required.

Figure 9.1: Costs by Starting Decade and Category



Note that in some cases actual expenditures will likely be spread out over the entire planning period.

Table 9.1 and *Figure 9.1* show only those proposed strategies with associated capital project costs. Several of the strategies proposed by the Plan do not require any capital expenditures for the individual WUG due to sufficient existing system capacity, continuation of strategy already being implemented, or cost borne by other entities, etc. Some of these strategies include municipal conservation, water purchase contract renewals, purchase of water from a wholesale water provider (WWP), pumping of additional groundwater for entities that already have the additional capacity available, continued use of return flows, and irrigation strategies involving use of the LCRA-SAWS Water Project (LSWP). While no capital expenditures are shown for these strategies, annual operational costs are incurred over the planning period. Some of these annual costs include implementation cost for municipal conservation efforts, annual purchase cost for water obtained under new or extended contracts, and additional annual energy costs associated with pumping of additional groundwater using existing facilities. In the case of the LSWP, per the Definitive Agreement between LCRA and SAWS, Region K is not responsible for the associated costs of the LSWP, which will be paid primarily through water use fees and surcharges imposed on SAWS. Annual costs associated with these strategies are factored into the comparison with socioeconomic impacts of unmet water needs discussed in Sections 9.4 and 9.5 below.

9.3 ANALYSIS OF POSSIBLE FINANCING OPTIONS

9.3.1 Municipal Water User Groups

Surveys were sent out to 78 districts and municipalities and two wholesale water providers (WWPs) with projected water shortages. This mailing included all municipal users and wholesale providers in the region who have an identified shortage during the planning period. Of these, 14 responses were received, two of which were from the City of Austin and LCRA, which are both characterized as WWPs. The surveys for WUGs that do not belong within a single political subdivision, such as unincorporated "county-other" users, were sent to the county judge. Responses received are tabulated in *Appendix 9A*, and the completed questionnaires and/or response correspondence is found in *Appendix 9B*.

Survey responses were received from 12 of the 78 districts and municipalities. Several of the responses were from WUGs showing no need for capital expenditures to meet their needs over the planning period. Consequently, no funding data was collected from these responses. Other responses fell within one of the groups discussed briefly below.

Several of the municipal districts indicated that they were fully built-out and did not intend to extend service into adjacent areas. This is typical, in cases where developers form utility districts tasked with providing water and wastewater service within a specified area. Other entities or future districts will likely absorb most of the project population growth in these areas. As discussed in Chapter 2, a survey was conducted in the past to allow the Region K WUGs to review and comment on the population projections, and revisions were made based upon any responses received. It is apparent that not all districts responded to that earlier survey; one response to this more recent survey indicated that population projections are incorrect and that the district is nearly built-out and currently has capacity to serve full build-out. It should be noted that formation of new districts, may reduce the number of state loan requests. New districts will likely need to rely on issuance of bonds to finance their initial infrastructure.

The remainder of the responses indicated that financing of capital infrastructure is expected to come from bonds, capital reserves, and/or grant and loan programs. The State programs mentioned included the Drinking Water State Revolving Fund, the Rural Assistance Fund, and TWDB funds. Smithville indicated the planned use of the Community Development Block Grant Program, which requires a 20 percent match from the community. The 20 percent match would come from cash reserves, as indicated in Smithville's response.

9.3.2 Non-Municipal Water User Groups

Non-municipal WUG demands, supplies, and resulting needs are reported at the county and basin level. It is expected that within the non-municipal water user categories, funding will come from a combination of the methods outlined below, which in turn, come from a review of existing funding programs, funding methodologies outlined as part of recommended strategies (discussed also in Chapter 4), and review of information contained in previous water plans.

<u>Manufacturing</u>: The only manufacturing WUG with a need and a capital cost associated with the recommended strategy is the Hays County – Colorado River Basin Manufacturing WUG. The strategy proposed for this WUG falls into the new/expanded use of groundwater category. It is anticipated that the manufacturers will directly construct the required infrastructure to supply the additional groundwater.

<u>Steam-Electric Power</u>: Steam-electric power is projected to increase in direct proportion to population and manufacturing growth, and along with it, an associated increase in water demand. The Matagorda County – Colorado Basin Steam-Electric Power WUG (South Texas Nuclear Operating Company) is the only user with an anticipated capital cost for addressing needs over the planning period. This capital cost is associated with development of a brackish groundwater desalination plant. It is expected that plant

owners will obtain financing through traditional methods in order to complete the project, and these costs will be passed through to the customer through the rate charged for providing electric power.

<u>Mining</u>: Shortages in the Mining WUG category are anticipated across the region, with the majority of the needs to be met through the new or expanded use of groundwater. Capital costs associated with new or additional facilities would be borne by the private mining company. In fact, much of the mining occurs in areas where the surface mine penetrates shallow groundwater, so the need is more for pumping and recirculation equipment than for actual groundwater wells.

<u>Livestock</u>: The primary strategy for addressing the needs of Livestock WUGs in the region is new or expanded use of groundwater supplies. The estimated capital costs required to implement this strategy were developed under the assumption that each individual livestock owner would develop or expand their groundwater use individually on their property, rather than from development of a larger collection and distribution system for a group of users. Therefore, it is anticipated that capital costs would be borne individually by the respective landowner.

<u>Irrigation</u>: Irrigation capital infrastructure costs are related to the precision laser-leveling component of the irrigation conservation strategy. HB 1437, enacted in 1999 during the 76th session of the Texas Legislature, authorized LCRA to transfer up to an additional 25,000 ac-ft/yr from the Colorado River Basin to new customers within the Brazos River Basin. The legislation allows the transfer only if there is no net loss to the Colorado River Basin and requires that any adverse effects of the transfer be mitigated. Funding for this mitigation is addressed through the establishment of an Agricultural Water Conservation Fund (Ag Fund). One of the mitigation projects proposed is the precision laser-leveling of rice fields. Irrigation users will be responsible for paying 20 percent of the capital cost of the precision leveling. Individual irrigators would predominantly fund this share of the capital cost. Assistance may also be available to the irrigators through the Ag Fund. Note that the capital costs shown above in *Table 9.1* and *Figure 9.1* represent the irrigators 20 percent capital cost portion.

Additional irrigation conservation measures and improvements are part of the LCRA-SAWS Water Project and, as mentioned above, the costs for the water project are to be borne by SAWS.

9.3.3 Wholesale Water Providers

There are two WWPs, as defined by the State planning process in Region K, LCRA and the City of Austin (COA).

<u>Lower Colorado River Authority (LCRA)</u>: LCRA has developed a 10-year plan, entitled "Water Services – 10-year Capital Improvement Plan" which provides information on specific projects planned for the next ten years. Specifically, the plan discusses four major categories of capital expenditures: Water and Wastewater Utilities, Stored Water, Hydroelectric, and Irrigation. With respect to funding, LCRA's plan indicates that its policy allows funding of its capital program to come from a combination of net revenues and debt. The plan states that water and wastewater utility, hydroelectric, flood, irrigation, and other river management projects are to be funded using new tax-exempt commercial paper debt, while net revenues will fund all other capital expenditures to the extent available.

<u>City of Austin (COA)</u>: Austin Water Utility (AWU) updates its ten-year Capital Improvements Program (CIP) plan annually. The update process includes reviewing all existing CIP projects, identifying new projects, and evaluating financing options. AWU generally finances its capital improvement projects

through a combination of cash or current revenues, bonds, and grant funding, to the extent available. The percent share of each funding source is typically 20 percent for cash or current revenues, 65 percent for bonds, and up to 15 percent for Federal Government Grant Programs (through the Bureau of Reclamation's Grant Program, for example.) To the extent that grant programs do not supplement the funding needs, the remainder would be funded by cash and bonds.

9.4 INTRODUCTION TO SOCIOECONOMIC IMPACTS OF UNMET WATER NEEDS

The following excerpts are taken directly from the Executive Summary to the TWDB report entitled *Socioeconomic Impacts of Unmet Water Needs in the Lower Colorado Planning Area*, dated August 2005. The full report, which includes the information below as well as additional sociological impacts, such as reduction in population and school enrollment, is provided in full as *Appendix 9C* to this chapter:

Section 357.7(4) of the rules for implementing Texas SB 1 requires RWPG 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 TWDB to provide technical assistance to complete socioeconomic impact assessments. In response to requests from RWPGs, staff of the TWDB's Office of Water Resources Planning designed and conducted analyses to evaluate socioeconomic impacts of unmet water needs.

Water shortages due to severe drought combined with infrastructure limitations would likely curtail or eliminate economic activity in business and industries heavily 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 business and industry, but they might also bias corporate decision makers against plant expansion or plant location in Texas. From a societal 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.

Table 9.2 and *Figure 9.2* summarize estimated economic impacts. Variables shown include:[1]

- **Sales** – economic output measured by sales revenue
- **Jobs** – number of full and part-time jobs 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 for the region
- **Business taxes** – sales, excise, fees, licenses, and other taxes paid during normal operation of an industry (does not include any type of income tax)

[1] When aggregated at a regional level, total sales are not necessarily a good measure of economic prosperity because they include sales to other industries for further processing. For example, a farmer sells rice to a rice mill, which the rice mill processes and sells to another consumer. Both transactions are counted in an input-output model. Thus, total sales "double count." Regional income plus business taxes are more suitable because they are a better measure of net economic returns.

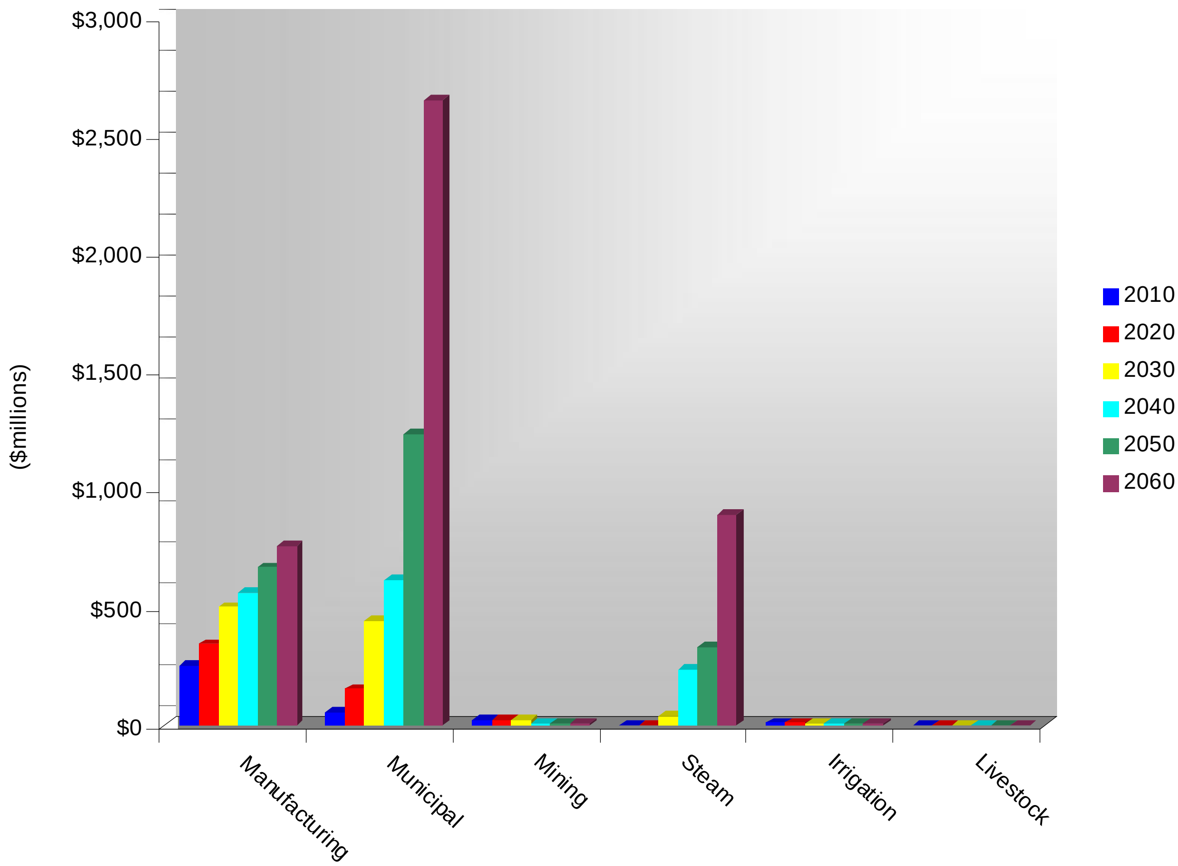
If drought of record conditions, return and water supplies are not developed, and study results indicate that the Region K Water Planning Area would suffer significant losses. If such conditions occurred in 2010, lost income to residents in the region could total $335 million with associated job losses as high as 4,475. State and local governments could lose nearly $8.32 million in tax receipts. If such conditions occurred in 2060, income losses could run $4,312 million, and job losses could total 49,385. Nearly $248 million worth of State and local taxes would be lost. Reported figures are probably conservative because they are based on estimated costs for a single year; however, in much of Texas, the drought of record lasted several years. For example, in 2030, models indicate that shortages would cost residents and businesses in the region $1,005 million in lost income. Thus, if shortages lasted for three years, total losses related to unmet needs could easily approach $3,015 million.

Table 9.2: Annual Economic Impacts of Unmet Water Needs

Year	Sales ($ millions)[1]	Income ($ millions)[1]	Jobs	State and Local Taxes ($ millions)[1]
2010	$553.83	$334.94	4,475	$8.32
2020	$855.68	$524.96	7,435	$15.98
2030	$1,525.45	$1,005.33	13,885	$39.51
2040	$2,098.74	$1,431.38	19,340	$83.84
2050	$2,803.69	$2,242.28	27,465	$117.29
2060	$4,734.38	$4,312.66	49,385	$248.47

Source: TWDB, Office of Water Resources Planning
[1] In year 2000 dollars

Figure 9.2: Distribution of Lost Income by Water Use Category



Source: TWDB, Office of Water Resources Planning

9.5 SOCIOECONOMIC IMPACTS AND ANNUAL COSTS OF IMPLEMENTING THE REGIONAL WATER PLAN

As discussed in the previous section and in more detail in the full report in *Appendix 9C*, there are significant negative economic impacts which would occur during the return of drought of record conditions at anytime during the planning period, if sufficient water supplies are not developed. These impacts have both sociological, and in turn, economic consequences on the region. The economic consequences to the region were summarized in *Table 9.2* in the previous section. *Table 9.3* below compares the total estimated annual cost of implementing the Regional Plan's recommended strategies with the total economic impact of unmet water needs, shown for each decade across the entire planning period.

Table 9.3: Comparison of Annual Costs of Implementing Strategies and Annual Economic Impacts of Unmet Water Needs

Year	Total Estimated Annual Cost of Strategies ($ millions)[1]	Total Socioeconomic Impact to Region ($ millions)[1]
2010	48.46	897.09
2020	54.53	1,396.62
2030	64.53	2,570.29
2040	71.86	3,613.96
2050	77.89	5,163.26
2060	99.56	9,295.51

[1] The total socioeconomic impacts provided in year 2000 dollars. Total estimated annual costs of strategies provided in 2nd Quarter 2002 dollars. The values are provided for comparison purposes only.

The annual socioeconomic cost to the region is larger than the annual cost of implementing water strategies by a factor of 18.5 in decade 2010, and increases to a factor of 93 by 2060. Therefore, if drought of record conditions were to occur during the planning period, the anticipated annual socioeconomic impacts of unmet water needs on the region greatly outweigh estimated annual costs of implementing the strategies recommended to meet those water needs.

It should also be noted here that the above analysis does not include costs for impact on the environment. There is no readily available study which defines the economic cost of reduced instream flows to the above cost impacts. There is data available about the economic impact of reduced inflows on the fishery industry in Matagorda Bay. The economic impact of the shrimp industry alone is estimated at $330 million annually and supports 30,000 jobs (Texas Center for Policy Study 2002). However it is difficult to determine whether or not the impacts predicted assume that the water provided in the LCRA Management Plan is considered available. LCRA is and remains committed to providing the instream flows and bay and estuary freshwater inflows currently included in their management plan, which would take place regardless of whether or not the management strategies noted in this plan are implemented. This issue deserves more in-depth study in the next round of planning.

APPENDIX 9A

TABULATED SURVEY RESULTS

Table 9A-1
Infrastructure Financing Survey Responses

RWPG	Name of Political Subdivision	Recommended Project/Strategy	Implementation Date	Capital Cost to be Paid by Political Subdivision	ID # from DB07	Planning on Implementing the Recommended Strategy? (Y/N)	IF 'NO': If 'no' explanation of how they will meet future water needs	IF 'YES' -----> % Cash Reserves	% Bonds	% Bank Loans	% Government Programs - Federal	% Government Programs - State	% Other	Other explanation	TOTAL % (should be 100%)	Name of Contact Person	Title	Phone
K	Shady Hollow MUD	Conservation	2010	$ -		N	Shady Hollow MUD is built out and we do not anticipate any additional need for water									Valerie Wheeler	General Manager	(512) 280-6622
K	Shady Hollow MUD	Contract Renewal	2040	$ -		N	see above									Valerie Wheeler	General Manager	(512) 280-6622
K	Bastrop	Conservation	2010	$ -		Y										Mike Fisher	Director W/WW	(512) 321-2124
K	Bastrop	Expand Other Aquifer Supply	2050	$ 314,000		Y						100%		Revolving Fund Grant/Loan	100%	Mike Fisher	Director W/WW	(512) 321-2124
K	Lakeway	Conservation	2010	$ -		Y								Lakeway is served by 3 utility districts and does not have a city owned water utility. The City of Lakeway does not plan on constructing any capital projects for water supply		Steve Jones	City Manager	(512) 314-7504
K	Lakeway	Contract Renewal	2030	$ -		Y								see above		Steve Jones	City Manager	(512) 314-7504
K	Lakeway	Purchase water from LCRA	2010	$ -		Y								see above		Steve Jones	City Manager	(512) 314-7504
K	Barton Creek West WSC	Conservation	2010	$ -		N	Barton Creek West is built out and we do not anticipate any additional need for water									Bruce Aupperle, PE	District Engineer	(512) 422-7838
K	Barton Creek West WSC	Purchase additional water from West Travis County RWS	2000	$ -		N	see above									Bruce Aupperle, PE	District Engineer	(512) 422-7838
K	Goldthwaite	Conservation	2010	$ -		Y										Bobby Rountree	City Manager	(325) 648-3186
K	Goldthwaite	Conservation	2010	$ -		Y										Bobby Rountree	City Manager	(325) 648-3186
K	Goldthwaite	Construct additional Goldthwaite off-channel reservoir		$ -		Y										Bobby Rountree	City Manager	(325) 648-3186
K	Goldthwaite	Construct Goldthwaite channel dam	2000	$ 1,405,950		Y			25%		50%	25%		USDA? Rural Water Assistance Fund, TWDB Funds, or other funding programs available at the time	100%	Bobby Rountree	City Manager	(325) 648-3186
K	Goldthwaite	Expand current Trinity Supply		$ -		Y										Bobby Rountree	City Manager	(325) 648-3186
K	Goldthwaite	Expand current Trinity Supply	2000	$ 3,944,000		Y			25%		50%	25%		see above	100%	Bobby Rountree	City Manager	(325) 648-3186
K	Goldthwaite	Expand current Trinity Supply (from Brazos basin)		$ -		Y										Bobby Rountree	City Manager	(325) 648-3186
K	Richland SUD	Conservation	2010	$ -		Y										August Pope	Manager	(325) 452-3210
K	Richland SUD	New Well (strategy added by WUG)	2005	$ 500,000		Y		16.6%	83.4%						100%	August Pope	Manager	(325) 452-3210
K	Smithville	Conservation	2010	$ -		Y										Tex Middlebrook	City Manager	(512) 237-3282
K	Smithville	Expand Current Carrizo-Wilcox Supply	2000	$ 332,000		Y		20%				80%		Community Development Block Grant. Requires 20% match.	100%	Tex Middlebrook	City Manager	(512) 237-3282
K	WTC MUD No.1	Contract Renewal	2020	$ -		-	This District is essentially built-out. District is a wholesale customer of Cedar Park, and is relying on Cedar Park to construct the water supply system in advance of need.								.	Mike Willatt		(512) 476-6604

Table 9A-1
Infrastructure Financing Survey Responses

IF 'NO' IF 'YES' ----->

RWPG	Name of Political Subdivision	Recommended Project/Strategy	Implementation Date	Capital Cost to be Paid by Political Subdivision	ID # from DB07	Planning on Implementing the Recommended Strategy? (Y/N)	If 'no' explanation of how they will meet future water needs	% Cash Reserves	% Bonds	% Bank Loans	% Government Programs - Federal	% Government Programs - State	% Other	Other explanation	TOTAL % (should be 100%)	Name of Contact Person	Title	Phone
K	Travis WCID #19	Conservation	2030	$ -		-	This District is essentially built-out. District is a wholesale customer of Travis Co MUD No.4, and is relying on the MUD to construct the water supply system in advance of need.									Mike Willatt		(512) 476-6604
K	Travis WCID #19	Contract Renewal	2010	$ -		-	see above									Mike Willatt		(512) 476-6604
K	Travis WCID #17	Conservation	2010	$ -		Y		30%	20%			50%		Water and Wastewater Load Program	100%	Deborah Gernes	General Manager	(512) 266-1111
K	Travis WCID #17	Contract Renewal	2020	$ -		Y		30%	20%			50%			100%	Deborah Gernes	General Manager	(512) 266-1111
K	Cimarron Park Water	Conservation	2010	$ -		N	The initial population estimates are wrong. Our current estimated population is 2037. Our service area is 96% built out. We project total build out population of 2118 for our service area. Hydrological studies on our 2 wells indicated that we have capacity for total build out. We are currently permitted for 118,000,000 gallons and project that 140,000,000 will meet build out demands. All of our infrastructure is already in place. We may connect to surface water when it becomes available for supplemental supply. We have planned to meet our service area demands since 1985.									Byron Townsend	President	(512) 295-2583
K	Cimarron Park Water	Expand current Edwards BFZ Supply	2000	$ 424,000		N	see above									Byron Townsend	President	(512) 295-2583
K	West Lake Hills	Conservation	2010	$ -		N	no additional comments provided									Daniel Sowada	City Administrator	(512) 327-3628
K	West Lake Hills	Purchase water from LCRA	2030	$ -		N	no additional comments provided									Daniel Sowada	City Administrator	(512) 327-3628
K	Flatonia	Conservation	2010	$ -		Y	We also plan on drilling a new well in the next few years					100%		TWDB Drinking Water Fund	100%	Robert Word	City Manager	(361) 865-3548
K	Flatonia	Expand current Gulf Coast Supply	2000	$ -		Y										Robert Word	City Manager	(361) 865-3548
K	City of Austin	Advanced water conservation for the City of Austin	2000	$ -		Y										David Anders & Teresa Lutes	Finance Manger, Systems Planning Manager	(512) 972-0323 (512) 972-0179
K	City of Austin	COA Reuse	2000	$ 142,981,000		Y		20%	65%		15%				100%	David Anders & Teresa Lutes	Finance Manger, Systems Planning Manager	(512) 972-0323 (512) 972-0180
K	City of Austin	Contract Renewal	2060	$ -		Y										David Anders & Teresa Lutes	Finance Manger, Systems Planning Manager	(512) 972-0323 (512) 972-0181

APPENDIX 9B

SURVEY QUESTIONNAIRES

LOWER COLORADO REGIONAL WATER PLANNING GROUP

John E. Burke, P.E.
Chairman

P.O. Drawer P
Bastrop, TX 78602

Phone: 512/303-3943
Fax: 512/303-4881

TO POLITICAL SUBDIVISIONS WITH WATER NEEDS IN LCRWPG

The Lower Colorado Regional Water Planning Group (LCRWPG), is currently updating the Regional Water Plan. Your political subdivision is projected to have water demands that exceed the currently available water supply during the 50-year planning period. This may be due to projected population and demand growth, limitations on groundwater use, or a combination of the two.

The LCRWPG is recommending a combination of water conservation, expanded use of groundwater, water reuse, desalination of brackish groundwater, and new or existing surface water supplies to meet the projected water demands. These recommendations for your political subdivision are summarized on the attached tables, which are excerpted from the tables in the Initially Prepared Plan. In these tables, it may be assumed that surface water will be treated and distributed through regional facilities, with individual water user groups paying a pro-rata share of the regional infrastructure costs. Local infrastructure (new wells, distribution mains and related equipment) will be funded and constructed by the political subdivision.

The Texas Water Code requires the Regional Water Planning Groups to survey all political subdivisions with projected water needs about infrastructure financing. The goal of the survey is to determine State funding levels for existing infrastructure loan and grant programs, and to identify any areas not addressed by current programs. For your reference, a list of existing loan and grant programs is included with this survey packet.

Please return the completed survey by <u>September 30, 2005</u> to:

Lower Colorado Regional Water Planning Group
c/o Turner Collie & Braden, Inc.
400 West 15th Street, Suite 500
Austin, Texas 78701
512-457-7741, or 713-267-3293
512-472-7519 Fax
E-mail address: Rebeka.lien@tcb.aecom.com or mark.lowry@tcb.aecom.com

If you have any questions regarding this survey, please contact: Rebeka Lien at 512/457-7741 or Mark Lowry, at 713-267-3293.

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ______________________

Political Subdivision (WUG or WWP) *SHADY HOLLOW MUD*

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Contract Renewal	2040		
TOTAL COST OF CAPITAL IMPROVEMENTS		$ 0	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☐ ***YES*** ☒ ***NO***

If 'no,' describe how you will meet your future water needs.

Shady Hollow MUD. is built out and we do not anticipate any additional need for water

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

☐ %________ Cash Reserves
☐ %________ Bonds
☐ %________ Bank Loans
☐ %________ Federal Government Programs
☐ %________ State Government Programs
☐ %________ Other________
%________ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

____

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Valerie Wheeler	Gen Mgr	280-6622

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ______________________

Political Subdivision (WUG or WWP) *BASTROP*

Recommended Project/Strategy	Implementation Date	Capital Cost to be paid by Political Subdivision	ID# from DBO7*
Conservation	2010		
Expand Other Aquifer supply	~~2000~~ 2050	314,000	
TOTAL COST OF CAPITAL IMPROVEMENTS		$314,000	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

X ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

____

____

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☐ %________ Cash Reserves
☐ %________ Bonds
☐ %________ Bank Loans
☐ %________ Federal Government Programs
☐ % 100 State Government Programs
☐ %________ Other________________
% ________ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

REVOLVING FUND GRANT/LOAN

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

MIKE FISHER	DIRECTOR W/WW	512-321-2124
Name	Title	Phone

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ______________________________

Political Subdivision (WUG or WWP) __ *LAKEWAY* ____________

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Contract Renewal	2030		
Purchase water from LCRA/Highland Lakes	2010		
TOTAL COST OF CAPITAL IMPROVEMENTS		$ 0	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☑ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

ق %__0__ Cash Reserves
ق %__0__ Bonds
ق %__0__ Bank Loans
ق %__0__ Federal Government Programs
ق %__0__ State Government Programs
ق %__0__ Other________
%__0__ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

---

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Steve Jones	City Manager	512-314-7504
Name	Title	Phone

Note: Lakeway is served by 3 utility districts and does not have a city owned water utility. The City of Lakeway does not plan on constructing any capital projects for water supply.

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ______________________________

Political Subdivision (WUG or WWP) *BARTON CREEK WEST WSC*

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Purchase additional water from West Travis County RWS	2000		
TOTAL COST OF CAPITAL IMPROVEMENTS		$ 0	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☐ ***YES*** ☒ ***NO***

If 'no,' describe how you will meet your future water needs.

Barton Creek West is built out and we do not anticipate any additional need for water.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☐ %________ Cash Reserves

☐ %________ Bonds

☐ %________ Bank Loans

☐ %________ Federal Government Programs

☐ %________ State Government Programs

☐ %________ Other________________

%________ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

____

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
BRUCE S. AUPPERLE, P.E.	DISTRICT ENGINEER	512-422-7838

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group K

Political Subdivision (WUG or WWP) *GOLDTHWAITE*

Recommended Project/Strategy	***Implementa-tion Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Conservation	2010		
Construct additional Goldthwaite off-channel reservoir			
Construct Goldthwaite channel dam	2000	1,405,950	
Expand current Trinity supply			
Expand current Trinity supply	2000	3,944,000	
Expand current Trinity supply (from Brazos basin)			
TOTAL COST OF CAPITAL IMPROVEMENTS		$5,349,950	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☒ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

___

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

☐ %______ Cash Reserves
☐ % 25 Bonds
☐ %______ Bank Loans
☐ % 50 Federal Government Programs (USDA?)
☐ % 25 State Government Programs
☐ %______ Other______
% ______ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

Rural Water Assistance Fund, TWDB Funds or whatever funding programs that are available at the time

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Bobby Rountree	City Manager	(325) 648-3186

This will depend on the type of grant funds that are available at the time

BR

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ______________________________

Political Subdivision (WUG or WWP) RICHLAND SUD

Recommended Project/Strategy	Implementation Date	Capital Cost to be paid by Political Subdivision	ID# from DBO7*
Conservation	2010		
New Well	2005	500,000.00	
TOTAL COST OF CAPITAL IMPROVEMENTS		$ 0 500,000.00	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☒ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

____

____

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☐ % 16.6 Cash Reserves

☐ % 83.4 Bonds (Revenue)

☐ % ______ Bank Loans

☐ % ______ Federal Government Programs

☐ % ______ State Government Programs

☐ % ______ Other ________________

% 100 TOTAL – (Sum should equal 100%)

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

NA

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

August Pope	Mgr	325-452-3210
Name	Title	Phone

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group Lower Colorado

Political Subdivision (WUG or WWP) *SMITHVILLE*

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Expand current Carrizo-Wilcox supply	2000	332,000	
TOTAL COST OF CAPITAL IMPROVEMENTS		$332,000	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☒ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

____

____

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☒ % 20 Cash Reserves
☐ % ______ Bonds
☐ % ______ Bank Loans
☐ % ______ Federal Government Programs
☒ % 80 State Government Programs
☐ % ______ Other ______________
% 100 *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

Community Development Block Grant. Requires 20% match.

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Tex Middlebrook	City Manager	512 237-3282
Name	Title	Phone

Lien, Rebeka

From: Willatt & Flickinger [mwillatt@wfaustin.com]

Sent: Tuesday, September 13, 2005 3:44 PM

To: Lien, Rebeka

Subject: WTC MUD NO. 1

Rebeka:

We received a sample survey to obtain infrastructure financing information from political subdivisons with needs, directed to Williamson-Travis Counties MUD No. 1.

This District is essentially built out. It has issued is last series of bonds.

The Distrit is a wholesale customer of the City of Cedar Park. It is relying upon Cedar Park to plan and construct the water supply system in advance of need.

Please let me know if further information is needed.

Mike Willatt
476-6604

Lien, Rebeka

From: Willatt & Flickinger [mwillatt@wfaustin.com]

Sent: Tuesday, September 13, 2005 3:44 PM

To: Lien, Rebeka

Subject: TRAVIS COUNTY WCID NO. 19

Rebeka:

We received a sample survey to obtain infrastructure financing information from political subdivisons with needs, directed to Williamson-Travis Counties MUD No. 1.

This District is essentially built out.

The Distrit is a wholesale customer of Travis County MUD No. 4. It is relying upon that MUD to plan and construct the water supply system in advance of need.

Please let me know if further information is needed.

Mike Willatt
476-6604

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group REGION K

Political Subdivision (WUG or WWP) *TRAVIS COUNTY WCID #17*

Recommended Project/Strategy	***Implementa-tion Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Contract Renewal	2020		
TOTAL COST OF CAPITAL IMPROVEMENTS		$ 0	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☒ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☐	% 30	Cash Reserves
☐	% 20	Bonds
☐	% 0	Bank Loans
☐	% 0	Federal Government Programs
☐	% 50	State Government Programs
☐	% ——	Other ________
	% 100	*TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

WATER AND WASTEWATER LOAN PROGRAM

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Deborah Gernes	General Manager	(512) 266-1111 Ext 13

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group LCRWPG

Political Subdivision (WUG or WWP) *CIMARRON PARK WATER COMPANY*

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Expand current Edwards BFZ supply	2000	424,000	
TOTAL COST OF CAPITAL IMPROVEMENTS		$424,000	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☐ **YES** ☒ **NO**

If 'no,' describe how you will meet your future water needs.

See Below Note

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☐ %________ Cash Reserves

☐ %________ Bonds

☐ %________ Bank Loans

☐ %________ Federal Government Programs

☐ %________ State Government Programs

☐ %________ Other__________

%________ TOTAL – (Sum should equal 100%)

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Byron T. Townsend	President	512-295-2583

The initial population estimates are wrong. Our current estimated population is 2037. Our service area is 96% built out. We project total build out population of 2118 for our service area. Hydrological studies on our 2 wells indicate that we have capacity for total build out. We are currently permitted for 118,000,000 gallons and project that 140,000,000 will meet build out demands. All of our infrastructure is already in place. We may connect to surface water when it becomes available for supplemental supply. We have planned to meet our service area demands since 1985.

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ____________________

Political Subdivision (WUG or WWP) *WEST LAKE HILLS*

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Purchase water from LCRA/Highland Lakes	2030		
TOTAL COST OF CAPITAL IMPROVEMENTS		$ 0	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☐ ***YES*** ☒ ***NO***

If 'no,' describe how you will meet your future water needs.

____

____

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☐ %________ Cash Reserves

☐ %________ Bonds

☐ %________ Bank Loans

☐ %________ Federal Government Programs

☐ %________ State Government Programs

☐ %________ Other________________

%________ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

____

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

DANIEL E. SOWADA — Name

CITY ADMINISTRATOR — Title

512-327-3628 — Phone

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ______________________

Political Subdivision (WUG or WWP) *FLATONIA*

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Conservation	2010		
Expand current Gulf Coast supply	2000		
TOTAL COST OF CAPITAL IMPROVEMENTS		$ 0	

*ID# not yet assigned

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☒ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

We also plan on drilling a new water well in the next few years.

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and

2) Percent share of the total cost to be met by each funding source.

☐ %______ Cash Reserves

☐ %______ Bonds

☐ %______ Bank Loans

☐ %______ Federal Government Programs

☐ % 100 State Government Programs

☐ %______ Other______

% 100 TOTAL – (Sum should equal 100%)

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

TWDB Drinking Water Fund

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Robert J Wood	City Manager	361 865 3548

SAMPLE SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group K

Political Subdivision (WUG or WWP) AUSTIN

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7****
Advanced water conservation for the City of Austin	2000		
COA reuse	2000	142,981,000	
Contract Renewal	2060		
~~Reduction in LCRA Commitment~~			
~~Reduction in LCRA Commitment~~			
~~ROR Increase due to COA Return Flows~~			
~~ROR Increase due to downstream Return Flows~~			
? - would need further clarification on these four?			
TOTAL COST OF CAPITAL IMPROVEMENTS		$142,981,000	

*ID# not yet assigned

Survey comments pertain to these Recommended Strategies.

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☒ ***YES***, ☐ ***NO***

however, only the FIRST THREE listed

If 'no,' describe how you will meet your future water needs.

___

___

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

☑	% 20	Cash Reserves
☑	% 65	Bonds
☐	% ___	Bank Loans
☑	% 15	Federal Government Programs
☐	% ___	State Government Programs
☐	% ___	Other ___
	% 100	*TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

___

___

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
David ANDERS	FINANCE Manager	(512) 972-0323
and Teresa Lutes	Systems Planning Manager	(512) 972-0179

Texas Water Development Board

Financial Assistance Programs

Public Works Infrastructure Construction

Clean Water State Revolving Fund Loan Program

- Type: Loan
- Uses: Planning, acquisition and construction, wastewater treatment, stormwater and nonpoint source pollution control, and reclamation/reuse projects.
- Applicants: Political Subdivisions. Individuals are eligible to apply for non-point source pollution control projects.
- Availability: An annual priority rating process applies to projects.

Drinking Water State Revolving Fund Loan Program

- Type: Loans and additional subsidies (subsidies are for disadvantaged communities only)
- Uses: Planning, acquisition and construction of water related infrastructure, including water supply and Source Water protection.
- Applicants: Community water system owners and Nonprofit Non-Community water system owners are eligible to apply for the funding. This includes political subdivisions of the state and private individuals.
- Availability: An annual priority rating process applies to projects.

Rural Water Assistance Fund Program

- Type: Loan
- Uses: Planning, acquisition and construction of water supply related infrastructure, including water treatment, water distribution pipelines, reservoir construction, and storage acquisition. May also be used for water quality enhancement projects such as wastewater collection and treatment systems.
- Applicants: Political Subdivisions and Nonprofit Water Supply Corporations.
- Availability: Not restricted.

State Participation in Regional Water and Wastewater Facilities Program

- Type: Deferred interest loan (State has a temporary ownership interest in a facility; State's ownership is purchased by applicant as their customer base grows.)
- Uses: Construction of regional water or wastewater construction project when the local sponsors are unable to assume debt for the optimally sized facility.
- Applicant: Political Subdivisions of the State and Water Supply Corporations which are sponsoring construction of a regional water or wastewater project can apply for funding.
- Availability: Limited Funds.

Water and Wastewater Loan Program

- Type: Loan
- Uses: Planning, acquisition and construction of water related infrastructure, including water supply, wastewater treatment, stormwater and nonpoint source pollution control, flood control, reservoir construction, storage acquisition, and agricultural water conservation projects, and municipal solid waste facilities.
- Applicants: Political Subdivisions and Nonprofit Water Supply Corporations.
- Availability: Not restricted.

Colonias

Economically Distressed Area Program for Water and Sewer Service

- Type: Grant, loan, or a combination grant/loan.
- Uses: To bring water and wastewater services to economically distressed areas (designated by TWDB) where the present water and wastewater facilities are inadequate to meet the minimal needs of residents. The program includes measures to prevent future substandard development.
- Applicants: Political subdivisions, and nonprofit water supply corporations, provided they meet certain program requirements.
- Availability: Limited Funds.

Colonia Plumbing Loan Program

- Type: Low-interest loan.
- Uses: assist low-to-moderate income colonia residents with financing plumbing connections to water and wastewater (sewer) systems and with installation of necessary plumbing improvements within their homes.
- Applicants: Local political subdivisions including cities, counties, water districts, water authorities, and non-profit water supply corporations in designated counties.
- Availability: Limited Funds.

Community Self-Help Program for Water and Sewer

- Type: Grant
- Uses: Actual cost to acquire water and wastewater systems to provide adequate service to Colonias where the local residents provide volunteer labor (sweat equity) to construct the facilities, and/or donate equipment, materials, and supplies. The dollar value of the assistance provided by the local residents must be at least 40% of the total amount of the cost of the project.
- Applicants: political subdivisions, including cities, counties, water districts, and nonprofit water supply corporations within Affected Counties (specified by statute).
- Availability: Limited Funds.

Flood Mitigation

Federal Emergency Management Agency Flood Mitigation Assistance

- Type: Grant
- Uses: Planning assistance to communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP). Eligible work includes: Acquisition of insured structures and real property; Relocation or demolition of insured structures; Dry flood proofing of insured structures; Elevation of insured structures; Minor, localized structural projects that are not fundable by State or other Federal programs; and Beach nourishment activities such as planting of dune grass.
- Applicants: Political subdivision, including any Indian or authorized tribal or native organization, that has zoning and building code jurisdiction over a particular area having special flood hazards, and is participating in the NFIP. Communities that are suspended or on probation from the NFIP are not eligible. A community applying for a FMA Project Grant must have an approved Flood Mitigation Plan.
- Availability: Dollar limits apply to each application.

Flood Protection Planning

- Type: Grant
- Uses: Evaluation of structural and nonstructural solutions to flooding problems and considers flood protection needs of the entire watershed. Upstream and/or downstream effects of proposed solutions must be considered in the planning. The proposed planning must be regional in nature by inclusion of an entire watershed.
- Applicants: Political subdivisions of the State of Texas with the legal authority to plan for and implement flood protection measures, and that are members of the National Flood Insurance Program.
- Availability: Projects compete annually for funding.

Groundwater - Natural Resources

Groundwater Conservation District Startup Loan Program

- Type: Loan
- Uses: Finance the start-up costs (salaries and payroll taxes; utilities; travel; insurance; building and office leases; office supplies and furniture; telephone and computer equipment; and legal and professional fees) of Groundwater Conservation Districts.
- Applicants: District or authority created under the Texas Constitution, Section 52, Art. III, or Section 59, Article XVI, that has the authority to regulate the spacing of water wells, the production from water wells, or both. The district must be a newly confirmed district or legislatively created district that does not require a confirmation election.
- Availability: Limited Funds.

Planning

Regional Facility Planning Grant Program

- Type: Grants
- Uses: Studies and analyses to evaluate and determine the most feasible alternatives to meet regional water supply and wastewater facility needs, estimate the costs associated with implementing feasible regional water supply and wastewater facility alternatives, and identify institutional arrangements to provide regional water supply and wastewater services for areas in Texas.
- Applicants: Political subdivisions with the legal authority to plan, develop, and operate regional facilities, and nonprofit water supply corporations.
- Availability: Projects compete annually for funding.

Regional Water Planning Group Grants

- Type: Grant
- Uses: planning activities for the long term water supply needs of Texas. Fundable tasks include determining future water demands, availability of future water supplies, and identifying solutions to meet demands. Funds are periodically available.
- Applicants: Political Subdivisions predesignated by the 16 Regional Water Planning Groups in the state.
- Availability: Limited Funds.

Research

Water Research Grant Program

- Type: Grant
- Uses: Water research that addresses one of the Texas Water Development Board's designated research topics published in its most recent Request For Proposals.
- Applicants: Individuals, political subdivisions of the state, and nonprofit water supply corporations are eligible to apply for funding.
- Availability: Annual application process published with Request for Proposals.

Agriculture

Agriculture Water Conservation Grants

- Type: Grant (up to 100%)
- Uses: demonstrations, education, research, technical assistance, and technology transfer. Grants may also be made to political subdivisions for agricultural water conservation projects for purchase and installation (on public or private property) of metering devices to measure irrigation water use in order to quantify effects of different water conservation strategies.
- Applicants: State Agencies and Political Subdivisions of the State
- Availability: Annual funding opportunity; Solicitations appear in Texas Register.

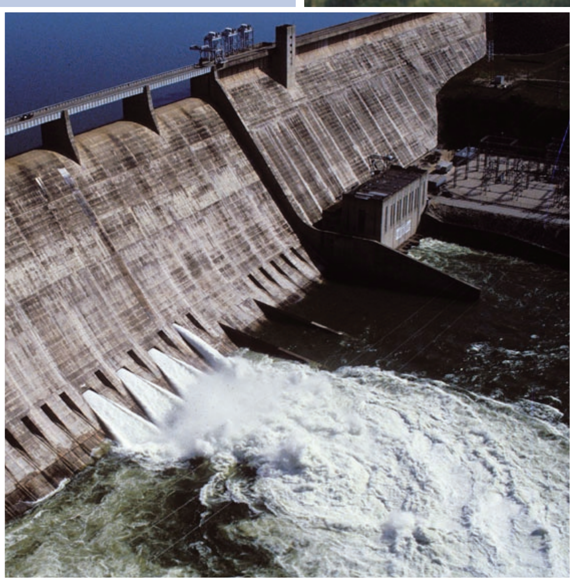
Agriculture Water Conservation Loans

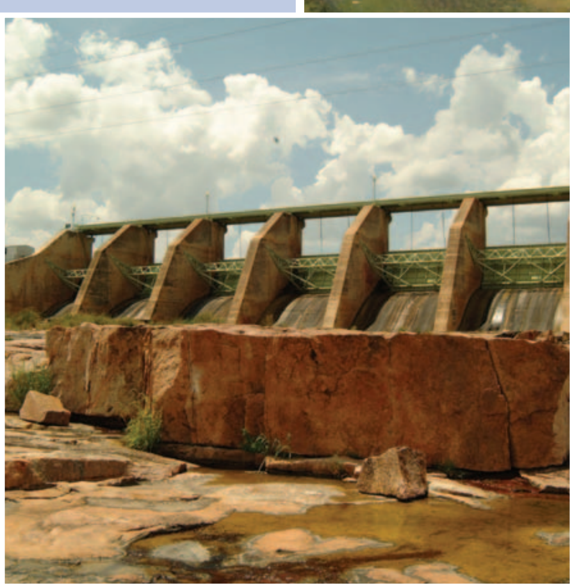
- Type: Loan
- Uses: Conservation projects that: 1.) improves water use efficiency of water delivery and application, or 2.) prepares irrigated land for conversion to dry land farming, or 3.) prepares dry land for more efficient use of natural precipitation, or 4.) purchases and installs on public or private property devices designed to indicate the amount of water withdrawn for irrigation use, or 5.) brush control activities conduced under Chapter 203 of Agriculture Code, or 6.) other conservation projects defined by TWDB rules.
- Applicants: Eligible applicants include political subdivisions of the state, institutions of higher education, interstate compact commissions, and nonprofit Water Supply Corporation (Chapter 69 of Water Code), Banks and farm credit system may apply for link deposit funds to make loans available to individuals.
- Availability: Limited Funds.

LCRA
ENERGY • WATER • COMMUNITY SERVICES
www.lcra.org

Water Services

10-Year Capital Improvement Plan





FY 2006 to FY 2015

LCRA Board of Directors

General Manager

Joseph J. Beal, P.E.

The Board of Directors is composed of 15 members appointed by the governor. Directors represent counties in the electric and water service areas. The directors meet regularly to set strategic corporate direction for the general manager and the staff, to approve projects and large expenditures, and to review progress on major activities and industry issues.

Cover photos, from top:
LCRA constructed the Brushy Creek Regional Wastewater Treatment System in Williamson County, which will eventually serve 500,000 people. The treatment plant is operated by the Brazos River Authority through an agreement with LCRA.

Flood gates are open at Mansfield Dam at Lake Travis, the lower Colorado River's only flood control structure,

Buchanan Dam at Lake Buchanan is one of six dams in a chain of dams operated by LCRA on the Colorado River.

Contents

Introduction

To ensure the protection and constructive use of the area's natural resources, LCRA recognized the need to invest capital in water infrastructure throughout the lower Colorado basin. From modernizing and strengthening the dams to expanding its water and wastewater utility operation, Water Services has developed a significant base of assets, resources that can be used to enhance safety; improve the regional environment and water quality; and provide essential utility services for the citizens of the basin.

In the 10-year period from fiscal year 1995 to fiscal year 2004, Water Services invested more than $570 million in diverse projects, including water rights purchases, hydroelectric improvements, flood management projects, dam safety and improvements, and water and wastewater utility acquisitions and expansions. These capital expenditures have built a strong foundation of assets for Water Services to help LCRA fulfill its statutory mission by:

- Expanding Water and Wastewater Utility Services to safeguard public health, worker safety, the environment and water quality ($304 million)
- Purchasing the Garwood and Pierce Ranch water rights to provide future water supply for our customers ($93 million)
- Upgrading and modernizing the Highland Lakes dams to ensure safety standards and the ability to resist the probable maximum flood ($82 million)
- Improving and refurbishing hydroelectric assets to maximize the power generating value of dams by improving reliability, lengthening asset life and increasing nameplate capacity ($50 million)
- Expanding flood warning and notification systems to protect the communities within the Texas Colorado River floodplain, developing computer models used to improve flood level forecasting and building the tools to evaluate the impact of various human and industrial activities on the basin's water quality ($31 million)
- Maintaining irrigation canals to ensure a steady water supply for agricultural demands ($14 million)

As a result of our capital program, Water Services greatly enhanced its system of six dams and lakes, six hydroelectric power plants and 812 miles of irrigation canals. In addition, Water Services built a water and wastewater utility portfolio that includes 36 water and wastewater systems and a regional biosolids composting facility. Also, advanced LCRA technology, such as automated stream and weather gauges, analyzes and relays critical information that enhances Water Services' flood management and public safety activities.

Addressing the issues: Water Services employees and stakeholders face significant challenges. Infrastructure decisions involve large commitments of funds and require long-term planning and implementation time frames. To meet these challenges, Water Services plans to invest $75.5 million during FY 2006 and $283 million over the 10-year period FY 2006 to FY 2015.

Rising waters inundate land downstream of the Colorado River during the Christmas flood of 1991.

The Water Services 10-Year Capital Improvement Plan addresses how these challenges will be met from FY 2006 through FY 2015. Here is a summary of the FY 2006 capital plan:

- $58.1 million, or 77 percent, is allocated for the construction, acquisition and improvement of water and wastewater utility systems in the lower Colorado River basin and Williamson County. This investment advances LCRA's mission by fostering the health of local economies and protecting the basin's ground and surface waters.
- Another $4.6 million, or 6 percent, is for ongoing stored water projects to improve flood management and the system of dams that Water Services operates. The dam, lake and river system is used not only to manage floods, but also to provide a reliable water supply for municipal, industrial and agricultural uses, to generate hydroelectricity, and to provide for safe recreational opportunities.
- 15 percent, or $11.3 million, of Water Services' capital budget is set aside for the continual improvement of LCRA hydroelectric facilities. Because hydroelectricity is a clean, low-cost source of power, it is a vital part of the power portfolio that LCRA uses to supply about 1 million people in more than 50 counties.
- 2 percent, or $1.5 million, is budgeted for improving LCRA's irrigation facilities. Maintaining worker safety and keeping the irrigation system operable for rice farmers and other customers are vital to the economy of Matagorda, Wharton and Colorado counties.

Hydromechanics inspect the gates at Buchanan Dam.

Capital Plan Outline

Each section of the Water Services 10-Year Capital Improvement Plan provides more details about the following four major categories of capital expenditures:

1) **Water and Wastewater Utilities:** Improve and expand water and wastewater utility systems

2) **Stored Water:** Enhance LCRA's ability to predict the severity of floods, identify areas of potential flood inundation and deliver water from the Colorado River to municipalities or industry

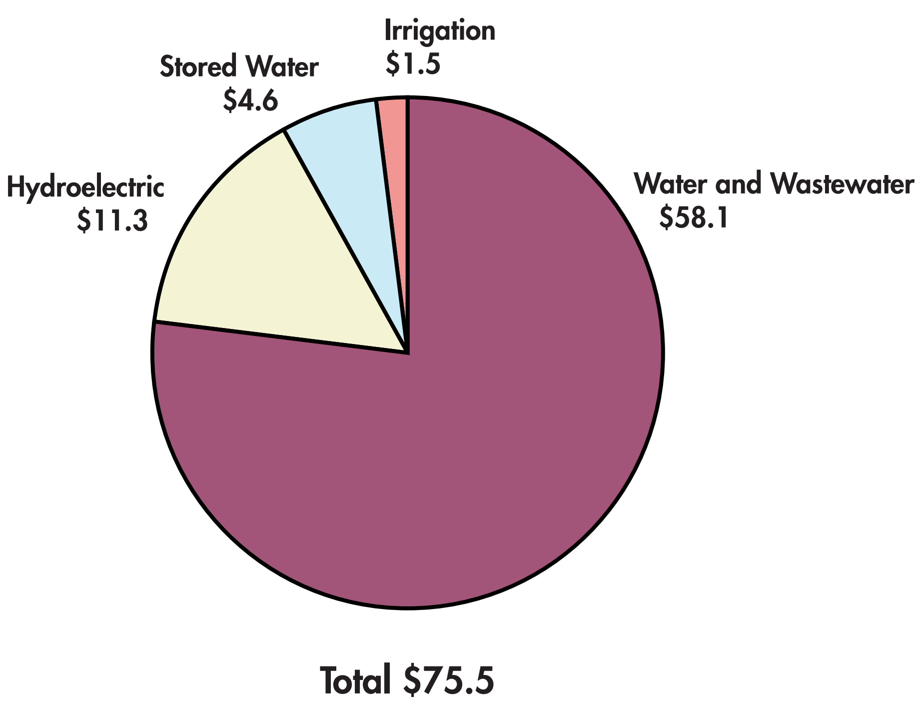
3) **Hydroelectric:** Increase the generating capacity, improve the operating efficiency, and extend the useful life of the hydroelectric generating equipment

4) **Irrigation:** Increase the operating efficiency, safety and reliability of the irrigation infrastructure

The specific projects within this 10-year Capital Improvement Plan include both those projects approved by the LCRA Board through March 2005 and those that will be presented to the Board at a later date for individual project approval. The size, scope and timing of the projects presented in this plan could vary significantly due to the factors affecting them, including changing organizational priorities.

Water Services
Capital Expenditures FY 2006

(Dollars in Millions)



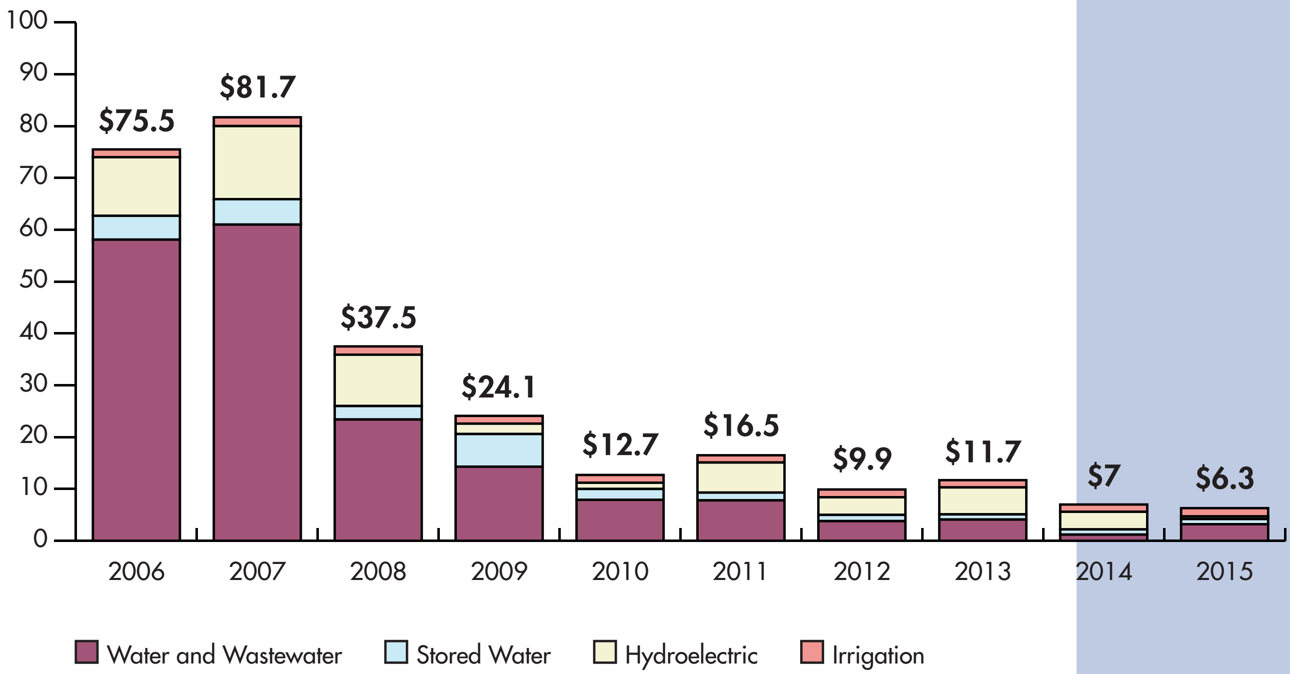
Funding Sources

LCRA policy allows Water Services to fund its capital program with a combination of net revenues and debt. In general:

- New tax-exempt commercial paper debt is issued for water and wastewater utility, hydroelectric, flood, irrigation and other river management projects.
- Net revenues fund all other capital expenditures to the extent available.

Water Services
Capital Expenditures FY 2006 to FY 2015

(Dollars in Millions)



Water and Wastewater Utilities

Ten years ago, Water Services' water and wastewater utility operations included only treatment of water and wastewater on a small scale with a total investment of less than $3 million. Through the end of FY 2005, Water Services plans to have invested $332 million to acquire, improve and expand 37 utility systems of varying sizes — 22 water systems, 14 wastewater systems and a biosolids composting facility — that serve more than 100,000 people throughout the water service area.

As an LCRA business unit, Water Services has several advantages in expanding its water and wastewater operations. As a regional organization, LCRA is unique in its ability to cut across political boundaries by providing services to several entities through one system. By consolidating functions, Water Services achieves economies of scale and provides more reliable service at a reasonable cost. Water Services has consolidated its water and wastewater systems into four regional operations: the West Travis County Regional System, the Hill Country Regional System, the Williamson County Regional System and the Southeast Regional System.

Water Services staff includes experts in engineering, construction, finance, operations and system planning. With support from LCRA's Corporate Services, Water Services staff assists communities in constructing and financing the improvements their systems need at competitive rates. Meanwhile, one of the biggest challenges Water Services faces is balancing the need to protect public health and the environment, by exceeding federal and state standards for water and wastewater quality, and the need to keep rates competitive. Water Services reviews rates annually and consolidates services when it is cost effective. In addition, the utility and watershed protection staffs work closely to determine how best to achieve water and wastewater quality goals. Taking a proactive approach, staff continually work to meet or exceed more stringent federal and state regulations.

A wastewater line is installed in an underground tunnel in Round Rock.

West Travis County Regional System

$16.7 million in FY 2006; $53.3 million from FY 2007 through FY 2015; $91.7 million lifetime total

The West Travis County utility system was established in 1994 to serve western Travis County and northern Hays County with a regional water supply and wastewater treatment system. Water Services began construction of the Hays County waterline extension at the request of residents and officials who needed surface water to replace their unreliable groundwater wells. Because the area lies in the Barton Springs watershed, Water Services built the extension with an unprecedented level of environmental sensitivity. This extension of the water line into Hays County demonstrates LCRA's ability to help communities achieve residential and commercial growth while protecting the environment.

In FY 2006, Water Services plans to spend $16.7 million on the West Travis County Regional System.

Major expenditures include almost $7 million for improvements to the water system and almost $4 million for wastewater treatment projects.

- For the following nine years, from FY 2007 through FY 2015, Water Services plans to spend $53.3 million on the West Travis County Region, including more than $30 million to improve and acquire water systems and more than $12 million on wastewater projects.

Hill Country Regional System

$5.1 million in FY 2006; $8.0 million from FY 2007 to FY 2015; $14.2 million lifetime total

Water Services has acquired several small water and wastewater systems that serve parts of four counties and has financially consolidated them to improve their management and operations. These systems include the Lometa, Lake Buchanan Water System, Harper, Bridgepoint, Sunrise Beach, Willows, London, Hamilton Creek, Sandy Harbor water systems, and the Lometa Wastewater System.

In FY 2004, Water Services began development of the North Lake Buchanan Regional Water System. This project will supply clean, safe water to eight communities within the Hill Country Region. Some of these systems currently have water supplies that do not meet Texas Commission on Environmental Quality standards. Others need more water supply to meet expected growth in the area. Through expansion of the Paradise Point surface water treatment plant, LCRA is consolidating operations and maintenance costs for the region. Thus, Water Services is providing a cost-effective solution that enhances drinking water quality throughout much of the region.

During FY 2006, Water Services plans to spend $5.1 million for projects within the Hill Country Region, including construction and system improvements for the North Lake Buchanan System.

- From FY 2007 through FY 2015, Water Services plans to spend $8 million for projects including construction and improvements to the North Lake Buchanan system.
- $5.3 million in FY 2007 for North Lake Buchanan System improvements and construction and improvements to the Buena Vista, Lometa and other Hill Country systems.

Williamson County Regional System

$31.7 million in FY 2006; $55.2 million from FY 2007 to FY 2015; $94.9 million lifetime total

In 1995, LCRA and the Brazos River Authority (Brazos) formed the Brazos-Colorado Water Alliance to coordinate regional water and wastewater services within the Williamson County area. The alliance's first project was to acquire, expand and operate the Brushy Creek Regional Wastewater System serving Round Rock, Cedar Park and parts of Austin. Brazos operates the Brushy Creek system and LCRA owns, manages and finances it. In addition to this original project, LCRA acquired the Hutto Wastewater Treatment Plant in 1998 and completed constructing a water system to serve approximately 16,000 residents in Leander in 2001. Through the end of FY 2004, Water Services has invested more than $127 million in water and wastewater assets in Williamson County, the largest being the Brushy Creek Regional Wastewater System with a cumulative investment of $96 million.

In FY 2006, Water Services plans to spend $31.7 million on the Williamson County Regional System for the projects including almost $24 million to continue expansion of the Brushy Creek wastewater plant and complete construction of the Onion Branch interceptor.

From FY 2007 through FY 2015, $55.2 million is planned to be spent on the projects including completion of Brushy Creek expansion, and completion of the Sandy Creek expansion to meet the future growth in the Leander area. Water Services also plans to spend more than $4 million to complete the Lower Brushy Creek Regional Wastewater Treatment Plant.

Southeast Regional System

$4.4 million in FY 2006; $8.6 million from FY 2007 to FY 2015; $18.3 million lifetime total

Since the early 1990s, Water Services has acquired and developed several wastewater systems in Bastrop County and has financially consolidated them to achieve economies of scale in their management and operations. Water Services currently owns and operates the Elgin, Camp Swift, Smithville, Tahitian Village and McKinney Roughs wastewater systems.

During FY 2006, Water Services plans to spend $4.4 million on projects including expansion of the Camp Swift wastewater treatment plant and lift station, sewer service to the M.D. Anderson complex and improvements to Bastrop County systems.

From FY 2007 to FY 2015, Water Services plans to spend $8.6 million for projects including more than $5 million in the Elgin area to meet current and expected growth.

In addition, Water Services will make minor capital and general additions expenditures that benefit many or all systems.

The West Travis County Regional Water System serves a growing population.

Summary

$58.0 million in FY 2006; $126.6 million from FY 2007 to FY 2015; $220.6 million lifetime total

Water Services' investment in this program strengthens LCRA's position as an environmental leader, a regional provider of water and wastewater services, and an organization that makes a difference in the region and communities.

Water and Wastewater Utilities
FY 2006 Business Plan Capital Expenditures

(Dollars in Millions)

	When Board Approved	Board Approved Amount	Est. Spent Inception-to-Date thru FY 2005
Water & Wastewater			
West Travis County Regional			
Water Projects			
Uplands WTP Phase 1 Expansion			
Uplands WTP Phase 2 Expansion			
Uplands WTP UV Disinfection			
Uplands WTP New Chemical Building & Chlorine Improvements			$550
Land Acquisition Lake Travis Regional WTP Site			
1280 Elevated Storage Tank Hwy 71 near Lakeway West 0.50 MG			
1280 Hydroelectric Grade Line (HGL) Hydropneumatic Tank Exp			
Acq of Home Depot & 3-105,000 Ground Storage Tanks & Dist. Lines	Apr 04	$251	$251
1308 Elevated Storage Tank County Line Pump Station 0.50 MG			
Uplands WTP High Service Pump Station	Apr-04	$4,835	$4,405
SW Pkwy Pump Station Upgrade from 5,000 to 6,300 gpm			
16" parallel water main on Hwy 71 from 620 to Bee Cave Tank (12300')			
16" parallel transmission main WTP to Crystal Mountain Tank			
Homestead Meadowfox Water Distribution System/Trans Main	Apr 04	$3,962	$3,712
20" Transmission Main WTP to Southwest Parkway Pump Station	Feb 04	$360	$360
20" Transmission Main WTP to Southwest Parkway Pump Station			
Hamilton Pool Water Line Extensions [1]			$421
Water Distribution System Seven Oaks (Reimb) [2]			$169
Water Distribution System Highpoint Dev Sawyer Ranch (Reimb) [2]			
W/WW Distribution System Spillman Ranch (Reimb) [2]			$26
Water Distribution System Spanish Oaks (Porter) (Reimb) [2]			
W/WW Distribution System-The Shoppes of the Galleria (Porter) CCNG [2]			
Water Distribution System Sawyer Ranch Road Water Line Imprv Ph 1-4 [2]			
24" Water main-Bee Cave Tank to Lazy Nine			
Driftwood Approach Main			
Water Distribution System - Lake Pointe (reimb) [2]	Apr 04, Feb 05	$475	$475
Water Distribution System - Lake Pointe (reimb) [2]			
Glenlake WSC - 300,000 Elevated Storage Tank			$24
Wastewater Projects			
Lake Pointe Ph III WWTP Expansion (150,000 gpd) to 675,000 gpd			
Lake Pointe Ph IV WWTP Expansion (225,000 gpd) to 1,000,000			
Lake Pointe Noise and Odor Abatement	Feb05	$850	$450
Lake Pointe post 1MGD WWTP Capacity			
Upgrade East Lift Station by 360 gpm for 620 gpm total			
Bee Cave PH II Regional Lift Station & Force Main			
Hamilton Pool WW Interceptor			
Future WW Interceptor "D" - Hamilton Pool Branch off of "C" (2,000 lf,8")			
Future WW Interceptor "E" (3,000 linear feet, 8")			
West Lake Hills, City of, Wastewater Collection Ph 1	Sept-00, Jan-04	$15,800	$10,897
West Lake Hills, City of, Wastewater Collection P 1			
Raw Water/Effluent Projects			
Land Acquisition-Lake Travis Raw Water Intake Site			
100 ac-ft Effluent Holding Pond at Reg WWTP + Pump Statn (Proj. 10)			
General Additions - West Travis County Regional	FY 2006 Bus Plan		
Total West Travis County Regional		$26,533	$21,740

[1] Grants/Contributions in aid of construction

[2] Developer reimbursements

FY 2006 Business Plan

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Life Total	10-Year Total FY 2006-2015
$1,000	$7,000	$4,000								$12,000	$12,000
							$1,800			$1,800	$1,800
				$800						$800	$800
$550										$1,100	$550
	$600									$600	$600
		$250		$100	$841					$1,191	$1,191
		$75								$75	$75
$251										$502	$251
	$936									$936	$936
$430										$4,835	$430
			$375							$375	$375
			$273	$1,546						$1,819	$1,819
				$300	$2,284					$2,584	$2,584
$250										$3,962	$250
										$360	$0
			$828	$1,932						$2,760	$2,760
$3,596	$1,108	$691								$5,816	$5,395
$166	$176	$176	$129	$84	$125	$125	$125	$125	$125	$1,525	$1,356
	$100	$100	$100	$100	$100					$500	$500
$156	$305	$288	$310	$89						$1,174	$1,148
$3,795	$0	$773	$1,146							$5,714	$5,714
$1,300	$524									$1,824	$1,824
$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$870	$870
	$240	$240	$240	$240	$240	$240	$240	$240	$240	$2,160	$2,160
$12	$37	$25	$25	$25	$25	$25	$25	$25	$25	$249	$249
										$475	$0
$256	$239	$239	$85							$819	$819
$110	$495	$495								$1,124	$1,100
$48										$48	$48
	$2,200	$2,200								$4,400	$4,400
$400										$850	$400
					$1,500	$1,500				$3,000	$3,000
							$75			$75	$75
	$441									$441	$441
	$510	$1,200								$1,710	$1,710
	$218									$218	$218
	$326									$326	$326
$3,450	$1,453									$15,800	$4,903
	$870									$870	$870
	$550									$550	$550
$250	$900	$900								$2,050	$2,050
$578	$330	$330	$330	$310	$310	$310	$310	$310	$310	$3,428	$3,428
$16,685	$19,645	$12,069	$3,928	$5,613	$5,512	$2,287	$2,662	$787	$787	$91,715	$69,975

Water and Wastewater Utilities
FY 2006 Business Plan Capital Expenditures, continued

(Dollars in Millions)

	When Board Approved	Board Approved Amount	Est. Spent Inception-to-Date thru FY 2005
Hill Country Regional			
Lometa - Kirby Tank protective coating upgrade			
Lometa ORCA funded Line Improvements	Feb 05	$72	$40
Lometa ORCA funded 6" Loop			
Lake Buchanan Water System - Buena Vista Imprv	Dec-03	$1,610	$100
Expand Buchanan WTP - 350 gpm to 525 gpm total			
Sunrise Beach-Renovate Existing Bolted Steel Tank on Sandy Mtn			
New 24,000 gal Storage Tank on Sandy Mtn (abandon conc.Tanks)			
N Lake Buchanan Reg Water System (TWDB funding)	Dec-03	$8,090	$600
Harper - Tank Protective Coating Upgrade			
Lometa - Misc. WW System Inflow & Infiltration Rehab			
Whitewater Springs Water System Improvements	Aug 03	$170	$170
Whitewater Springs Water System Improvements			
Smithwick Mills Water System (TWDB funding)-new well/trans [1]	Dec-03	$761	$150
Ridge Harbor Water System Improvements			
General Additions - Hill Country Regional	FY 2006 Bus Plan		
Total - Hill Country Regional		$10,703	$1,060
Williamson County Regional			
Sandy Creek WTP Expansion (2 mgd) to 6 mgd Total	Mar-04, Aug-04	$3,380	$2,680
Sandy Creek WTP Expansion (6 mgd) to 12 mgd Total			
Brushy Creek (East) 10 mgd WWTP Expansion, to 21.5 mgd	Mar 04, Feb 05	$4,694	$2,610
Brushy Creek (East) 10 mgd WWTP Expansion, to 21.5 mgd			
Brushy Creek (East) 15 mgd WWTP Expansion, to 36.5 mgd			
Brushy Creek-Reclaimed Water	Jun-04	$660	$660
Brushy Creek-Reclaimed Water			
Onion Branch Interceptor to Contract 20			$277
Brushy Creek Parallel Contract 6			
Brushy Creek Upper Lake Creek Interceptor			
Brushy Creek Monitoring and I&I Mitigation			$297
Brushy Creek Rehab Collection Lines			$207
Hutto Phase 2 WWTP Expansion			$80
Lower Brushy Creek Regional WWTP, Ph. 1 - 1.0 mgd			
Liberty Hill WWTP to .4 mgd [1]	Apr-03, Jun-04	$2,700	$1,200
Liberty Hill WWTP to .4 mgd [1]			
Williamson County MUD 13 - Liberty Hill Wastewater [2]			
The Lookout Group Liberty Hill Wastewater [2]			
Total Williamson County Regional		$11,434	$8,011

[1] Grants/Contributions in aid of construction

[2] Developer reimbursements

FY 2006 Business Plan

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Life Total	10-Year Total FY 2006-2015
	$80									$80	$80
$32										$72	$32
	$75									$75	$75
$500	$400	$610								$1,610	$1,510
					$750					$750	$750
$65										$65	$65
$29										$29	$29
$4,000	$3,490									$8,090	$7,490
		$35								$35	$35
$50	$50	$50								$150	$150
										$170	$0
$185										$185	$185
$50	$561									$761	$611
	$500									$500	$500
$185	$160	$160	$160	$160	$160	$160	$160	$160	$160	$1,625	$1,625
$5,096	$5,316	$855	$160	$160	$910	$160	$160	$160	$160	$14,197	$13,137
$700										$3,380	$700
	$1,320	$5,940	$5,940							$13,200	$13,200
$2,084										$4,694	$2,084
$18,673	$23,433									$42,106	$42,106
									$1,500	$1,500	$1,500
										$660	$0
$1,459	$3,459									$4,918	$4,918
$1,040	$999									$2,316	$2,039
									$250	$250	$250
									$250	$250	$250
$248										$545	$248
$207										$414	$207
$1,600	$630									$2,310	$2,230
$132	$2,205	$2,073								$4,410	$4,410
$1,500										$2,700	$1,500
$3,800	$650									$4,450	$4,450
$252	$503	$503	$503	$755	$755	$755	$1,006			$5,032	$5,032
		$201	$403	$403	$403	$402				$1,812	$1,812
$31,695	$33,199	$8,717	$6,846	$1,158	$1,158	$1,157	$1,006	$0	$2,000	$94,947	$86,936

Water and Wastewater Utilities
FY 2006 Business Plan Capital Expenditures, continued

(Dollars in Millions)

	When Board Approved	Board Approved Amount	Est. Spent Inception-to-Date thru FY 2005
Southeast Region			
Elgin Wastewater Treatment Plant Site Acquisition			
Elgin Wastewater Treatment Expansion			
Elgin Inflow & Infiltration Reduction Collection System Rehab			
Elgin Inflow & Infiltration Reduction Structural Rehab			
Elgin Elm Creek Lift Station Expansion			
MD Anderson Sewer Service [1]			$200
Camp Swift WWTP - Expand WWTP to 0.70 MGD	Nov-03	$550	$550
Camp Swift WWTP - Expand WWTP to 0.70 MGD			$450
The Colony WWTP Expansion	May 04	$75	
McKinney Roughs Expand WWTP to 25,000 gpd			
McKinney Rough Expand WWTP to 50,000 gpd			
Windmill Ranch WWTP (Woodbine) Construct 250,000 gpd	Sep 03, Mar 04, Sep 04	$4,118	$3,900
Matagorda Dunes WWTP [1]			$100
Alleyton Water System Acquisition			
Alleyton Wastewater System Acquisition			
Creedmoor Maha [1]	May-04	$1,000	
General Additions - Southeast Region	FY 2006 Bus Plan		
Total Southeast Region		$5,743	$5,200
Water & Wastewater Common			
Minor Capital - Water/Wastewater	FY 2006 Bus Plan		
General Additions - Water/Wastewater	FY 2006 Bus Plan		
Total W/WW Common		$0	$0
Total Water and Wastewater Utilities		**$54,413**	**$36,011**

[1] Grants/Contributions in aid of construction

[2] Developer reimbursements

FY 2006 Business Plan

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Life Total	10-Year Total FY 2006-2015
	$160									$160	$160
		$1,250	$2,850							$4,100	$4,100
$180										$180	$180
$100	$100	$100	$100	$100						$500	$500
$100	$720									$820	$820
$800	$595									$1,595	$1,395
										$550	$0
$1,600	$800									$2,850	$2,400
$75										$75	$75
$50										$50	$50
				$430						$430	$430
$218										$4,118	$218
$920										$1,020	$920
$50										$50	$50
$20										$20	$20
$200	$200	$200	$200	$200						$1,000	$1,000
$105	$70	$70	$70	$70	$70	$70	$70	$70	$70	$735	$735
$4,418	$2,645	$1,620	$3,220	$800	$70	$70	$70	$70	$70	$18,253	$13,053
$149	$149	$149	$149	$149	$149	$149	$149	$149	$149	$1,490	$1,490
$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$40	$40
$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$1,530	$1,530
$58,047	**$60,958**	**$23,414**	**$14,307**	**$7,884**	**$7,803**	**$3,827**	**$4,051**	**$1,170**	**$3,170**	**$220,642**	**$184,631**

Stored Water Projects

One of Water Services' greatest challenges is to reduce the risk of destruction caused by flooding in the lower Colorado River basin. Population growth has complicated this task tremendously. The chain of two storage lakes and four pass-through lakes was designed as a water storage and flood management system, with designated floodplains around the lakes to prevent damage during floods. Not only does continued building of homes and businesses near the lakes alter the basin's environmental landscape, but it also challenges Water Services to effectively communicate with the basin's ever-increasing and changing population, particularly during emergencies.

Water Services is overseeing several projects to help reduce the risk to life and property by devastating floods. These involve upgrading and expanding flood forecasting and management capabilities and more clearly identifying flood-prone areas. The projects also will help Water Services evaluate flood control alternatives in the lower Colorado River basin in coordination with federal, state and local authorities. In addition, Water Services is working with local communities, through the Texas Colorado River Floodplain Coalition, to provide better understanding of the need for strong, effective local floodplain management programs. Water Services is also developing projects to assess and preserve the environmental quality of the basin.

Flood Damage Evaluation Project

$0.4 million in FY 2006; $0.7 million in FY 2007; $2.5 million lifetime total

LCRA has joined with the U.S. Army Corps of Engineers (USACE) to develop flood damage reduction alternatives and ecosystem restoration needs along the Colorado River from the Highland Lakes to the Gulf of Mexico. By partnering with USACE, Water Services is providing important technical and financial support to communities by taking advantage of cost sharing opportunities with the USACE.

This project is critical to LCRA's flood management responsibilities because it will develop the most accurate floodplain information possible; share that information with other communities along the river; and identify potential projects that could reduce flood damages in our basin. LCRA is the lead local sponsor for the project and has additional supporting agreements with the City of Austin, Travis County, the City of Sunset Valley, and the City of Wharton that allow these communities to participate in this study with the USACE.

A River Services engineer monitors rising floodwaters.

The project is a collection of steps and phases that include: a baseline hydrologic analysis to model runoff into creeks and rivers from rainfall events of various statistical probabilities (25-year, 100-year, etc.) and a baseline hydraulic analysis to model the depths and velocities of flows in the creeks and rivers from these statistical storms. These baseline activities will include determination of flood elevations and identification of flood damage centers suitable for additional study.

Based on the baseline flood damages, additional studies will be performed to evaluate and recommend cost-effective plans to mitigate damages in flood-prone areas. These selected plans may, depending on the availability of local and federal funds, be further developed into construction projects that are cost-shared with the USACE. These construction projects are not expected to begin before 2007 and their costs are not included in the Flood Damage Evaluation Project.

Hydromet Expansion Project:

$1.2 million in FY 2006; $4.6 million from FY 2007 to FY 2015; $7.9 million lifetime total

The Hydromet Expansion Project will enter its third phase in FY 2006. The first phase — from FY 1999 to FY 2003 — focused on improving 74 existing gauging stations, building 103 new gauges, adding communications capabilities, and making related improvements. The second phase — from FY 2004 to FY 2005 — shifted the focus from gauge expansion to technology integration. This third phase will complete the gauge build-out and accommodate the cost and schedule of the Technology Integration Project. In FY 2005 Water Services finished several pilot projects that will be completely integrated in early FY 2006. These include the following:

Data Acquisition Technology — New Remote Terminal Units (RTUs or field data loggers) and code upgrades to the existing RTUs will extend the capabilities and useful life of the equipment that is already in the field, in addition to allowing LCRA to collect Hydromet information four times faster than the current system supports.

Weather Decision Support System — New radar data will give the LCRA meteorologist, hydrologists, and modeling staff more detailed information about what is happening around the basin. The rainfall information from this system will feed directly into the new Flood Forecast Model and will greatly enhance LCRA's ability to predict lake levels.

Visualization Tools — New technology in the River Operations Center (ROC) will improve the staff's capability to capture, analyze, display and share the information that is collected by the Hydromet system.

This technology, combined with an expanded and improved data collection network and improved models, will allow Water Services to make better decisions when managing the Colorado River and its corresponding system of lakes and dams.

FY 2006 will see the start of phase 3 of the Hydromet expansion, which will focus on adding the final gauges needed to complete the system for a total of 243 gauges. The number and basic locations of the remaining gauges was determined in late 2002 when the staff conducted an analysis based on modeling needs, radar coverage, identified gaps in gauge coverage, sub-basin coverage, operational needs and radio coverage. A total of 46 new gauges are planned for phase 3. Sixteen will be built in FY 2006, 16 more in FY 2007, and 14 will be completed in FY 2008 for a total cost of $1.8 million. From FY 2009 to FY 2015, $500,000 has been allocated annually for continuing technological improvements to the Hydromet system.

River Management Model (RMM) Project:

$1.3 million in FY 2006; $0.5 million in FY 2007; $2.8 million lifetime total

The River Management Model project is actually a family of related but independent projects. The portfolio consists of a Flood Forecast Model, a Daily Operations Model, Topographic Data Collection, and a Decision Support Tool to support these models and others. In addition, the Water Supply Planning Model (RiverWare) was included in the portfolio for FY 2005 but is being listed as a separate item for FY 2006 and beyond.

The Flood Forecast Model project ($320,000 in FY 2006), which uses the Corps Water Management System (CWMS) as its base, was implemented in FY 2005 and will be enhanced in FY 2006 when additional features have been developed. By producing more accurate and detailed flood forecasts and operational supply data, the RMM tools will enable Water Services to better coordinate flood management operations and enhance public safety throughout the region in addition to providing more efficient water supply releases.

Another RMM project for FY 2006 — the Topographic Data Collection project ($431,000 in FY 2006) — will support Flood Forecast Model technology by collecting detailed topographic data from various areas of the basin. This information will give modelers more accurate information to use with the flood forecast and daily operations models because it will allow them to better understand how the watershed responds in those areas. The Daily Operations Model project ($542,000 in FY 2006) will create a more effective release schedule and maximize the water available for generating power, drinking water and other uses of the lower Colorado River.

RMM also includes a project to develop Decision Support Tools ($518,000 in FY 2007), which will provide a more comprehensive decision support system that will standardize how the modeling teams interact with and make decisions using the various models. The concept is that this scenario management programs will assist with post-processing of data for management visualization, reporting and graphical displays and will give a common "look and feel" and integration of data with both the water supply and water quality models.

RiverWare

$0.3 million in FY 2006; $0.4 million from FY 2007 to FY 2009; $0.7 lifetime total

This project is developing a water supply model in support of the RMM modernization program in the RiverWare development platform. The model will support LCRA's long-range water supply planning efforts, assist in determining environmental conditions to maintain in-stream flows and releases to the bays and estuaries, and automate report generation for regulatory and planning purposes. The development will also provide the foundation for future RMM phases, including the support of decisions related to the daily reservoir operations and releases for downstream water rights.

Existing modeling tools were developed in-house in the late 1980s. These tools have been regularly maintained to accommodate system operational changes. Constraints of these tools now stem largely from their antiquated architecture. Use of these tools is cumbersome and they are difficult to maintain due to obsolete programming environment. Maintenance requires extensive and time consuming programming additions because the tools lack expandability. The complexity of the internally developed code, which has been continuously modified over past years, makes it difficult for external stakeholders to understand. Over time, the complex and specific nature of the existing program has limited the training and knowledge transfer capabilities for this application.

RiverWare provides a commercially available platform with published documentation and experience of other users nationally. The generalized nature of the development platform provides for flexibility of system components, operational policies, and constraints. The software supports visual configuration and a specialized rule-based language rather than requiring modifications to the source code.

The base RiverWare model was completed at a cost below the previously budgeted amount. Additional activities will add capabilities to the model to support hydrogeneration, water rights analysis, tributary water right simulations, Lometa reservoir operations modeling, forced evaporation cooling reservoirs, reservoir sedimentation and return flow analyses. These extensions will enable analyses of the efficiency of LCRA operations that were previously not possible. Extensions will also include run-time improvements to improve the efficiency of the model performance and effective use of staff time.

Colorado River Environmental Models (CREM) Project

$0.8 million in FY 2006; $6.2 million from FY 2007 to FY 2015; $7.9 million lifetime total

LCRA is entering the third year of an effort to develop CREM computer models, information management tools and staff capabilities needed to assess the water quality of the lower Colorado River basin and to perform environmental analyses in support of our regulatory activities and stewardship of the river. The initiative also will involve working with the Texas Commission on Environmental Quality to establish water quality standards for the Colorado River basin. Furthermore, the information gathered from this project will have an impact on LCRA Water Management Plan, the LCRA-SAWS Water Project, and the permitting of wastewater treatment plants.

Stricter management of water supply and river flows, increasing pollution loads brought about by growing population, and greater regulatory pressure all require greater water quality related systems and data management in the future. Developing the models and integrating them into a comprehensive information management network will be phased throughout a six-year program. Some of these models will be required to gain regulatory approval for any additional water rights or for the transfer of water from the basin. In addition, some of these models will be critical for understanding the impact growth in Austin will have on the water quality of the river and how its use as a drinking water source may be affected. Also, these models will assist in making proper decisions regarding treatment standards for wastewater discharges into the river, streams and lakes and other decisions required to protect the basin's water resources.

Buchanan Floodgate Rehabilitation

$3.5 million in FY 2009

Water Services plans to conduct an extensive cleaning and rehabilitation of the floodgate superstructure and walkways at Buchanan Dam. During FY 2009, Water Services will spend $3.5 million for this project.

Summary

In summary, $4.6 million will be spent on stored water projects in FY 2006 and $21.7 million will be spent from FY 2007 to FY 2015.

The flood management projects and the CREM project offer LCRA an opportunity to perform a regional leadership role in environmental protection and public safety. By developing and sharing this valuable information, the projects also create goodwill with LCRA's constituencies and potential customers.

Stored Water Projects
FY 2006 Business Plan Capital Expenditures

(Dollars in Millions)

	When Board Approved	Board Approved Amount	Est. Spent Inception-to-Date thru FY 2005
Stored Water			
COE Flood Damage Evaluation Project - Phase II	Aug-02	$2,500	$1,356
COE Ecosystem Restoration Project (Placeholder)			
Colorado River Environmental Models (CREM) - Phase II	Nov-03	$2,900	$861
Colorado River Environmental Models (CREM) - Future			
Hydromet Expansion - Phase II	Jun-03	$2,575	$2,045
Hydromet Expansion - Phase III			
Hydromet Expansion - Future Technology Improvements			
Riverware Future Enhancements			
River Management Models (RMM)	Jun-04	$1,073	$959
River Management Models (RMM) future			
Buchanan - Floodgates, Structure, and Instrumentation			
Lometa Raw Water Facilities (Minor Capital)	FY2006 Bus. Plan		
Lometa Raw Water Facilities (General Additions)	FY2006 Bus. Plan		
Minor Capital - River Management	FY2006 Bus. Plan		
Minor Capital - Hydromet System	FY2006 Bus. Plan		
Total Stored Water		**$9,048**	**$5,221**

FY 2006 Business Plan

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Life Total	10-Year Total FY 2006-2015
$431	$713									$2,500	$1,144
		$250	$500	$250						$1,000	$1,000
$830	$1,209									$2,900	$2,039
	$1,172	$1,214	$1,124	$775	$434	$232				$4,951	$4,951
$530										$2,575	$530
$689	$617	$510								$1,816	$1,816
			$500	$500	$500	$500	$500	$500	$500	$3,500	$3,500
$300	$128	$128	$128							$684	$684
$114										$1,073	$114
$1,179	$518									$1,697	$1,697
			$3,500							$3,500	$3,500
$20	$10	$10	$10	$10	$10	$10	$10	$10	$10	$110	$110
$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$500	$500
$187	$187	$187	$187	$187	$187	$187	$187	$187	$187	$1,870	$1,870
$284	$284	$284	$284	$284	$284	$284	$284	$284	$284	$2,840	$2,840
$4,614	**$4,888**	**$2,633**	**$6,283**	**$2,056**	**$1,465**	**$1,263**	**$1,031**	**$1,031**	**$1,031**	**$31,516**	**$26,295**

Hydroelectric Projects

In 1993, LCRA began its Hydroelectric Modernization Program, which was based on a comprehensive engineering study that evaluated the condition of the 13 generating units at the six hydroelectric power plants. The engineering assessment examined all major components and other equipment and recommended a work plan for each plant's specific needs. The engineering study also recommended operational improvements, such as improving the water release schedule to produce hydroelectric energy at the highest value.

To date, Water Services has rehabilitated 10 of the 13 generating units. Of the 10 rehabilitated units, four were upgraded before the 1992 engineering study that led to modernization in 1993 and, consequently, are not considered part of the Hydroelectric Modernization Program. Through the end of FY 2005, Water Services will have completed the following hydroelectric modernization program projects:

- Inks Plant unit 1 at a cost of $6.8 million to increase total capacity to 14 megawatts (MW), an increase of 2.5 MW or 24 percent;
- Buchanan Plant units 1 and 2 at a cost of $10.1 million to increase total capacity to 51 MW, an increase of 10.3 MW or 41 percent;
- Marshall Ford Plant unit 2 at a cost of $9.1 million to increase total capacity to 103.9 MW, an increase of 9.5 MW or 38 percent; and
- Wirtz Plant units 1 and 2 at a cost of $13.4 million to increase total capacity to 56.8 MW, an increase of 4 MW or 7 percent.

Work on the major components has involved the rehabilitation of the generating units' turbines, generators and governors and plant auxiliary equipment. The generator converts the mechanical power produced by water flowing through the waterwheel turbine into electrical energy. The governing system controls the speed of the unit by regulating the flow of water through the turbine. This permits synchronization of the generator with the electrical distribution system. Rehabilitating these components extends the life of the generating units and increases their generating capacity and efficiency.

Starcke Plant Units 1 and 2

$7.4 million in FY 2006; $11.5 million from FY 2007 to FY 2008; $24.9 million lifetime total

The two generating units at Starcke Plant have been in continuous operation since 1951. The overall condition of the turbines and generators is good for equipment of that age; however, a major overhaul of both units is recommended to extend their useful life and increase their combined generating capacity.

Water Services is in the process of conducting a two-year rehabilitation of unit 1 at a projected cost of $13 million. The rehabilitation of unit 2 will begin in FY 2007 at an estimated cost of $11.9 million over two years. The expected combined generating capacity will be 39.6 MW, an increase of 3.6 MW or 10 percent.

Buchanan Plant Unit 3

No expenditures in FY 2006; $4.8 million from FY 2012 to FY 2014; $4.8 million lifetime total

The rehabilitation of Buchanan units 1 and 2 was completed at a cost of $10 million, significantly less than the $11.5 million originally budgeted. The rehabilitation of unit 3 will begin in FY 2012 and will cost $4.8 million.

Mansfield Units 1 and 3

No expenditures in FY 2006; $3.3 million from FY 2010 to FY 2013; $3.3 million lifetime total

The refurbishment and upgrade of Mansfield units 1 and 3 will extend the life of the generators and increase their current efficiency. This work to complete the project will occur during planned outages.

Miller Units 1 and 2

No expenditures in FY 2006; $1.1 million from FY 2013 to FY 2014; $1.1 million lifetime total

The rehabilitation of Miller units 1 and 2 will extend the life of the generators by replacing governors and controls, upgrading governor technologies and installing new controls to interface with the new governors.

Wirtz Floodgate Rehabilitation

$2.5 million in FY 2008

Water Services plans to conduct an extensive cleaning and rehabilitation of the floodgate superstructure and walkways at Wirtz Dam. During FY 2008, Water Services will spend $2.5 million for this project.

Miller Dam Floodgate Rehabilitation

$2.5 million in FY 2011

Water Services plans to conduct an extensive cleaning and rehabilitation of the floodgate superstructure and walkways at Tom Miller Dam. During FY 2011, Water Services will spend $2.5 million for this project.

Intake Gate Rehabilitation

$2.8 million in FY 2006; $8.0 million from FY 2007 to FY 2009; $10.8 million lifetime total

This project involves the inspection and rehabilitation of the intake gates at each of the six power plants for $20.8 million. The intake gates are extremely important safety systems. They provide a means for routine closure to remove water from the turbine for maintenance and emergencies. As with the turbines and generators, many of the gates were constructed in the 1930s and 1940s. The coating system on the intake gates have deteriorated, allowing corrosion and the potential for structural weaknesses and unreliable operation if not refurbished.

Employees fabricate cooling water piping at Wirtz Dam.

Phase 1 of the project was completed during FY 2001 at a cost of $528,000 and involved an overall inspection and evaluation of the intake gates at five of the six hydroelectric plants. Phase 2, approved by the Board for $5.0 million, included improvements on Wirtz and Miller units 1 and 2 intake gates and has been completed. The detailed engineering for Starcke, Mansfield and Buchanan is under way and refurbishment work is proceeding as part of Phase 3.

Upgrades at the Starcke, Buchanan, Miller and Mansfield dams will be completed during phase 3 of the project at an additional cost of $10.8 million. As a result of the engineering evaluation, it was determined that the work required to upgrade the facilities and equipment to acceptable standards was more extensive than originally anticipated. From FY 2005 to FY 2008, $10.8 million is expected to be spent to complete the rehabilitation at Buchanan, Starcke, Miller and Mansfield.

Other Substation Upgrades

$5 million between FY 2008 and FY 2013; $5 million lifetime total

The Wirtz step-up transformers will be replaced to handle the increasing transmission system voltage. At Miller, Mansfield, Wirtz and Starcke, breakers, relays and associated equipment will be replaced to maintain reliable generation from each facility. In addition, equipment must be modified due to deregulation and new rules adopted by the Public Utility Commission of Texas requiring separation of generation assets from transmission assets. The substation upgrades are staged, beginning in FY 2008, and expected to be complete by FY 2013.

Install Replacement Trash Racks - Miller

$0.4 million in FY 2006; $0.4 million lifetime total

Another significant hydroelectric improvement includes replacement of the current Miller turbine intake trash racks with a modern, more efficient unit. Trash racks provide a protective barrier over the entrance of the intake gates to keep large debris from entering the turbine. Water Services expects to spend $0.4 million in FY 2006 to install new trash racks with a modern design that prevents fatigue cracks and improves the collection of debris.

Wirtz Elevator Upgrade

$0.3 million in FY 2008; $0.3 million lifetime total

The plant elevator controls and drive will be replaced to provide safe access to electrical equipment and support timely floodgate operations.

Hydro Security

$0.3 million in FY 2006; $1.7 million from FY 2007 to FY 2013; $2.0 million lifetime total

Based on a comprehensive Security Study completed in FY 2005, Water Services will implement significant security improvements at the dams.

Miller Responsive Reserve

$0.3 million in FY 2007; $0.3 million lifetime total

Modifications to the turbine, controls and plant auxiliaries will be made to permit the turbine/generators to provide responsive reserve to the Ancillary Services market.

In addition, hydroelectric improvements also include $500,000 to be spent during FY 2006 and $450,000 per year for the remainder of the 10-year plan period for general additions and minor capital improvements. Under the general additions program, worn or obsolete equipment will be upgraded or replaced at all six hydroelectric plants, according to priority assessments that are reviewed annually and based on the goals of improving operations or reducing maintenance. Minor capital improvements include replacement vehicles, security equipment and other routine tools and equipment.

Summary

$11.3 million in FY 2006; $48.7 million from FY 2007 to FY 2015

The hydroelectric capital program strengthens LCRA's position as an environmental leader by extending the useful life and operating efficiency of this clean, low-cost source of power.

The hydroelectric capital improvements will cost an estimated $60 million over the 10-year plan period and an estimated $11.3 million during FY 2006.

Hydroelectric Projects
FY 2006 Business Plan Capital Expenditures

(Dollars in Millions)

	When Board Approved	Board Approved Amount	Est. Spent Inception-to-Date thru FY 2005
Hydroelectric			
Starcke Hydroelectric Modernization	Oct-03	$24,875	$6,017
Buchanan Plant - Unit #3			
Rehabilitate intake structures - Phase III (Mansfield and Buchanan)			$0
Wirtz Substation Upgrade			
Miller Substation Upgrade			
Inks Substation Upgrade			
Mansfield Substation Upgrade			
Starcke Substation Upgrade			
Elevator Upgrade Wirtz			
Mansfield Units 1&3 and Balance of Unit & Plant			
Miller Units 1&2 Governors and Mechanical Seal			
Wirtz - Floodgates and Structure			
Miller Rehabilitate Floodgate Structure			
Miller - Install Replacement Trash Racks			
Hydro Security			
Miller Responsive Reserve			
General Additions - Hydroelectric	FY2006 Bus Plan		
Minor Capital - Hydroelectric	FY2006 Bus Plan		
Total Hydroelectric		**$24,875**	**$6,017**

FY 2006 Business Plan

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Life Total	10-Year Total FY 2006-2015
$7,417	$11,026	$419								$24,879	$18,862
						$261	$2,459	$2,030		$4,750	$4,750
$2,781	$1,983	$5,001	$1,035							$10,800	$10,800
					$210	$89	$1,261			$1,560	$1,560
			$215							$215	$215
				$104	$846					$950	$950
				$215	$92	$830	$225			$1,362	$1,362
		$880								$880	$880
		$300								$300	$300
				$164	$1,417	$1,463	$273			$3,317	$3,317
							$218	$872		$1,090	$1,090
		$2,500								$2,500	$2,500
					$2,500					$2,500	$2,500
$349										$349	$349
$250	$250	$250	$250	$250	$250	$250	$250			$2,000	$2,000
	$300									$300	$300
$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$3,000	$3,000
$224	$224	$224	$224	$224	$224	$224	$224	$224	$224	$2,240	$2,240
$11,321	**$14,083**	**$9,874**	**$2,024**	**$1,257**	**$5,839**	**$3,417**	**$5,210**	**$3,426**	**$524**	**$62,992**	**$56,975**

Irrigation Projects

Lakeside Irrigation District

$0.5 million in FY 2006; $3.9 million from FY 2007 to FY 2015

The Lakeside Irrigation District plans to spend $343,000 during FY 2006 for general additions, primarily to rebuild the river to Lakeside Pumping Plant and control structures, install security fencing and continue plant automation work. From FY 2007 to FY 2015, a total of $2.4 million is budgeted in general additions to improve and enhance safety and ensure equipment reliability. In addition, $123,000 is planned during FY 2006 and $706,000 from FY 2007 to FY 2015 for minor capital items such as trucks and other equipment items.

From FY 2011 to FY 2012, Lakeside plans to spend $819,000 to rehabilitate the intake bay structure at the River Plant and for suction piping replacement.

Gulf Coast Irrigation District

$0.9 million in FY 2006; $6.7 million from FY 2007 to FY 2015

The Gulf Coast Irrigation District plans to spend $636,000 during FY 2006 in general additions, primarily to be used for upgrading obsolete switchgear and replacing discharge piping at plants 1 and 2. In addition, the Gulf Coast district has $4.2 million allocated for general additions from FY 2007 to FY 2015, primarily to be used in enhancing safety and equipment reliability. In addition, expenditures of $120,000 are planned during FY 2006 and $1.1 million from FY 2007 to FY 2015 for minor capital items.

From FY 2006 to FY 2015, the Gulf Coast district will spend $1.5 million in replacing discharge and suction pipes at the Lane City plant, redesigning the monorail and replacing switching controls at the Bay City plant.

Garwood Irrigation District

$0.2 million in FY 2006; $3.1 million from FY 2007 to FY 2015

The Garwood Irrigation District plans to spend $123,000 during FY 2006 to automate the relift plant and for bridge upgrades and $2.2 million from FY 2007 to FY 2015 to improve and enhance safety and equipment reliability. These general additions are primarily for critical improvements to electrical and building and bridge structures and other support equipment. In addition, $29,000 is planned during FY 2006 and $650,000 from FY 2007 to FY 2015 for minor capital items.

In FY 2007, the Garwood district plans on spending $258,000 to replace the switchgear controls within its district.

Summary

$1.5 million in FY 2006; $13.7 million from FY 2007 to FY 2015

The investment in the irrigation program creates a safer workplace for LCRA employees, uses advanced technology to increase efficiency, and demonstrates to the community that LCRA is committed to making a difference in the region. Water Services expects to spend $1.5 million during FY 2006 for capital expenditures in the three irrigation districts. Throughout the 10-year plan, an average of $272,000 per year will be spent on the purchase of trucks, tools and other vehicles and equipment. From FY 2006 to FY 2015, Water Services plans to spend $9.9 million on general additions items, primarily on the improvement of critical electrical and control systems, rehabilitation of intake and discharge piping and in construction of building and bridge structures.

Maintenance must be done on irrigation canals during the winter in between growing seasons.

Irrigation Projects
FY 2006 Business Plan Capital Expenditures

(Dollars in Millions)

	When Board Approved	Board Approved Amount	Est. Spent Inception-to-Date thru FY 2005
Irrigation			
River Plant Intake Bay Structure Rehab			
Suction Piping Replacement			
Replace Switchgear Equipment - Garwood			
Upstream Bank Stabilization - Plant 1 Gulf Coast			
Lane City Plant - Replace Discharge Pipes			
Lane City Plant - Replace Suction Pipes			
Bay City Plant #1 - Equipment Replacement			
Bay City - Plant #3 - Redesign Monorail			
Bay City - Plant #3 - Replace Switchgear Controls pumps 3 & 4			
Bay City - Plant #3 - Replace Switchgear Controls pumps 1 & 2			
General Additions - Lakeside	FY 2006 Bus Plan		
General Additions - Gulf Coast	FY 2006 Bus Plan		
General Additions - Garwood	FY 2006 Bus Plan		
Minor Capital - Lakeside	FY 2006 Bus Plan		
Minor Capital - Gulf Coast	FY 2006 Bus Plan		
Minor Capital - Garwood	FY 2006 Bus Plan		
Total Irrigation		**$0**	**$0**

FY 2006 Business Plan											
FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Life Total	10-Year Total FY 2006-2015
					$288	$295				$583	$583
						$236				$236	$236
	$258									$258	$258
				$280						$280	$280
					$316					$316	$316
						$236				$236	$236
									$191	$191	$191
			$218							$218	$218
$120										$120	$120
			$131							$131	$131
$343	$270	$117	$338	$336	$140	$118	$363	$372	$343	$2,740	$2,740
$636	$551	$797	$268	$384	$219	$251	$629	$484	$597	$4,816	$4,816
$123	$196	$350	$338	$67	$200	$124	$309	$316	$324	$2,347	$2,347
$123	$216	$72	$45	$65	$57	$68	$48	$84	$51	$829	$829
$120	$229	$179	$100	$151	$138	$70	$47	$124	$57	$1,215	$1,215
$29	$40	$36	$37	$212	$65	$63	$64	$66	$67	$679	$679
$1,494	**$1,760**	**$1,551**	**$1,475**	**$1,495**	**$1,423**	**$1,461**	**$1,460**	**$1,446**	**$1,630**	**$15,195**	**$15,195**

About LCRA

LCRA is a conservation and reclamation district created by the Texas Legislature in 1934. LCRA provides energy, water and community services to the people of Texas. It cannot levy taxes, but funds its operations with income from the sale of electricity, water and other services.

LCRA generates electricity and sells it wholesale to 42 customers, including city-owned utilities and cooperatives that serve more than 1 million people in Texas. LCRA also builds and operates transmission projects through a nonprofit corporation it created, manages and protects the lower Colorado River, provides water and wastewater utilities, owns and operates parks, and offers economic and community development assistance to communities.

LCRA
ENERGY • WATER • COMMUNITY SERVICES

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APPENDIX 9C

SOCIOECONOMIC IMPACTS OF UNMET WATER NEEDS IN LOWER COLORADO WATER PLANNING AREA, TWDB, AUGUST 2005

Socioeconomic Impacts of Unmet Water Needs in Lower Colorado Water Planning Area

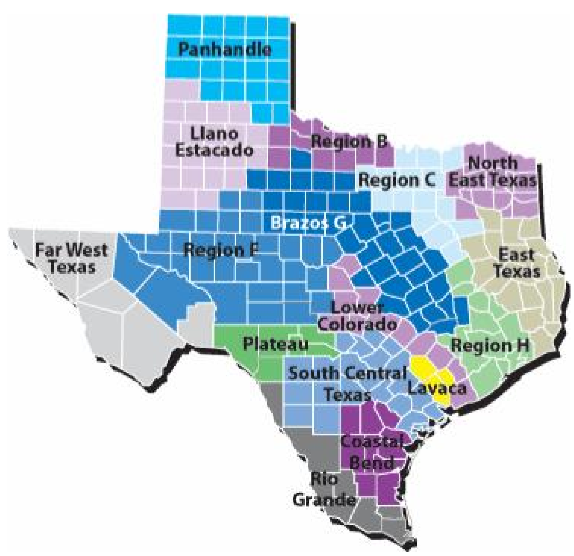
Prepared by:

Stuart Norvell and Kevin Kluge of The Texas Water Development Board's Office of Water Resources Planning

Prepared in support of the:

Lower Colorado Water Planning Group and the 2006 Texas State Water Plan

August 2005



Section	Title	Page

Tables

Executive Summary

Background

Water shortages due to severe drought combined with infrastructure limitations would likely curtail or eliminate economic activity in business and industries heavily 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 business and industry, but they might also bias corporate decision makers against plant expansion or plant location in Texas. From a societal 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.

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.

Overview of Methodology

Two components make up the overall approach to this study: 1) an economic impact module and 2) a social impact module. Economic analysis addresses potential impacts of unmet water needs including effects on residential water consumers and losses to regional economies stemming from reductions in economic output for agricultural, industrial and commercial water uses. Impacts to agriculture, industry and commercial enterprises were estimated using regional “input-output” models commonly used by researchers to estimate how reductions in business activity might affect a given economy. Estimated impacts are *independent* and distinct “what if” scenarios for a given point in time (i.e., 2010, 2020, 2030, 2040, 2050 and 2060). Reported figures are scenarios that illustrate what could happen in a given year if: 1) water supply infrastructure and/or water management strategies do not change through time, 2) the drought of record recurs. Details regarding the methodology and assumptions for individual water use categories (i.e., municipal consumers including residential and commercial water users, manufacturing, steam-electric, mining, and agriculture) are in the main body of the report.

The social component focuses on demographic effects including changes in population and school enrollment. Methods are based on population projection models developed by the TWDB for regional and state water planning. With the assistance of the Texas State Data Center, TWDB staff modified these models and applied them for use here. Basically, the social impact module incorporates results from the economic impact module and assesses how changes in a region’s economy due to water shortages could affect patterns of migration in a region.

Summary of Results

Table E-1 and Figure E-1 summarize estimated economic impacts. Variables shown include:[1]

- **sales** - economic output measured by sales revenue;
- **jobs -** number of full and part-time jobs 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 for the region; and
- **business taxes -** sales, excise, fees, licenses and other taxes paid during normal operation of an industry (does not include any type of income tax).

If drought of record conditions return and water supplies are not developed, study results indicate that the Region K Water Planning Area would suffer significant losses. If such conditions occurred 2010, lost income to residents in the region could total $335 million with associated job losses as high as 4,475. State and local governments could lose nearly $8.32 million in tax receipts. If such conditions occurred in 2060, income losses could run $4,312 million, and job losses could total 49,385. Nearly $248 million worth of state and local taxes would be lost. Reported figures are probably conservative because they are based on estimated costs for a single year; however, in much of Texas, the drought of record lasted several years. For example, in 2030 models indicate that shortages would cost residents and businesses in the region $1,005 million in lost income. Thus, if shortages lasted for three years total losses related to unmet needs could easily approach $3,015 million.

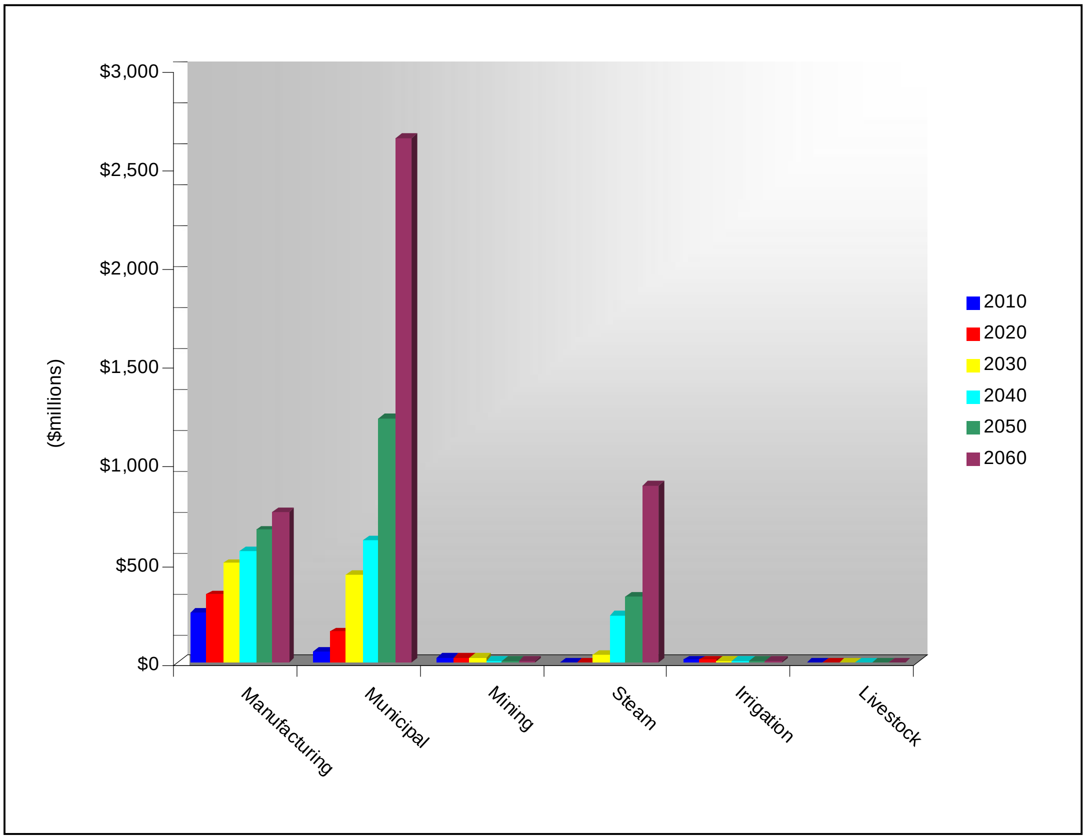
Table E-1: Annual Economic Impacts of Unmet Water Needs
(years, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Income ($millions)	Jobs	State and Local Taxes ($millions)
2010	$553.83	$334.94	4,475	$8.32
2020	$855.68	$524.96	7,435	$15.98
2030	$1,525.45	$1,005.33	13,885	$39.51
2040	$2,098.74	$1,431.38	19,340	$83.84
2050	$2,803.69	$2,242.28	27,465	$117.29
2060	$4,734.38	$4,312.66	49,385	$248.47

Source: Texas Water Development Board, Office of Water Resources Planning

[1] When aggregated at a regional level, total sales are not necessarily a good measure of economic prosperity because they include sales to other industries for further processing. For example, a farmer sells rice to a rice mill, which the rice mill processes and sells it to another consumer. Both transactions are counted in an input-output model. Thus, total sales “double count.” Regional income plus business taxes are more suitable because they are a better measure of net economic returns.

Figure E-1: Distribution of Lost Income by Water Use Category
(years: 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)



Source: Texas Water Development Board Office of Water Resources Planning

Table E-2 shows potential losses in population and school enrollment. Changes in population stem directly from the number of lost jobs estimated as part of the economic impact module. In other words, many - but not all - people would likely relocate due to a job loss and some have families with school age children. Section 1.3 in the main body of the report discusses methodology in detail.

Table E-2: Estimated Regional Social Impacts of Unmet Water Needs
(years, 2010, 2020, 2030, 2040, 2050 and 2060)

Year	Population Losses	Declines in School Enrollment
2010	6,315	1,605
2020	10,495	2,665
2030	19,595	4,980
2040	27,295	6,935
2050	38,760	9,845
2060	69,670	17,700

Source: Based on models developed by the Texas Water Development Board, Office of Water Resources Planning and the Texas State Data Center.

Introduction

Texas is one the nation's fastest growing states. From 1950 to 2000, population in the state grew from about 8 million to nearly 21 million. By the year 2050, the total number of people living in Texas is expected to reach 40 million. Rapid growth combined with Texas' susceptibility to severe drought makes water supply a crucial issue. If water infrastructure and water management strategies are not improved, Texas could face serious social, economic and environmental consequences - not only in our large metropolitan cities, but also on our farms and rural areas.

Water shortages due to severe drought combined with infrastructure limitations would likely curtail or eliminate economic activity in business and industries heavily 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 business and industry, but they might also bias corporate decision makers against plant expansion or plant location in Texas. From a societal 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.

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 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 analyses. In response to requests from regional planning groups, TWDB staff designed and conducted required studies. The following document prepared by the TWDB's Office of Water Resources Planning summarizes analysis and results for the Region K Water Planning Area. Section 1 provides an overview of concepts and methodologies used in the study. Sections 2 and 3 provide detailed information and analyses for each water use category employed in the planning process (i.e., irrigation, livestock, municipal, manufacturing, mining and steam-electric).

1. Overview of Terms and 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 Measuring Economic Impacts

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 and benefits of providing water to people, businesses and the environment. Analysis in this report focuses strictly on demand side impacts. Specifically, it addresses the potential economic impacts of unmet water needs including: 1) losses to regional economies stemming from reductions in economic output, and 2) costs to residential water consumers associated with implementing emergency water procurement and conservation programs.

1.1.1 Impacts to Agriculture, Business and Industry

As mentioned earlier, severe water shortages would likely affect the ability of business and industry to operate resulting in lost output, which would adversely affect the regional economy. A variety tools are available to estimate such 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).

Basically, an IO/SAM model is an accounting framework that traces spending and consumption between different economic sectors including businesses, households, government and "foreign" economies in the form of exports and imports. As an example, Table 1 shows a highly aggregated segment of an IO/SAM model that focuses on key agricultural sectors in a local economy. The table contains transactions data for three agricultural sectors (cattle ranchers, dairies and alfalfa farms). Rows in Table 1 reflect sales from each sector to other local industries and institutions including households, government and consumers outside of the region in the form of exports. Columns in the table show purchases by each sector in the same fashion. For instance, the dairy industry buys $11.62 million worth of goods and services needed to produce milk. Local alfalfa farmers provide $2.11 million worth of hay and local households provide about $1.03 million worth of labor. Dairies import $4.17 million worth of inputs and pay $2.61 million in taxes and profits. Total economic activity in the region amounts to about $807.45 million. The entire table is like an accounting balance sheet where total sales equal total purchases.

Table 1: Example of a County-level Transaction and Social Accounting Matrix for Agricultural Sectors ($millions)

Sectors	Cattle	Dairy	Alfalfa	All other Industries	Taxes, govt. & profits	Households	Exports	Total
Cattle	$3.10	$0.01	$0.00	$0.03	$0.02	$0.06	$10.76	$13.98
Dairy	$0.07	$0.13	$0.00	$0.25	$0.01	$0.00	$11.14	$11.60
Alfalfa	$0.00	$2.11	$0.00	$0.01	$0.02	$0.01	$10.38	$12.53
Other industries	$2.20	$1.56	$2.90	$50.02	$70.64	$66.03	$48.48	$241.83
Taxes, govt. & profits	$2.37	$2.61	$5.10	$77.42	$0.23	$49.43	$83.29	$220.45
Households	$0.82	$1.03	$1.38	$50.94	$45.36	$7.13	$14.64	$121.30
Imports	$5.41	$4.17	$3.16	$63.32	$104.17	$5.53	$0.00	$185.76
Total	$13.97	$11.62	$12.54	$241.99	$220.45	$128.19	$178.69	$807.45

* Columns contain purchases and rows represent sales. Source: Adapted from Harris, T.R., Narayanan, R., Englin, J.E., MacDiarmid, T.R., Stoddard, S.W. and Reid, M.E. "*Economic Linkages of Churchill County*." University of Nevada Reno. May 1993.

To understand how an IO/SAM model works, first visualize that $1 of additional sales of milk is injected into the dairy industry in Table 1. For every $1 the dairies receive in revenue, they spend 18 cents on alfalfa to feed their cows; nine cents is paid to households who provide farm labor, and another 13 cents goes to the category "other industries" to buy items such as machinery, fuel, transportation, accounting services etc. Nearly 22 cents is paid out in the form of profits (i.e., returns to dairy owners) and taxes/fees to local, state and federal government. The value of the initial $1 of revenue in the dairy sector is referred to as a first-round or **direct effect.**

As the name implies, first-round or direct effects are only part of the story. In the example above, alfalfa farmers must make 18 cents worth of hay to supply the increased demand for their product. To do so, they purchase their own inputs, and thus, they spend part of the original 18 cents that they received from the dairies on firms that support their own operations. For example, 12 cents is spent on fertilizers and other chemicals needed to grow alfalfa. The fertilizer industry in turn would take these 12 cents and spend them on inputs in its production process and so on. The sum of all re-spending is referred to as the **indirect effect** of an initial increase in output in the dairy sector.

While direct and indirect impacts capture how industries respond to a change, **induced impacts** measure the behavior of the labor force. As demand for production increases, employees in base industries and supporting industries will have to work more; or alternatively, businesses will have to hire more people. As employment increases, household spending rises. Thus, seemingly unrelated businesses such as video stores, supermarkets and car dealers also feel the effects of an initial change.

Collectively, indirect and induced effects are referred to as **secondary impacts**. In their entirety, all of the above changes (direct and secondary) are referred to as **total economic impacts**. By nature, total impacts are greater than initial changes because of secondary effects. The magnitude of the increase is what is popularly termed a multiplier effect. Input-output models generate numerical multipliers that estimate indirect and induced effects.

In an IO/SAM model impacts stem from changes in output measured by sales revenue that in turn come from changes in consumer demand. In the case of water shortages, one is not assuming a change in demand, but rather a supply shock - in this case severe drought. Demand for a product such as corn has not necessarily changed during a drought. However, farmers in question lack a crucial input (i.e., irrigation water) for which there is no *short-term* substitute. Without irrigation, she cannot grow irrigated crops. As a result, her cash flows decline or cease all together depending upon the severity of the situation. As cash flows dwindle, the farmer's income falls, and she has to reduce expenditures on farm inputs such as labor. Lower revenues not only affect her operation and her employees directly, but they also indirectly affect businesses who sell her inputs such as fuel, chemicals, seeds, consultant services, fertilizer etc.

The methodology used to estimate regional economic impacts consists of three steps: 1) develop IO/SAM models for each county in the region and for the region as whole, 2) estimate direct impacts to economic sectors resulting from water shortages, and 3) calculate total economic impacts (i.e., direct plus secondary effects).

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.[2] Using IMPLAN software and data, transaction tables conceptually similar to the one discussed previously (see Table 1 on page 7) were estimated for

[2]The basic IMPLAN database consists of national level technology matrices based on the Benchmark Input-Output Accounts generated the U.S. Bureau of Economic Analysis and estimates of final demand, final payments, industry output and employment for various economic sectors. IMPLAN's 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 the national totals using a matrix ratio allocation system and county data are balanced to state totals. In other words, much of the data in IMPLAN is based on a national average for all industries.

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 industry 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 year 2000 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 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. All sectors in the IMPLAN database were assigned to a specific water use category (see Attachment A of this report).

Step 2: *Estimate Direct Economic Impacts of Water Shortages*

As mentioned above, direct impacts accrue to immediate businesses and industries that rely on water. Without water industrial processes could suffer. However, output responses would likely vary depending upon the severity of a shortage. A small shortage relative to total water use may have a nominal effect, but as shortages became more critical, effects on productive capacity would increase.

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. 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]

Note that 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.

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]

- if unmet water needs are 0 to 5 percent of total water demand, no corresponding reduction in output is assumed;
- if water shortages are 5 to 30 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 0.25 percent reduction in output;
- if water shortages are 30 to 50 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 0.50 percent reduction in output; and
- if water shortages are greater than 50 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 1.0 percent (i.e., a proportional reduction).

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. When calculating direct effects for the municipal, steam electric, manufacturing and livestock water use categories, sales to final demand were applied to avoid double counting impacts. 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:

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

[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 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*." Prepared by Spectrum Economics, Inc. November, 1991.

$D_{i,t}$ = 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*.

Direct impacts to irrigation and mining are based upon the same formula; however, total sales as opposed to final sales were used. To avoid double counting, secondary impacts in sectors other than irrigation and mining (e.g., manufacturing) were reduced by an amount equal to or less than direct losses to irrigation and mining. In addition, in some instances closely linked sectors were moved from one water use category to another. For example, although meat packers and rice mills are technically manufacturers, in some regions they were reclassified as either livestock or irrigation. All direct effects were estimated at the county level and then summed to arrive at a regional figure. See Section 2 of this report for additional discussion regarding methodology and caveats used when estimating direct impacts for each water use category.

Step 3: *Estimate Secondary and Total Economic Impacts of Water Shortages*

As noted earlier, the effects of reduced output would extend well beyond sectors directly affected. Secondary impacts were derived using the same formula used to estimate direct impacts; however, regional level *indirect* and *induced* multiplier coefficients were applied and only final sales were multiplied.

1.1.2 Impacts Associated with Domestic Water Uses

IO/SAM models are not well suited for measuring impacts of shortages for domestic uses, which make up the majority of the municipal category.[5] To estimate impacts associated with domestic uses, municipal water demand and thus needs were subdivided into two categories - residential and commercial. Residential water is considered "domestic" and includes water that people use in their homes for things such as cooking, bathing, drinking and removing household waste and for outdoor purposes including lawn watering, car-washing and swimming pools. Shortages to residential uses were valued using a tiered approach. In other words, the more severe the 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 costs would be much higher in this case because people could probably not live with such a reduction, and would be forced to find emergency alternatives. The alternative assumed in this study is a very uneconomical and worst-case scenario (i.e., hauling water in from other communities by truck or rail). Section 2.3.3 of this report discusses methodology for municipal uses in greater detail.

[5] A notable exception is the potential impacts to the nursery and landscaping industry that could arise due to reductions in outdoor residential uses and impacts to "water intensive" commercial businesses (see Section 2.3.3).

1.2 Measuring Social Impacts

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 much harder to measure in quantitative terms. Nevertheless, social effects associated with drought and water shortages usually have close ties 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.[6]

Social impacts measured in this study focus strictly on demographic effects including changes in population and school enrollment. Methods are based on models used by the TWDB for state water planning and by the U.S. Census Bureau for national level population projections. With the assistance of the Texas State Data Center (TSDC), TWDB staff modified population projection models used for state water planning and applied them here. Basically, the social impact model incorporates results from the economic component of the study and assesses how changes in labor demand due to unmet water needs could affect migration patterns in a region. Before discussing particulars of the approach model, some background information regarding population projection models is useful in understanding the overall approach.

1.2.1 Overview of Demographic Projection Models

More often than not, population projections are reported as a single number that represents the size of an overall population. While useful in many cases, a single number says nothing about the composition of projected populations, which is critical to public officials who must make decisions regarding future spending on public services. For example, will a population in the future have more elderly people relative to today, or will it have more children? More children might mean that more schools are needed. Conversely, a population with a greater percentage of elderly people may need additional healthcare facilities. When projecting future populations, cohort-survival models break down a population into groups (i.e., cohorts) based on factors such as age, sex and race. Once a population is separated into cohorts, one can estimate the magnitude and composition of future population changes.

Changes in a population's size and makeup in survival cohort models are driven by three factors:

[6] 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.

1. *Births:* Obviously, more babies mean more people. However, only certain groups in a population are physically capable of bearing children- typically women between the ages of 13 and 49. The U.S. Census Bureau and the TSDC continually updates fertility rates for different cohorts. For each race/ethnicity category, birth rates decline and then stabilize in the future.

2. *Deaths:* When people die, populations shrink. Unlike giving birth, however, everyone is capable of dying and mortality rates are applied to all cohorts in a given population. Hence their name, cohort-survival models use survival rates as opposed to mortality rates. A survival rate is simply the probability that a given person with certain attributes (i.e., race, age and sex) will survive over a given period of time.

3. *Migration*: Migration is the movement of people in or out of a region. Migration rates used to project future changes in a region are usually based on historic population data. When analyzing historic data, losses or increases that are not attributed to births or deaths are assumed to be the result of migration. Migration can be further broken down into changes resulting from economic and non-economic factors. Economic migrants include workers and their families that relocate because of job losses (or gains), while non-economic migrants move due to lifestyles choices (e.g., retirees fleeing winter cold in the nation's heartland and moving to Texas).

In summary, knowledge of a population's composition in terms of age, sex and race combined with information regarding birth and survival rates, and migratory patterns, allows a great deal of flexibility and realism when estimating future populations. For example, an analyst can isolate population changes due to deaths and births from changes due to people moving in and out of a region. Or perhaps, one could analyze how potential changes in medical technology would affect population by reducing death rates among certain cohorts. Lastly, one could assess how changes in *economic conditions* might affect a regional population

1.2.2 Methodology for Social Impacts

Two components make up the model. The first component projects populations for a given year based on the following six steps:

1) *Separate "special" populations from the "general" population of a region:* The general population of a region includes the portion subject to rates of survival, fertility, economic migration and non-economic migration. In other words, they live, die, have children and can move in and out of a region freely. "Special populations," on the other hand, include college students, prisoners and military personnel. Special populations are treated differently than the general population. For example, fertility rates are not applied to prisoners because in general inmates at correctional facilities do not have children, and they are incapable of freely migrating or out of a region. Projections for special populations were compiled by the TSDC using data from the Higher Education Coordinating Board, the Texas Department of Criminal Justice and the U.S. Department of Defense. Starting from the 2000 Census, general and special populations were broken down into the following cohorts:

- age cohorts ranging from age zero to 75 and older,
- race/ethnicity cohorts, including Anglo, Black, Hispanic and "other," and
- gender cohorts (male and female).

2) *Apply survival and fertility rates to the general population* : Survival and fertility rates were compiled by the TSDC with data from the Texas Department of Health (TDH). Natural decreases (i.e., deaths) are estimated by applying survival rates to each cohort and then subtracting estimated deaths from the total population. Birth rates were then applied to females in each age

and race cohort in general and special populations (college and military only) to arrive at a total figure for new births.

3) *Estimate economic migration based on labor supply and demand*: TSDC year 2000 labor supply estimates include all non-disabled and non-incarcerated civilians between the ages of 16 and 65. Thus, prisoners are not included. Labor supply for years beyond 2001 was calculated by converting year 2000 data to rates according to cohort and applying these rates to future years. Projected labor demand was estimated based on historical employment rates. Differences between total labor supply and labor demand determines the amount of in or out migration in a region. If supply is greater than demand, there is an out-migration of labor. Conversely, if demand is greater than supply, there is an in-migration of labor. The number of migrants does not necessarily reflect total population changes because some migrants have families. To estimate how many people might accompany workers, a migrant worker profile was developed based on the U.S. Census Bureau's Public Use Microdata Samples (PUMs) data. Migrant profiles estimate the number of additional family members, by age and gender that accompany migrating workers. Together, workers and their families constitute economic migration for a given year.

4) *Estimate non-economic migration*: As noted previously, migration patterns of individuals age 65 and older are generally independent of economic conditions. Retirees usually do not work, and when they relocate, it is primarily because of lifestyle preferences. Migratory patterns for people age 65 or older are based on historical PUMs data from the U.S. Census.

5) *Calculate ending population for a given year*: The total year-ending population is estimated by adding together: 1) surviving population from the previous year, 2) new births, 3) net economic migration, 4) net non-economic migration and 5) special populations. This figure serves as the baseline population for the next year and the process repeats itself.

The second component of the social impact model is identical to the first and includes the five steps listed above for each year where water shortages are reported (i.e., 2010, 2020, 2030, 2040, 2050 and 2060). The only difference is that labor demand changes in years with shortages. Shifts in labor demand stem from employment impacts estimated as part of the economic analysis component of this study with some slight modifications. IMPLAN employment data is based on the number of full and part-time jobs as opposed to the number of people working. To remedy discrepancies, employment impacts from IMPLAN were adjusted to reflect the number of people employed by using simple ratios (i.e., labor supply divided by number of jobs) at the county level. 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.

1.3 Clarifications, Assumptions and Limitations of Analysis

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) While useful for planning purposes, this study is not a benefit-cost analysis (BCA). BCA 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 BCA if done so properly.

2) Since this is not a BCA, future impacts are not weighted differently. In other words, estimates are not “discounted.” If used as a measure of benefits in a BCA, one must consider the uncertainty of estimated monetary impacts.

3) All monetary figures are reported in constant year 2000 dollars.

4) Shortages reported by regional planning groups are the starting point for socioeconomic analyses. No adjustments or assumptions regarding the magnitude or distributions of unmet needs among different water use categories are incorporated in the analysis.

5) 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.

6) 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.

7) 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 population projections are based on reduced employment in the region, they should be considered an upper bound as well.

8) IO models are static in nature. Models and resultant multipliers are based upon the structure of the U.S. and regional economies in the year 2000. In contrast, unmet water needs are projected to occur well into the future (i.e., 2010 through 2060). Thus, the analysis assumes that the general structure of the economy remains the same over the planning horizon.

9) With respect to municipal needs, an important assumption is that people would eliminate all outdoor water use before indoor water uses were affected, and people would implement emergency indoor water conservation measures before commercial businesses had to curtail operations, and households had to seek alternative sources of water. Section 2.3.3 discusses this in greater detail.

10) 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 Texas for many communities lasted several years.

2. Economic Impacts

Part 2 of this report summarizes economic analysis for each water use category. Section 2.1 presents the year 2000 economic baseline for Region K. Section 2.2 presents results for agricultural water uses including livestock and irrigated crop production, while Section 2.3 reviews impacts to municipal and industrial water uses including manufacturing, mining, steam-electric and municipal demands.

2.1 Economic Baseline

Table 2 summarizes baseline economic variables for the region. In year 2000, people and businesses Region K produced $91,321 million in output that generated nearly $51,566 million in income for residents in the area. In 2000, economic activity supported an estimated 892,485 full and part-time jobs. Business and industry also generated about $3,888 million in state and local taxes. Sections 2.2.and 2.3 discuss contributions of individual water use categories in greater detail.

Table 2: Year 2000 Economic Baseline for Region K (monetary figures are reported in $millions)

	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Irrigation	$51.25	$0.97	$50.27	2,448	$31.37	$2.85
%	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%
Livestock	$319.49	$57.87	$261.62	9,001	$217.26	$13.92
%	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%
Manufacturing	$20,796.08	$4,148.20	$16,647.88	83,237	$8,620.01	$198.81
%	23%	15%	26%	9%	17%	5%
Mining	$1,529.60	$397.97	$1,131.63	3,895	$635.6	$74.6
%	2%	1%	2%	<1%	1%	2%
Municipal	$67,520.42	$23,014.57	$44,505.85	792,075	$41,272.41	$3,456.76
%	74%	83%	70%	89%	80%	89%
Steam Electric	$1,104.29	$155.41	$948.88	1,829	$789.72	$141.43
%	1%	1%	2%	< 1%	2%	4%
Total	$91,321.12	$27,774.99	$63,546.14	892,485	$51,566.40	$3,888.39
%	100%	100%	100%	100%	100%	100%

Source: Based input-output models generated using IMPLAN Pro software from MIG Inc.

2.2 Agriculture

Agriculture is a small but important component of the region's economy. In 2000, farmers using irrigation produced about $51 million dollars worth of crops that generated $31million worth of income for the region. With $320 million in sales, the region's livestock industry is considerably larger in terms of dollars output. Collectively, irrigated farming and the livestock industry accounted for roughly two percent of regional income and jobs.

2.2.1 Irrigation

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 Natural Resources Conservation Service (NRCS) 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 3 shows TWDB crops included in corresponding IMPLAN sectors. Table 5 shows year 2000 baseline economic data for irrigation in the region.[7] With nearly $43 million in sales, rice is predominant in Region K and is totally dependent upon the availability of irrigation water. Since irrigation shortages are projected to occur in areas with significant rice production (i.e., Wharton, Colorado and Matagorda counties), the analysis assumes that all shortages accrue to rice production. Table 5 summarizes estimated impacts.[8] Attachment B of this report shows the effects by county, and Attachment C shows impacts by major river basin.

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[7] Although consistent and comprehensive data are not available, a significant irrigated acreage in Region K is used for sod and horticultural applications including ornamental landscape plants and trees. Impacts to the horticultural industry were included as part of the analysis for the municipal category (see Section 2.3.3), and to avoid double counting, impacts are not tallied as irrigation impacts.

[8] Reduced output estimates for rice production are based on an assumed harvest value of $390 per acre for first plantings and $155 for ratoon crops. Total value of output per acre is $545. Figures are based on data from the Texas A&M Crop Enterprise Budgets.

Table 3: Crop Classifications Used in TWDB Water Use Survey and Corresponding IMPLAN Crop Sectors Applied in Socioeconomic Impact Analysis	
IMPLAN Sector	TWDB Sector
Cotton	Cotton
Feed Grains	Corn, sorghum and “forage crops”
Food Grains	Rice, wheat and "other grains"
Fruits	Citrus
Hay and Pasture	Alfalfa and “other hay and pasture”
Oil Crops	Peanuts, soybeans and “other oil crops”
Sugar Crops	Sugarbeets and sugarcane
Tree Nuts	Pecans
Vegetables *	Deep-rooted vegetables, shallow-rooted vegetables and potatoes
Other Crops	"All other crops" "other orchards" and vineyards

* includes melons.

Table 4: Year 2000 Baseline for Irrigation in Region K (monetary figures are reported in $millions)

	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Rice	$42.70	$0.40	$42.30	2155	$26.0	$2.5
Tree Nuts	$3.77	$0.30	$3.47	120	$2.5	$0.1
Cotton	$2.10	$0.04	$2.06	27	$1.1	$0.1
Other Irrigated Crops	$2.68	$0.23	$2.45	146	$1.82	$0.17
Total Irrigation	$51.25	$0.97	$50.27	2,448	$31.37	$2.85

* Data are currently not available for nursery and sod production. Source: Based on input-output models generated using IMPLAN Pro software from MIG Inc, and data from the Texas Agricultural Statistics Service.

Table 5: Annual Economic Impacts Associated with Unmet Irrigation Water Needs
(years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$17.55	$10.56	665	$1.03
2020	$16.88	$10.15	640	$0.99
2030	$11.62	$6.99	440	$0.68
2040	$10.73	$6.46	410	$0.63
2050	$7.18	$4.32	275	$0.42
2060	$5.40	$3.25	205	$0.32

Source: Based on economic impact models developed by the Texas Water Development Board, Office of Water Planning.

2.2.2 Livestock

Livestock water shortages are projected to occur in Colorado, Hays and Llano counties. Relative to other water use categories needs for livestock are small, and the analysis assumes that livestock farmers would haul water by truck to fill stock tanks. Table 6 shows estimated annual costs. Attachment B of this report shows impacts by county, and Attachment C shows impacts by major river basin.

Table 6: Annual Costs to Livestock Producers
(years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	$millions
2010	$1.23
2020	$1.23
2030	$1.23
2040	$1.23
2050	$1.23
2060	$1.23

Source: Texas Water Development Board, Office of Water Planning.

2.3 Municipal and Industrial

Municipal and industrial (M&I) water uses make up the overwhelming majority of economic activity in the region. In 2000, M&I users generated about 97 percent of sales, income and jobs for regional residents.

2.3.1 Manufacturing

Table 7 summarizes baseline economic data for manufacturing sectors in Region K. Unlike some other areas of the state where petroleum and chemicals dominate manufacturing, Region K is characterized by high-tech companies in and around the Austin area. Computers, semiconductors and related devices account for about one-half of all manufacturing activity in the region.

Table 7: Year 2000 Baseline for Manufacturing in Region K (monetary figures are reported in $millions)						
Sector	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Electronic Computers	$6,684.42	$1,404.47	$5,279.96	20,341	$2,928.30	$60.39
Semiconductors and Related Devices	$4,123.00	$888.48	$3,234.52	15,289	$2,195.69	$36.33
Special Industry Machinery	$1,603.84	$50.25	$1,553.59	3,361	$497.74	$14.58
Telephone and Telegraph Apparatus	$955.96	$198.63	$757.33	1,731	$335.96	$7.67
Computer Peripheral Equipment	$670.21	$162.14	$508.07	2,198	$169.86	$5.30
Industrial Organic Chemicals	$536.76	$178.86	$357.90	703	$131.89	$9.52
All Other Manufacturing Sectors	$6,221.90	$1,265.37	$4,956.52	39,615	$2,360.57	$65.02
Total	$20,796.08	$4,148.20	$16,647.88	83,237	$8,620.01	$198.81

Source: Generated using IMPLAN models and data from MIG, Inc.

Direct impacts to manufacturing were estimated by distributing water shortages among industrial sectors at the county level. Care was taken to include only sectors recorded in the TWDB Water Uses 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 uses. To maintain consistency between IMPLAN and TWDB databases, Standard Industrial Classification (SIC) codes in TWDB databases were matched to IMPLAN sector codes for each affected county. Non-matches were excluded when calculating direct impacts.

The distribution of water shortages among TWDB manufacturing sectors is weighted according to year 2000 water use. Accordingly, industries with the greatest use are affected the most. As a general observation, these sectors include petroleum and chemical refineries, plastic producers, semiconductor manufacturers, paper mills, food processors and cement manufacturers. Other manufacturing sectors use considerably less water for productive processes and are less likely to suffer substantial negative effects due to water shortages.

The Region K 2006 Water Plan indicates that under drought of record conditions, shortages to manufacturing water uses would occur in Bastrop, Blanco, Fayette, Llano, Matagorda, Mills and Travis counties. Table 8 summarizes estimated impacts. Attachment B of this report shows impacts by county, while Attachment C shows impacts by major river basin.

Table 8: Annual Economic Impacts Associated with Unmet Manufacturing Water Needs (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)				
Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$466.80	$250.69	2,915	$4.97
2020	$676.79	$341.65	4,015	$8.93
2030	$1,071.69	$500.34	5,870	$17.80
2040	$1,202.67	$563.10	6,635	$19.76
2050	$1,452.89	$667.99	7,870	$24.97
2060	$1,664.07	$756.16	9,220	$28.33

* Estimates are based on projected economic activity in the region. Source: Based on economic impact models developed by the Texas Water Development Board, Office of Water Planning.

2.3.2 Mining

Table 9 summarizes sales, employment and regional income for the mining industry in Region K. In 2000, mining sectors sold $1,529 million worth of output and generated $636 million in regional income. Natural gas and petroleum extraction accounts for about 95 percent of mining activity. At this juncture, it important to stress that output for the natural gas and oil sectors represent transactions by corporate entities based in Region K. However, it does not necessarily reflect the *physical* extraction of gas or oil in the region. To account for potential discrepancies related to data reporting, TWDB analysts used data from the Texas Railroad Commission (TRC) to estimate actual oil and gas production in affected counties by comparing well-head market prices for crude and gas to TRC production statistics. Records show that in year 2000 only $366 million worth of gas and oil came from wells in Region K counties - primarily in Wharton ($138 million), Fayette ($113), Matagorda ($69 million) and Colorado ($35 million) counties.

Table 9: Year 2000 Baseline for Mining Sectors in Region K (monetary figures are reported in $millions)						
Sector	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Natural Gas & Crude Petroleum*	$1,091.34	$299.61	$791.73	2,886	$475.13	$55.74
Natural Gas Liquids*	$334.02	$91.70	$242.32	247	$97.05	$15.26
Aggregate	$80.53	$3.05	$77.49	624	$49.88	$2.50
Other Mining Sectors	$23.71	$3.62	$20.09	138	$13.56	$1.12
Total	$1,529.60	$397.97	$1,131.63	3,895	$635.62	$74.62

* Represents sales from corporations located in Region K as opposed to the physical extraction of oil and gas from wells located within regional boundaries. Some sales are from wells outside of the region. Based on production figures published by the Texas Railroad Commission and price data from the Energy Information Agency, extraction from counties in Region K was valued at $366 million in year 2000. Source for tabular data: Generated using data from MIG, Inc., and models developed by the TWDB using IMPLAN software.

Another consideration with respect to mining is the fact that the 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 shows 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. In Region K, counties with reported mining shortages oil and gas extraction is limited and TRC records indicate that there is currently no water-flood extraction taking place. As a result, impacts to oil and gas production are assumed to be nominal over the planning horizon. In counties with reported shortages, data indicate that water shortages would primarily affect aggregate (i.e., sand, gravel and crushed stone) operations.

The 2006 Region K Water Plan indicates that under drought of record conditions, shortages to mining would occur in Bastrop, Burnet and Colorado counties. Table 10 summarizes total estimated impacts for Burnet and Colorado counties. Data needed for estimating impacts in Bastrop County are not sufficient. Attachment B of this report shows impacts by county, and Attachment C shows impacts distributed by major river basin.

Table 10: Annual Economic Impacts Associated with Unmet Water Needs for Mining
(years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$30.65	$19.04	265	$0.95
2020	$30.36	$18.86	265	$0.94
2030	$29.95	$18.60	260	$0.93
2040	$10.35	$6.43	70	$0.32
2050	$8.48	$5.27	75	$0.26
2060	$8.16	$5.07	70	$0.25

* Estimates are based on *projected* economic activity in the region. Source: Based on economic impact models developed by the Texas Water Development Board, Office of Water Resources Planning.

2.3.3 Municipal

Table 11 summarizes economic activity for municipal water uses. In 2000, businesses and institutions that make up the municipal category produced $67,520 million worth of goods and services. In return, they received $41,272 million in wages, salaries and profits. Municipal uses generate the bulk of business taxes in the region - nearly $3,456 million (90 percent). Top commercial sectors in terms of income and output include wholesale trade, state and local government, real estate, banking, computer and data processing services, communications and eating and drinking establishments.

Table 11:Year 2000 Baseline for Municipal Sectors in Region K (monetary figures are reported in $millions)						
Sector	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Wholesale Trade	$5,858.33	$2,435.51	$3,422.82	32,545	$3,232.72	$840.75
Real Estate	$5,098.37	$1,299.90	$3,798.47	22,621	$3,023.51	$603.12
Computer and Data Processing	$3,794.57	$1,151.64	$2,642.93	33,577	$3,070.15	$57.60
Communications, Except Radio	$3,040.86	$803.15	$2,237.71	8,468	$1,582.46	$168.41
State & Local Government *	$5,813.6	$5,813.6	$0.0	118,818	$5,813.6	$0.0
Eating & Drinking	$2,027.49	$100.14	$1,927.34	50,793	$989.99	$138.13
All other municipal sectors	$40,243.2	$10,798.0	$29,445.2	517,737	$22,497.9	$1,622.2
Total	$67,520.42	$23,014.57	$44,505.85	792,075	$41,272.41	$3,456.76

*Does not include education. Source: Generated using data from MIG, Inc., and models developed by the TWDB using IMPLAN software.

Estimating direct economics impacts for the municipal category is complicated for several reasons. For one, municipal uses comprise a range of different consumers including commercial businesses, institutions (e.g., schools and government) and households. However, reported shortages do not specify how needs are distributed among different consumers. In other words, how much of a municipal need is commercial and how much is residential? 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 (see Attachment A). For example, if year 2000 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) and thus annual use is 6.7 acre-feet. 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.” The estimated proportion of water used for commercial purposes ranges from about 5 to 35 percent of total municipal demand at the county level. Less populated rural counties occupy the lower end of the spectrum, while larger metropolitan counties are at the higher end.

As mentioned earlier, a key study assumption is that people would eliminate outdoor water use before indoor water consumption was affected; and they would implement *voluntary* emergency indoor water conservation measures before people had to curtail business operations or seek emergency sources of water. This is logical because most water utilities have drought contingency plans. Plans usually specify curtailment or elimination of outdoor water use during periods of drought. 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.”[9] Thus, when assessing municipal needs there are several important considerations: 1) how much of a need would people reduce via eliminating outdoor uses and implementing emergency indoor conservation measures; and 2) what are the economic implications of such measures?

Determining how much water is used for outdoor purposes is key to answering these questions. The proportion used here is based on several secondary sources. The first is a major study sponsored by the American Water Works Association, which surveyed cities in states

[9] 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.

including Colorado, Oregon, Washington, California, Florida and Arizona. On average across all cities surveyed 58 percent of residential water use was for outdoor activities. In cities with climates comparable to large metropolitan areas of Texas, the average was 40 percent.[10]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.[11] A study conducted for the California Urban Water Agencies (CUWA) calculated values ranging from 25 to 35 percent.[12] Unfortunately, there does not appear to be any comprehensive research that has estimated non-agricultural outdoor water use in Texas. As an approximation, an average annual value of 30 percent based on the above references was selected to serve as a rough estimate in this study. With respect to emergency indoor conservation measures, this analysis assumes that citizens in affected communities would reduce needs by an additional 20 percent. Thus, 50 percent of total needs could be eliminated before households and businesses had to implement emergency water procurement activities.

Eliminating outdoor watering would have a range of economic implications. For one, such a restriction would likely have adverse impacts on the landscaping and horticultural industry. If people are unable to water their lawns, they will likely purchase less lawn and garden materials such as plants and fertilizers. On the other hand, during a bad drought people may decide to invest in drought tolerant landscaping, or they might install more efficient landscape plumbing and other water saving devices. But in general, the horticultural industry would probably suffer considerable losses if outdoor water uses were restricted or eliminated. For example, many communities in Colorado, which is in the midst of a prolonged drought, have severely restricted lawn irrigation. In response, the turf industry in Colorado has laid off at least 50 percent of its 2,000 employees.[13] To capture impacts to the horticultural industry, regional sales net of exports for the greenhouse and nursery sectors and the landscaping services sector were reduced in proportion to reductions in outdoor water use. Note that these losses would not necessarily appear as losses to the regional or state economies because people might spend the money that they would have spent on landscaping on other goods. Thus, the net effect on state or regional accounts could be neutral.

Other considerations include the “welfare” losses to consumers who had to forgo outdoor and indoor water uses to reduce needs. In other words, the water that people would have to give up has an economic value. Estimating the economic value of this forgone water for each planning area would be a very time consuming and costly task, and thus secondary sources served as a proxy. Previous research funded by the TWDB, explored consumer “willingness to pay” for avoiding restrictions on water use.[14] Surveys revealed that residential water consumers in Texas would be willing to pay - on average across all income levels - $36 to avoid a 30 percent reduction in water availability lasting for at least 28 days. Assuming the average person in Texas uses 140 gallons per day and the typical household in the state has 2.7 persons (based on U.S. Census data), total monthly water use is 13,205 gallons per household. Therefore, the value of restoring 30 percent of average monthly water use during shortages to residential consumers is roughly

[10] 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).

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

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

[13] Based on assessments of the Rocky Mountain Sod Growers. See, “*Drought Drying Up Business for Landscapers*.” Associated Press. September, 17 2002.

[14] See, Griffin, R.C., and Mjelde, W.M. “*Valuing and Managing Water Supply Reliability*. Final Research Report for the Texas Water Development Board: Contract no. 95-483-140.” December 1997.

one cent per gallon or $2,930 per acre-foot. This figure serves as a proxy to measure consumer welfare losses that would result from restricted outdoor uses and emergency indoor restrictions.

The above data help address the impacts of incurring water needs that are 50 percent or less of projected use. Any amount greater than 50 percent would result in municipal water consumers having to seek alternative sources. Costs to residential and non-water intensive commercial operations (i.e., those that use water only for sanitary purposes) are based on the most likely alternative source of water in the absence of water management strategies. In this case, the most likely alternative is assumed to be "hauled-in" water from other communities at annual cost of $6,530 per acre-foot for small rural communities and approximately and $10,995 per acre-foot for metropolitan areas.[15]

This is not an unreasonable assumption. It happened during the 1950s drought and more recently in Texas and elsewhere. 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 hauled delivered to their homes by private contractors.[16] 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.[17] In Australia, four cities have run out of water as a result of drought, and residents have been trucking in water since November 2002. One town has five trucks carting about one acre-foot eight times daily from a source 20 miles away. They had to build new roads and infrastructure to accommodate the trucks. Residents are currently restricted to indoor water use only.[18]

Direct impacts to commercial sectors were estimated in a fashion similar to other business sectors. Output was reduced among "water intensive" commercial sectors according to the severity of projected shortages. Water intensive is defined as non-medical related sectors that are heavily dependent upon 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,
§ hotels and lodging places, and
§ eating and drinking establishments.

For non-water intensive sectors, it is assumed that businesses would haul water by truck and/or rail.

An example will illustrate the breakdown of municipal water needs and the overall approach to estimating impacts of municipal needs. Assume City B has an unmet need of 50 acre

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[15] For rural communities, figure assumes an average truck hauling distance of 50 miles at a cost of 8.4 cents per ton-mile (an acre foot of water weighs about 1,350 tons) with no rail shipment. For communities in metropolitan areas, figure assumes a 50 mile truck haul, and a rail haul of 300 miles at a cost of 1.2 cents per ton-mile. Cents per ton-mile are based on figures in: Forkenbrock, D.J., "*Comparison of External Costs of Rail and Truck Freight Transportation*." Transportation Research. Vol. 35 (2001).

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

[17] Associated Press, "*Ballinger Scrambles to Finish Pipeline before Lake Dries Up*." May 19, 2003.

[18] Healey, N. (2003) *Water on Wheels*, Water: Journal of the Australian Water Association, June 2003.

feet in 2020 and projected demands of 200 acre-feet. In this case, residents of City B could eliminate needs via restricting all outdoor water use. City A, on the other hand, has an unmet need of 150 acre-feet in 2020 with a projected demand of 200 acre-feet. Thus, total shortages are 75 percent of total demand. Emergency outdoor and indoor conservation measures would eliminate 50 percent of projected needs; however, 50 acre-feet would still remain. This remaining portion would result in costs to residential and commercial water users. Water intensive businesses such as car washes, restaurants, motels, race tracks would have to curtail operations (i.e., output would decline), and residents and non-water intensive businesses would have to have water hauled-in assuming it was available.

The last element of municipal water shortages considered focused on lost water utility revenues. Estimating these was straightforward. Analyst used 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, averages 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 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.

The Region K 2006 Water Plan indicates that under drought of record conditions, municipal water shortages would occur in most counties in the region. Tables 12 through 15 summarize estimated impacts to domestic uses, commercial businesses, water utilities and the horticultural industry. Attachment B of this report shows impacts by county, and Attachment C shows impacts by major river basin.

Table 12: Annual Economic Impacts of Unmet Water Needs for Water Intensive Commercial Businesses (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$17.56	$9.91	410	$0.97
2020	$88.41	$56.15	2,045	$4.33
2030	$254.20	$165.23	5,895	$12.03
2040	$400.20	$261.05	9,310	$18.85
2050	$626.48	$410.20	14,610	$29.34
2060	$1,064.94	$700.26	24,900	$49.57

* Estimates are based on *projected* economic activity in the region. Source: Texas Water Development Board, Office of Water Resources Planning.

Table 13: Annual Economic Impacts of Unmet Water Needs for the Horticultural Industry (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)				
Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$11.06	$7.04	220	$0.21
2020	$23.50	$14.96	475	$0.45
2030	$56.49	$35.95	1,205	$1.08
2040	$67.64	$43.05	1,470	$1.29
2050	$113.10	$71.98	2,645	$2.16
2060	$313.78	$199.70	9,570	$5.99
Source: Generated by the Texas Water Development Board, Office of Water Resources Planning.				

Table 14: Annual Impacts Associated with Unmet Domestic Water Needs (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)	
Year	$millions
2010	$36.48
2020	$81.95
2030	$242.50
2040	$312.29
2050	$751.82
2060	$1,754.45
Source: Generated by Texas Water Development Board, Office of Water Resources Planning.	

Table 15: Impacts to Water Utilities (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)		
Year	Revenues ($millions)	Utility Taxes ($millions)
2010	$10.20	$0.18
2020	$19.74	$0.35
2030	$50.96	$0.90
2040	$58.63	$1.03
2050	$112.65	$1.98
2060	$369.82	$6.51
Source: Texas Water Development Board, Office of Water Resources Planning.		

2.3.4 Steam Electric

The steam electric sector represents economy activity associated with retail and wholesale transactions of electricity. As shown in Table 16, in 2000 the electric services sector generated annual sales of $1,104 million that resulted in $790 million worth of income for Region K residents.[19] The electric services sector directly supports an estimated 1,829 full and part-time jobs.

Table 169:Year 2000 Baseline for Steam Electric (monetary figures are in $millions)

Sector	Sales Activity			No. of Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Electric Services	$1,104.29	$155.41	$948.88	1,829	$789.72	$141.43

Source: Generated using data from MIG, Inc., and models developed by the TWDB using IMPLAN software.

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, particularly during drought when surface flows are reduced. Low water levels could affect raw water intakes and water discharge outlets (i.e., outfalls) at power facilities 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 lake or river levels could result in permit compliance issues due to reduced dilution and dispersion of heat and subsequent impacts on aquatic biota near outfalls.[20] But the primary concern would be a loss of head (i.e., pressure) over intake structures that would decrease flows through intake tunnels. This could 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, which implies that output (i.e., sales of electricity) would decline.

Among all water use categories, steam-electric is unique and cautions are necessary when applying methods used in this study. Measured changes to an economy using input-output models stem directly from changes in sales revenue. 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 power plants in a given region. If one plant became inoperable due to water shortages, plants in other areas or generation facilities that do not rely heavily water (e.g., gas powered turbines or “peaking plants”) might be able to compensate for lost generating capacity. Utilities could also offset lost production via purchases on the spot market.[21] In Region K projected shortages for are severe enough that sustained

[19] IMPLAN output data report all sales transactions for particular utility in a given county - including sales generated from stations outside a county. As a countermeasure, analysts estimated sales for affected counties using production and price data from the U.S. Energy Information Administration.

[20] Section 316 (b) of the Clean Water Act requires that thermal wastewater discharges do not harm fish and other wildlife.

[21] 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 (e.g., transmission constraints); utilities could offset lost power that resulted from waters shortages with purchases via the power grid. Losses offset through grid purchases or from peaking plants would likely result in higher production costs, which utilities would ultimately pass on to consumers in the form of higher utility bills. Determining the impacts of higher costs is not considered in this study.

power outages would likely result and not only would electric utilities lose revenue, but businesses without power would suffer huge economic losses as well. However, potential lost economic activity for utility customers resulting from power outages are not included here to avoid double counting lost output.

The Region K 2006 Water Plan indicates that under drought of record conditions, steam-electric water shortages would occur in Bastrop, Fayette, Matagorda and Travis counties. Table 17 summarizes estimated impacts. Attachment B of this report shows impacts by county. All impacts associated with unmet needs for the power industry would result from shortages in the Colorado River Basin.

Table 17: Annual Economic Impacts Associated with Unmet Water Needs for Steam-electric Water Uses
(years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Total Sales	Regional Income ($millions)	Jobs	Business Taxes
2010	$0.00	$0.00	0	$0.00
2020	$0.00	$0.00	0	$0.00
2030	$50.53	$34.47	210	$6.08
2040	$348.50	$237.78	1,440	$41.96
2050	$482.92	$329.48	1,995	$58.14
2060	$1,308.20	$892.55	5,410	$157.51

Source: Generated by the Texas Water Development Board, Office of Water Planning.

3. Regional Social Impacts

As discussed previously in Section 1.2, estimated social impacts focus changes including population loss and subsequent related in school enrollment. As shown in Table 19, water shortages in 2010 could result in a population loss of 6,315 people with a corresponding reduction in school enrollment of 1,605. Models indicate that shortages in 2060 could cause population in the region to fall by 69,700 people and school enrollment by 17,700 students.

Table 19: Estimated Regional Social Impacts of Unmet Water Needs (years, 2010, 2020, 2030, 2040, 2050 and 2060)		
Year	Population Losses	Declines in School Enrollment
2010	6,315	1,605
2020	10,490	2,665
2030	19,595	4,980
2040	27,295	6,930
2050	38,760	9,845
2060	69,700	17,700
Source: Generated by the Texas Water Development Board, Office of Water Planning.		

Attachment A: Baseline Regional Economic Data

Tables A-1 through A-6 contain data from several sources that form a basis of analyses in this report. Economic statistics were extracted and processed via databases purchased from MIG, Inc. using IMPLAN Pro™ software. Values for gallons per employee (i.e. GED coefficients) for the municipal water use category are based on several secondary sources.[22] County-level data sets along with multipliers are not included given their large sizes (i.e., 528 sectors per county each with 12 different multiplier coefficients). Fields in Tables A-1 through A-6 contain the following variables:

§ *GED* - average gallons of water use per employee per day (municipal use only);

§ *total sales* - total industry production measured in millions of dollars (equal to shipments plus net additions to inventories);

§ *intermediate sales* - sales to other industries in the region measured in millions of dollars;

§ *final sales* - all sales to end-users including sales to households in the region and exports out of the region;

§ *jobs* - number of full and part-time jobs (annual average) required by a given industry;

§ *regional income* - total payroll costs (wages and salaries plus benefits), proprietor income, corporate income, rental income and interest payments;

§ *business taxes* - sales taxes, excise taxes, fees, licenses and other taxes paid during normal business operations (includes all payments to federal, state and local government except income taxes).

[22] 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.

Table A-1: Economic Data for Irrigated Agriculture in Region K (Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Rice	$42.70	$0.40	$42.30	2155	$26.0	$2.5
Tree Nuts	$3.77	$0.30	$3.47	120	$2.5	$0.1
Cotton	$2.10	$0.04	$2.06	27	$1.1	$0.1
Feed Grains	$1.05	$0.07	$0.98	30	$0.7	$0.1
Hay and Pasture	$0.66	$0.04	$0.62	89	$0.4	<$0.1
Oil Bearing Crops	$0.49	$0.06	$0.43	18	$0.3	<$0.1
Vegetables	$0.47	$0.06	$0.41	9	$0.4	<$0.1
Total	$51.25	$0.97	$50.27	2448	$31.37	$2.85

Data do not include non-irrigated acreage.

Table A-2: Economic Data for Livestock Sectors, Region K (Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Cattle Feedlots	$123.3	$14.6	$108.7	754	$108.0	$8.5
Dairy Farm Products	$13.6	$2.4	$11.1	225	$11.2	$0.1
Hogs, Pigs and Swine	$6.8	$6.7	$0.1	294	$4.0	$0.5
Miscellaneous Livestock	$8.0	$0.8	$7.2	929	$4.1	$0.1
Other Meat Animal Products	$0.9	$0.1	$0.8	53	$0.4	$0.0
Poultry and Eggs	$56.3	$9.7	$46.7	841	$27.2	$0.5
Ranch Fed Cattle	$58.8	$13.3	$45.5	2682	$29.8	$2.1
Range Fed Cattle	$48.8	$10.0	$38.9	2500	$30.6	$2.0
Sheep, Lambs and Goats	$2.9	$0.4	$2.5	723	$1.9	$0.1
Total	$319.49	$57.87	$261.62	9001	$217.26	$13.92

Table A-3: Economic Data for Municipal Sectors, Region K (Year 2000)

Sector	GED	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Accounting, Auditing and Bookkeeping	120	$464.7	$384.9	$79.8	6349	$366.2	$4.2
Advertising	117	$354.1	$221.6	$132.5	2872	$196.2	$3.5
Agricultural, Forestry, Fishery Services	-	$40.2	$6.7	$33.6	1752	$23.4	$1.0
Air Transportation	171	$259.2	$73.9	$185.3	2893	$126.7	$18.1
Amusement and Recreation Services,	427	$133.6	$4.5	$129.1	4821	$76.3	$7.4
Apparel & Accessory Stores	68	$246.2	$16.5	$229.7	6235	$136.1	$39.3
Arrangement Of Passenger	130	$99.1	$24.2	$74.9	665	$68.5	$3.0
Automobile Parking and Car Wash	681	$56.1	$8.6	$47.5	1323	$37.9	$2.6
Automobile Rental and Leasing	147	$101.8	$65.7	$36.1	1046	$59.4	$8.0
Automobile Repair and Services	55	$541.6	$115.4	$426.3	5724	$284.7	$25.8
Automotive Dealers & Service Stations	49	$1,205.5	$195.0	$1,010.5	12804	$718.9	$186.4
Banking	59	$1,644.0	$612.6	$1,031.4	7516	$1,062.1	$26.6
Beauty and Barber Shops	216	$128.7	$14.4	$114.3	4124	$79.6	$1.6
Bowling Alleys and Pool Halls	86	$5.3	$0.0	$5.3	261	$2.8	$0.5
Building Materials & Gardening	35	$318.8	$34.2	$284.5	5658	$227.5	$52.4
Business Associations	160	$333.6	$41.6	$291.9	7491	$240.5	$0.2
Child Day Care Services	120	$184.4	$0.0	$184.4	4344	$66.5	$1.9
Colleges, Universities, Schools	75	$57.6	$0.7	$56.9	2443	$35.1	$0.0
Commercial Sports Except Racing	391	$3.1	$1.8	$1.2	70	$2.0	$0.2
Communications, Except Radio and TV	47	$3,040.9	$803.1	$2,237.7	8468	$1,582.5	$168.4
Computer and Data Processing Services	40	$3,794.6	$1,151.6	$2,642.9	33577	$3,070.1	$57.6
Credit Agencies	156	$841.3	$391.1	$450.3	17833	$486.8	$31.1
Detective and Protective Services	84	$151.5	$76.5	$74.9	4559	$115.1	$2.1
Doctors and Dentists	203	$1,511.8	$0.0	$1,511.8	14568	$1,020.3	$19.6
Domestic Services	-	$70.3	$70.3	$0.0	7010	$70.4	$0.0
Eating & Drinking	157	$2,027.5	$100.1	$1,927.3	50793	$990.0	$138.1
Electrical Repair Service	37	$59.5	$18.1	$41.4	682	$26.1	$2.3
Elementary and Secondary Schools	169	$41.1	$0.0	$41.1	1644	$25.8	$0.0
Engineering, Architectural Services	87	$1,227.1	$679.0	$548.1	11813	$602.0	$8.9
Equipment Rental and Leasing	29	$245.2	$157.7	$87.5	2122	$104.6	$7.3
Federal Government - Military	-	$120.2	$120.2	$0.0	3103	$120.2	$0.0

Table A-3: Economic Data for Municipal Sectors, Region K (Year 2000)

Federal Government - Non-Military	-	$650.4	$650.4	$0.0	11236	$650.4	$0.0
Food Stores	98	$719.3	$23.7	$695.7	17943	$539.3	$114.9
Funeral Service and Crematories	111	$36.9	$0.0	$36.9	928	$24.5	$1.1
Furniture & Home Furnishings Stores	42	$348.2	$30.5	$317.7	6886	$225.9	$54.6
Gas Production and Distribution	51	$354.2	$169.8	$184.4	353	$87.2	$24.1
General Merchandise Stores	47	$335.8	$14.8	$321.0	9345	$211.2	$53.6
Greenhouse and Nursery Products	-	$97.6	$29.2	$68.4	2501	$67.0	$0.9
Hospitals	76	$973.0	$0.7	$972.3	14602	$607.1	$3.4
Hotels and Lodging Places	230	$441.0	$164.8	$276.2	7250	$244.0	$31.4
Insurance Agents and Brokers	89	$603.7	$237.7	$366.0	10170	$468.5	$6.4
Insurance Carriers	136	$1,093.9	$77.9	$1,016.0	7261	$604.9	$62.0
Job Trainings & Related Services	141	$75.1	$20.8	$54.3	1968	$38.6	$0.2
Labor and Civic Organizations	122	$82.7	$0.3	$82.4	5519	$62.0	$0.0
Landscape and Horticultural Services	-	$188.0	$99.3	$88.7	4978	$112.2	$4.8
Laundry, Cleaning and Shoe Repair	517	$168.2	$32.0	$136.2	6147	$123.8	$4.3
Legal Services	76	$886.6	$374.4	$512.2	8065	$682.5	$7.9
Local Government Passenger Transit	-	$28.7	$3.6	$25.1	543	-$47.8	$0.0
Local, Interurban Passenger Transit	68	$180.1	$23.5	$156.6	3214	$115.6	$4.1
Maintenance and Repair Oil and Gas	25	$204.0	$86.6	$117.3	1315	$117.7	$8.0
Maintenance and Repair Other Facilities	25	$1,100.6	$347.5	$753.1	16640	$761.1	$5.1
Maintenance and Repair, Residential	25	$732.1	$206.6	$525.5	5273	$223.5	$3.0
Management and Consulting Services	87	$981.0	$604.9	$376.1	10700	$527.5	$7.0
Membership Sports and Recreation	427	$127.4	$2.8	$124.6	3758	$70.8	$5.0
Miscellaneous Personal Services	129	$126.0	$17.1	$108.9	1839	$35.0	$2.7
Miscellaneous Repair Shops	124	$128.9	$77.6	$51.4	1823	$61.0	$3.8
Miscellaneous Retail	132	$991.3	$80.3	$911.0	22952	$621.8	$151.4
Motion Pictures	113	$376.1	$215.2	$160.9	3714	$163.4	$5.7
Motor Freight Transport and	85	$708.7	$446.3	$262.4	6885	$280.7	$8.8
New Government Facilities	63	$1,273.3	$0.0	$1,273.3	7936	$515.8	$8.1
New Highways and Streets	45	$312.1	$0.0	$312.1	2704	$126.7	$2.1
New Industrial and Commercial	63	$1,222.0	$0.0	$1,222.0	9954	$458.4	$9.5
New Mineral Extraction Facilities	63	$867.4	$8.8	$858.6	11755	$550.0	$44.4
New Residential Structures	35	$2,265.3	$0.0	$2,265.3	14206	$468.4	$15.8
New Utility Structures	63	$536.0	$0.0	$536.0	4866	$232.2	$3.0
Nursing and Protective Care	197	$206.9	$0.0	$206.9	5700	$152.1	$5.2
Other Business Services	84	$1,424.2	$734.6	$689.6	12678	$641.5	$23.3
Other Educational Services	116	$234.7	$16.9	$217.8	3902	$109.6	$8.2
Other Federal Government Enterprises	-	$5.7	$2.9	$2.8	28	$2.5	$0.0
Other Medical and Health Services	168	$478.1	$21.1	$457.0	9609	$257.0	$8.0
Other Nonprofit Organizations	122	$98.9	$5.2	$93.7	4634	$45.5	$0.6
Other State and Local Govt Enterprises	-	$411.0	$110.5	$300.5	2023	$154.1	$0.0
Owner-occupied Dwellings	89	$3,160.9	$0.0	$3,160.9	0	$1,984.5	$409.9
Personnel Supply Services	484	$711.2	$458.4	$252.8	27854	$684.9	$13.5
Photofinishing, Commercial	112	$283.4	$136.6	$146.7	2407	$119.3	$7.3
Pipe Lines, Except Natural Gas	49	$21.3	$4.5	$16.8	41	$14.8	$1.8
Portrait and Photographic Studios	184	$25.9	$3.5	$22.4	587	$12.8	$0.6
Racing and Track Operation	391	$13.4	$1.2	$12.2	319	$5.2	$2.4
Radio and TV Broadcasting	64	$379.4	$221.4	$158.0	1680	$186.3	$6.8
Railroads and Related Services	68	$36.0	$19.7	$16.2	283	$11.9	$0.6
Real Estate	89	$5,098.4	$1,299.9	$3,798.5	22621	$3,023.5	$603.1
Religious Organizations	328	$69.0	$0.0	$69.0	590	$4.4	$0.0
Research, Development & Testing	123	$535.6	$211.8	$323.8	7357	$322.7	$5.9
Residential Care	111	$149.1	$0.0	$149.1	4288	$103.5	$1.5
Sanitary Services and Steam Supply	51	$66.3	$53.3	$13.0	260	$27.7	$12.1
Security and Commodity Brokers	59	$524.0	$309.0	$215.0	3093	$173.1	$15.9
Services To Buildings	67	$306.6	$206.2	$100.4	7630	$143.0	$5.7
Social Services, N.E.C.	42	$241.5	$19.3	$222.2	3874	$116.3	$0.4
State & Local Government - Education	-	$1,008.1	$1,008.1	$0.0	30685	$1,008.1	$0.0
State & Local Government - Non-	-	$5,813.6	$5,813.6	$0.0	118818	$5,813.6	$0.0
State and Local Electric Utilities	-	$932.6	$129.5	$803.0	1590	$410.2	$0.0
Theatrical Producers, Bands Etc.	36	$74.0	$51.0	$22.9	988	$27.0	$2.4
Transportation Services	40	$66.7	$30.1	$36.6	538	$49.8	$0.6
U.S. Postal Service	-	$245.4	$133.7	$111.7	3002	$182.8	$0.0
Watch, Clock, Jewelry and Furniture	50	$11.4	$0.1	$11.3	201	$4.1	$0.6
Water Supply and Sewerage Systems	51	$56.6	$16.7	$39.9	262	$30.8	$3.8
Water Transportation	353	$37.1	$12.2	$24.9	175	$7.8	$0.7
Wholesale Trade	43	$5,858.3	$2,435.5	$3,422.8	32545	$3,232.7	$840.7
Total		$67,520.42	$23,014.57	$44,505.85	792,075	$41,272.41	$3,456.76

NEC = not elsewhere classified. “na” = not available.

Table A-4: Economic Data for Manufacturing Sectors, Region K (Year 2000)

Sector	GED	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Aircraft	62	$11.5	$0.3	$11.2	48	$2.1	$0.1
Aircraft and Missile Engines and Parts	62	$1.4	$0.6	$0.8	7	$0.4	$0.0
Aircraft and Missile Equipment,	62	$32.7	$0.4	$32.3	247	$14.7	$0.3
Aluminum Rolling and Drawing	179	$81.6	$2.1	$79.6	277	$13.6	$0.6
Analytical Instruments	41	$80.7	$13.6	$67.2	401	$24.6	$0.8
Animal and Marine Fats and Oils	523	$26.6	$6.7	$19.9	107	$6.9	$0.2
Apparel Made From Purchased Materials	26	$47.1	$0.6	$46.5	475	$9.2	$0.2
Architectural Metal Work	95	$18.5	$0.5	$18.1	147	$11.0	$0.2
Asphalt Felts and Coatings	278	$1.5	$1.5	$0.1	3	$1.0	$0.0
Automotive and Apparel Trimmings	26	$11.6	$2.1	$9.5	83	$2.2	$0.1
Blast Furnaces and Steel Mills	424	$2.3	$1.4	$1.0	8	$0.3	$0.0
Blended and Prepared Flour	215	$0.8	$0.0	$0.8	3	$0.1	$0.0
Blinds, Shades, and Drapery Hardware	36	$17.8	$0.1	$17.7	211	$7.8	$0.1
Blowers and Fans	47	$8.7	$0.2	$8.6	88	$3.3	$0.1
Boat Building and Repairing	125	$3.5	$0.0	$3.5	35	$0.9	$0.0
Book Printing	37	$3.4	$3.0	$0.3	21	$1.3	$0.0
Book Publishing	37	$379.1	$10.3	$368.9	1631	$118.2	$4.1
Bookbinding & Related	37	$8.8	$4.0	$4.8	114	$5.0	$0.1
Bottled and Canned Soft Drinks & Water	575	$58.5	$0.4	$58.1	170	$12.7	$0.5
Brass, Bronze, and Copper Foundries	179	$1.0	$0.0	$1.0	29	$0.6	$0.0
Bread, Cake, and Related Products	96	$14.7	$4.6	$10.1	85	$5.3	$0.1
Brick and Structural Clay Tile	202	$31.0	$0.2	$30.8	284	$12.3	$0.4
Broad-woven Fabric Mills and Finishing	263	$0.7	$0.3	$0.4	7	$0.2	$0.0
Canned Fruits and Vegetables	643	$15.3	$0.1	$15.2	69	$4.8	$0.1
Canned Specialties	469	$1.7	$0.0	$1.7	4	$0.4	$0.0
Canvas Products	26	$0.7	$0.3	$0.3	10	$0.3	$0.0
Carpets and Rugs	980	$0.3	$0.0	$0.3	2	$0.1	$0.0
Cement, Hydraulic	202	$57.8	$0.1	$57.6	156	$21.3	$0.9
Cheese, Natural and Processed	678	$26.0	$5.6	$20.3	62	$3.3	$0.2
Chemical Preparations, N.E.C	268	$1.5	$1.0	$0.5	4	$0.5	$0.0
Commercial Fishing	-	$17.4	$1.1	$16.3	574	$15.7	$0.6
Commercial Printing	37	$290.4	$121.9	$168.4	2352	$111.6	$3.3
Communications Equipment N.E.C.	51	$23.2	$9.5	$13.7	225	$14.7	$0.2
Computer Peripheral Equipment,	43	$670.2	$162.1	$508.1	2198	$169.9	$5.3
Computer Storage Devices	43	$1.5	$0.4	$1.1	5	$0.2	$0.0
Computer Terminals	43	$1.5	$0.4	$1.1	113	$1.4	$0.0
Concrete Block and Brick	242	$25.9	$0.2	$25.7	153	$9.3	$0.4
Concrete Products, N.E.C	242	$24.1	$0.1	$24.0	198	$8.7	$0.3
Condensed and Evaporated Milk	679	$12.8	$1.8	$11.0	25	$2.8	$0.1
Confectionery Products	165	$13.3	$0.1	$13.2	60	$2.4	$0.1
Construction Machinery and Equipment	87	$7.3	$0.3	$7.0	28	$1.6	$0.1
Converted Paper Products, N.E.C	863	$2.5	$0.0	$2.5	11	$0.8	$0.0
Cookies and Crackers	97	$0.1	$0.0	$0.1	1	$0.0	$0.0
Cordage and Twine	315	$0.3	$0.0	$0.3	3	$0.1	$0.0
Cottonseed Oil Mills	520	$6.6	$1.1	$5.5	18	$0.7	$0.0
Curtains and Draperies	26	$1.0	$0.1	$0.9	12	$0.2	$0.0
Cut Stone and Stone Products	13	$30.6	$0.3	$30.3	379	$16.2	$0.3
Cutlery	152	$1.7	$0.1	$1.6	19	$1.4	$0.0
Cyclic Crudes, Interm. & Indus. Organic	309	$536.8	$178.9	$357.9	703	$131.9	$9.5
Die-cut Paper and Board	863	$49.7	$0.6	$49.0	349	$17.4	$0.6
Dolls	40	$0.1	$0.0	$0.1	3	$0.1	$0.0
Drugs	182	$362.6	$74.2	$288.3	1718	$192.6	$4.0
Electric Lamps	51	$0.2	$0.0	$0.2	2	$0.1	$0.0
Electrical Equipment, N.E.C.	104	$67.7	$5.7	$61.9	339	$10.7	$0.3
Electrical Industrial Apparatus, N.E.C.	30	$0.7	$0.5	$0.2	3	$0.1	$0.0
Electromedical Apparatus	88	$9.3	$3.1	$6.2	35	$2.9	$0.1
Electronic Components, N.E.C.	169	$203.9	$159.4	$44.5	801	$42.3	$1.5
Electronic Computers	43	$6,684.4	$1,404.5	$5,280.0	20341	$2,928.3	$60.4
Fabricated Metal Products, N.E.C.	85	$22.4	$4.3	$18.2	164	$7.3	$0.2
Fabricated Plate Work (Boiler Shops)	95	$40.5	$0.7	$39.8	382	$23.3	$0.4
Fabricated Rubber Products, N.E.C.	73	$2.0	$0.0	$2.0	12	$0.8	$0.0
Fabricated Structural Metal	95	$23.7	$0.5	$23.2	128	$10.2	$0.3
Fabricated Textile Products, N.E.C.	26	$15.9	$3.1	$12.8	107	$4.8	$0.1
Farm Machinery and Equipment	58	$4.5	$1.7	$2.8	27	$1.1	$0.0
Fasteners, Buttons, Needles, Pins	48	$0.1	$0.0	$0.1	2	$0.1	$0.0
Fertilizers, Mixing Only	268	$8.4	$0.9	$7.5	26	$1.4	$0.1
Flavoring Extracts and Syrups, N.E.C.	576	$19.2	$0.6	$18.6	110	$12.7	$0.1
Flour and Other Grain Mill Products	215	$0.7	$0.0	$0.7	2	$0.1	$0.0
Fluid Milk	681	$38.9	$2.0	$36.9	106	$6.4	$0.3
Food Preparations, N.E.C	244	$22.6	$0.1	$22.5	138	$5.2	$0.1
Food Products Machinery	28	$1.3	$0.8	$0.6	7	$0.9	$0.0
Forest Products	-	$2.2	$0.1	$2.1	99	$1.5	$0.1
Forestry Products	-	$1.7	$0.0	$1.7	17	$1.3	$0.3
Frozen Specialties	469	$20.3	$0.2	$20.1	114	$6.8	$0.1

Table A-4: Economic Data for Manufacturing Sectors, Region K (Year 2000)

Furniture and Fixtures, N.E.C	36	$1.2	$0.2	$1.1	5	$0.4	$0.0
Games, Toys, and Childrens Vehicles	41	$15.9	$0.1	$15.7	128	$9.5	$0.2
Gaskets, Packing and Sealing Devices	119	$36.6	$0.5	$36.1	332	$11.1	$0.2
Glass and Glass Products, Exc Containers	163	$28.2	$15.7	$12.5	192	$14.0	$0.4
Greeting Card Publishing	37	$1.6	$0.0	$1.5	10	$0.6	$0.0
Gum and Wood Chemicals	129	$7.7	$1.7	$6.0	22	$3.4	$0.1
Hand and Edge Tools, N.E.C.	152	$4.5	$1.5	$3.0	35	$2.7	$0.0
Hardware, N.E.C.	152	$2.3	$1.0	$1.3	12	$1.0	$0.0
Hardwood Dimension and Flooring Mills	74	$0.6	$0.5	$0.1	8	$0.2	$0.0
Housefurnishings, N.E.C	26	$0.3	$0.0	$0.2	2	$0.1	$0.0
Household Cooking Equipment	52	$2.1	$0.0	$2.1	11	$0.6	$0.0
Household Furniture, N.E.C	36	$1.8	$0.7	$1.1	26	$0.5	$0.0
Household Refrigerators and Freezers	52	$0.3	$0.0	$0.3	2	$0.1	$0.0
Ice Cream and Frozen Desserts	680	$0.4	$0.1	$0.3	2	$0.1	$0.0
Industrial and Fluid Valves	85	$1.1	$0.5	$0.6	5	$0.2	$0.0
Industrial Furnaces and Ovens	47	$1.3	$0.0	$1.3	11	$0.4	$0.0
Industrial Gases	644	$22.3	$7.4	$14.9	138	$17.2	$0.5
Industrial Machines N.E.C.	47	$137.8	$1.9	$135.9	1209	$64.7	$1.3
Industrial Patterns	67	$0.1	$0.0	$0.1	1	$0.0	$0.0
Industrial Trucks and Tractors	67	$2.2	$0.7	$1.5	13	$0.5	$0.0
Inorganic Chemicals Nec.	646	$1.2	$0.4	$0.8	5	$0.5	$0.0
Instruments To Measure Electricity	41	$111.5	$11.1	$100.4	572	$37.3	$0.9
Internal Combustion Engines, N.E.C.	153	$1.9	$1.0	$0.9	6	$0.2	$0.0
Iron and Steel Foundries	179	$28.1	$0.2	$27.9	217	$9.4	$0.3
Jewelers Materials and Lapidary Work	38	$0.5	$0.0	$0.5	4	$0.2	$0.0
Jewelry, Precious Metal	36	$175.8	$2.9	$172.9	1245	$77.0	$1.9
Laboratory Apparatus & Furniture	41	$0.5	$0.0	$0.5	3	$0.1	$0.0
Lawn and Garden Equipment	58	$0.4	$0.2	$0.2	2	$0.1	$0.0
Leather Goods, N.E.C	156	$0.4	$0.0	$0.3	9	$0.3	$0.0
Leather Tanning and Finishing	148	$0.7	$0.4	$0.3	3	$0.1	$0.0
Lighting Fixtures and Equipment	51	$120.7	$1.5	$119.2	787	$41.6	$1.3
Lime	242	$20.8	$0.2	$20.7	84	$7.5	$0.3
Logging Camps and Logging Contractors	104	$0.5	$0.5	$0.0	4	$0.2	$0.0
Luggage	153	$0.8	$0.1	$0.6	7	$0.3	$0.0
Machine Tools, Metal Cutting Types	67	$4.2	$1.3	$2.8	49	$1.9	$0.0
Magnetic & Optical Recording Media	104	$10.0	$4.3	$5.7	30	$3.1	$0.1
Malt Beverages	571	$3.1	$0.2	$2.9	13	$1.0	$0.5
Manifold Business Forms	37	$14.0	$3.5	$10.5	86	$5.7	$0.2
Manufactured Ice	469	$1.9	$0.1	$1.9	43	$1.2	$0.0
Manufacturing Industries, N.E.C.	53	$31.5	$0.9	$30.6	299	$13.5	$0.3
Marking Devices	45	$0.9	$0.1	$0.8	13	$0.7	$0.0
Mattresses and Bedsprings	36	$24.1	$2.1	$22.1	219	$6.1	$0.1
Meat Packing Plants	638	$39.0	$6.1	$32.9	104	$2.8	$0.2
Mechanical Measuring Devices	41	$230.0	$12.3	$217.7	1348	$110.4	$3.1
Metal Coating and Allied Services	404	$21.1	$6.4	$14.7	136	$8.1	$0.2
Metal Doors, Sash, and Trim	95	$1.5	$0.1	$1.5	14	$0.6	$0.0
Metal Household Furniture	36	$1.6	$0.2	$1.4	14	$0.4	$0.0
Metal Office Furniture	36	$2.5	$0.0	$2.4	13	$0.8	$0.0
Metal Partitions and Fixtures	36	$10.3	$4.4	$5.8	82	$3.1	$0.1
Metal Stampings, N.E.C.	183	$37.5	$11.8	$25.8	236	$13.4	$0.3
Metalworking Machinery, N.E.C.	67	$0.9	$0.4	$0.5	4	$0.1	$0.0
Millwork	32	$19.0	$18.2	$0.8	177	$7.6	$0.2
Mineral Wool	211	$0.4	$0.0	$0.4	3	$0.1	$0.0
Minerals, Ground Or Treated	211	$30.5	$0.2	$30.3	171	$14.6	$0.4
Mining Machinery, Except Oil Field	87	$5.9	$0.4	$5.5	40	$2.3	$0.1
Miscellaneous Fabricated Wire Products	85	$12.9	$4.8	$8.1	133	$5.2	$0.1
Miscellaneous Plastics Products	119	$308.2	$5.7	$302.5	1735	$91.1	$2.1
Miscellaneous Publishing	37	$62.6	$25.8	$36.8	338	$36.0	$0.8
Mobile Homes	32	$88.6	$0.1	$88.5	721	$37.8	$1.2
Motor Vehicle Parts and Accessories	143	$72.2	$25.9	$46.3	331	$16.6	$0.2
Motor Vehicles	143	$5.0	$0.0	$5.0	9	$0.8	$0.0
Motors and Generators	30	$11.1	$6.3	$4.8	68	$5.5	$0.2
Musical Instruments	39	$2.9	$0.0	$2.8	30	$1.7	$0.0
Newspapers	37	$161.3	$73.8	$87.5	1647	$85.3	$2.0
Nonferrous Castings, N.E.C.	179	$22.8	$0.9	$21.9	53	$3.3	$0.2
Nonferrous Wire Drawing and Insulating	179	$36.1	$3.0	$33.1	118	$10.1	$0.4
Nonmetallic Mineral Products, N.E.C.	211	$5.4	$0.1	$5.3	58	$2.3	$0.1
Oil Field Machinery	47	$58.8	$8.2	$50.6	456	$27.4	$0.6
Ophthalmic Goods	69	$3.8	$0.1	$3.6	35	$1.2	$0.0
Optical Instruments & Lenses	69	$1.0	$0.2	$0.8	13	$0.5	$0.0
Paints and Allied Products	128	$1.4	$0.0	$1.3	4	$0.5	$0.0
Paper Coated & Laminated Packaging	863	$1.7	$0.0	$1.7	7	$0.5	$0.0
Paper Mills, Except Building Paper	1385	$2.5	$0.0	$2.5	11	$0.5	$0.0
Paperboard Containers and Boxes	134	$1.0	$0.9	$0.1	6	$0.1	$0.0
Paperboard Mills	114	$0.6	$0.0	$0.6	1	$0.1	$0.0
Paving Mixtures and Blocks	278	$39.5	$35.1	$4.4	107	$17.3	$0.3
Periodicals	37	$107.9	$36.8	$71.1	631	$42.5	$1.1
Petroleum Refining	1437	$8.2	$2.9	$5.4	3	$1.0	$0.1

Table A-4: Economic Data for Manufacturing Sectors, Region K (Year 2000)

Phonograph Records and Tape	51	$0.2	$0.1	$0.1	3	$0.1	$0.0
Photographic Equipment and Supplies	141	$17.7	$1.8	$15.9	59	$4.4	$0.2
Pickles, Sauces, and Salad Dressings	643	$2.5	$0.1	$2.4	8	$0.9	$0.0
Pipe, Valves, and Pipe Fittings	85	$9.8	$4.3	$5.4	73	$4.4	$0.1
Plate Making	37	$6.5	$2.0	$4.6	99	$5.3	$0.1
Plating and Polishing	404	$11.6	$5.4	$6.2	43	$9.3	$0.1
Pleating and Stitching	26	$0.3	$0.0	$0.3	7	$0.2	$0.0
Polishes and Sanitation Goods	451	$2.0	$0.3	$1.8	10	$1.3	$0.0
Potato Chips & Similar Snacks	244	$17.0	$0.6	$16.4	66	$4.1	$0.1
Pottery Products, N.E.C	66	$1.0	$0.0	$1.0	15	$0.3	$0.0
Poultry Processing	639	$12.1	$1.5	$10.6	85	$3.4	$0.1
Power Transmission Equipment	47	$61.1	$0.7	$60.4	362	$23.1	$0.6
Prefabricated Metal Buildings	95	$43.3	$0.8	$42.4	260	$22.0	$0.4
Prefabricated Wood Buildings	32	$6.8	$0.0	$6.7	55	$2.2	$0.1
Prepared Feeds, N.E.C	469	$40.9	$0.7	$40.2	110	$4.0	$0.3
Prepared Fresh Or Frozen Fish Or Seafood	638	$0.2	$0.0	$0.2	1	$0.1	$0.0
Primary Aluminum	179	$0.9	$0.0	$0.9	4	$0.1	$0.0
Primary Batteries, Dry and Wet	104	$10.8	$0.3	$10.5	67	$5.0	$0.1
Printed Circuit Boards	169	$237.2	$185.5	$51.8	2883	$144.5	$1.9
Printing Ink	268	$0.5	$0.4	$0.1	2	$0.1	$0.0
Public Building Furniture	36	$20.2	$4.3	$15.9	110	$5.5	$0.1
Pumps and Compressors	47	$3.8	$0.1	$3.7	17	$0.7	$0.0
Radio and Tv Communication Equipment	51	$143.6	$58.7	$84.9	346	$56.5	$1.4
Radio and TV Receiving Sets	51	$23.8	$2.2	$21.6	161	$6.0	$0.2
Railroad Equipment	61	$0.9	$0.0	$0.8	4	$0.1	$0.0
Ready-mixed Concrete	242	$144.5	$1.0	$143.5	906	$52.5	$2.1
Refrigeration and Heating Equipment	107	$6.8	$4.3	$2.5	28	$2.4	$0.1
Relays & Industrial Controls	30	$10.1	$7.2	$2.9	41	$4.9	$0.1
Rice Milling	215	$0.8	$0.0	$0.8	2	$0.1	$0.0
Roasted Coffee	243	$4.5	$1.1	$3.5	6	$1.3	$0.0
Rubber and Plastics Hose and Belting	119	$5.0	$0.0	$5.0	38	$1.8	$0.0
Salted and Roasted Nuts & Seeds	243	$2.9	$0.0	$2.9	8	$0.3	$0.0
Sausages and Other Prepared Meats	638	$96.9	$15.2	$81.7	457	$14.9	$0.6
Sawmills and Planing Mills, General	74	$3.7	$3.4	$0.3	24	$0.8	$0.0
Scales and Balances	47	$0.3	$0.1	$0.2	3	$0.1	$0.0
Screw Machine Products and Bolts, Etc.	95	$1.9	$1.1	$0.9	15	$0.8	$0.0
Search & Navigation Equipment	40	$38.0	$1.2	$36.8	191	$11.8	$0.4
Secondary Nonferrous Metals	179	$4.5	$0.3	$4.2	13	$0.3	$0.0
Semiconductors and Related Devices	169	$4,123.0	$888.5	$3,234.5	15289	$2,195.7	$36.3
Service Industry Machines, N.E.C.	47	$12.0	$3.7	$8.3	54	$5.2	$0.1
Sheet Metal Work	95	$26.9	$0.8	$26.1	182	$11.9	$0.3
Ship Building and Repairing	125	$1.0	$0.0	$1.0	12	$0.3	$0.0
Shoes, Except Rubber	151	$0.1	$0.0	$0.1	1	$0.0	$0.0
Signs and Advertising Displays	50	$26.2	$6.9	$19.2	270	$12.3	$0.3
Small Arms Ammunition	48	$2.2	$0.0	$2.2	28	$1.7	$0.2
Soap and Other Detergents	451	$2.2	$0.3	$1.9	16	$1.2	$0.0
Special Dies and Tools and Accessories	67	$10.2	$7.2	$3.0	109	$5.6	$0.1
Special Industry Machinery N.E.C.	28	$1,603.8	$50.3	$1,553.6	3361	$497.7	$14.6
Sporting and Athletic Goods, N.E.C.	42	$79.6	$0.5	$79.0	523	$36.0	$3.0
Steam Engines and Turbines	153	$4.8	$2.4	$2.4	14	$1.8	$0.0
Structural Wood Members, N.E.C	32	$36.2	$24.6	$11.6	329	$12.0	$0.3
Surface Active Agents	451	$1.4	$0.6	$0.8	3	$0.3	$0.0
Surgical and Medical Instrument	88	$18.2	$5.4	$12.8	97	$5.8	$0.2
Surgical Appliances and Supplies	88	$267.8	$29.4	$238.4	1244	$88.7	$3.6
Switchgear and Switchboard Apparatus	30	$13.1	$6.4	$6.7	71	$6.1	$0.1
Synthetic Rubber	653	$0.6	$0.5	$0.1	2	$0.1	$0.0
Telephone and Telegraph Apparatus	51	$956.0	$198.6	$757.3	1731	$336.0	$7.7
Textile Bags	26	$0.6	$0.3	$0.2	9	$0.1	$0.0
Textile Goods, N.E.C	315	$0.6	$0.0	$0.6	5	$0.1	$0.0
Toilet Preparations	451	$17.0	$0.6	$16.4	54	$7.1	$0.1
Transformers	70	$2.2	$0.9	$1.3	19	$0.9	$0.0
Transportation Equipment, N.E.C	62	$4.9	$0.1	$4.8	22	$0.8	$0.0
Travel Trailers and Camper	143	$0.2	$0.0	$0.2	1	$0.0	$0.0
Truck Trailers	143	$1.1	$0.0	$1.1	9	$0.3	$0.0
Typesetting	37	$7.0	$2.3	$4.7	81	$2.8	$0.1
Typewriters and Office Machines N.E.C.	43	$0.5	$0.1	$0.4	5	$0.1	$0.0
Upholstered Household Furniture	36	$1.8	$0.0	$1.8	24	$0.5	$0.0
Welding Apparatus	67	$0.6	$0.1	$0.4	3	$0.1	$0.0
Wet Corn Milling	215	$3.4	$0.2	$3.2	6	$0.7	$0.0
Wines, Brandy, and Brandy Spirits	573	$1.7	$0.0	$1.7	9	$0.3	$0.2
Wiring Devices	51	$6.5	$0.4	$6.2	50	$2.9	$0.1
Womens Handbags and Purses	154	$0.1	$0.0	$0.1	2	$0.0	$0.0
Wood Containers	109	$9.5	$2.7	$6.8	122	$4.7	$0.1
Wood Household Furniture	36	$5.8	$0.3	$5.5	67	$2.1	$0.0
Wood Kitchen Cabinets	32	$82.6	$41.8	$40.7	1057	$37.1	$0.7
Wood Pallets and Skids	82	$5.2	$5.0	$0.2	53	$2.7	$0.1
Wood Partitions and Fixtures	36	$7.5	$4.8	$2.7	78	$2.2	$0.0
Wood Products, N.E.C	82	$2.5	$0.9	$1.5	28	$0.7	$0.0

Table A-4: Economic Data for Manufacturing Sectors, Region K (Year 2000)

Yarn Mills and Finishing Of Textiles, N.E.C.	487	$0.2	$0.1	$0.1	2	$0.1	$0.0
Total		$20,796.08	$4,148.20	$16,647.88	83,237	$8,620.01	$198.81

NEC = not elsewhere classified. "na" = not available.

Table A-5: Economic Data for Mining Sectors, Region K Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Chemical, Fertilizer Mineral Mining	$6.7	$1.0	$5.8	65	$4.4	$0.3
Clay, Ceramic, Refractory Minerals	$9.1	$0.1	$9.0	29	$5.4	$0.3
Coal Mining	$3.2	$2.5	$0.7	12	$0.9	$0.4
Crushed Stone	$21.5	$0.7	$20.9	167	$13.1	$0.7
Metal Ores, Not Elsewhere Classified	$0.1	$0.0	$0.1	1	$0.0	$0.0
Misc. Nonmetallic Minerals, N.E.C.	$4.5	$0.0	$4.4	30	$2.8	$0.1
Natural Gas & Crude Petroleum	$1,091.3	$299.6	$791.7	2,886	$475.1	$55.7
Natural Gas Liquids	$334.0	$91.7	$242.3	247	$97.0	$15.3
Potash, Soda, and Borate Minerals	$0.1	$0.0	$0.1	1	$0.0	$0.0
Sand and Gravel	$59.0	$2.4	$56.6	458	$36.8	$1.8
Total	$1,529.60	$397.97	$1,131.63	3895	$635.6	$74.6

na = "not available"

Table A-6: Economic Data for the Steam Electric Sector, Region K (Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Electric Services	$1,104.3	$155.4	$950.0	1,829	$789.7	$141.4

na = "not available"

Attachment B: Distribution of Economic Impacts by County and Water User Group

Tables B-1 through B-9 show economic impacts by county and water user group; however, **caution** is warranted. Figures shown for specific counties are *direct* impacts only. For the most part, figures reported in the main text for all water use categories uses include *direct and secondary* impacts. Secondary effects were estimated using regional level multipliers that treat each regional water planning area as an aggregate and autonomous economy. Multipliers do not specify where secondary impacts will occur at a sub-regional level (i.e., in which counties or cities). All economic impacts that would accrue to a region as a whole due to secondary economic effects are reported in Tables B-1 through B-9 as “secondary regional level impacts.”

For example, assume that in a given county (or city) water shortages caused significant reductions in output for a manufacturing plant. Reduced output resulted in lay-offs and lost income for workers and owners of the plant. This is a *direct* impact. Direct impacts were estimated at a county level; and thus one can say with certainty that direct impacts occurred in that county. However, secondary impacts accrue to businesses and households throughout the region where the business operates, and it is impossible using input-output models to determine where these businesses are located spatially.

The same logic applies to changes in population and school enrollment. Since employment losses and subsequent out-migration from a region were estimated using *direct* and *secondary* multipliers, it is impossible to say with any degree of certainty how many people a given county would lose regardless of whether the economic impact was direct or secondary. For example, assume the manufacturing plant referred to above is in County A. If the firm eliminated 50 jobs, one could state with certainty that water shortages in County A resulted in a loss of 50 jobs in that county. However, one could not unequivocally say whether 100 percent of the population loss due to lay-offs at the manufacturing would accrue to County A because many affected workers might commute from adjacent counties. This is particularly true in large metropolitan areas that overlay one or counties. Thus, population and school enrollment impacts cannot be reported at a county level.

Irrigation

Table B-1: Distribution of Economic Impacts by County and Water User Groups: (Irrigation)

Lost Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	$1.02	$0.89	$0.76	$0.62	$0.47	$0.31
Secondary Regional Level Impacts	$0.46	$0.40	$0.34	$0.28	$0.21	$0.14
Matagorda						
Direct Impacts	$6.11	$6.06	$2.91	$2.79	$2.66	$2.53
Secondary Regional Level Impacts	$2.77	$2.74	$1.32	$1.26	$1.20	$1.14
Wharton						
Direct Impacts	$4.95	$4.67	$4.33	$3.98	$1.81	$0.88
Secondary Regional Level Impacts	$2.24	$2.11	$1.96	$1.80	$0.82	$0.40
Total	$17.55	$16.88	$11.62	$10.73	$7.18	$5.40
Lost Income ($millions)						
County	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	$0.62	$0.54	$0.46	$0.38	$0.29	$0.19
Secondary Regional Level Impacts	$0.27	$0.24	$0.20	$0.16	$0.12	$0.08
Matagorda						
Direct Impacts	$3.72	$3.68	$1.77	$1.70	$1.62	$1.54
Secondary Regional Level Impacts	1.6227	1.608	0.772	0.74	0.706	0.671
Wharton						
Direct Impacts	$3.01	$2.84	$2.64	$2.42	$1.10	$0.53
Secondary Regional Level Impacts	$1.32	$1.24	$1.15	$1.06	$0.48	$0.23
Total	$10.56	$10.15	$6.99	$6.46	$4.32	$3.25
Lost Jobs *						
	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	51	45	38	31	24	16
Secondary Regional Level Impacts	5	4	4	3	2	1
Matagorda						
Direct Impacts	308	306	147	141	134	128
Secondary Regional Level Impacts	29	28	14	13	13	12
Wharton						
Direct Impacts	250	236	219	201	91	44
Secondary Regional Level Impacts	23	22	20	19	9	4
Total	666	641	441	408	273	205
Lost Business Taxes ($millions)						
County	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	$0.06	$0.05	$0.04	$0.04	$0.03	$0.02
Secondary Regional Level Impacts	$0.03	$0.02	$0.02	$0.02	$0.01	$0.01
Matagorda						
Direct Impacts	$0.36	$0.36	$0.17	$0.16	$0.16	$0.15
Secondary Regional Level Impacts	0.158	0.156	0.075	0.072	0.069	0.065
Wharton						
Direct Impacts	$0.29	$0.28	$0.26	$0.24	$0.11	$0.05
Secondary Regional Level Impacts	$0.13	$0.12	$0.11	$0.10	$0.05	$0.02
Total	$1.03	$0.99	$0.68	$0.63	$0.42	$0.32

*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning

Livestock

Table B-2: Projected Costs to Livestock Producers						
County	2010	2020	2030	2040	2050	2060
Burnet	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14
Colorado	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09
Llano	$0.40	$0.40	$0.40	$0.40	$0.40	$0.40
Matagorda	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37
Colorado	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07
Total	$1.23	$1.23	$1.23	$1.23	$1.23	$1.23
Source: Texas Water Development Board, Office of Water Resources Planning						

Manufacturing

Table B-3: Distribution of Economic Impacts by County and Water User Groups: (Manufacturing)						
Lost Output (Total Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$2.59	$5.50	$9.06	$12.29	$14.88	$38.81
Secondary Regional Level Impacts	$2.09	$4.44	$7.31	$9.92	$12.00	$31.31
Blanco						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Llano						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Matagorda						
Direct Impacts	$0.00	$61.78	$232.81	$251.99	$345.04	$372.85
Secondary Regional Level Impacts	$0.00	$45.60	$171.81	$185.96	$254.64	$275.16
Mills						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Travis						
Direct Impacts	$278.45	$330.06	$381.80	$434.07	$481.95	$524.14
Secondary Regional Level Impacts	$177.60	$210.51	$243.51	$276.85	$307.39	$334.29
Fayette						
Direct Impacts	$3.92	$12.21	$16.40	$20.41	$23.89	$56.51
Secondary Regional Level Impacts	$2.15	$6.70	$8.99	$11.19	$13.10	$30.99
Total	$466.80	$676.79	$1,071.69	$1,202.67	$1,452.89	$1,664.07
Lost Income ($millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	14	30	50	68	82	214
Secondary Regional Level Impacts	30	64	106	143	173	452
Blanco						
Direct Impacts	0	0	0	0	0	0
Secondary Regional Level Impacts	0	0	0	0	0	0
Llano						
Direct Impacts	0	0	0	0	0	0
Secondary Regional Level Impacts	0	0	0	0	0	0
Matagorda						
Direct Impacts	0	81	306	331	453	490
Secondary Regional Level Impacts	0	364	1370	1483	2031	2195
Mills						
Direct Impacts	0	0	0	0	0	0
Secondary Regional Level Impacts	0	0	0	0	0	0

Travis						
Direct Impacts	1101	1305	1510	1717	1906	2073
Secondary Regional Level Impacts	1731	2052	2373	2698	2996	3258
Fayette						
Direct Impacts	13	41	55	69	80	190
Secondary Regional Level Impacts	24	75	101	126	147	349
Total	2,914	4,013	5,871	6,635	7,869	9,220
Lost Jobs*						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$0.65	$1.39	$2.29	$3.10	$3.76	$9.80
Secondary Regional Level Impacts	$1.23	$2.61	$4.30	$5.84	$7.07	$18.45
Blanco						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Llano						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Matagorda						
Direct Impacts	$0.00	$15.16	$57.14	$61.85	$84.69	$91.51
Secondary Regional Level Impacts	$0.00	$23.92	$90.13	$97.56	$133.58	$144.35
Mills						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Travis						
Direct Impacts	$138.55	$164.23	$189.98	$215.98	$239.81	$260.80
Secondary Regional Level Impacts	$108.36	$128.44	$148.57	$168.91	$187.54	$203.96
Fayette						
Direct Impacts	$0.65	$2.01	$2.70	$3.36	$3.93	$9.30
Secondary Regional Level Impacts	$1.25	$3.89	$5.22	$6.49	$7.61	$17.99
Total	$250.69	$341.65	$500.34	$563.10	$667.99	$756.16
Lost Business Taxes ($millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$0.02	$0.05	$0.07	$0.10	$0.12	$0.32
Secondary Regional Level Impacts	$0.06	$0.12	$0.20	$0.27	$0.33	$0.87
Blanco						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Llano						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Matagorda						
Direct Impacts	$0.00	$1.09	$4.12	$4.45	$6.10	$6.59
Secondary Regional Level Impacts	$0.00	$1.72	$6.49	$7.03	$9.62	$10.40
Mills						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Travis						
Direct Impacts	$2.61	$3.09	$3.57	$4.06	$4.51	$4.91
Secondary Regional Level Impacts	$2.21	$2.62	$3.03	$3.45	$3.83	$4.16
Fayette						
Direct Impacts	$0.03	$0.08	$0.10	$0.13	$0.15	$0.36
Secondary Regional Level Impacts	$0.05	$0.16	$0.21	$0.26	$0.31	$0.73
Total	$4.97	$8.93	$17.80	$19.76	$24.97	$28.33

*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning

Mining

Table B-4: Distribution of Economic Impacts by County and Water User Groups: (Mining)						
Lost Output (Total Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	$13.38	$13.38	$13.38	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$6.22	$6.22	$6.22	$0.00	$0.00	$0.00
Matagorda						
Direct Impacts	$4.87	$4.87	$4.87	$4.87	$4.87	$4.87
Secondary Regional Level Impacts	$2.26	$2.26	$2.26	$2.26	$2.26	$2.26
Wharton						
Direct Impacts	$2.68	$2.48	$2.20	$2.20	$0.92	$0.70
Secondary Regional Level Impacts	$1.25	$1.15	$1.02	$1.02	$0.43	$0.32
Total	$30.65	$30.36	$29.95	$10.35	$8.48	$8.16
Lost Income ($millions)						
County	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	$8.34	$8.34	$8.34	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$3.84	$3.84	$3.84	$0.00	$0.00	$0.00
Matagorda						
Direct Impacts	$3.03	$3.03	$3.03	$3.03	$3.03	$3.03
Secondary Regional Level Impacts	$1.40	$1.40	$1.40	$1.40	$1.40	$1.40
Wharton						
Direct Impacts	$1.67	$1.54	$1.37	$1.37	$0.57	$0.44
Secondary Regional Level Impacts	$0.77	$0.71	$0.63	$0.63	$0.26	$0.20
Total	$19.04	$18.86	$18.60	$6.43	$5.27	$5.07
Lost Jobs*						
County	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	104	104	104	0	0	0
Secondary Regional Level Impacts	66	66	66	0	0	0
Matagorda						
Direct Impacts	38	38	38	38	38	38
Secondary Regional Level Impacts	24	24	24	24	24	24
Wharton						
Direct Impacts	21	19	17	5	7	5
Secondary Regional Level Impacts	13	12	11	3	5	3
Total	266	263	260	71	74	71
Lost Business Taxes ($millions)						
County	2010	2020	2030	2040	2050	2060
Colorado						
Direct Impacts	$0.42	$0.42	$0.42	$0.00	$0.00	$0.00
Secondary Regional Level Impacts	$0.19	$0.19	$0.19	$0.00	$0.00	$0.00
Matagorda						
Direct Impacts	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15
Secondary Regional Level Impacts	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07
Wharton						
Direct Impacts	$0.08	$0.08	$0.07	$0.07	$0.03	$0.02
Secondary Regional Level Impacts	$0.04	$0.04	$0.03	$0.03	$0.01	$0.01
Total	$0.95	$0.94	$0.93	$0.32	$0.26	$0.25
*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning						

Municipal

Impacts to the horticultural industry were estimated at the regional level only and are not included in the tables below.

Table B-5: Lost Water Utility Revenues (Municipal)

County	2010	2020	2030	2040	2050	2060
Bastrop	$0.00	$0.00	$0.27	$0.96	$8.88	$14.18
Blanco	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Burnett	$0.39	$1.06	$3.92	$4.77	$7.51	$8.78
Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fayette	$0.05	$0.46	$0.96	$1.37	$2.07	$2.73
Hays	$1.74	$4.27	$5.82	$7.40	$10.07	$11.62
Llano	$0.99	$0.98	$0.98	$1.09	$2.82	$2.83
Mills	$0.48	$0.49	$0.50	$0.50	$0.49	$0.48
San Saba	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01
Travis	$4.59	$10.56	$35.36	$39.46	$77.78	$326.17
Wharton	$0.00	$0.00	$0.01	$0.01	$0.00	$0.00
Williamson	$1.95	$1.91	$3.14	$3.07	$3.03	$3.03
Total	$10.20	$19.74	$50.96	$58.63	$112.65	$369.82

Source: Texas Water Development Board, Office of Water Resources Planning

Table B-6: Lost Water Utility Taxes (Municipal)

County	2010	2020	2030	2040	2050	2060
Bastrop	$0.00	$0.00	$0.00	$0.02	$0.16	$0.25
Blanco	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Burnett	$0.01	$0.02	$0.07	$0.08	$0.13	$0.15
Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fayette	$0.00	$0.01	$0.02	$0.02	$0.04	$0.05
Hays	$0.03	$0.08	$0.10	$0.13	$0.18	$0.20
Llano	$0.02	$0.02	$0.02	$0.02	$0.05	$0.05
Mills	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
San Saba	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Travis	$0.08	$0.19	$0.62	$0.69	$1.37	$5.74
Wharton	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Williamson	$0.03	$0.03	$0.06	$0.05	$0.05	$0.05
Total	$0.18	$0.35	$0.90	$1.03	$1.98	$6.51

Source: Texas Water Development Board, Office of Water Resources Planning

Table B-7: Impacts Associated with Unmet Needs for Domestic Water Uses						
County	2010	2020	2030	2040	2050	2060
Bastrop	$0.00	$5.08	$22.67	$53.56	$289.81	$504.57
Blanco	$0.36	$0.50	$0.56	$0.62	$0.68	$0.77
Burnett	$0.87	$2.36	$9.06	$12.44	$20.94	$26.97
Colorado	$0.31	$0.32	$0.31	$0.28	$0.27	$0.26
Fayette	$0.72	$1.83	$2.57	$3.32	$4.71	$7.57
Hays	$6.11	$19.39	$30.90	$44.70	$89.03	$104.40
Llano	$3.54	$3.76	$3.78	$4.85	$13.72	$15.92
Mills	$1.35	$1.41	$1.44	$1.43	$1.38	$1.54
San Saba	$0.00	$0.00	$0.00	$0.01	$0.01	$0.01
Travis	$13.36	$37.65	$155.32	$175.55	$315.93	$1,077.10
Wharton	$0.00	$0.00	$0.01	$0.01	$0.00	$0.00
Williamson	$9.86	$9.66	$15.88	$15.52	$15.33	$15.33
Total	$36.48	$81.95	$242.50	$312.29	$751.82	$1,754.45
Source: Texas Water Development Board, Office of Water Resources Planning						

Table B-8: Distribution of Economic Impacts by County and Water User Groups: (Commercial Water Uses)						
Lost Output (Total Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$1.80
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.95
Burnett						
Direct Impacts	$0.00	$0.44	$1.73	$1.98	$2.37	$2.66
Secondary Regional Level Impacts	$0.00	$0.25	$1.00	$1.14	$1.37	$1.53
Hays						
Direct Impacts	$0.10	$2.99	$6.17	$7.96	$9.59	$10.42
Secondary Regional Level Impacts	$0.10	$3.12	$6.43	$8.30	$9.99	$10.85
Llano						
Direct Impacts	$9.70	$10.03	$10.38	$16.21	$22.31	$29.00
Secondary Regional Level Impacts	$5.00	$5.17	$5.35	$8.35	$11.50	$14.95
Travis						
Direct Impacts	$0.00	$42.04	$146.22	$235.34	$378.01	$661.52
Secondary Regional Level Impacts	$0.00	$20.75	$72.18	$116.17	$186.59	$326.53
Williamson						
Direct Impacts	$1.42	$1.93	$2.54	$2.54	$2.54	$2.54
Secondary Regional Level Impacts	$1.24	$1.68	$2.21	$2.21	$2.21	$2.21
Total	$17.56	$88.41	$254.20	$400.20	$626.48	$1,064.94
Lost Income ($millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.97
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.55
Burnett						
Direct Impacts	$0.00	$0.20	$0.79	$0.91	$1.09	$1.22
Secondary Regional Level Impacts	$0.00	$0.15	$0.59	$0.67	$0.81	$0.90
Hays						
Direct Impacts	$0.05	$1.68	$3.46	$4.47	$5.38	$5.84
Secondary Regional Level Impacts	$0.06	$1.77	$3.65	$4.71	$5.68	$6.17
Llano						
Direct Impacts	$5.40	$5.59	$5.78	$9.03	$12.43	$16.16
Secondary Regional Level Impacts	$2.96	$3.06	$3.17	$4.95	$6.81	$8.85
Travis						

Direct Impacts	$0.00	$29.17	$101.44	$163.26	$262.23	$458.90
Secondary Regional Level Impacts	$0.00	$12.59	$43.80	$70.49	$113.23	$198.15
Williamson						
Direct Impacts	$0.72	$0.97	$1.27	$1.27	$1.27	$1.27
Secondary Regional Level Impacts	$0.72	$0.97	$1.28	$1.28	$1.28	$1.28
Total	$9.91	$56.15	$165.23	$261.05	$410.20	$700.26
Lost Jobs*						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	0	0	0	0	0	48
Secondary Regional Level Impacts	0	0	0	0	0	11
Burnett						
Direct Impacts	0	9	36	41	49	55
Secondary Regional Level Impacts	0	3	12	14	17	18
Hays						
Direct Impacts	3	80	166	214	257	280
Secondary Regional Level Impacts	1	34	71	92	110	120
Llano						
Direct Impacts	285	295	305	477	656	853
Secondary Regional Level Impacts	60	62	64	100	137	179
Travis						
Direct Impacts	0	1,223	4,252	6,843	10,992	19,236
Secondary Regional Level Impacts	0	254	883	1,421	2,283	3,995
Williamson						
Direct Impacts	46	62	81	81	81	81
Secondary Regional Level Impacts	16	21	28	28	28	28
Total	410	2,043	5,898	9,310	14,610	24,903
Lost Business Taxes ($millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.10
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.06
Burnett						
Direct Impacts	$0.00	$0.02	$0.06	$0.07	$0.08	$0.09
Secondary Regional Level Impacts	$0.00	$0.01	$0.05	$0.05	$0.06	$0.07
Hays						
Direct Impacts	$0.01	$0.18	$0.37	$0.48	$0.57	$0.62
Secondary Regional Level Impacts	$0.01	$0.20	$0.42	$0.54	$0.65	$0.70
Llano						
Direct Impacts	$0.52	$0.54	$0.56	$0.87	$1.20	$1.56
Secondary Regional Level Impacts	$0.28	$0.29	$0.30	$0.47	$0.65	$0.84
Travis						
Direct Impacts	$0.00	$1.89	$6.57	$10.57	$16.98	$29.72
Secondary Regional Level Impacts	$0.00	$0.99	$3.43	$5.52	$8.86	$15.51
Williamson						
Direct Impacts	$0.08	$0.10	$0.14	$0.14	$0.14	$0.14
Secondary Regional Level Impacts	$0.08	$0.11	$0.14	$0.14	$0.14	$0.14
Total	$0.97	$4.33	$12.03	$18.85	$29.34	$49.57

*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning

Steam Electric

Table B-9: Distribution of Economic Impacts by County and Water User Groups: (Steam-electric)						
Lost Output (Total Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$0.00	$0.00	$0.00	$30.50	$132.45	$132.45
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$9.47	$41.10	$41.10
Fayette						
Direct Impacts	$0.00	$0.00	$30.12	$112.07	$112.59	$139.85
Secondary Regional Level Impacts	$0.00	$0.00	$9.35	$34.78	$34.94	$43.40
Matagorda						
Direct Impacts	$0.00	$0.00	$8.44	$123.39	$123.51	$123.62
Secondary Regional Level Impacts	$0.00	$0.00	$2.62	$38.29	$38.33	$38.36
Travis						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$602.46
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$186.96
Total	$0.00	$0.00	$50.53	$348.50	$482.92	$1,308.20
Lost Income ($millions)						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	$0.00	$0.00	$0.00	$21.86	$94.93	$94.93
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$5.41	$23.48	$23.48
Fayette						
Direct Impacts	$0.00	$0.00	$21.59	$80.33	$80.70	$100.23
Secondary Regional Level Impacts	$0.00	$0.00	$5.34	$19.87	$19.96	$24.79
Matagorda						
Direct Impacts	$0.00	$0.00	$6.05	$88.44	$88.52	$88.61
Secondary Regional Level Impacts	$0.00	$0.00	$1.50	$21.87	$21.89	$21.91
Travis						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$431.80
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$106.80
Total	$0.00	$0.00	$34.47	$237.78	$329.48	$892.55
Lost Jobs *						
County	2010	2020	2030	2040	2050	2060
Bastrop						
Direct Impacts	0	0	0	51	219	219
Secondary Regional Level Impacts	0	0	0	115	499	499
Fayette						
Direct Impacts	0	0	50	186	186	232
Secondary Regional Level Impacts	0	0	113	422	424	527
Matagorda						
Direct Impacts	0	0	14	204	205	205
Secondary Regional Level Impacts	0	0	32	465	465	466
Travis						
Direct Impacts	0	0	0	0	0	998
Secondary Regional Level Impacts	0	0	0	0	0	2,269
Total	0	0	209	1,442	1,998	5,413
Lost Business Taxes ($millions)						
County						
Bastrop						
Direct Impacts	$0.00	$0.00	$0.00	$3.86	$16.75	$16.75
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.95	$4.14	$4.14
Fayette						
Direct Impacts	$0.00	$0.00	$3.81	$14.18	$14.24	$17.69

Table B-9: Distribution of Economic Impacts by County and Water User Groups: (Steam-electric)						
Secondary Regional Level Impacts	$0.00	$0.00	$0.94	$3.51	$3.52	$4.37
Matagorda						
Direct Impacts	$0.00	$0.00	$1.07	$15.61	$15.62	$15.64
Secondary Regional Level Impacts	$0.00	$0.00	$0.26	$3.86	$3.86	$3.87
Travis						
Direct Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$76.20
Secondary Regional Level Impacts	$0.00	$0.00	$0.00	$0.00	$0.00	$18.85
Total	$0.00	$0.00	$6.08	$41.96	$58.14	$157.51
*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning						

Attachment C: Allocation of Economic Impacts by River Basin

Tables C-1 through C-5 distribute regional economic and social impacts by major river basin. Impacts were allocated based on distribution of water shortages among counties. For instance, if 50 percent of water shortages in River Basin A and 50 percent occur in River Basin then impacts were split equally among the two basins.

Irrigation

Table C-1 Distribution of Impacts among Major River Basins (Irrigation)						
Lost Sales ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.02	$0.02	$0.01	$0.01	$0.01	$0.01
Brazos-Colorado	$9.39	$9.10	$6.32	$5.90	$3.99	$2.93
Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado-Lavaca	$5.11	$5.00	$3.52	$3.32	$2.28	$1.83
Guadalupe	$0.01	$0.01	$0.01	$0.01	$0.00	$0.00
Lavaca	$3.01	$2.74	$1.76	$1.49	$0.89	$0.63
Total	$17.55	$16.88	$11.62	$10.73	$7.18	$5.40
Lost Income ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
Brazos-Colorado	$5.65	$5.47	$3.80	$3.55	$2.40	$1.76
Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado-Lavaca	$3.07	$3.01	$2.11	$2.00	$1.37	$1.10
Guadalupe	$0.01	$0.01	$0.00	$0.00	$0.00	$0.00
Lavaca	$1.81	$1.65	$1.06	$0.90	$0.53	$0.38
Total	$10.56	$10.15	$6.99	$6.46	$4.32	$3.25
Job Losses*						
Basin	2010	2020	2030	2040	2050	2060
Brazos	1	1	1	1	0	0
Brazos-Colorado	357	346	240	224	151	111
Colorado	0	0	0	0	0	0
Colorado-Lavaca	194	190	133	126	87	69
Guadalupe	0	0	0	0	0	0

Table C-1 Distribution of Impacts among Major River Basins (Irrigation)						
Lavaca	114	104	67	57	34	24
Total	666	641	441	408	273	205
Lost Business Taxes ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Brazos-Colorado	$0.55	$0.53	$0.37	$0.35	$0.23	$0.17
Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado-Lavaca	$0.30	$0.29	$0.21	$0.19	$0.13	$0.11
Guadalupe	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lavaca	$0.18	$0.16	$0.10	$0.09	$0.05	$0.04
Total	$1.03	$0.99	$0.68	$0.63	$0.42	$0.32
*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning						

Livestock

Table C-2: Distribution of Impacts among Major River Basins (Livestock)						
($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29
Brazos-Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado	$0.50	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado-Lavaca	$0.37	$0.00	$0.00	$0.00	$0.00	$0.00
Guadalupe	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lavaca	$0.07	$0.00	$0.00	$0.00	$0.00	$0.00
total	$1.23	$0.29	$0.29	$0.29	$0.29	$0.29
Source: Texas Water Development Board, Office of Water Resources Planning						

Manufacturing

Table C-3 Distribution of Impacts among Major River Basins (Manufacturing)						
Lost Sales ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos-Colorado	$0.00	$137.87	$299.89	$329.32	$440.96	$503.92
Colorado	$461.93	$534.00	$764.80	$864.58	$1,002.12	$1,147.93
Lavaca	$4.88	$4.93	$7.00	$8.77	$9.81	$12.21
Total	$466.80	$676.79	$1,071.69	$1,202.67	$1,452.89	$1,664.07
Lost Income ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos-Colorado	$0.00	$69.60	$140.01	$154.19	$202.74	$228.99
Colorado	$248.07	$269.57	$357.06	$404.80	$460.74	$521.62
Lavaca	$2.62	$2.49	$3.27	$4.11	$4.51	$5.55
Total	$250.69	$341.65	$500.34	$563.10	$667.99	$756.16
Job Losses*						
Basin	2010	2020	2030	2040	2050	2060

Table C-3 Distribution of Impacts among Major River Basins (Manufacturing)						
Brazos-Colorado	0	817	1,643	1,817	2,388	2,792
Colorado	2,884	3,166	4,190	4,769	5,428	6,360
Lavaca	30	29	38	48	53	68
Total	2,914	4,013	5,871	6,635	7,869	9,220
Lost Business Taxes ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos-Colorado	$0.00	$1.82	$4.98	$5.41	$7.58	$8.58
Colorado	$4.92	$7.04	$12.71	$14.20	$17.22	$19.54
Lavaca	$0.05	$0.07	$0.12	$0.14	$0.17	$0.21
Total	$4.97	$8.93	$17.80	$19.76	$24.97	$28.33
*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning						

Mining

Table C-4 Distribution of Impacts among Major River Basins (Mining)						
Lost Sales ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.02	$0.03	$0.08	$0.07	$0.08	$0.08
Brazos-Colorado	$0.04	$0.05	$0.06	$0.04	$0.04	$0.04
Colorado	$30.37	$29.97	$29.45	$10.00	$8.08	$7.76
Lavaca	$0.23	$0.30	$0.37	$0.25	$0.28	$0.28
Total	$30.65	$30.36	$29.95	$10.35	$8.48	$8.16
Lost Income ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.01	$0.02	$0.05	$0.05	$0.05	$0.05
Brazos-Colorado	$0.03	$0.03	$0.03	$0.02	$0.02	$0.02
Colorado	$18.86	$18.62	$18.29	$6.21	$5.02	$4.82
Lavaca	$0.14	$0.19	$0.23	$0.15	$0.17	$0.17
Total	$19.04	$18.86	$18.60	$6.43	$5.27	$5.07
Job Losses*						
Basin	2010	2020	2030	2040	2050	2060
Brazos	0	0	1	1	1	1
Brazos-Colorado	0	0	0	0	0	0
Colorado	263	260	255	68	70	67
Lavaca	2	3	3	2	2	2
Total	532	526	519	141	147	141
Lost Business Taxes ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Brazos-Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado	$0.94	$0.93	$0.92	$0.31	$0.25	$0.24
Lavaca	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
Total	$0.95	$0.94	$0.93	$0.32	$0.26	$0.25
*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning						

Municipal

Table C-5: Distribution of Impacts among Major River Basins (Municipal)						
Lost Sales ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.62	$21.53	$28.74	$29.69	$40.93	$46.88
Brazos-Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado	$34.02	$106.41	$326.38	$491.93	$803.59	$1,680.82
Colorado-Lavaca	$0.04	$0.03	$0.04	$0.02	$0.03	$0.03
Guadalupe	$0.98	$1.70	$3.13	$2.26	$3.37	$4.57
Lavaca	$3.15	$1.98	$3.36	$2.57	$4.31	$5.32
Total	$38.82	$131.65	$361.65	$526.48	$852.22	$1,737.62
Lost Income ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.87	$27.02	$41.14	$38.99	$56.29	$89.05
Brazos-Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado	$47.36	$133.53	$467.21	$646.04	$1,105.12	$3,192.66
Colorado-Lavaca	$0.06	$0.03	$0.05	$0.03	$0.04	$0.06
Guadalupe	$1.37	$2.13	$4.48	$2.97	$4.63	$8.69
Lavaca	$4.38	$2.48	$4.81	$3.38	$5.92	$10.10
Total	$54.04	$165.20	$517.69	$691.41	$1,172.00	$3,300.56
Job Losses*						
Basin	2010	2020	2030	2040	2050	2060
Brazos	10	412	565	608	829	918
Brazos-Colorado	0	0	0	0	0	0
Colorado	551	2,035	6,411	10,074	16,269	32,912
Colorado-Lavaca	1	1	1	0	1	1
Guadalupe	16	32	62	46	68	90
Lavaca	51	38	66	53	87	104
Total	628	2,518	7,104	10,782	17,254	34,024
Lost Business Taxes ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.02	$0.84	$1.11	$1.19	$1.61	$1.67
Brazos-Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Colorado	$1.20	$4.14	$12.64	$19.79	$31.57	$59.83
Colorado-Lavaca	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Guadalupe	$0.03	$0.07	$0.12	$0.09	$0.13	$0.16
Lavaca	$0.11	$0.08	$0.13	$0.10	$0.17	$0.19
Total	$1.37	$5.12	$14.01	$21.17	$33.49	$61.86
*May not sum to figures presented in main body of report due to rounding. Source: Texas Water Development Board, Office of Water Resources Planning						

Steam-electric

All impacts for steam-electric water needs are associated with shortages in the Colorado River Basin.

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CHAPTER 10.0: PUBLIC INVOLVEMENT ACTIVITIES

10.1 OVERVIEW

The Lower Colorado Regional Water Planning Group (LCRWPG) made a commitment to conducting public outreach as a part of their duties as Planning Group members. The public involvement effort was led by Planning Group member Julia Marsden and a five-member Public Involvement Committee that she chaired. Committee members were Ronald Gertson, Mark Jordan, Teresa Lutes, Haskell Simon, and Jennifer Walker.

Major aspects of this effort included:

- **Holding more than 41 open regular monthly meetings of the Planning Group** for presentation of material, discussion, deliberation, voting on specific measures, and public comment between January 2001 and December 2005. Members of the public attended all of these meetings, which were posted on the Internet on the Travis County and Lower Colorado River Authority (LCRA) bulletin boards. Every meeting included a scheduled time for public comment and questions. Thirty of these meetings were held at McKinney Roughs (City of Cedar Creek), in Bastrop County. An additional 18 meetings were held in Bastrop in Bastrop County, Bay City in Matagorda County, Fredericksburg in Gillespie County, Columbus in Colorado County, Wharton in Wharton County, Burnet in Burnet County, and San Marcos in Hays County.
    - This included holding a public meeting with Region L to discuss potential programs that could be pursued in common and potential strategies that cross regional boundaries. In addition, individual Planning Group members served as liaisons to this region and reported on related developments at the monthly meetings.
    - These open meetings were publicized through news releases to the local, weekly, and daily papers and radio stations.
- **Serving as speakers at more than 20 civic and interest group meetings** representing a wide spectrum of interests and public opinion. These presentations took place throughout the planning period and in various counties of the region.
- **Conducting 4 surveys** to obtain feedback on population projections and water demand and to obtain information regarding water supply sources and water conservation strategies.
- **Maintaining a web page** with documentation and notices of meetings and discussions, with links from the LCRA home page and the Texas Water Development Board (TWDB) website.
- **Providing fact sheets** that were used as handouts at the public meetings and hearing.
- **Forming an Environmental Flow Committee** in order to update the Environmental Flow Section of the Region K Plan and to address additional environmental concerns as they arise. The committee, consisting of ten members, wrote Section 2.4, Environmental Water Demands for the Regional Water Plan.
- **Forming the Groundwater Management Plan Review Committee** with several Groundwater Conservation District (GCD) representatives to determine if there are conflicts with Region K's existing or proposed Regional Water Plan and those of other districts.

- **Forming a Public Involvement Committee** to involve the public with the water planning process by providing information and obtaining feedback from the public.
- **Developing policy statements** through the Region K Legislative Committee regarding public involvement and education that have been adopted by Region K and which are located in Chapter 8 of the report.
- **Forming a Water Modeling Committee** to provide technical and directional guidance to the contractor, TCB, on the use and output of Groundwater Availability Models (GAMs) for the various aquifers in the Region and the surface Water Availability Model (WAM) for the Colorado River to determine the total water available to the region.
- **Giving an interview with a local radio station** regarding the water planning process.

Once the Region K Initially Prepared Regional Water Plan was approved by the Planning Group, the Group continued required public involvement by:

- **Holding two public meetings throughout the region**, which were publicized through news releases and advertisements, and which prompted media interviews.
- **Holding a public hearing** to solicit public comments on the Initially Prepared-Regional Water Plan.
- **Making the Draft Regional Water Plan** available to the public by placing a copy of the Draft Water Plan in at least one public library in each county and either the county courthouse's law library or the county clerk's office. The Draft Water Plan was also posted on the TWDB website.
- **Issuing news releases** regarding the proposal to more than 50 media outlets within the region, providing an OpEd column from the LCRA General Manager, and conducting other media relations that resulted in coverage of meetings and the proposal's features in both the print and electronic media.

These activities of the Regional Water Planning Group (RWPG) members are discussed in more detail below.

10.2 PLANNING GROUP MEETINGS THROUGHOUT THE REGION

Regular Monthly Meetings

Forty-one Planning Group meetings were held between January 2001 and December 2005 for presentation of material, discussion, deliberation, voting on specific measures, and public comment. These meetings were held throughout the region to enable a broader spectrum of the public to observe the work and to ask questions or comment. *Table 10.1* provides information on the feedback and comments received at the meetings held throughout the region. One joint meeting was held with Region L.

Table 10.1 LCRWPG Publicized "Local" Meetings Throughout the Region

Date	Meeting Location	# Public Attending	Public Comments
1/10/01	McKinney Roughs, Bastrop County	1	None.
2/14/01	City of Austin, Travis County	11	None.
4/18/01	City of Bastrop, Bastrop County	8	Nora Mullarkey, Chair of the Texas Section of the American Water Works Association (AWWA) Conservation and Reuse Division, spoke to the group about a bill reintroduced by Representative Knollenberg that would repeal the national standards for low flow toilets. This could have enormous impacts, as one assumption of the regional plan is that low flow fixtures will be installed in all new construction. The City of Austin has had a 95 percent satisfaction rate with low flow toilets under its free toilet program. Seventy percent of municipal conservation comes from plumbing fixtures. She encouraged the group to contact their legislators to oppose House Resolution (HR) 1474. She offered to provide a sample letter. David Meesey volunteered to speak to the Houston Region Planning Group about the issue.
5/31/01	City of Columbus, Colorado County	8	None.
8/8/01	McKinney Roughs, Bastrop County	4	None.
10/10/01	McKinney Roughs, Bastrop County	2	None.
12/12/01	McKinney Roughs, Bastrop County	4	None.
2/13/02	McKinney Roughs, Bastrop County	17	Concerns were expressed regarding the trustworthiness of Texas Parks & Wildlife Department's (TPWD) technical information regarding the unique stream segment studies item.
3/27/02	McKinney Roughs, Bastrop County	9	It was asked, if the state water fee were to be passed, would the region get more or less money out of the fund than it contributes. The infrastructure report may be the only input the region has in the process, and it is entirely possible that large cities such as Dallas or Houston could end up with a disproportionate share of the funding.

Table 10.1 LCRWPG Publicized "Local" Meetings Throughout the Region (continued)

Date	Meeting Location	# Public Attending	Public Comments
5/8/02	McKinney Roughs, Bastrop County	9	None.
7/10/02	City of Bastrop, Bastrop County	9	None.
10/23/02	McKinney Roughs, Bastrop County	13	None.
12/11/02	City of Burnet, Burnet County	16	None.
2/12/03	McKinney Roughs, Bastrop County	14	A Goldwater Conservation District meeting notice was handed out; all interested parties were invited to attend.
5/14/03	McKinney Roughs, Bastrop County	16	None.
7/30/03	City of Wharton, Wharton County	9	Neighbors for Neighbors would be submitting a letter.
9/10/03	McKinney Roughs, Bastrop County	10	None.
12/10/03	City of Fredericksburg, Gillespie County	13	None.
1/28/04	McKinney Roughs, Bastrop County	20	None.
2/25/04	City of Bastrop, Bastrop County	10	None.
3/31/04	Bay City, Matagorda County	18	None.
5/12/04	City of Burnet, Burnet County	13	None.
7/20/04 Joint meeting with Region L	City of San Marcos, Hays County	60	None.
11/10/04	McKinney Roughs, Bastrop County	6	None.
12/8/04	McKinney Roughs, Bastrop County	8	It was stated that there would be a public stakeholder workshop on freshwater inflows listed in the Bay City Civic on December 13.

Table 10.1 LCRWPG Publicized "Local" Meetings Throughout the Region (continued)

Date	Meeting Location	# Public Attending	Public Comments
1/12/05	McKinney Roughs, Bastrop County	14	None.
2/9/05	McKinney Roughs, Bastrop County	10	None.
3/9/05	McKinney Roughs, Bastrop County		Minutes not on web yet.
4/13/05	City of Austin, Travis County		Minutes not on web yet.
4/27/05	McKinney Roughs, Bastrop County		Minutes not on web yet.
5/11/05	City of Bastrop, Bastrop County		Minutes not on web yet.
5/25/05	Bay City, Matagorda County		Minutes not on web yet.
6/8/05	City of Bastrop, Bastrop County		Minutes not on web yet.
6/22/05	City of Bastrop, Bastrop County		Minutes not on web yet.
7/13/05	City of Bastrop, Bastrop County		Minutes not on web yet.
7/27/05	City of Bastrop, Bastrop County		Minutes not on web yet.
9/28/05	City of Bastrop, Bastrop County		Minutes not on web yet.
10/26/05	City of Fredericksburg Gillespie County		Minutes not on web yet.
11/30/05	City of Bastrop, Bastrop County		Minutes not on web yet.
12/14/05	City of Bastrop, Bastrop County		Minutes not on web yet.

10.3 PRESENTATION TO CIVIC AND SPECIAL-INTEREST GROUPS

Using their own materials and a standardized set of presentation materials, Planning Group members gave more than 20 presentations to civic and special-interest groups. *Table 10.2* provides a summary of this outreach effort with a listing of the LCRWPG presentations to civic and special interest groups.

These presentations were made to groups composed of individuals from all types of general and special interests that were identified by the TWDB in the establishment of the RWPGs.

Table 10.2 LCRWPG Public Outreach Record: Presentations by Group Members to Community Groups

Presenter	Date	City	County	Community Group	Topic/Subject
Ronald Gertson	Monthly, throughout planning process		Wharton	Coastal Bend Groundwater	Update on Region K planning
Ronald G. Fieseler	Various	San Antonio	Bexar	Region L	Region K Activities/Issues
Ronald G. Fieseler	Various	Boerne	Kendall	Hill Country Alliance	Region K Activities/Issues
Ronald G. Fieseler	Various	Johnson City	Blanco	Blanco-Pedernales GCD	Region K Activities/Issues
Julia Marsden	10/6/01	San Antonio	Bexar	Workshop Water for People & the Environment	Public Participation in Water Decisions
Julia Marsden	8/29/02	Austin	Travis	United Nations Association	Region K Water Planning
Julia Marsden & Teresa Lutes	3/8/04	Austin	Travis	League of Women Voters of the Austin Area – Monday Unit Meeting	Austin Water Supply Planning (overview with Region K context)
Julia Marsden and Teresa Lutes	3/10/04	Austin	Travis	League of Women Voters of the Austin Area – Monday Unit Meeting	Austin Water Supply Planning (overview with Region K context)
Julia Marsden	4/13/04	Austin	Travis	UT LAMP	State Water Planning & Region K
Teresa Lutes	7/13/04	Austin	Travis	Green Building Program Seminar	Austin Water Supply Planning (overview with Region K context)
Rebeka Lien	9/13/04	Elgin	Bastrop/ Travis	CAPARO	Water Planning
John E. Burke	10/28/04	Austin	Travis	Texas Society of Professional Engineers	Related to Regional Planning
Teresa Lutes	10/12/04	Austin	Travis	UT Quest Group program	Austin Water Supply Planning (overview with Region K context)
John E. Burke	12/14/04	Bastrop	Bastrop	Bastrop Chamber of Commerce	Related to Regional Planning
John E. Burke	1/27/05	Austin	Travis	TRWA/TWCA Water Law Seminar	Related to Regional Planning
Teresa Lutes	4/20/05	Austin	Travis	Travis Chapter of the Texas Society of Professional Engineers	Austin Water Supply Planning (overview with Region K context)

Table 10.2 LCRWPG Public Outreach Record: Presentations by Group Members to Community Groups (*continued*)

Presenter	Date	City	County	Community Group	Topic/Subject
Myron Hess for Jennifer Walker	4/27/05	Austin	Travis	Austin Bastrop River Corridor Partnership	Water Planning
Teresa Lutes	5/4/05	Austin	Travis	City of Austin Water and Wastewater Commission Meeting	Austin Water Supply Planning (overview with Region K context)
Ron Anderson	6/9/05	San Antonio	Bexar	LSWP Advisory Group	Region K Update
Julia Marsden	6/17/05	Austin	Travis	Texas Campaign for the Environment	Water Planning Update & Issues

10.4 REGION K ACTIVITIES

10.4.1 Environmental Flow Committee

The Environmental Flows Committee was formed in September 2003 in order to update Section 2.4, Environmental Flows Demand section of the Region K Water Plan. The committee also addressed other environmental issues as they arose. There are 10 people on the committee.

The Committee had its first meeting on October 20, 2003, and heard presentations from TPWD specialists on instream flows and freshwater inflows. Committee members discussed Chapter 2 and what would be included in that chapter.

The Environmental Flows Committee met on March 24, 2004, at the TCB offices. There were 19 people in attendance. Colette Barron from TPWD gave a presentation on the department's participation in the LCRA Water Management Plan. Dean Robbins (Texas Water Conservation Association) and Ken Kramer (Sierra Club) gave presentations on their group's proposals for legislation to protect environmental flows. The committee also decided on control points for TWDB's Stream Flow Assessment.

On May 12, 2004, the committee met and generated an outline for Section 2.4 of the Region K Water Plan and reviewed all the projects and studies occurring in the basin as well as potential legislative directives. The reason for this was so that water providers would have one place to look and determine what all the various projects occurring in the basin were and be able to assess their potential for affecting environmental flows requirements or the amount of water available for environmental flows.

On September 8, 2004, the committee met and divided up writing responsibilities for Section 2.4. This was a short meeting via conference call. The Region K members that agreed to help write Section 2.4 were Jennifer Walker, Mark Jordan, Julia Marsden, Haskell Simon, Ronald Fieseler, and Teresa Lutes.

The committee wrote Section 2.4, the Environmental Water Demands section of the Region K Water Plan, and in November of 2004 turned Section 2.4 of the Region K Water Plan over to the consulting firm. Section 2.4 has been included in the plan.

10.4.2 Groundwater Management Plan Review Committee

The Region K Groundwater Management Plan Review Committee, consisting of several GCD representatives and other interest groups, worked to make an internal comparison of other Groundwater Management Plans to Region K's Regional Water Plan. The Committee determined if there were conflicts with Region K's existing or proposed Regional Water Plan and the Water Plan of other districts. Members of Region K have been able to observe the review process and provide representation of various interest groups.

10.4.3 Public Involvement Committee

The Public Involvement Committee of Region K is responsible for informing the public and for obtaining feedback regarding the Water Planning process of Region K. In order to accomplish this, the Public Involvement Committee met monthly to plan two public meetings and a public hearing, develop electronic newsletters for Region K's website, place ads with local papers, send news releases for the Region K regular monthly meetings, promote and support the giving of presentations to special interest groups, and write the public involvement chapter of Region K's Water Plan.

10.4.4 Legislative Committee: Public Involvement and Education Policy

The Region K Legislative Committee developed policy statements that have been adopted by Region K which are located in Chapter 8 of this report. Below are the policy statements concerning public involvement and education as devolved by the Region K Legislative Committee.

Public Involvement

Background Information

From its inception through the legislative process of writing, refining, and passage, and of writing the rules to implement the legislation, Senate Bill (SB) 1 was intended to create a grassroots, bottom up water planning process. Prior to SB 1, state water plans were written and implemented from the top down.

The new process empowered local jurisdictions and regional groups to write water plans that would be melded to produce a state plan. In creating RWPGs to oversee the creation of these plans, the legislation called for representation of a number of diverse groups on the regional groups. Both the inclusion of diverse interests and the focus on local and regional groups brought about a new method of writing the State Water Plan. Pubic involvement is key to the success of this new process.

Policy Statement

LCRWPG believes that better decisions are reached and carried out when the public is actively involved in those decisions. LCRWPG members are committed to conducting public outreach as part of their duties as Planning Group members.

RWPG members shall continue to make a major effort to reach out to interest groups, civic leaders, small water utilities, and the public at large throughout the region.

The LCRWPG will:

- Encourage public attendance and participation at regular meetings
- Hold open meetings of the Planning Group
- Hold regular monthly meetings in locations throughout the region
- Publicize basin-wide meetings through invitations and news releases
- Provide the opportunity for the public to participate in the planning process at each meeting by scheduling time for public comment
- Use a comment/participation card at each meeting
- Maintain a web page
- Publish an E-Newsletter
- Use contributed funds to supplement the project's public involvement budget
- Utilize focus groups when necessary
- Participate in the Lower Colorado River Authority-San Antonio Water Supply (LCRA-SAWS) Working Group
- Hold public meetings and public hearings to gain public input on the Water Plan

All of these efforts make information and updates on the regional water planning process available to thousands of people throughout the region.

Actions Needed

This public process was initiated in the production of the first water plan and will continue as the 5-year update is conducted and submitted to the State. Since this public involvement process is contained in SB 1 and the implementing rules, no legislative action is required. The Planning Group should be vigilant that no weakening of the public process occurs.

Timing and/or Conflicts

These recommendations should be included in the final report submitted to TWDB along with a description of the public involvement activities carried out by the Planning Group.

Education

Background Information

Population growth in Region K brings residents together who are unfamiliar with the regional water planning process. Longtime residents need to stay abreast of planning developments. People move from part of the state to another. And people get interested in different issues at different times. Each of these factors calls for continuing education on the water planning process. Education is a necessary part of the grassroots, regional water planning process as envisaged by SB 1.

Policy Statement

The LCRWPG is committed to public education as one of the RWPG's and individual Planning Group's ongoing responsibilities. Published reports and materials, presentations at regular meetings, and group member presentations to civic and community groups all serve as an education vehicle. Public education strengthens public understanding of regional water planning which is essential to these efforts to plan for water for Texas' future. The Planning Group commits to participation in future legislative efforts to create public awareness of the importance of water conservation.

The LCRWPG will:

- Work to increase participation and attendance at regular meetings
- Increase multimedia efforts through radio and television talk shows and newspapers to inform the public
- Find ways to increase the distribution of E-Newsletters that update Planning Group activities and focus on issues of interest in the basin
- Publicize the website as an important source of information
- Continue to emphasize presentations at regular meetings that inform the public about critical issues such as water reuse, the health of the bays and estuaries, irrigation conservation strategies, the LCRA-SAWS Water Project, and potential water management strategies
- Increase contacts with civic and interest groups
- Update the Region K LCRWPG Fact Sheet

Actions Needed

Public education was initiated in the production of the first water plan and will continue as the 5-year update is conducted and submitted to the State.

In addition, the LCRWPG shall support the recommendations of the Water Conservation Implementation Task Force to the Legislature to establish a statewide awareness, education campaign to raise State citizen awareness and knowledge of the importance of water conservation to the State and its future water supplies.

Timing and/or Conflict

The education campaign should be adopted during the 2005 79th Legislative Session.

10.4.5 Water Modeling Committee

The Water Modeling Committee was formed to provide technical and directional guidance to the contractor, TCB, on the use and output of GAMs for the various aquifers in the region and the surface WAM for the Colorado River to determine the total water available to the region.

The committee, consisting of nine members, had three meetings (October 1 and November 29, 2004; January 6, 2005), and a WAM technical subcommittee met eight times (January 21 and 28, March 11 and 21, April 1 and 21, May 3, and June 1, all in 2005).

10.4.6 Advertising and Media

The Public Involvement Committee authorized advertisements in local newspapers for the purpose of dispersing information regarding the public meetings, promoting subscriptions to the newsletter, and directing the public to the Region K website. Moreover, ads were placed in publications which included the *Austin American-Statesman* and the *Austin Chronicle*. Legal notices were distributed to more than 50 local media outlets in the Region K area. *Appendix 10A* contains a sample press release for a regular monthly LCRWPG meeting open to the public.

Internet communications included the listings of the newsletter, meeting locations and times, and the LCRWPG's Initially Prepared Regional Water Plan.

10.4.7 Surveys

The Planning Group conducted four surveys to obtain feedback on population projections and water demand and to gain information regarding water supply sources and water conservation strategies. These letters and surveys are summarized below, and examples of the survey letters and types of responses are contained in *Appendix 10B*.

- The Regional Water Planning Population Projections survey was mailed on September 16, 2002, to stakeholders in the Region K area soliciting feedback on the population projections. Ten comments were received. See *Appendix 10B* for the survey letter and example responses.
- The Regional Water Planning Water Demand Projections survey was sent on February 7, 2003, to 123 stakeholders within Region K soliciting feedback on the water projections that were based on the population projections adopted by the RWPG. Ten responses were received. See *Appendix 10B* for the survey letter and example responses.
- A survey to identify water supply sources was mailed on August 2, 2004. Fourteen responses were received. See *Appendix 10B* for the survey letter and an example response.
- A survey to help identify the water conservation strategies used by water user groups was mailed to Region K stakeholders on September 28, 2004. Twenty-five responses were received. See *Appendix 10B* for the survey letter and an example response.

10.4.8 Public Meetings and Hearing

In addition to the meetings shown earlier in *Table 10.1*, additional meetings were held for the primary purpose of gaining input and answering questions from the public. This included one public hearing and two public meetings for comment on the Initially Prepared Regional Water Plan. All three of these meetings are summarized in *Table 10.3* below, with details in *Appendix 10C*.

Table 10.3 Region K Public Meetings and Hearing

Date	Location	Public Attendance	Media Attendance	Comments*
8/23/05	Knights of Columbus Hall, Columbus, Colorado County	27	3	4 written comments 2 verbal comments
8/30/05	Burnet Civic Center, Burnet, Burnet County	53	1	26 written comments 6 verbal comments
9/7/05	One Texas Center, Austin, Travis County	63	1	4 written comments 8 verbal comments

* The verbal and written comments from the meetings as well as the responses can be found in *Appendix 10D.*

The public hearing was advertised throughout the region in legal ads as required by Chapter 357, "Regional Water Planning Guidelines." Display advertisements were placed in newspapers throughout the region, and radio spots were purchased. News releases were also issued. A printed copy of the public hearing presentation appears in *Appendix 10C*. *Appendix 10D* contains all of comments received (public, state, and federal) and the responses.

10.5 RELATED OUTREACH ACTIVITIES WITHIN THE REGION K AREA BEYOND THE LCRWPG

There are several ongoing studies, workgroups, and legislative committees whose findings may affect the way water needs are met, what the requirements will be, and other factors. The following related studies are activities within the Region K area beyond the LCRWPG.

10.5.1 LCRA Water Management Plan

LCRA currently operates the Lower Colorado River under provisions of the 1999 Water Management Plan (WMP). This plan is approved by Texas Commission on Environmental Quality (TCEQ) as a condition of the LCRA's water rights permits for Lakes Buchanan and Travis, the two major water supply reservoirs in the Highland Lakes. Recommended amendments to the plan were developed through a stakeholder process that began in early 2001 and are currently under review by TCEQ. Several parties have contested this round of amendments.

General information and a copy of the recommended updates can be found on the LCRA's website at http://www.lcra.org/water/wmp.html.

10.5.2 Freshwater Inflow Needs Study for Matagorda Bay

The study is a reassessment of freshwater inflows needs for Matagorda Bay including a review and update of a bay system study conducted in 1997. It is a joint effort of LCRA, Lavaca-Navidad River Authority, TPWD, TWDB, and TCEQ. Each study partner is represented on a Freshwater Inflow Needs Study (FINS) Advisory Committee. The FINS began on April 1, 2002, and is scheduled for completion by June 30, 2005. State agencies will use the results to evaluate a number of strategies for meeting freshwater inflow needs in accordance with their statutory responsibilities. When the study is complete, LCRA will consider the study results to determine whether to seek further revisions to the WMP.

10.5.3 The LCRA-SAWS Water Project Scientific Studies

LCRA and SAWS have undertaken the study of the project's water supply potential, construction and operational costs, and environmental effects. During this study period, the proposal will be re-examined, refined with current information, and examined with public input. This study period started in 2004 and is scheduled for completion in 2010. Annual project viability assessments will be conducted each November. The assessments as well as monthly update reports can be found at the project website at: http://www.lcra.org/lswp. At the end of the study period, if LCRA and SAWS determine the project is technically feasible, environmentally sound, and cost effective, the implementation period will follow. For answers to specific questions, contact lcrasawswaterproject@lcra.org.

10.5.4 Study Commission on Water for Environmental Flows

The 78th Texas Legislature established a Study Commission on Water for Environmental Flows, which is composed of 18 members. The Governor, the Lieutenant Governor, and the Speaker of the House each appointed five members, and three other positions on the panel are filled by the directors of TCEQ, TWDB, and TPWD. The Study Commission is charged with conducting public hearings and studying implications of public policy to balance the demands on water resources by a growing population with the requirements of the riverine and bay and estuarine systems. The Study Commission was required to appoint a Scientific Advisory Committee to assist in this effort. The Scientific Advisory Committee submitted a final report to the Study Commission October 26, 2004. The Study Commission is scheduled to report to the Legislature by the end of 2004. The committee's report as well as the latest developments can be found at the Senate website at http://www.senate.state.tx.us/75r/senate/commit/c890/c890.htm.

10.5.5 Senate Committee on Water Policy

Lieutenant Governor David Dewhurst created the Senate Committee on Water Policy in the fall of 2003. The chair of this committee is Senator Kenneth Armbrister. The committee is charged to study all issues related to ground and surface water law, policy, and management. Issues such as the role of federal, state, regional, and local governments and their coordination in setting consistent, nondiscriminatory water policies; the authority of TCEQ as it relates to water contracts; the role of the Edwards Aquifer Authority; the role of groundwater conservation districts; the regional water planning process; conjunctive use of both ground and surface water resources; Rule of Capture; historic use standards; water infrastructure and financing; inter-basin transfers; junior water rights; conservation; water quality standards; drought preparedness; and water marketing. The committee was not limited to these topics. The committee is to submit its final report no later than December 1, 2004.

Information on the committee's activities and their report can be found at:
http://www.senate.state.tx.us/75r/senate/commit/c750/c750.htm.

The Lieutenant Governor also created the Senate Subcommittee on the Lease of State Water Rights. The subcommittee is charged to study the following proposals:

- Lease permanent school funds and permanent university lands and their water rights for the purposes of developing and marketing water
- Analyze the present and future effects of such proposals on local aquifers, historic streamflows, local underground water conservation districts, and other public and private water interests

- Study the process by which the General Land Office considers proposals to lease state water rights, including the methodology for holding open meetings, obtaining public input, meeting competitive bidding requirements, and coordination with TCEQ and other governmental units with possible regulatory oversight.

Information on the committee's activities and its report can be found at: http://www.senate.state.tx.us/75r/Senate/commit/c755/c755.htm.

10.5.6 Agriculture Water Conservation Fund Advisory Committee

House Bill 1437, passed by the Texas Legislature in 1999, authorizes LCRA to transfer up to 25,000 acre-feet of water per year to Williamson County under certain conditions. House Bill 1437 specifies that there be an Agriculture Water Conservation Fund Advisory Committee to confer with LCRA regarding the expenditure of surcharge funds which are added to the water charges by the sale of water to Williamson County. The "no net loss" provision in the legislation requires that these funds be used only for the development of water resources or other strategies to replace the amount of water transferred to Williamson County.

LCRA subsequently contracted with the LBJ School of Public Affairs that conducted six public meetings in 2004 for the purpose of obtaining public input regarding the definition of "no net loss." Two public meetings were held in Georgetown, two were held in Wharton, one public meeting was held in Marble Falls, and one public meeting was held in Burnet.

10.5.7 Irrigation District Advisory Panel

There are advisory panels for each of the three irrigation systems operated by LCRA: Garwood, Lakeside, and Gulf Coast. These groups are self-elected and are sponsored by LCRA. LCRA discusses with these groups anything related to LCRA's operations that is relevant to the customer groups. The discussions range from rate changes, changes in operations procedures, key projects impacting the irrigation districts, and other items that need to be communicated.

10.5.8 Envision Central Texas

It is not news to state that the growth in Central Texas has been phenomenal. Population growth is one reason regional water planning was adopted by the Legislature in 1997 with SB 1. The current population in the Central Texas area of Bastrop, Caldwell, Hays, Travis, and Williamson Counties currently surpasses 1.4 million. Projections indicate that within the next 20 to 40 years this figure is expected to exceed 2.5 million.

Envision Central Texas (ECT), a nonprofit organization composed of citizens from Bastrop, Caldwell, Hays, Travis, and Williamson Counties, was founded in 2002 to address the growth pressure on the five-county region. Since the area overlaps parts of Region K, the Region K public member was asked to serve on the ECT Board of Directors. The Board, made up of diverse interests representing business, environmental, social equity, neighborhood and policymaker interests, worked to assist the public development and implementation of a regional vision with an emphasis on land use, transportation, and the environment. ECT has no regulatory powers and does not seek to impose a plan on the region or its local governments. Instead the mission is a cooperative partnership of regional interests directed at a common vision.

Recognizing early that a vision must be based on the opinions of many, ECT sought community input in a variety of ways over the time the vision was being formed. Focus groups and telephone surveys were conducted in the summer of 2002; a series of public workshops were held in the all counties in the fall of 2002; six Community Test Site Planning Workshops, which served as pilot projects to examine different planning tools, were hosted in the five counties.

Based on the input from the different workshops, telephone surveys, and focus groups, ECT created four potential growth scenarios for residents to consider. In the fall of 2003, ECT created and conducted a survey. The feedback resulted in more than 12,500 survey responses.

The survey focused on five areas of concern about the patterns and consequences of growth. Development over the area's aquifers was one of the five. The survey asked two questions about water. One tied the four possible growth scenarios to future development over the Edwards aquifer. The second asked the level of the respondents concern about the water supply keeping pace with development in Central Texas. The vision, announced in May 2004, contains the protection of water quality and sustainable water supplies, both surface and groundwater for the region.

APPENDIX 10A

LCRWPG SAMPLE PRESS RELEASE

FOR IMMEDIATE RELEASE	FOR MORE INFORMATION CONTACT:
July 19, 2005	John Burke
Chairman	(512) 303-3943

Lower Colorado Regional Water Planning Group (Region K) Meeting and Public Meetings Scheduled

BASTROP – The Lower Colorado Regional Water Planning Group (Region K) will hold a meeting at 10:00 a.m. on Wednesday, July 27, at Aqua Water Supply, 415 Old Austin Highway, in Bastrop, Texas. The public is invited to attend and provide input on elements of a future regional water plan that will map out how to conserve water supplies, meet future water needs and respond to future droughts in the Lower Colorado River Basin.

Agenda items include discussion and action on revisions to Draft Chapter 3 to include supply from the Lower Trinity Aquifer, discussion and action on revised Draft Chapter 4 – Identification, Evaluation and Selection of Water Management Strategies based on need, discussion and action on revised Draft Chapter 5 – Impacts of Water Management Strategies, discussion and action on revised Draft Chapter 7 – Regional Plan Consistency with State's Long-Term Resource Protection Goals, discussion and action on revised Draft Chapter 10 – Public Involvement Activities, and discussion and action on the Executive Summary. The agenda also includes adoption of the Lower Colorado Regional Water Planning Group's (Region K) Initially Prepared Plan (IPP).

The public is also invited to participate in a public meeting for the Region K Draft Water Plan that will be held at 6 pm on August 23rd at the Knights of Columbus Hall in Columbus, TX and at 6 pm on August 30th at the Burnet Civic Center in Burnet. A public hearing for the Draft Water Plan will also be held at 6 pm on September 7th at the One Texas Center in Austin, TX. The purpose of the public meetings and hearing is to inform the public regarding the Draft Water Plan for Region K and solicit public feedback and comment. Written and oral comments may be submitted at both meetings and hearing. However, to become part of the official record, comments must be submitted at the public hearing or in writing by November 6, 2005.

Region K Planning Group efforts respond to comprehensive water legislation passed by the 75th Texas Legislature designed to address Texas' vulnerability to drought and to the limits of existing water supplies in order to meet the Lone Star State's increasing demands for water. Region K consists of all or portions of the following counties: Bastrop, Blanco, Burnet, Colorado, Fayette, Gillespie, Hays, Llano, Matagorda, Mills, San Saba, Travis, Wharton and Williamson.

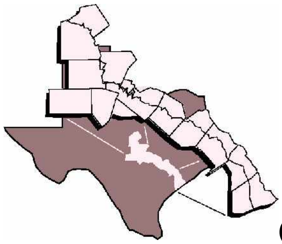
Additional information on the project can be obtained at **www.regionk.org**

APPENDIX 10B

LCRWPG SURVEYS

THE REGIONAL WATER PLANNING POPULATION PROJECTIONS SURVEY

Lower Colorado Region



(Region K)

September 16, 2002

RE: Regional Water Planning <u>Population Projections</u>
Lower Colorado Region (Region K)

Dear Mayor, County Judge, or Water Utility Official;

As you are probably aware Senate Bill 1, among other things, established a Regional Water Planning process that has been implemented on a state-wide basis. Under this program, the state has been divided into 16 regional water planning areas. For each region, an appointed Regional Water Planning Group (RWPG) is overseeing the preparation of the regional water plan. Each of these areas is to prepare a regional water plan that addresses both near and long–term water needs. The second round of planning is underway and the Regional Water Planning Groups are to submit these revised plans to the Texas Water Development Board (TWDB) by January 6, 2006. The Lower Colorado Regional Water Planning Group (Region K) consists of Bastrop, Blanco, Burnet, Colorado, Fayette, Gillespie, Hays (partial), Llano, Matagorda, Mills, San Saba, Travis, Wharton (partial), and Williamson (partial) counties. Turner Collie & Braden Inc. (TC&B) has been retained by the Lower Colorado Regional Water Planning Group (LCRWPG) to perform technical analyses and to assist with the development of the regional water plan.

A key element in the regional water planning process is to prepare revised population and water demand projections for each decade from the year 2010 through 2060 in part based on the Federal Census conducted in 2000. The Texas Water Development Board (TWDB) is responsible for making the population projections. TC&B has compiled the projections and the RWPG is soliciting input from the Water User Groups (WUG). Projections for future water demand will be based on the populations projections approved by the TWDB. That projected demand will be compared to the supply to determine what shortages may exist. Strategies will then be developed to address identified shortages. Attached you will find the TWDB criteria required to be used in proposing changes to the population projected.

Before finalizing and submitting proposed population revisions to the TWDB for their approval, we would like to give you an opportunity to review and comment on the population projections developed by the TWDB for your water user group. Your assistance in providing additional information in support of further refinements will improve the accuracy of the population projections and thereby the water demand projections. Population projections have been developed at a county level and for each water user group with a population in excess of 500, utilities that use more than 280 acre feet per year, and designated Collective Reporting Units

(CRUs). Smaller communities and rural areas not included in the foregoing are addressed as "county other".

The enclosed package includes:

1) Population projections for your water user group (municipality, community, collective reporting units (CRUs), or county other),
2) Population projections for the counties in the Region K Water Planning Area, and;
3) a copy of the TWDB guidelines for revisions to population projections.

Once the population numbers have been finalized water demand projections will be developed.

We would appreciate receiving any comments you may have on the TWDB population projections by October 15, 2002. Please mail, FAX, or e-mail your comments to:

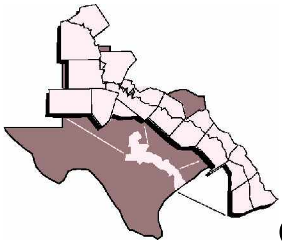
Ms Connie Hinojos
Turner Collie & Braden Inc.
400 West 15th Street, Suite 500
Austin, Texas 78701
Phone: (512) 472-4519 Fax: (512) 472-7519
connie.hinojos@tcb.aecom.com

If you have any questions about the enclosed information, please contact us at the phone number provided above. On behalf of the Region K Regional Water Planning Group, we appreciate your interest and assistance.

Respectfully submitted,

Bill E. Couch, AICP
Senior Project Manager
Turner Collie & Braden Inc
Email: bill.couch@tcb.aecom.com

Lower Colorado Region



(Region K)

Criteria for Adjusting Sub-County Populations

Texas Water Development Board Requirements
Applicable to all Water User Groups (WUGS)

The projected population growth throughout the planning period for the cities, utilities, and the rural area (County-Other) within a county is a function of a number of factors, including the entity's share of the county's growth between 1990 and 2000, as well as local information provided by Planning Groups. The total county population, as projected by TWDB will act as a control total for the populations within the county. Any adjustments to a city, utility or remaining County-Other population must involve a justifiable redistribution of projected populations within the county so that the county total remains the same.

Criteria: One or more of the following criteria must be verified by the Planning Group and the Executive Administrator for consideration of revising the sub-county population projections:

a) The population growth rate for a city, utility or County-Other over the last five years (1995-2000) is substantially greater than the growth rate between 1990 and 2000.

b) Identification of areas that have been annexed by a city since the 2000 Census.

c) Identification of the expansion of a utility's CCN or service area since the last update by the TNRCC to the digital boundary data.

Data Requirements: The Planning Group must provide the following data associated with the identified criteria to the Executive Administrator for justifying any revisions to the county-level population projections:

1) Population estimates for cities developed and published by the State Data Center or by a regional council of governments will be used to verify criteria (a) for cities.
2) The verified number of residential connections and permanent population served will be used to verify criteria (a) for utilities.
3) The estimated population of an area that has been annexed by a city or has become part of a CCN or service area for a water utility. In addition, the geographical boundary of the area must be presented in an acceptable map or ArcView shapefile.
4) Other data that the Planning Group believes is important to justify any changes to the population projections.

Region K SB2 Population Projection WUG Responses

COMMENT/QUESTION #1:

9-25-02: Richard Eason (261-6222, ext.14) from the Lakeway MUD called regarding the 2 letters we sent him for Lakeway and Lakeway MUD. He doesn't feel that the TWDB is accurately representing the situation in that area. The City of Lakeway does not provide service to anyone; Lakeway MUD services almost all of the city and no one outside the city limits; WCID #17 services the remainder of the city as well as a large county-other area. He feels the 1990 population distribution shown in the TWDB table is not accurate. In addition, he says that the MUD's service area is land-locked and finite and the MUD can only grow another 20% total and TWDB shows much more than that. WCID #17 has a much larger potential for future growth. His suggestion is to remove the City of Lakeway from table completely and alter projections for MUD and WCID, which would include all of the City of Lakeway.

TWDB Table P1 Excerpt:

WUG - Lakeway MUD & City of Lakeway	County Name	1990	2000	2010	2020	2030	2040	2050	2060
City of Lakeway	Travis	**4,044**	**8,002**	10,789	14,519	17,965	20,117	22,394	24,738
	% increases by decade	*97.9%*	*34.8%*	*34.6%*	*23.7%*	*12.0%*	*11.3%*	*10.5%*	
Lakeway MUD	Travis	72	700	1,142	1,734	2,281	2,622	2,983	3,355
	% increases by decade	*872.2%*	*63.1%*	*51.8%*	*31.5%*	*14.9%*	*13.8%*	*12.5%*	
Travis Co. WCID #17	Travis	4,185	11,023	15,838	22,283	28,236	31,954	35,887	39,936
	% increases by decade	*163.4%*	*43.7%*	*40.7%*	*26.7%*	*13.2%*	*12.3%*	*11.3%*	
Total		8,301	19,735	27,770	38,537	48,483	54,693	61,264	68,029
	% increases by decade	*137.7%*	*40.7%*	*38.8%*	*25.8%*	*12.8%*	*12.0%*	*11.0%*	

The following TWDB WUG email explanation that accompanied tables P1-P4 provides most of the needed answers (except for MUD land-locked issue):

In some cases where the WUG is a utility, the utility's service area overlaps geographically with a city WUG. In this case, the "shared city population" was subtracted from the utility population total, leaving the projected population of the city WUG to reflect the geographical (Census) boundaries of the city. These shared populations are shown in Table P-3.

TWDB Table P3 Excerpt:

Utility Name	County Name	1990 Net Population	2000 Net Population	1990 Shared Population	2000 Shared Population	1990 Shared Population City(ies)	2000 Shared Population City(ies)
Lakeway MUD	Travis	72	700	3,528	8,002	**Lakeway (3,528)**	**Lakeway (8,002)**
Travis Co. WCID #17	Travis	4,185	11,023	315	791	~~Austin (180)~~; Lakeway (135)	~~Austin (482)~~; Lakeway (309)
					City of Lakeway Total	**3,663**	**8,311**
					Unexplained differences between City of Lakeway total pop from tables P1 and P3	381	-309

COMMENT/QUESTION #2:

9-18-02: Voicemail from Tommy Collier @ Kingsland Water Supply Corporation. He received Region K letter and has questions on Llano and Burnet counties pop #s. We show decrease in Llano Co. pop after year 2020 and they are anticipating increases in population (Burnet Co increases shown seem OK). Please call him back to discuss why Llano Co pop is decreasing in our table (915-388-6611).

WUG - Kingsland Water Supply Corporation	County Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
New SB2 Projections	Burnet	Colorado	315	366	426	487	545	608	682
New SB2 Projections	**Llano**	Colorado	3,625	3,692	***3,672***	***3,551***	***3,380***	***3,207***	***3,071***
New SB2 Projections	Total		3,940	4,058	4,098	4,038	3,925	3,815	3,753
WSC Projections	**Llano**	Colorado	3,625	3,692	3,672	3,672	3,672	3,672	3,672
SB2 under-estimation			***0***	***0***	***0***	***-121***	***-292***	***-465***	***-601***

Region K SB2 Population Projection WUG Responses

COMMENT/QUESTION #3:

10-3-02: Fax from Mr. Mike Willatt (Willatt & Flickinger Attorneys at Law) on behalf of **Travis County WCID # 19.** The population projections need to be corrected as follows: There are 191 buildable lots within the service area of WCID #19, and one high school. Currently there are houses on 177 lots. The remaining 14 lots should be built out within the next few years.

WUG - Travis Co. WCID #19	County Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
New SB2 Projections	Travis	Colorado	553	716	935	1,137	1,263	1,396	1,533
WCID Projections (# connections * 3.5 multiplier)			620	669	669	669	669	669	669
SB2 over-estimation			***-67***	***48***	***267***	***469***	***595***	***728***	***865***

(It is not clear whether or not they are saying that no more growth is anticipated beyond the 191 lots in the WCID #19 service area)

COMMENT/QUESTION #4:

10-3-02: Fax from Brooksmith SUD in Mills County: "9 active meters in Mill's County; 3 non-active meters in Mills County."

WUG - Brooksmith SUD	County Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
New SB2 Projections	Mills	Colorado	39	39	45	46	47	46	44
SUD Projections (# connections * 3 multiplier)			27						

COMMENT/QUESTION #5:

10-3-02: Fax from North Austin MUD #1 c/o Eco Resources: The county-based sub-population projections for the NA MUD #1 are reversed. The Williamson County portion of the District should be the larger values.

WUG - North Austin MUD #1	County Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
Corrected SB2 Projections	**Williamson**	Brazos	7,023	7,023	7,023	7,023	7,023	7,023	7,023
Corrected SB2 Projections	**Travis**	Colorado	780	780	780	780	780	780	780
New SB2 Projections	Total		7,803	7,803	7,803	7,803	7,803	7,803	7,803

COMMENT/QUESTION #6:

10-3-02: Letter from the City of Cedar Park: Attached are the City of Cedar Park's water service area population projections.

WUG - City of Cedar Park	County Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
New SB2 Projections	Travis	Colorado	541	922	1,432	1,903	2,197	2,508	2,828
City Projections for Entire City Service Area			41,424	73,110	96,866	109,578	128,373	-	-

(The projections provided by the City of Cedar Park are not divided by Water Planning Region. Most of the City's population is has been assigned to Region G and only the portion shown above from the TWDB are attributable to Region K)

COMMENT/QUESTION #7:

Fax from the City of Austin is very lengthy - please refer directly to the 7-page letter. No specific request for population projection revisions was made.

WUG - City of Austin	County Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
New SB2 Projections	Travis	Colorado	644,752	768,138	933,273	1,085,806	1,181,072	1,281,847	1,385,602
New SB2 Projections	Williamson	Brazos	11,810	20,486	30,775	43,008	56,310	70,782	86303
New SB2 Projections	Total		656,562	788,624	964,048	1,128,814	1,237,382	1,352,629	1,471,905

COMMENT/QUESTION #8:

10-22-02: Fax from the Mountain City Oaks Water System: Attached are their water service area population projections. They do not expect to grow beyond the TWDB's 2010 projections, because they are almost fully developed.

WUG - Mountain City Oaks Water System	County Name	Basin Name	2000	2010	2020	2030	2040	2050	2060
New SB2 Projections	Hays	Colorado	536	737	967	1,206	1,446	1,734	1,961
MCOWS Projections			536	737	737	737	737	737	737
SB2 over-estimation			***0***	***0***	***230***	***469***	***709***	***997***	***1,224***

COMMENT/QUESTION #9:

7-11-02: Summary of letter from the Hill Country Underground Water Conservation District (HCUWCD, Gillespie Co.). Gillespie Co. is situated within 80 miles of the metropolitan areas of Austin and San Antonio and currently Gillespie Co. is experiencing the development of bedroom communities similar to other counties adjacent to these metropolitan areas. This type of growth and subsequent migration will probably only increase in the future. In addition, over the past few years, considerable improvements and expansions have been made and are currently planned for water, sewage, roads, drainage, schools, and airport to deal with the current and future growth occurring in this county.

7-24-02: Summary of letter from the Hill Country Underground Water Conservation District (HCUWCD, Gillespie Co.). For Gillespie County, the new projections show an increase in population from 20,814 in 2000 to 28,845 in 2030, then a reduction occurs from 2030 down to 22,842 in 2060. Since the model does not provide a very good representation of population growth due to migration (as per Dr. Hardin, TWDB), which may very well occur in the Hill Country, then I would like to request that the maximum population projected in 2030 be maintained through 2060.

WUG - All of Gillespie County	2000	2010	2020	2030	2040	2050	2060
SB2 County-Other	11,903	13,776	15,732	16,496	15,618	14,269	13,063
SB2 City of Fredericksburg	8,911	10,313	11,778	12,349	11,693	10,683	9,779
SB2 Total	20,814	24,089	27,510	28,845	27,311	24,952	22,842
Gillespie Co. Projections	20,814	24,089	27,510	28,845	28,845	28,845	28,845
SB2 under-estimation	***0***	***0***	***0***	***0***	***-1,534***	***-3,893***	***-6,003***

It should be noted that all TWDB SB2 Gillespie Co. WUG projections show a decrease in population every decade after 2030, which the HCUWCD did not make mention of. We have chosen to show the compromise between of having county population projections remain constant after 2030.

COMMENT/QUESTION #10:

7-24-02: Summary of letter from the Region K Representative for County-Other concerning the Colorado County population projections. For Colorado County, he collected data on new developments under construction in the county (by basin), and septic permits requested since 1998; and he analyzed census tract population distribution between the lavaca and colorado basins. (see letter for details)

WUG - All of Colorado County	2000	2010	2020	2030	2040	2050	2060
SB2 Columbus (Colorado Basin)	3,916	4,053	4,231	4,331	4,371	4,379	4,333
SB2 Eagle Lake (Brazos-Col. & Col. Basins)	3,664	3,792	3,959	4,052	4,090	4,097	4,054
SB2 Weimar (Colorado & Lavaca Basins)	1,981	2,050	2,140	2,190	2,212	2,215	2,192
SB2 County-Other (Brazos-Col. Basin)	1,031	1,067	1,115	1,141	1,150	1,154	1,141
SB2 County-Other (Colorado Basin)	6,572	6,801	7,101	7,268	7,336	7,349	7,272
Region K Representative Projections	**7,774**						
SB2 County-Other (Lavaca Basin)	3,226	3,338	3,486	3,568	3,601	3,607	3,569
Region K Representative Projections	**2,024**						
Colorado County Total	20,390	21,101	22,032	22,550	22,760	22,801	22,561
total county decadal changes		**711**	**931**	**518**	**210**	**41**	**-240**
CUMULATIVE county decadal changes		**711**	**1,642**	**2,160**	**2,370**	**2,411**	**2,171**
Region K Representative Minimum Cumulative Changes							**3,800**

THE REGIONAL WATER PLANNING WATER DEMAND PROJECTIONS SURVEY

Lower Colorado Region

February 7, 2003

(Region K)

Honorable Ronnie McDonald
804 Pecan
Bastrop, TX 78602

RE: Regional Water Planning *__Water Demand__* Projections for Region K
Water User Group: Bastrop "County-Other"

Dear Sirs,

As you are probably aware, Senate Bill 1, among other things, established a Regional Water Planning process that has been implemented on a statewide basis. Under this program, the State of Texas has been divided into 16 regional water-planning areas. For each region, an appointed Regional Water Planning Group (RWPG) is overseeing plan preparation. Each of these areas is to prepare a regional water plan that addresses both short-term and long-term water needs. Detailed information on this planning process can be found on the Texas Water Development Board's (TWDB) website (www.twdb.state.tx.us).

The second round of planning is currently underway and the RWPGs are to submit revised plans to the TWDB by January 6, 2006. The Lower Colorado Regional Water Planning Group (Region K) consists of Bastrop, Blanco, Burnet, Colorado, Fayette, Gillespie, Hays (partial), Llano, Matagorda, Mills, San Saba, Travis, Wharton (partial), and Williamson (partial) counties. Turner Collie & Braden Inc. (TC&B) has been retained by the Lower Colorado Regional Water Planning Group (LCRWPG) to perform technical analyses and to assist with the development of Region K's water plan.

A key element in the regional water planning process is to prepare revised population and water demand projections for each WUG by decade from the year 2000 through 2060, in part based on the Federal Census conducted in 2000. The TWDB is responsible for developing the population projections and daily per capita water use rates for each Water User Group (WUG). TC&B solicited input from each Region K WUG on the draft TWDB population projections in September 2002. The revised population projections adopted by the RWPG are now in the TWDB's review process and the final projections are expected to be released by the TWDB in early March 2003. Even though the final population projections are not yet available, the RWPG is required to proceed with the next phase of adopting water demand projections.

Using the revised population projections adopted by the RWPG and the TWDB's projected water use rates, TC&B has calculated water demands for each WUG and __now the RWPG is soliciting input from each WUG on the water demand projections__. After the revision process for water demands has been completed, these projections will be compared to the region's water supplies to determine what shortages may exist. Strategies will then be developed to address identified shortages.

Before finalizing and submitting proposed water demand revisions to the TWDB for their approval, we would like to give you an opportunity to review and comment on the water demand projections developed by the TWDB for your Water User Group. Your assistance in providing additional information in support of further refinements will improve the accuracy of these projections and thereby the determination of water shortages in Region K. Attached you will find the TWDB criteria required for proposing changes to the proposed water demands projections. Population and water demand projections have been developed at the county level for each designated water user group. The TWDB defines a WUG as a community with a population in excess of 500, utilities that use more than 280 acre-feet per year, and designated Collective Reporting Units (CRUs). Smaller communities and rural areas not included above are grouped into a "County-Other" WUG. Countywide non-municipal water use categories include manufacturing, electric power generation, mining, irrigation, and livestock.

This letter packet includes:

1. Decadal water demand projections for your WUG and the other municipal WUGs in your county [municipality, community, collective reporting unit (CRU), County-Other, or utility];
2. Graph comparing water demand projections (1st round of planning vs. the current 2nd round) for your Region K county, and;
3. The TWDB guidelines for revisions to water demand projections.

Once the water demand numbers have been finalized, the revised demands will be compared to the available supplies to determine the water needs for the planning horizon for each entity.

We would appreciate receiving any comments you may have on the TWDB water demand projections by March 7, 2003. Please mail, FAX, or e-mail your comments to:

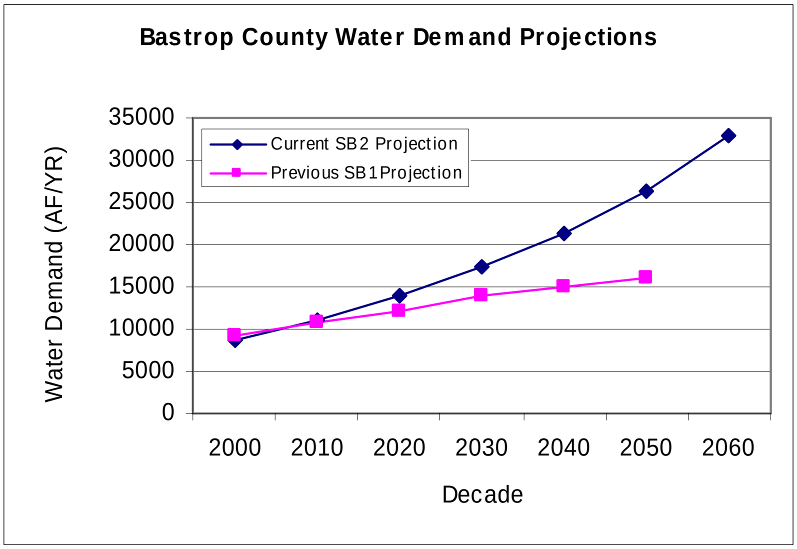
Ms. Connie Townsend
Turner Collie & Braden Inc.
400 West 15th Street, Suite 500
Austin, Texas 78701
Phone: (512) 472-4519 Fax: (512) 472-7519
connie.townsend@tcb.aecom.com

If you have any questions about the enclosed information, please contact us at the phone number provided above. On behalf of the Region K Water Planning Group, we appreciate your interest and assistance.

Respectfully submitted,

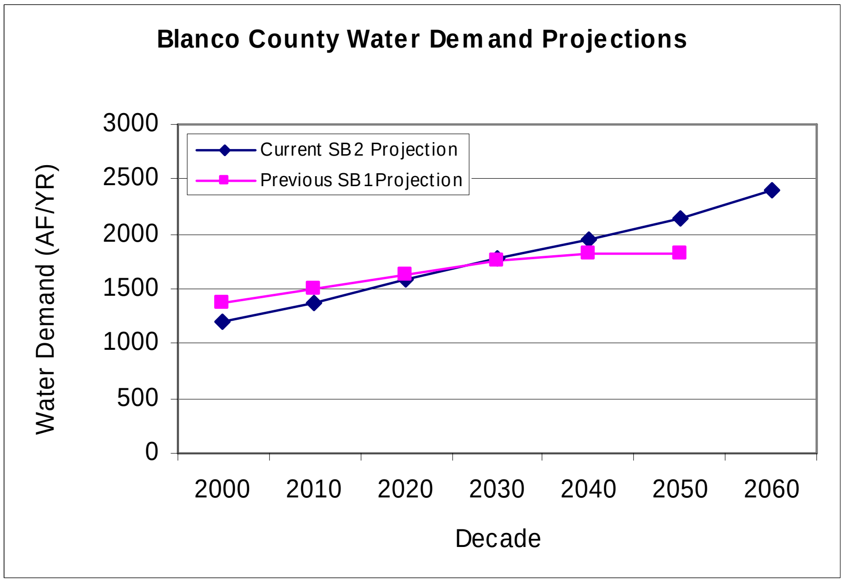
Bill E. Couch

Bill E. Couch, AICP
Senior Project Manager
Turner Collie & Braden Inc



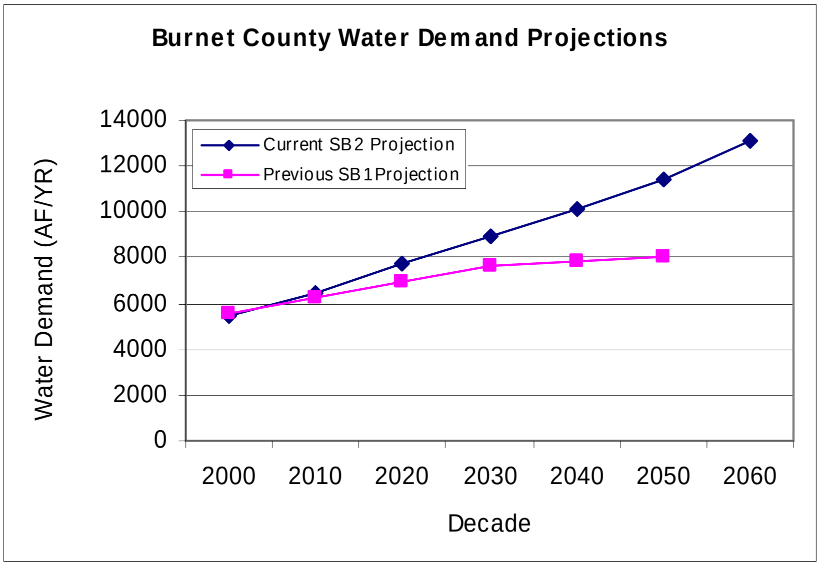
Region K Bastrop County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
Aqua WSC	Colorado	New WUG	4,051	4,777	5,748	6,850	8,197	9,890	12,101
Bastrop Co. WCID #2	Colorado	New WUG	238	341	473	626	801	1,029	1,315
Creedmoor-Maha WSC	Colorado	New WUG	15	19	23	29	35	43	54
Lee County WSC	Brazos	New WUG	40	49	61	75	92	112	139
Lee County WSC	Colorado	New WUG	62	77	95	117	143	175	217
Manville WSC	Colorado	New WUG	46	67	94	125	161	207	266
Polonia WSC	Colorado	New WUG	15	18	23	29	35	44	55
Bastrop	Colorado	Current SB2 Projection	1,226	1,460	1,755	2,115	2,518	3,040	3,709
		Previous SB1 Projection	1,307	1,529	1,750	2,005	2,155	2,646	-
		% Change	*-6%*	*-5%*	*0.3%*	*6%*	*17%*	*15%*	-
County-Other	Brazos	Current SB2 Projection	56	93	140	194	257	336	435
		Previous SB1 Projection	317	376	435	499	537	549	-
		% Change	*-82%*	*-75%*	*-68%*	*-61%*	*-52%*	*-39%*	-
County-Other	Colorado	Current SB2 Projection	1,380	2,274	3,428	4,747	6,275	8,210	10,631
		Previous SB1 Projection	5,662	6,705	7,748	8,879	9,545	9,761	-
		% Change	*-76%*	*-66%*	*-56%*	*-47%*	*-34%*	*-16%*	-
County-Other	Guadalupe	Current SB2 Projection	37	61	91	127	167	219	284
		Previous SB1 Projection	65	76	87	101	108	110	-
		% Change	*-43%*	*-20%*	*5%*	*25%*	*55%*	*99%*	-
County-Other (Total)	-	Current SB2 Projection	*1,473*	*2,428*	*3,660*	*5,067*	*6,699*	*8,764*	*11,350*
		Previous SB1 Projection	6,044	7,157	8,270	9,479	10,190	10,420	-
		% Change	*-76%*	*-66%*	*-56%*	*-47%*	*-34%*	*-16%*	-
Elgin	Colorado	Current SB2 Projection	971	1,063	1,193	1,344	1,521	1,757	2,066
		Previous SB1 Projection	1,014	1,113	1,226	1,374	1,442	1,736	-
		% Change	*-4%*	*-5%*	*-3%*	*-2%*	*6%*	*1%*	-
Smithville	Colorado	Current SB2 Projection	651	732	838	972	1,122	1,319	1,577
		Previous SB1 Projection	794	830	922	1,025	1,072	1,283	-
		% Change	*-18%*	*-12%*	*-9%*	*-5%*	*5%*	*3%*	-



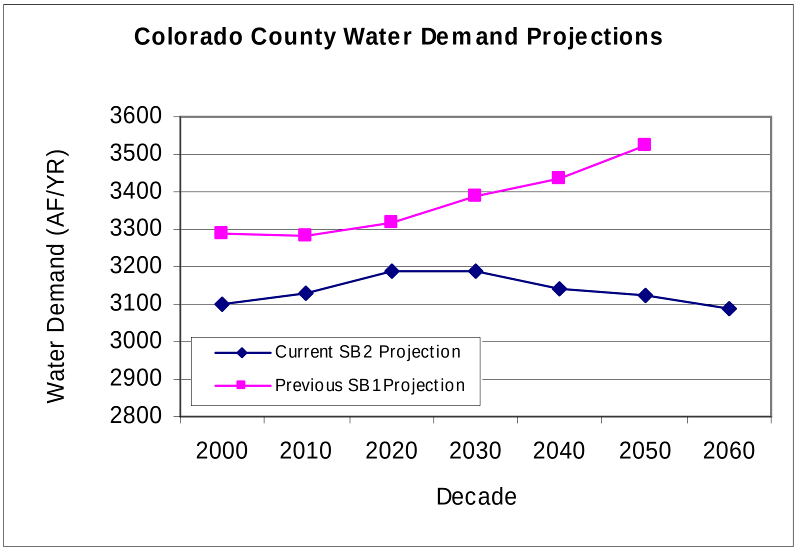
Region K Blanco County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
Canyon Lake WSC	Guadalupe	New WUG	126	188	263	334	397	466	545
Blanco	Guadalupe	Current SB2 Projection	280	303	331	360	381	409	445
		Previous SB1 Projection	377	365	348	340	330	330	-
		% Change	*-26%*	*-17%*	*-5%*	*6%*	*16%*	*24%*	-
County-Other	Colorado	Current SB2 Projection	332	363	407	450	484	526	581
		Previous SB1 Projection	348	401	458	510	532	527	-
		% Change	*-5%*	*-9%*	*-11%*	*-12%*	*-9%*	*-0.2%*	-
County-Other	Guadalupe	Current SB2 Projection	179	195	219	242	260	283	313
		Previous SB1 Projection	285	331	380	424	444	438	-
		% Change	*-37%*	*-41%*	*-42%*	*-43%*	*-41%*	*-35%*	-
County-Other (Total)	-	Current SB2 Projection	*510*	*559*	*626*	*692*	*744*	*809*	*895*
		Previous SB1 Projection	633	732	838	934	976	965	-
		% Change	*-19%*	*-24%*	*-25%*	*-26%*	*-24%*	*-16%*	-
Johnson City	Colorado	Current SB2 Projection	288	320	360	397	429	467	512
		Previous SB1 Projection	352	398	447	490	506	528	-
		% Change	*-18%*	*-20%*	*-19%*	*-19%*	*-15%*	*-12%*	-



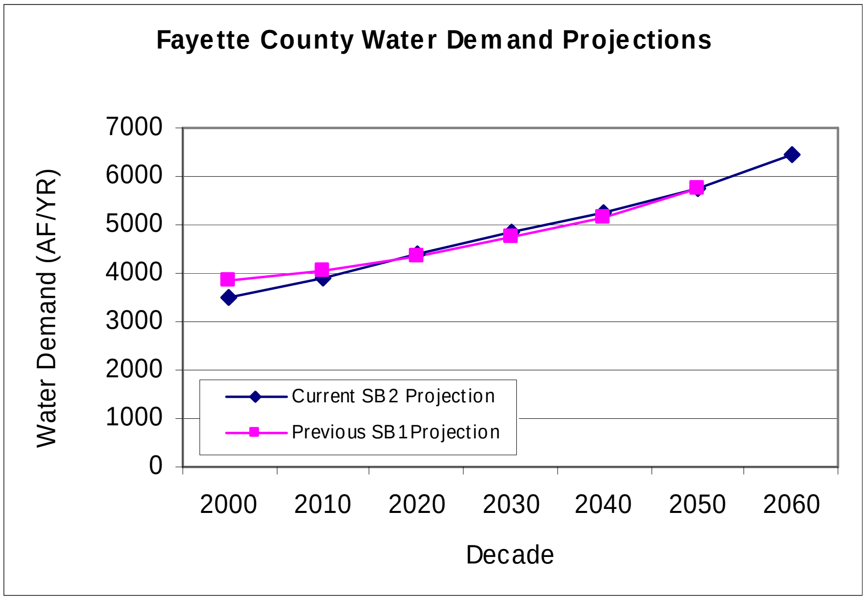
Region K Burnet County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
Chisholm Trail SUD	Brazos	New WUG	15	21	29	37	45	53	63
Kempner WSC	Brazos	New WUG	228	298	381	466	548	636	741
Kingsland WSC	Colorado	New WUG	49	55	63	70	77	85	95
Lake LBJ MUD	Colorado	New WUG	200	227	261	293	324	359	402
Bertram	Brazos	Current SB2 Projection	226	258	295	334	371	412	463
		Previous SB1 Projection	207	200	190	184	185	191	-
		% Change	*9%*	*29%*	*55%*	*82%*	*100%*	*116%*	-
Burnet	Colorado	Current SB2 Projection	849	983	1,143	1,300	1,461	1,635	1,849
		Previous SB1 Projection	912	1,078	1,179	1,286	1,307	1,338	-
		% Change	*-7%*	*-9%*	*-3%*	*1%*	*12%*	*22%*	-
Cottonwood Shores	Colorado	Current SB2 Projection	121	147	177	208	239	271	312
		Previous SB1 Projection	141	160	164	168	170	171	-
		% Change	*-14%*	*-8%*	*8%*	*24%*	*40%*	*59%*	-
County-Other	Brazos	Current SB2 Projection	392	468	566	660	753	853	981
		Previous SB1 Projection	613	686	781	872	890	917	-
		% Change	*-36%*	*-32%*	*-28%*	*-24%*	*-15%*	*-7%*	-
County-Other	Colorado	Current SB2 Projection	1,237	1,479	1,786	2,083	2,378	2,693	3,097
		Previous SB1 Projection	1,580	1,726	1,934	2,134	2,167	2,226	-
		% Change	*-22%*	*-14%*	*-8%*	*-2%*	*10%*	*21%*	-
County-Other (Total)	-	Current SB2 Projection	*1,629*	*1,948*	*2,351*	*2,743*	*3,131*	*3,546*	*4,077*
		Previous SB1 Projection	*2,193*	*2,412*	*2,715*	*3,006*	*3,057*	*3,143*	-
		% Change	*-26%*	*-19%*	*-13%*	*-9%*	*2%*	*13%*	-
Granite Shoals	Colorado	Current SB2 Projection	327	385	453	525	592	669	763
		Previous SB1 Projection	286	345	400	456	471	493	-
		% Change	*14%*	*12%*	*13%*	*15%*	*26%*	*36%*	-
Marble Falls	Colorado	Current SB2 Projection	1,322	1,463	1,639	1,814	1,985	2,178	2,413
		Previous SB1 Projection	1,372	1,624	1,874	2,105	2,177	2,264	-
		% Change	*-4%*	*-10%*	*-13%*	*-14%*	*-9%*	*-4%*	-
Meadowlakes	Colorado	Current SB2 Projection	492	687	916	1,150	1,372	1,618	1,903
		Previous SB1 Projection	453	451	440	441	459	486	-
		% Change	*9%*	*52%*	*108%*	*161%*	*199%*	*233%*	-



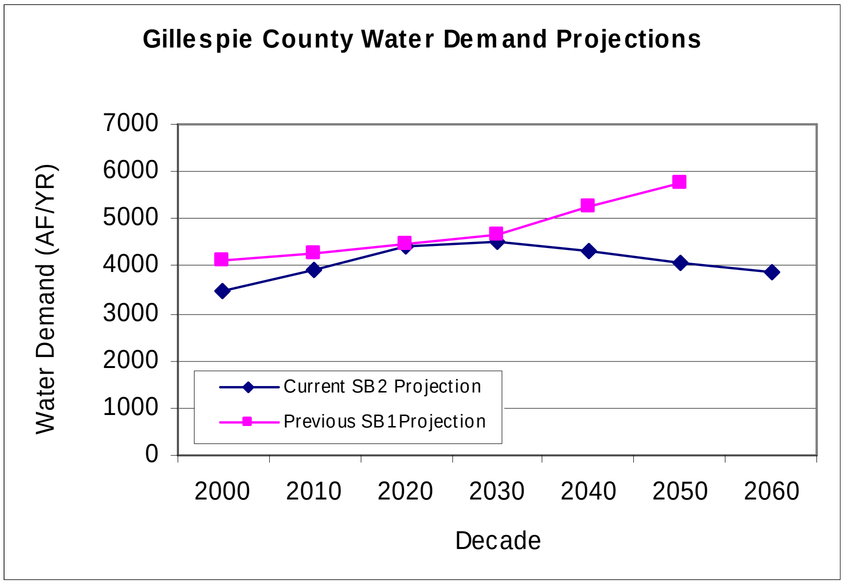
Region K Colorado County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
Columbus	Colorado	Current SB2 Projection	1,009	1,026	1,057	1,067	1,062	1,060	1,048
		Previous SB1 Projection	1,018	1,070	1,126	1,198	1,252	1,321	-
		% Change	*-1%*	*-4%*	*-6%*	*-11%*	*-15%*	*-20%*	-
County-Other	Brazos-Colorado	Current SB2 Projection	113	114	115	114	111	110	109
		Previous SB1 Projection	122	116	110	109	104	104	-
		% Change	*-7%*	*-2%*	*4%*	*4%*	*7%*	*6%*	-
County-Other	Colorado	Current SB2 Projection	721	724	732	725	707	700	692
		Previous SB1 Projection	799	761	732	711	692	678	-
		% Change	*-10%*	*-5%*	*0%*	*2%*	*2%*	*3%*	-
County-Other	Lavaca	Current SB2 Projection	354	355	359	356	347	343	340
		Previous SB1 Projection	253	241	232	226	218	214	-
		% Change	*40%*	*47%*	*55%*	*57%*	*59%*	*60%*	-
County-Other (Total)	-	Current SB2 Projection	*1,189*	*1,192*	*1,206*	*1,194*	*1,164*	*1,153*	*1,141*
		Previous SB1 Projection	*1,174*	*1,118*	*1,074*	*1,046*	*1,014*	*996*	-
		% Change	*1%*	*7%*	*12%*	*14%*	*15%*	*16%*	-
Eagle Lake	Brazos-Colorado	Current SB2 Projection	171	173	176	176	173	172	170
		Previous SB1 Projection	376	380	390	403	412	429	-
		% Change	*-54%*	*-54%*	*-55%*	*-56%*	*-58%*	*-60%*	-
Eagle Lake	Colorado	Current SB2 Projection	395	400	405	405	399	397	393
		Previous SB1 Projection	375	379	390	402	411	428	-
		% Change	*5%*	*6%*	*4%*	*1%*	*-3%*	*-7%*	-
Eagle Lake (Total)	-	Current SB2 Projection	*566*	*573*	*581*	*581*	*573*	*569*	*563*
		Previous SB1 Projection	*751*	*759*	*780*	*805*	*823*	*857*	-
		% Change	*-25%*	*-24%*	*-26%*	*-28%*	*-30%*	*-34%*	-
Weimar	Colorado	Current SB2 Projection	235	237	241	241	239	237	235
		Previous SB1 Projection	154	151	151	153	154	156	-
		% Change	*53%*	*57%*	*59%*	*58%*	*55%*	*52%*	-
Weimar	Lavaca	Current SB2 Projection	102	103	104	105	103	103	102
		Previous SB1 Projection	189	185	187	188	190	193	-
		% Change	*-46%*	*-44%*	*-44%*	*-44%*	*-46%*	*-47%*	-
Weimar (Total)	-	Current SB2 Projection	*337*	*340*	*345*	*346*	*342*	*340*	*336*
		Previous SB1 Projection	*343*	*336*	*338*	*341*	*344*	*349*	-
		% Change	*-2%*	*1%*	*2%*	*1%*	*-1%*	*-3%*	-



Region K Fayette County WUGs - Projected Municipal Water Demands

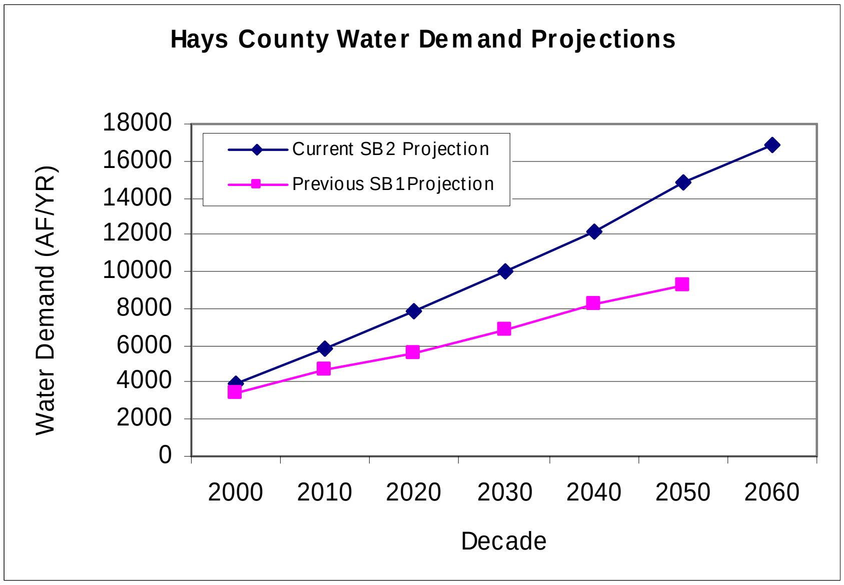
Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
Aqua WSC	Colorado	New WUG	58	80	101	118	131	147	169
Fayette WSC	Colorado	New WUG	509	846	1,193	1,464	1,676	1,933	2,274
Fayette WSC	Lavaca	New WUG	45	74	105	129	147	170	200
Lee County WSC	Colorado	New WUG	167	254	338	407	461	522	609
County-Other	Brazos	Current SB2 Projection	0	0	0	0	0	0	0
		Previous SB1 Projection	2	2	2	3	3	3	-
		% Change	*-93%*	*-87%*	*-94%*	*-96%*	*-92%*	*-96%*	-
County-Other	Colorado	Current SB2 Projection	702	464	307	206	137	93	64
		Previous SB1 Projection	1,386	1,431	1,536	1,654	1,804	2,030	-
		% Change	*-49%*	*-68%*	*-80%*	*-88%*	*-92%*	*-95%*	-
County-Other	Guadalupe	Current SB2 Projection	53	31	18	11	6	4	2
		Previous SB1 Projection	348	360	386	416	454	510	-
		% Change	*-85%*	*-91%*	*-95%*	*-97%*	*-99%*	*-99%*	-
County-Other	Lavaca	Current SB2 Projection	308	185	111	68	41	25	16
		Previous SB1 Projection	76	78	84	91	99	111	-
		% Change	*305%*	*137%*	*32%*	*-25%*	*-59%*	*-77%*	-
County-Other (Total)	-	Current SB2 Projection	*1,063*	*681*	*436*	*285*	*185*	*122*	*82*
		Previous SB1 Projection	*1,812*	*1,871*	*2,008*	*2,164*	*2,360*	*2,654*	-
		% Change	*-41%*	*-64%*	*-78%*	*-87%*	*-92%*	*-95%*	-
Flatonia	Guadalupe	Current SB2 Projection	69	76	82	88	92	97	105
	Lavaca	Current SB2 Projection	239	263	286	306	319	337	363
Flatonia (Total)	-	Current SB2 Projection	*308*	*339*	*368*	*394*	*410*	*434*	*468*
Flatonia	Guadalupe only	Previous SB1 Projection	365	387	406	442	483	532	-
		% Change	*-15%*	*-12%*	*-9%*	*-11%*	*-15%*	*-18%*	-
La Grange	Colorado	Current SB2 Projection	803	963	1,129	1,264	1,362	1,483	1,656
		Previous SB1 Projection	975	1,058	1,173	1,304	1,433	1,593	-
		% Change	*-18%*	*-9%*	*-4%*	*-3%*	*-5%*	*-7%*	-
Schulenburg	Lavaca	Current SB2 Projection	562	644	733	801	853	919	1,012
		Previous SB1 Projection	705	740	756	818	889	977	-
		% Change	*-20%*	*-13%*	*-3%*	*-2%*	*-4%*	*-6%*	-



Region K Gillespie County WUGs - Projected Municipal Water Demands

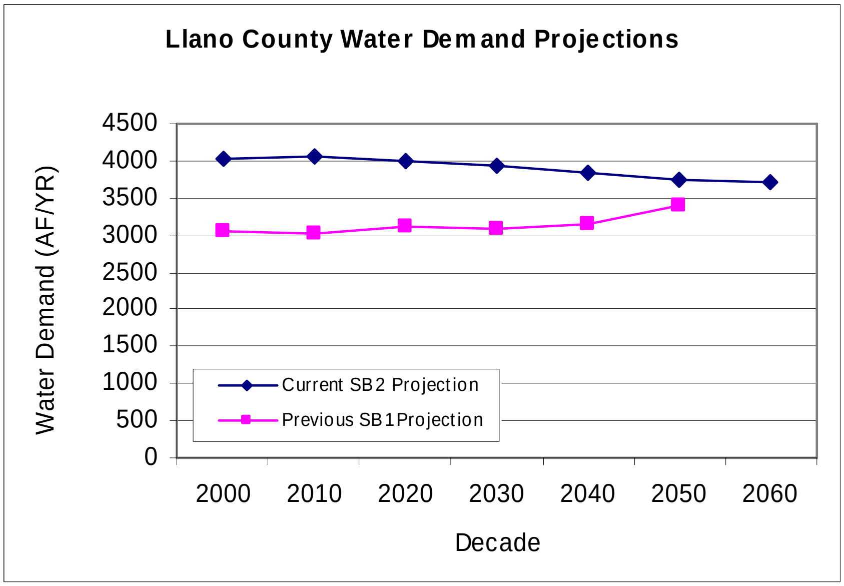
Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
County-Other	Colorado	Current SB2 Projection	1,417	1,581	1,754	1,786	**1,750**	**1,732**	**1,732**
		Previous SB1 Projection	1,712	1,752	1,822	1,882	2,092	2,218	-
		% Change	*-17%*	*-10%*	*-4%*	*-5%*	*-16%*	*-22%*	-
County-Other	Guadalupe	Current SB2 Projection	49	55	61	62	**61**	**60**	**60**
		Previous SB1 Projection	11	11	12	12	13	14	-
		% Change	*347%*	*399%*	*407%*	*416%*	*367%*	*329%*	-
County-Other (Total)	-	Current SB2 Projection	*1,467*	*1,636*	*1,815*	*1,848*	***1,811***	***1,792***	***1,792***
		Previous SB1 Projection	*1,723*	*1,763*	*1,834*	*1,894*	*2,105*	*2,232*	-
		% Change	*-15%*	*-7%*	*-1%*	*-2%*	*-14%*	*-20%*	-
Fredericksburg	Colorado	Current SB2 Projection	2,026	2,299	2,586	2,670	2,502	2,274	2,081
		Previous SB1 Projection	2,407	2,496	2,653	2,781	3,163	3,536	-
		% Change	*-16%*	*-8%*	*-3%*	*-4%*	*-21%*	*-36%*	-

Note: SB2 water demand projections that are in **bold** text, have population revision requests imbedded in the water demand calculations.



Region K Hays County WUGs - Projected Municipal Water Demands

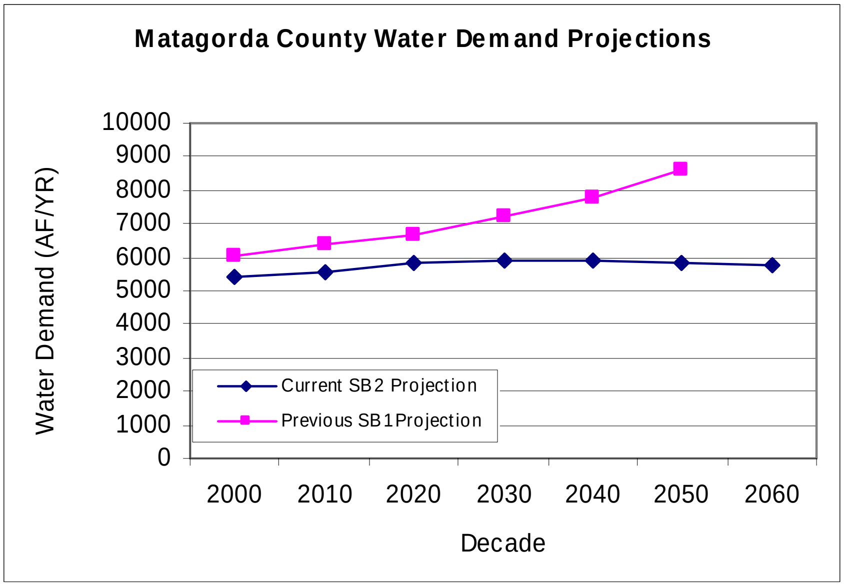
Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
Cimarron Park Water Co.	Colorado	New WUG	327	403	489	582	676	789	882
Dripping Springs WSC	Colorado	New WUG	217	348	501	660	817	1,013	1,166
Hill Country WSC	Colorado	New WUG	209	440	702	980	1,249	1,582	1,844
Mountain City	Colorado	New WUG	89	118	153	189	225	270	305
Buda	Colorado	Current SB2 Projection	385	487	602	721	844	990	1,110
		Previous SB1 Projection	446	830	916	1,093	1,304	1,572	-
		% Change	*-14%*	*-41%*	*-34%*	*-34%*	*-35%*	*-37%*	-
County-Other	Colorado	Current SB2 Projection	2,407	3,551	4,830	6,142	7,476	9,136	10,442
		Previous SB1 Projection	2,604	3,409	4,172	5,139	6,257	6,841	-
		% Change	*-8%*	*4%*	*16%*	*20%*	*19%*	*34%*	-
Dripping Springs	Colorado	Current SB2 Projection	321	438	569	706	844	1,015	1,149
		Previous SB1 Projection	371	428	483	575	688	818	-
		% Change	*-14%*	*2%*	*18%*	*23%*	*23%*	*24%*	-



Region K Llano County WUGs - Projected Municipal Water Demands

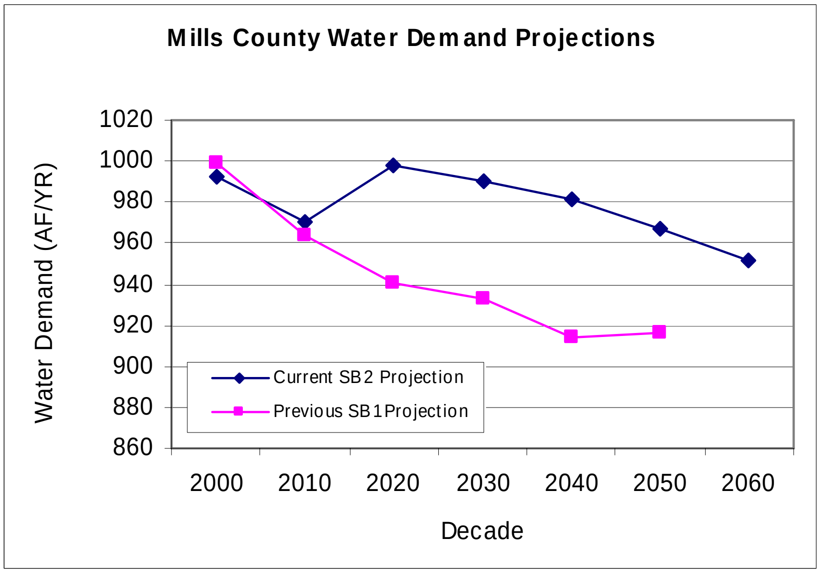
Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Lake LBJ MUD	Colorado	New WUG	1,335	1,339	**1,328**	**1,312**	**1,296**	**1,290**	**1,290**
Sunrise Beach Village	Colorado	New WUG	173	173	171	164	154	145	139
County-Other	Colorado	Current SB2 Projection	976	983	973	**973**	**967**	**962**	**962**
		Previous SB1 Projection	1,485	1,485	1,628	1,668	1,694	1,898	-
		% Change	*-34%*	*-34%*	*-40%*	*-42%*	*-43%*	*-49%*	-
Kingsland (WSC)	Colorado	Current SB2 Projection	560	554	543	**531**	**518**	**514**	**514**
		Previous SB1 Projection	522	502	472	463	472	493	-
		% Change	*7%*	*10%*	*15%*	*15%*	*10%*	*4%*	-
Llano	Colorado	Current SB2 Projection	998	1,005	988	945	889	837	801
		Previous SB1 Projection	1,060	1,033	1,003	955	974	1,002	-
		% Change	*-6%*	*-3%*	*-1%*	*-1%*	*-9%*	*-16%*	-

Note: SB2 water demand projections that are in **bold** text, have population revision requests imbedded in the water demand calculations.



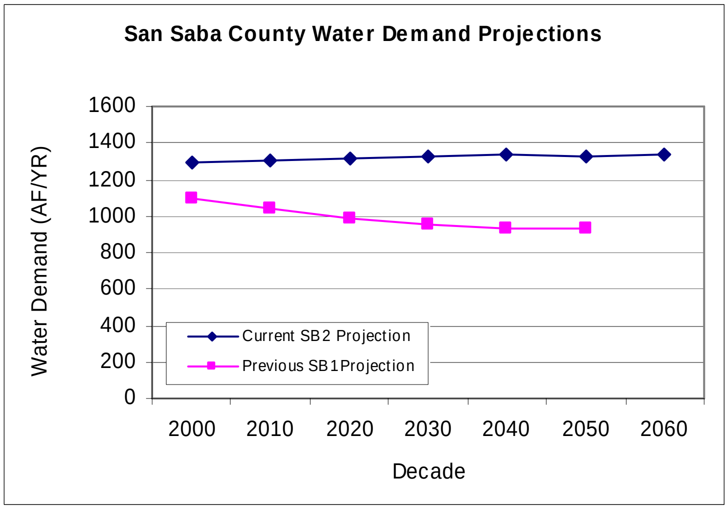
Region K Matagorda County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Orbit Systems INC	Colorado-Lavaca	New WUG	2	2	2	2	2	2	2
Southwest Utilities	Brazos-Colorado	New WUG	78	80	83	84	84	83	82
Bay City	Brazos-Colorado	Current SB2 Projection	3,136	3,236	3,387	3,445	3,441	3,406	3,375
		Previous SB1 Projection	3,340	3,516	3,683	4,003	4,341	4,780	-
		% Change	*-6%*	*-8%*	*-8%*	*-14%*	*-21%*	*-29%*	-
County-Other	Brazos-Colorado	Current SB2 Projection	769	787	815	819	808	796	789
		Previous SB1 Projection	690	713	739	791	845	944	-
		% Change	*11%*	*10%*	*10%*	*4%*	*-4%*	*-16%*	-
County-Other	Colorado	Current SB2 Projection	154	158	164	164	162	160	158
		Previous SB1 Projection	158	167	179	198	219	248	-
		% Change	*-2%*	*-5%*	*-9%*	*-17%*	*-26%*	*-36%*	-
County-Other	Colorado-Lavaca	Current SB2 Projection	567	581	601	604	596	587	582
		Previous SB1 Projection	569	589	611	656	702	788	-
		% Change	*-0.4%*	*-1%*	*-2%*	*-8%*	*-15%*	*-25%*	-
County-Other (Total)	-	Current SB2 Projection	*1,490*	*1,526*	*1,580*	*1,588*	*1,566*	*1,544*	*1,530*
		Previous SB1 Projection	*1,417*	*1,469*	*1,529*	*1,645*	*1,766*	*1,980*	-
		% Change	*5%*	*4%*	*3%*	*-3%*	*-11%*	*-22%*	-
Palacios	Colorado-Lavaca	Current SB2 Projection	716	745	777	787	789	780	773
		Previous SB1 Projection	824	871	916	999	1,086	1,208	-
		% Change	*-13%*	*-14%*	*-15%*	*-21%*	*-27%*	*-35%*	-



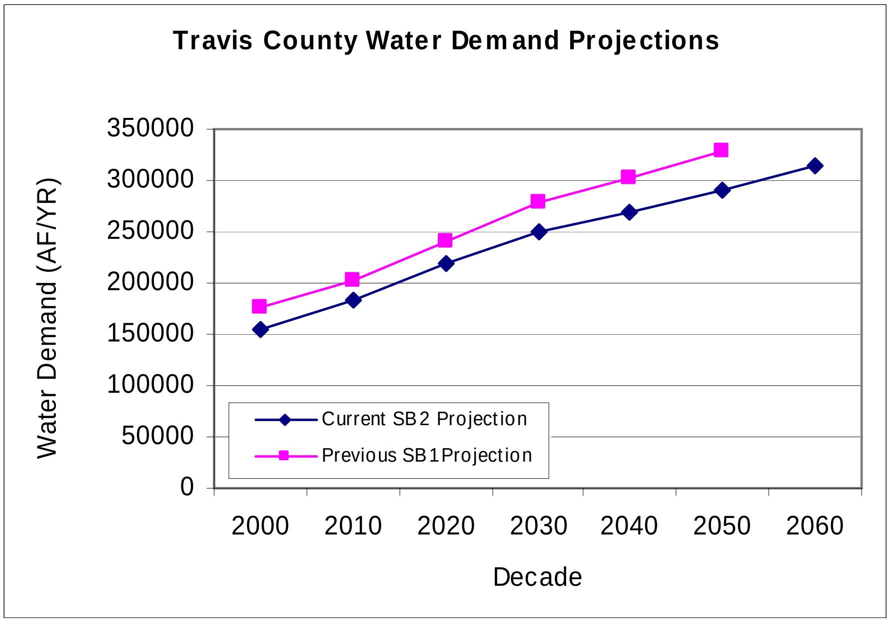
Region K Mills County WUGs - Projected Municipal Water Demands

Region K Municipal Water User	River Basin	Type of Projection	**Municipal Water Demand Projections** (AF/YR)						
			2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Brooksmith SUD	Colorado	New WUG	7	7	8	8	8	8	7
County-Other	Brazos	Current SB2 Projection	165	160	166	163	160	157	154
		Previous SB1 Projection	186	178	173	169	163	163	-
		% Change	*-11%*	*-10%*	*-4%*	*-4%*	*-2%*	*-3%*	-
County-Other	Colorado	Current SB2 Projection	242	235	243	239	235	230	226
		Previous SB1 Projection	255	244	239	234	225	224	-
		% Change	*-5%*	*-4%*	*2%*	*2%*	*4%*	*3%*	-
County-Other (Total)	-	Current SB2 Projection	408	395	408	402	395	388	380
		Previous SB1 Projection	441	422	412	403	388	387	-
		% Change	*-8%*	*-6%*	*-1%*	*-0.3%*	*2%*	*0.2%*	-
Goldthwaite	Brazos	Current SB2 Projection	9	9	9	9	9	8	8
	Colorado	Current SB2 Projection	569	560	573	572	570	563	556
Goldthwaite (Total)	-	Current SB2 Projection	577	568	582	580	578	571	564
Goldthwaite	Colorado	Previous SB1 Projection	558	542	529	530	526	529	-
		% Change	*3%*	*5%*	*10%*	*9%*	*10%*	*8%*	-



Region K San Saba County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
Richland SUD	Colorado	New WUG	185	188	199	207	213	213	215
County-Other	Colorado	Current SB2 Projection	219	227	240	252	264	262	265
		Previous SB1 Projection	404	378	356	341	328	328	-
		% Change	*-46%*	*-40%*	*-33%*	*-26%*	*-19%*	*-20%*	-
San Saba	Colorado	Current SB2 Projection	892	884	877	869	862	856	856
		Previous SB1 Projection	696	662	629	616	599	599	-
		% Change	*28%*	*34%*	*39%*	*41%*	*44%*	*43%*	-



Region K Travis County WUGs - Projected Municipal Water Demands

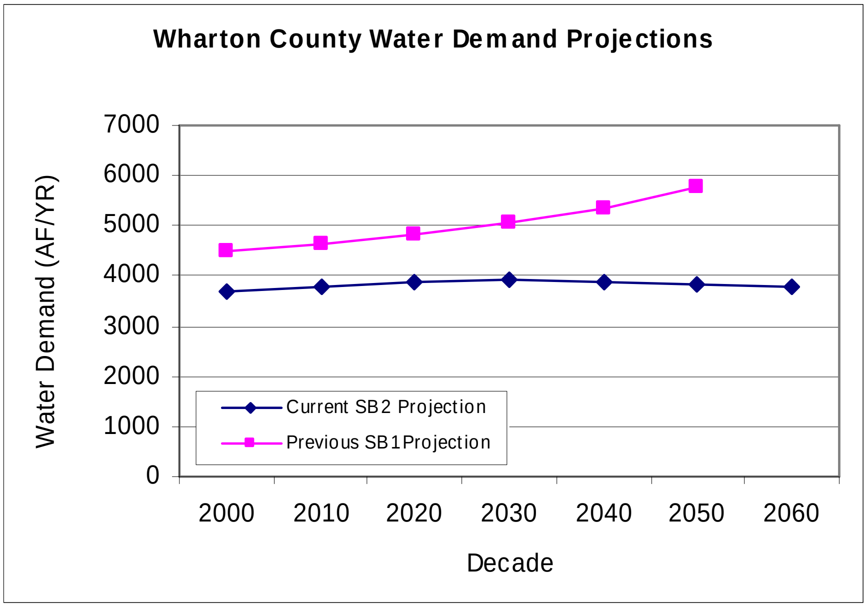
Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Aqua WSC	Colorado	New WUG	868	958	1,097	1,216	1,296	1,380	1,478
Barton Creek West WSC	Colorado	New WUG	403	401	398	395	393	391	391
Bee Cave Village	Colorado	New WUG	343	493	694	879	994	1,116	1,243
Briarcliff Village	Colorado	New WUG	183	254	350	439	494	551	613
Cedar Park	Colorado	New WUG	112	188	290	383	442	505	570
Creedmoor-Maha WSC	Colorado	New WUG	531	612	717	820	884	950	1,029
Creedmoor-Maha WSC	Guadalupe	New WUG	14	16	19	21	23	25	27
Elgin	Colorado	New River Basin	6	9	14	18	21	24	27
Goforth WSC	Colorado	New WUG	24	30	39	47	52	58	63
Hill Country WSC	Colorado	New WUG	145	238	364	483	554	632	713
Jonestown WSC	Colorado	New WUG	107	122	145	164	176	190	205
Lakeway MUD	Colorado	New WUG	460	757	1,154	1,519	1,748	1,991	2,241
Loop 360 WSC	Colorado	New WUG	795	**1,228**	**1,225**	**1,221**	**1,218**	**1,218**	**1,218**
Lost Creek MUD	Colorado	New WUG	951	935	921	906	891	882	882
Manville WSC	Colorado	New WUG	1,291	1,730	2,348	2,895	3,234	3,619	4,015
Mustang Ridge	Colorado	New WUG	80	93	111	128	139	150	162
Mustang Ridge	Guadalupe	New WUG	21	25	30	34	37	40	43
N. Austin MUD #1	Colorado	New WUG	1,007	983	968	952	928	920	920
N. Travis Co. MUD #5	Colorado	New WUG	314	514	792	1,043	1,195	1,364	1,538
River Place on Lake Austin	Colorado	New WUG	919	**1,470**	**1,723**	**1,723**	**1,717**	**1,717**	**1,717**
Shady Hollow MUD	Colorado	New WUG	763	747	731	716	700	694	694
The Hills (= Hurst Creek MUD)	Colorado	New WUG	**525**	**567**	**733**	**733**	**729**	**729**	**729**
Travis Co. WCID #17	Colorado	New WUG	2,037	2,855	3,940	4,961	5,578	6,264	6,970
Travis Co. WCID #18	Colorado	New WUG	688	852	1,074	1,277	1,402	1,533	1,681
Travis Co. WCID #19	Colorado	New WUG	293	376	488	590	655	722	793
Travis Co. WCID #20	Colorado	New WUG	404	462	460	457	456	455	455
W. Travis Co. Regional WS	Colorado	New WUG	537	781	1,113	1,418	1,603	1,809	2,021
Williamson-Travis Co. MUD #1	Colorado	New WUG	144	198	273	343	385	432	481
Windermere Utility Co.	Colorado	New WUG	1,415	**2,157**	**2,222**	**2,201**	**2,180**	**2,180**	**2,180**

Note: SB2 water demand projections that are in **bold** text, have population revision requests imbedded in the water demand calculations.

Region K Travis County WUGs - Projected Municipal Water Demands

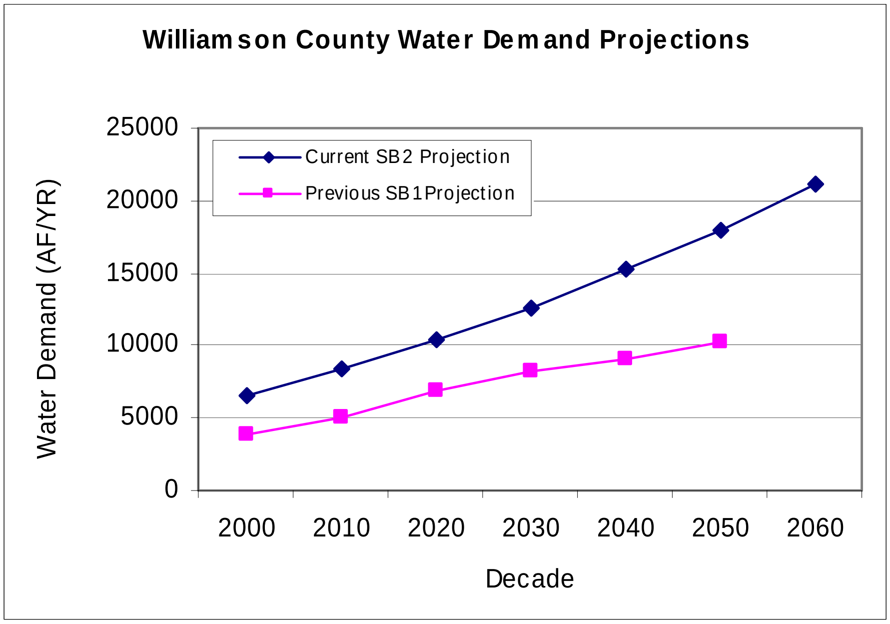
Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR) 2000	2010	2020	2030	2040	2050	2060
Anderson Mill (MUD)	Colorado	Current SB2 Projection	0	0	0	0	0	0	0
		Previous SB1 Projection	35	34	34	33	32	34	-
		% Change	*-100%*	*-100%*	*-100%*	*-100%*	*-100%*	*-100%*	-
Austin	Colorado	Current SB2 Projection	**125,487**	**145,831**	**173,803**	**198,353**	**214,321**	**231,054**	**249,635**
		Previous SB1 Projection	152,755	176,336	210,137	243,955	265,274	289,942	-
		% Change	*-18%*	*-17%*	*-17%*	*-19%*	*-19%*	*-20%*	-
County-Other	Colorado	Current SB2 Projection	3,182	2,278	**1,635**	**1,143**	**711**	**340**	**52**
		Previous SB1 Projection	14,085	14,534	15,854	17,190	17,892	18,892	-
		% Change	*-77%*	*-84%*	*-90%*	*-93%*	*-96%*	*-98%*	-
County-Other	Guadalupe	Current SB2 Projection	0.64	0.61	0.58	0.56	0.54	0.53	0.53
		Previous SB1 Projection	79	82	89	97	100	106	-
		% Change	*-99%*	*-99%*	*-99%*	*-99%*	*-99%*	*-99%*	-
County-Other (Total)	-	Current SB2 Projection	*3,183*	*2,279*	*1,635*	*1,144*	*712*	*341*	*53*
		Previous SB1 Projection	14,164	14,616	15,943	17,287	17,992	18,998	-
		% Change	*-78%*	*-84%*	*-90%*	*-93%*	*-96%*	*-98%*	-
Jonestown	Colorado	Current SB2 Projection	245	280	329	372	400	429	463
		Previous SB1 Projection	243	284	334	400	438	485	-
		% Change	*1%*	*-1%*	*-1%*	*-7%*	*-9%*	*-12%*	-
Lago Vista	Colorado	Current SB2 Projection	1,494	2,005	2,697	3,337	3,729	4,157	4,597
		Previous SB1 Projection	1,821	2,995	2,519	2,995	3,291	3,630	-
		% Change	*-18%*	*-33%*	*7%*	*11%*	*13%*	*15%*	-
Lakeway	Colorado	Current SB2 Projection	2,653	3,527	4,713	5,790	6,461	7,192	7,944
		Previous SB1 Projection	1,587	1,868	2,240	2,693	2,964	3,287	-
		% Change	*67%*	*89%*	*110%*	*115%*	*118%*	*119%*	-
Manor	Colorado	Current SB2 Projection	266	285	312	336	351	368	388
		Previous SB1 Projection	255	313	349	393	419	449	-
		% Change	*4%*	*-9%*	*-11%*	*-14%*	*-16%*	*-18%*	-
Pflugerville	Colorado	Current SB2 Projection	2,909	4,315	6,190	7,921	8,968	10,131	11,328
		Previous SB1 Projection	2,876	3,378	4,061	4,908	5,410	5,963	-
		% Change	*1%*	*28%*	*52%*	*61%*	*66%*	*70%*	-
Rollingwood	Colorado	Current SB2 Projection	380	377	376	374	372	371	373
		Previous SB1 Projection	454	508	588	675	726	793	-
		% Change	*-16%*	*-26%*	*-36%*	*-45%*	*-49%*	*-53%*	-
Round Rock	Colorado	Current SB2 Projection	242	398	604	791	908	1,035	1,166
		Previous SB1 Projection	25	36	51	63	73	85	-
		% Change	*869%*	*1006%*	*1084%*	*1156%*	*1143%*	*1117%*	-
Wells Branch (MUD)	Colorado	Current SB2 Projection	1,527	1,508	1,490	1,472	1,444	1,435	1,435
		Previous SB1 Projection	1,113	1,074	1,013	1,013	1,025	1,064	-
		% Change	*37%*	*40%*	*47%*	*45%*	*41%*	*35%*	-
West Lake Hills	Colorado	Current SB2 Projection	1,435	1,604	1,832	2,047	2,177	2,318	2,469
		Previous SB1 Projection	1,541	1,925	2,420	2,956	3,294	3,682	-
		% Change	*-7%*	*-17%*	*-24%*	*-31%*	*-34%*	*-37%*	-

Note: SB2 water demand projections that are in **bold** text, have population revision requests imbedded in the water demand calculations.



Region K Wharton County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
County-Other	Brazos-Colorado	Current SB2 Projection	1,315	1,338	1,373	1,378	1,360	1,346	1,332
		Previous SB1 Projection	1,204	1,246	1,299	1,368	1,446	1,572	-
		% Change	*9%*	*7%*	*6%*	*1%*	*-6%*	*-14%*	-
County-Other	Colorado	Current SB2 Projection	496	505	518	519	513	508	502
		Previous SB1 Projection	872	897	927	971	1,020	1,106	-
		% Change	*-43%*	*-44%*	*-44%*	*-46%*	*-50%*	*-54%*	-
County-Other	Colorado-Lavaca	Current SB2 Projection	265	270	277	278	274	272	269
		Previous SB1 Projection	238	245	252	265	277	299	-
		% Change	*12%*	*10%*	*10%*	*5%*	*-1%*	*-9%*	-
County-Other (Total)	-	Current SB2 Projection	*2,076*	*2,113*	*2,167*	*2,175*	*2,148*	*2,126*	*2,103*
		Previous SB1 Projection	*2,314*	*2,388*	*2,478*	*2,604*	*2,743*	*2,977*	-
		% Change	*-10%*	*-12%*	*-13%*	*-16%*	*-22%*	*-29%*	-
Wharton	Brazos-Colorado	Current SB2 Projection	1,101	1,141	1,175	1,191	1,189	1,181	1,169
		Previous SB1 Projection	1,578	1,641	1,699	1,793	1,895	2,047	-
		% Change	*-30%*	*-30%*	*-31%*	*-34%*	*-37%*	*-42%*	-
Wharton	Colorado	Current SB2 Projection	503	522	537	544	544	540	534
		Previous SB1 Projection	151	157	163	172	181	196	-
		% Change	*233%*	*232%*	*230%*	*217%*	*200%*	*176%*	-
Wharton (Total)	-	Current SB2 Projection	*1,604*	*1,663*	*1,712*	*1,735*	*1,732*	*1,721*	*1,703*
		Previous SB1 Projection	*1,729*	*1,798*	*1,862*	*1,965*	*2,076*	*2,243*	-
		% Change	*-7%*	*-7%*	*-8%*	*-12%*	*-17%*	*-23%*	-



Region K Williamson County WUGs - Projected Municipal Water Demands

Region K Municipal Water User Group	River Basin	Type of Projection	Municipal Water Demand Projections (AF/YR)						
			2000	2010	2020	2030	2040	2050	2060
N. Austin MUD #1	Brazos	New WUG	112	109	107	106	103	102	102
Anderson Mill (MUD)	Brazos	Current SB2 Projection	1,504	1,464	1,434	1,405	1,375	1,355	1,355
		Previous SB1 Projection	1,963	1,975	1,943	1,986	2,031	2,106	-
		% Change	*-23%*	*-26%*	*-26%*	*-29%*	*-32%*	*-36%*	-
Austin	Brazos	Current SB2 Projection	2,275	3,855	5,688	7,804	10,155	12,686	15,467
		Previous SB1 Projection	1,779	3,037	4,757	6,092	6,905	7,866	-
		% Change	*28%*	*27%*	*20%*	*28%*	*47%*	*61%*	-
County-Other **("COA RETAIL")**	Brazos	Current SB2 Projection	2,696	2,890	3,096	3,316	3,570	3,868	4,247
		Previous SB1 Projection	72	103	144	178	200	215	-
		% Change	*3645%*	*2706%*	*2050%*	*1763%*	*1685%*	*1699%*	-

Criteria for Adjusting Sub-County Water Demands

Texas Water Development Board Requirements Applicable to all Water User Groups

TWDB Exhibit B, Page 40

4.2.5.c Municipal Water Use

Municipal water use is defined as residential and commercial water use. Residential use includes single and multi-family residential 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, i.e., each category uses water primarily for drinking, cleaning, sanitation, cooling, and landscape watering. Reported municipal water use data for the year 2000 was used to calculate the base per capita water use for each city. The municipal water demand projections shall incorporate anticipated future water savings due to the natural installation of plumbing fixtures to more water-efficient fixtures, as detailed in the 1991 State Water-Efficient Plumbing Act. All other future water savings due to conservation programs undertaken by cities, utilities or county-other will be classified as Water Management Strategies (WMSs) by the Regional Water Planning Group (RWPG).

Criteria**:** One or more of the following criteria must be verified by the RWPG and the Executive Administrator for consideration of revising the municipal water demand projections:

1. A revision by the Census Bureau of a city's 2000 population will require revision of the city's annual per capita water use.
2. Any changes to the population projections for an entity will require revisions to the municipal water use projections.
3. Errors identified in the reporting of municipal water use for an entity.
4. Evidence that the year 2000 water use was abnormal due to temporary infrastructure constraints.
5. Evidence that per capita water use from a year between 1995-1999 would be more appropriate because that year was more representative of below-normal rainfall conditions.
6. Trends indicating that per capita water use for a city, utility or rural area of a county have increased over the latest period of analysis, beginning in 1990, and evidence that these trends will continue to rise in the short-term future.
7. Evidence that the number of fixture installations to water-efficient fixtures between 1990 and 2000 is different than the TWDB schedule.

Data Requirements**:** The RWPG must provide the following data associated with the identified criteria to the Executive Administrator of the TWDB for justifying any revisions to the municipal water use projections:

1. Annual municipal water production (total surface water diversions and/or groundwater pumpage and water purchased from other entities) for an entity measured in acre-feet.
2. The volume of water sales by an entity to other water users (cities, industries, water districts, water supply corporations, etc.) measured in acre-feet.
3. Net annual municipal water use, defined as total water production less sales to other water users (cities, industries, water districts, water supply corporations, etc.) measured in acre-feet.
4. Documentation of temporary infrastructure constraints.
5. Drought index or growing season rainfall data to document a year different than 2000 as the dry year.
6. Documentation of the number of water-efficient fixtures replaced between 1990 and 2000.
7. In order to verify increasing per capita water use trends for a city or rural area of a county and therefore revising projections of per capita water use to reflect this increasing trend, the following data must be provided with the request from the RWPG:
    a. Historical per capita water use estimates based on net annual municipal water use for the city, utility or rural area of a county, beginning in1990.
    b. A trend analysis, which must take into account the variation in annual rainfall.
    c. Revised projections of per capita water use for a city, utility, or county rural area, will be submitted by the RWPG (where an increasing trend in per capita water use has been verified for a city or rural area of a county).
    d. Growth data in residential, commercial &/or public sectors that would justify an increase in per capita water use.
8. Other data the RWPG believes is important to justify revisions to the State Water Plan municipal water use projections.

Comments on Region K Municipal Water Demands

1	-----Original Email Message----- Sent: Monday, March 03, 2003 5:15 PM From: Kaye Markette, Severn Trent Services To: Hinojos, Connie (TC&B) Subject: **William -Travis Counties MUD #1** Regional Water Planning This MUD is almost completely built out. We currently have 1,891 connections. Historically we used an average of 18 million per month in 2001; in 2002 we used 16 million per month. The growth you have projected for 2020 and above looks high to me. Please advise. *Region K Reply March 14, 2003:* Water demands are based on a per capita water use rate multiplied by the population. Population projections were sent to the Will/Trav MUD #1 Sept 2002 for review and comment. We received no request for population revisions from this utility Water User Group. Population projections have now been finalized and we are now in the process of reviewing water demand projections. Population projections will be able to be revised again in 5 years during the next plan update process. If you feel that the draft TWDB per capita water use rates do not reflect those experienced in the MUD's service area, please follow the criteria for revisions that were included with the water demands and are also listed below. Thank you for your interest and participation in the State's water planning process. *2nd Region K Reply March 17, 2003:* I spoke with the TWDB this morning and there is a possiblility that we can add an item (to cap the W/T MUD#1 population) at the future TWDB Board Meeting for Water Demand Revisions. Are you requesting that your population be held constant at the Year 2010 projection of 1,699? Attached is a spreadsheet with revisions: << File: WT_MUD1.xls >> The water use information provided in your email (16-18MG/month avg.) does match up well with populations and/or water use rate projections. Please note that we are only responsible for the portion of the MUD's service area that is within Region K (Travis County). Your request for revisions will need to be specific to the Region K portion. Please reply as soon as possible on what the MUD is requesting in terms of population and water demand revisions. You will also need to provide the necessary documentation for service area boundaries etc for whatever revisions you do request (which will need to include Year 2000 actual population and water use data and the future data for your revisions request). If you need to request revisions for the Williamson Co. portion of the MUD's servi *3rd Region K Reply April 16, 2003:* The TWDB has extended the comment period for water demand projections (which in your case would include the potential capping of the MUD's population). I have not heard from you since I replied to your March 3rd email. Does the MUD intend to pursue a Region K revision request?
2	Phone call 3-7-03 from Linda Striker with the **Fayette County Groundwater Conservation District** The FCGWCD is a fairly new entity and the County Judge sent them the Region K comment letter for "County-Other". Why has the "County-Other" water demand decreased so much from the previous planning projections? *Region K Reply :* The decrease is due to the TWDB's reorganization of Municipal WUGs. Previously, utilities etc. were part of "County-Other" & now many have become independent WUGs that are accounted for separately.
3	Phone call 2-18-03 from Bob Mathis, City Administrator for the **City of Buda, Hays County** How were projections calculated? Why are current planning projections lower than the SB1 projections? What is the impact of these TWDB projections other than for plannning? He doesn't think that Dripping Springs should be growing faster than Buda because Buda is on the high-growth I-35 corridor. He will prepare/send projections. *Region K Reply:* We provided the requested information and are <u>waiting</u> to receive Buda's revision request.
4	Phone call 2-12-03 from Mr. Miller - Manager, **City of Lago Vista, Travis County** How were projections calculated? Why are current planning projections lower than SB1 projections? He will go over information we provide him & decide whether or not to prepare a revision request for the City of Lago Vista. *Region K Reply:* We provided the requested information and are <u>waiting</u> to receive a revision request.
5	-----Original Email Message----- Sent: Wednesday, February 12, 2003 7:15 AM From: Bobby Roundtree, Goldthwaite City Manager To: Hinojos, Connie (TC&B) Subject: Water Demand Projections for **Mills County / City of Goldthwaite** Why are current planning projections for "County-Other" lower than the SB1 projections? What caused the decrease - the 2000 census indicated an increase in County population? Why does the City and County projected usage decline during the planning period? *Region K Reply:* We provided the requested information and he is not going to request a revision.

6	FAX 2-12-03 from Mike Willatt - Attorney for **Travis County WCID #19** The WCID has the same comments sent 2-7-03 in response to the Region K population comment letter: There are 191 buildable lots within the WCID's service area and one high school. Currently there are houses on 177 lots. The remaining lots should be built-out within the next few years. *Region K Reply:* Your revision request to have the WCID's population capped were presented to the LCRWPG, but were not selected by the group for submission to the TWDB. There may be a possibility that the TWDB would be willing to address "capping only" population projections with the extra going to "County-Other". Your request will be presented again in light of this possibility.
7	-----Original Email Message----- Sent: Friday, February 21, 2003 3:55 PM From: Jeffrey A. Koska To: Hinojos, Connie Cc: Wyatt Doyle Subject: **Lake LBJ MUD, Llano County -** Projected Water Usage The MUD submits that there are some problems with the estmations derived for Lake LBJ MUD's water demand projections. The majority of the growth in water demand has been in Llano County. We do not foresee any decline in the water use due to a new subdivision that was constructed & the current growth of new homes in this county. We have experienced a 3.9% growth in total demand for the last year, with a 3.56%, 5.06% & a 4.12% growth for a 5,10 & 15 year growth rate, respectively (MUD provided spreadsheet). We do expect accelerated growth in Burnet Co. due to a new Marriot Resort with 350 rooms to be completed in 2004 & growth in an are where developers have had signifcant interest in building new additions. Even without these expanded interest we see a steady growth of 3%. That 3% increase shows a flaw in Lake LBJ MUD's water demand projections. Example is 2020 projections via 3% growth indicates a usage of 856 MG/YR, whereas the TWDB estimates 517 MG/YR. *Region K Reply:* Water demands are based on a per capita water use rate multiplied by the population. Population projections were sent to Lake LBJ MUD Sept 2002 for review and comment. We received no request for population revisions from the Lake LBJ Utility Water User Group. The Llano County population totals were requested by others to be held constant as opposed to decreasing over the plannning period. Population projections have now been finalized and we are now in the process of reviewing water demand projections. Population projections will be able to be revised again in 5 years during the next plan update process. However, from the MUD's spreadsheet, when converted from MG/year to acre-feet/year the MUD's Year 2000 water use is slightly less than that predicted by the TWDB (using the same population). If you feel that the draft TWDB per capita water use rates do not reflect those experienced in the Lake LBJ service area, please follow the criteria for revisions if you would like to submit a revisions request for water use rates.
8	Letter 3-17-03 from Paul Tybor (HCUWCD), **City of Fredericksburg, Gillespie County** The current TWDB water demand projection for City of Fredericksburg Year 2000 is 16% lower than the previous round of SB1 planning and is 18% lower than the City's actual pumpage for Year 2000. In addition, the City's annual pumpage for each of the last 10 years has been greater than the TWDB's current Year 2000 projection (HCUWCD provided historical pumpage chart). As a result, it appears that an adjustment should be made to increase the projected amount for the City of Fredericksburg. In addition, although the HCUWCD does not have any actual pumpage data for the "County-Other" water use in Gillespie County, these "County-Other" projections should also probably be adjusted upward in a manner similar to the City of Fredericksburg. *Region K Reply :* Based on the actual Y2000 water use data in Paul Tybor's February 17th letter for the Year 2000, it looks like the TWDB's Draft Water Use Rate Projections may be too low for the City. We will revise the Y2000 water demand and the corresponding water use rate and will use the same TWDB's rate reductions per decade to project future years water demand projections.

9	Letter 3-6-03 from Chris Lippe, P.E., Director W/WW Utility, **City of Austin, Travis County** Item 4: We have reviewed the current TWDB per capita water use rate projections for the COA & the Year 2000 rate that the TWDB used as the basis for the projections. We anticipate requesting that an alternate per capita water use be used instead. Year 2000 rate is not as high as that used in the previous plan (a mid-1980's drought-of-record rate). Austin implemented mandatory water conservation measures in the summer of 2000, due primarily to infrastructure limitations; &, the total annual rainfall in the Austin area for the Year 2000 was at or above normal. Consequently, Y2000 may not be the best per capita water use rate to represent drought demands for the COA in this planning round. We are researching our historical per capita rates & rainfall to recommend use of a higher per capita water use rate, in accordance with the TWDB's data requirements. <u>Use Y1998 rate = 175 gpm</u> *Region K Reply :* Item 4 (per capita water use rates) of the COA's comment letter meets the TWDB Criteria for requesting revisions to the Region K water demands. Water demands are based on a per capita water use rate multiplied by the population. Population projections have already been finalized by the TWDB and we are now in the process of reviewing water demand projections. Population projections will be able to be revised again in 5 years during the next plan update process. We will request the water use rate revision request from the COA.
10	Letter 3-6-03 from Thomas Stewart, Utilities Director, **City of Marble Falls, Burnet County** Upon reviewing the water demand data, the City of Marble Falls has some serious concerns about the final results. The proposed plan takes water away from the City. The expected growth for the City is expected to be in the 6% - 10% range. There are future developments in the approval stages right now, which will add 1,400 new houses and 150,000 sq.ft. of commercial building in the next few years. As shown in the annual water use from 1995 - 2002 included in this letter, the usage for 2002 is greater than that projected by the TWDB for 2010. The City is examining a reclaimed water system that would reduce the potable water demand in the future. *Region K Reply :* Water demands are based on a per capita water use rate multiplied by the population. The City of Marble Falls did not request revision to the TWDB's population projections when the population demand letters were sent out in September 2002. The comment/revision period for population projections has already ended and cannot be adjusted. Each Municipal Water User Group will have another opportunity to review population projections in 5 years when the next plan update process will occur. However, based on the data in your February 27th letter for the Year 2000, it looks like the Draft Water Use Rate Projections may be too low for the City. We will revise the Y2000 water demand and the corresponding water use rate and will use the same TWDB's rate reductions per decade to project future years water demand projections.

IDENTIFICATION OF WATER SUPPLY SOURCES SURVEY

August 2, 2004 TC&B Project No. 052321353.0001

«WATER_SYSTEM»
«CONTACT»
«ADDRESS1»
«City», «State» «Zip»

Re: **Lower Colorado Regional Water Plan**

Dear Sir or Madam:

Turner Collie & Braden (TC&B) is in the process of updating the 2001 regional water plan for the Lower Colorado Regional Water Planning Group (Region K), which includes your area. The 2001 Region K regional water plan was prepared along with plans from 15 other regional planning areas, which collectively became the 2002 State Water Plan.

The regional planning groups are utilizing new population, water demand projections, and water supply availability estimations to revise and update the 2001 plans in order to meet future water needs in an economical and environmentally sound manner. The regional plans must also take into consideration water conservation and drought management measures. For more information about the regional water planning process refer to the Texas Water Development Board (TWDB) website:
http://www.twdb.state.tx.us/RWPG/what-is-rwp.asp

Each city/ community/ water utility in the region that meets the following criteria is classified as a water user group:

- Cities with a population of 500 or more;
- Individual utilities providing more than 280 acre-feet per year of water for municipal use;
- Collective Reporting Units (CRUs) consisting of grouped utilities having a common association.

The regional water plan requires that the population, water demands, water supply, and water management strategies be determined for each designated water user group in the region.

The Region K revised populations and water demands have already been approved by the Texas Water Development Board, and Region K is now in the process of determining the water supply numbers. We are trying to collect information on the water supply sources for your city/ community/ water utility in order to revise the 2001 regional water plan.

Turner Collie & Braden Inc.

The water supply information will be compared to the water demands to determine where there are water needs or shortages in the region. Water management strategies will be developed for all of the shortages to assure that every water user group in the region will have adequate water supply for the next fifty years.

Please provide the following information on the sources of water supply for your city/ community/ water utility:

1. Contact Information
2. Type of water (groundwater, surface water, purchased, etc.)
3. Name of Water Supply Sources
4. Name of Water Provider
5. Amount of contract/ permit/ water right, or capacity of wells if groundwater is the source of supply and you do not have a groundwater permit
6. Water right/ permit/ contract ID number
7. Year of expiration of contract/ permit

Attached is a form to help you compile the necessary data. Please send your information to the address below or fax the information to (512) 472-7519 by **August 31, 2004**. If you have any questions, please contact one of the Region K consultants, Rebeka Lien with TC&B by phone at (512) 457-7741 or by email at rebeka.lien@tcb.aecom.com.

Sincerely,

Rebeka Lien, P.E.
Project Engineer
Turner Collie & Braden
400 West 15th St, Suite 500
Austin, TX 78701

Region K Water User Group Water Supply Information Form

Contact Information:

City/Community/Water Utility Name: ______________________________

County your City/Community/Water Utility is located in:______________________________

Name of Contact Person: ______________________________

Phone Number of Contact Person: ______________________________

Address of Contact Person:______________________________

Email of Contact Person: ______________________________

Type of Source (Groundwater, Surface Water, etc.)	Name of Water Supply Sources	Water Provider	Amount of contract/ permit/ water right/ well capacity	Water Right/ Permit/ Contract #	Expiration Year
Example: Groundwater	Edwards Aquifer	BSEACD	3,000 ac-ft/yr	Permit # 1234	2005
Example: Surface Water	Highland Lakes	LCRA	2,000 ac-ft/yr	Contract # 456	2010
Example: Groundwater	Carrizo Wilcox Aquifer	Self	3,500 ac-ft/yr	Well capacity	2040 (anticipated well life)

Please send your information to the address below or fax the information to (512) 472-7519 by **August 31, 2004**. If you have any questions, please contact one of the Region K consultants, Rebeka Lien with TC&B by phone at (512) 457-7741 or by email at rebeka.lien@tcb.aecom.com.

Mail to: Rebeka Lien, Turner Collie & Braden, 400 West 15th St, Suite 500 Austin, TX 78701

WILLATT & FLICKINGER
ATTORNEYS AT LAW

2001 NORTH LAMAR • AUSTIN, TEXAS 78705 • (512) 476-6604 • FAX (512) 469-9148

August 24, 2004

Ms. Rebeka Lien, P.E.
Project Engineer
Turner Collie & Braden
400 West 15th Street, Ste. 500
Austin, Texas 78701

Re: Lower Colorado Regional Water Plan

Dear Rebeka:

Enclosed is the completed Region K Water User Group Water Supply Information Form for Travis County WCID No. 19.

Very truly yours,

Mike Willatt

Mike Willatt

MW/jc
Enclosure

1\19\ltrs\lien-8
8/24/04

Region K Water User Group Water Supply Information Form

Contact Information:

City/Community/Water Utility Name: Travis County WCID No. 19

County your City/Community/Water Utility is located in: Travis

Name of Contact Person: Mike Willatt

Phone Number of Contact Person: 512/476-6604

Address of Contact Person: 2001 North Lamar, Austin, Texas 78705

Email of Contact Person: mwillatt @wfaustin.com

Type of Source (Groundwater, Surface Water, etc.)	Name of Water Supply Sources	Water Provider	Amount of contract/ permit/ water right/ well capacity	Water Right/ Permit/ Contract #	Expiration Year
Example: Groundwater	Edwards Aquifer	BSEACD	3,000 ac-ft/yr	Permit # 1234	2005
Example: Surface Water	Highland Lakes	LCRA	2,000 ac-ft/yr	Contract # 456	2010
Example: Groundwater	Carrizo Wilcox Aquifer	Self	3,500 ac-ft/yr	Well capacity	2040 (anticipated well life)
Surface Water	Lake Travis	potable water contr. w/ Travis County MUD No. 4	as needed to serve the 212 lots w/n the Dist.		2026

Please send your information to the address below or fax the information to (512) 472-7519 by **August 31, 2004**. If you have any questions, please contact one of the Region K consultants, Rebeka Lien with TC&B by phone at (512) 457-7741 or by email at rebeka.lien@tcb.aecom.com.

Mail to: Rebeka Lien, Turner Collie & Braden, 400 West 15th St, Suite 500 Austin, TX 78701

IDENTIFICATION OF WATER CONSERVATION STRATEGIES SURVEY

September 28, 2004 TC&B Project No. 052321353.0001

ANDERSON MILL MUD
C/O MICHAEL BAMER-GEN MGR
11500 EL SALIDO PKY
AUSTIN, TX 78750-1375

Re: **Lower Colorado Regional Water Plan**

Dear Sir or Madam:

Turner Collie & Braden (TC&B) is in the process of updating the 2001 regional water plan for the Lower Colorado Regional Water Planning Group (Region K), which includes your area. Region K comprises the following counties: **Bastrop, Blanco, Burnet, Colorado, Fayette, Gillespie, Hays (partial), Llano, Matagorda, Mills, San Saba, Travis, Wharton (partial), and Williamson (partial).** The 2001 Region K regional water plan was prepared along with plans from 15 other regional planning areas, which collectively became the 2002 State Water Plan.

The regional planning groups are utilizing new population projections, water demand projections, and water supply availability estimations to revise and update the 2001 plans in order to meet future water needs in an economical and environmentally sound manner. The regional plans must also take into consideration water conservation and drought management measures. For more information about the regional water planning process refer to the Texas Water Development Board (TWDB) website: http://www.twdb.state.tx.us/RWPG/what-is-rwp.asp

Each city/ community/ water utility in the region that meets the following criteria is classified as a water user group:

- Cities with a population of 500 or more;
- Individual utilities providing more than 280 acre-feet per year of water for municipal use;
- Collective Reporting Units (CRUs) consisting of grouped utilities having a common association.

The regional water plan requires that the population, water demands, water supply, and water management strategies be determined for each designated water user group in the region.

The Region K revised populations and water demands have already been approved by the Texas Water Development Board, and Region K will soon be in the process of determining the water management strategies, with conservation being the first strategy that will be implemented. We are trying to collect information on any currently used water conservation strategies for your city/ community/ water utility in order to revise the 2001 regional water plan.

Turner Collie & Braden Inc.

Water management strategies will be developed for all of the shortages to assure that every water user group in the region will have adequate water supply for the next fifty years. Information from your city/ community/ water utility will be useful in developing the appropriate water management strategies. If your city/ community/ water utility currently has a water conservation or drought management plan in place, we would prefer to list strategies you are already using. If your city/ community/ water utility does not currently have such a plan, we may suggest conservation strategies from a list of Best Management Practices (BMPs) that has been created by the State Task Force on Water Conservation.

Please provide the following information on the water management strategies for your city/ community/ water utility:

1. Contact Information
2. Whether you currently have a Conservation Plan or Drought Contingency Plan in place
3. What conservation strategies are used, if any
4. Results of whether the conservation strategies have been effective, if any
5. Suggestions for alternative conservation strategies you would be interested in

Attached is a form to help you compile the necessary data. Please send your information to the address below or fax the information to (512) 472-7519 by **October 22, 2004**. If you have any questions, please contact one of the Region K consultants, Rebeka Lien with TC&B by phone at (512) 457-7741 or by email at rebeka.lien@tcb.aecom.com.

Sincerely,

Rebeka Lien

Rebeka Lien, P.E.
Project Engineer
Turner Collie & Braden
400 West 15th St, Suite 500
Austin, TX 78701

Region K Water User Group Water Conservation Strategies Information Form

Contact Information:

1. City/Community/Water Utility Name: ______________________________
2. County or Counties (**in Region K**) your City/Community/Water Utility is located in: ______________
3. Name of Contact Person: ______________________________
4. Phone Number of Contact Person: ______________________________
5. Address of Contact Person: ______________________________
6. Email address of Contact Person: ______________________________

Water Conservation Information:

1. Do you currently have a Water Conservation Plan or Drought Contingency Plan in place? (Y/N) ________
2. What Conservation strategies do you currently use? ______________________________
3. How effective has your conservation strategy implementation been? ______________________________
4. Please list probable water conservation strategies that you are or would consider implementing in the future. ___

Water Conservation Information Examples:

1. Do you currently have a Water Conservation Plan in place? (Y/N) **Yes**
2. What Conservation strategies do you currently use? **Ultra Low-Flow Toilet Replacement Program**
3. How effective has your conservation strategy implementation been? **Water Use Reduction of approximately 10%**
4. Please list probable water conservation strategies that you are or would consider implementing in the future. **Development Incentives for Irrigation Conservation (ex. Incentives for businesses with automatic rain shut-offs gages for sprinkler systems)**

1. Do you currently have a Water Conservation Plan in place? (Y/N) **No**
2. What Conservation strategies do you currently use? **N/A**
3. How effective has your conservation strategy implementation been? **N/A**
4. Please list probable water conservation strategies that you are or would consider implementing in the future. **Public Informational Brochures on water conservation savings practices**

1. Do you currently have a Water Conservation Plan in place? (Y/N) **Yes**
2. What Conservation strategies do you currently use? **School Education Program**
3. How effective has your conservation strategy implementation been? **No results yet**
4. Please list probable water conservation strategies that you are or would consider implementing in the future. **Waste Water Reuse for irrigation purposes**

Please send your information to the address below or fax the information to (512) 472-7519 by **October 22, 2004**. If you have any questions, please contact one of the Region K consultants, Rebeka Lien with TC&B by phone at (512) 457-7741 or by email at rebeka.lien@tcb.aecom.com.

Mail to: Rebeka Lien, Turner Collie & Braden, 400 West 15th St, Suite 500 Austin, TX 78701

Region K Water User Group Water Conservation Strategies Information Form

Contact Information:

1. City/Community/Water Utility Name: AQUA W.S.C.
2. County or Counties (**in Region K**) your City/Community/Water Utility is located in: BASTROP, TRAVIS
3. Name of Contact Person: CHUCK KELLOGG
4. Phone Number of Contact Person: 303-3943
5. Address of Contact Person: 415 OLD AUSTIN HWY, BASTROP, TX 78602
6. Email address of Contact Person: CKELLOGG@AQUAWSC.COM

Water Conservation Information:

1. Do you currently have a Water Conservation Plan or Drought Contingency Plan in place? (Y/N) YES
2. What Conservation strategies do you currently use?
   NEWSLETTER TO MEMBERS
   LANDSCAPE IRRIGATION AUDITS
   ELECTRONIC METER READ
3. How effective has your conservation strategy implementation been?
   PUBLIC AWARENESS AND PARTICIPATION IS ON THE RISE. ACTUAL % IS DIFFICULT TO DETERMINE IN A YEAR LIKE THIS ONE SINCE THE RAIN FALL WAS HIGH.
4. Please list probable water conservation strategies that you are or would consider implementing in the future.
   SCHOOL EDUCATION PROGRAM
   WATER AUDIT PROGRAM FOR AQUA W.S.C. DISTRIBUTION SYSTEM
   ALTERNATIVE WATER SOURCE & RAIN FALL CATCHMENT & USE
   DEVELOPMENT OF IRRIGATION DEMONSTRATION PROJECT

Water Conservation Information Examples:

1. Do you currently have a Water Conservation Plan in place? (Y/N) **Yes**
2. What Conservation strategies do you currently use? **Ultra Low-Flow Toilet Replacement Program**
3. How effective has your conservation strategy implementation been? **Water Use Reduction of approximately 10%**
4. Please list probable water conservation strategies that you are or would consider implementing in the future. **Development Incentives for Irrigation Conservation (ex. Incentives for businesses with automatic rain shut-offs gages for sprinkler systems)**

1. Do you currently have a Water Conservation Plan in place? (Y/N) **No**
2. What Conservation strategies do you currently use? **N/A**
3. How effective has your conservation strategy implementation been? **N/A**
4. Please list probable water conservation strategies that you are or would consider implementing in the future. **Public Informational Brochures on water conservation savings practices**

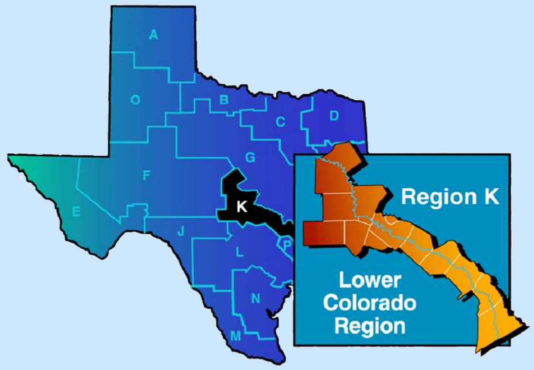
1. Do you currently have a Water Conservation Plan in place? (Y/N) **Yes**
2. What Conservation strategies do you currently use? **School Education Program**
3. How effective has your conservation strategy implementation been? **No results yet**
4. Please list probable water conservation strategies that you are or would consider implementing in the future. **Waste Water Reuse for irrigation purposes**

Please send your information to the address below or fax the information to (512) 472-7519 by **October 22, 2004**. If you have any questions, please contact one of the Region K consultants, Rebeka Lien with TC&B by phone at (512) 457-7741 or by email at rebeka.lien@tcb.aecom.com.

Mail to: Rebeka Lien, Turner Collie & Braden, 400 West 15th St, Suite 500 Austin, TX 78701

APPENDIX 10C

LCRWPG INITIALLY PREPARED REGIONAL WATER PLAN PUBLIC HEARING PRESENTATION



Public Hearing for Initially Prepared Plan Lower Colorado Regional Water Planning Group September 7, 2005 Austin, Texas

1

Lower Colorado Regional Water Planning Group Voting Board Members

Interest	Name	Entity	County	Contact
Public	Julia Marsden	League of Women Voters	Travis	512-306-1325
Counties	Chris King	Wharton Co. Commissioners Court	Wharton	979-335-7541
	Bill Neve	Burnet Co. Commissioners Court	Burnet	512-756-4729
	Billy Roeder	Gillespie Co. Commissioners Court	Gillespie	830-997-7502
	James Sultemeier	Blanco Co. Commissioners Court	Blanco	830-868-4471
Municipalities	Dennis Jones	City of Lago Vista	Travis	512-267-7565
	Teresa Lutes	City of Austin	Williamson	512-972-0179
Industries	Barbara Johnson	Austin Area Research Organization, Inc.	Travis	512-477-4000
Agricultural	Bill Miller	Rancher	Llano	325-247-4074
	Haskell Simon	Rice Industry Rep. and Farmer	Matagorda	979-245-1708
Environmental	Jim Barho	Protect Lakes Inks, Buchanan	Burnet	512-756-8080
	Ron Fieseler	Blanco-Pedernales GCD	Hays	830-868-9196
	Jennifer Walker	Sierra Club, Lone Star Chapter	Travis	512-477-1729
Small Businesses	Ronald Gertson		Wharton	979-234-3130
	Harold Streicher	Assistant Fayette County Attomey	Fayette	979-968-8402
Elec. Generating Utilities	Rick Gangluff	STP Nuclear Operating Company	Matagorda	361-972-7879
River Authorities	Mark Jordan	LCRA	Travis	512-473-4023
Water Districts	Paul Tybor	Hill Country UWCD	Gillespie	830-997-4472
Water Utilities	John Burke	Aqua WSC	Bastrop	512-303-3943
Other(s)	Roy Varley		Mills	325-648-2333
	Bob Pickens		Colorado	979-732-5058
Recreation	Del Waters	The Ski Dock	Travis	512-918-2628

2

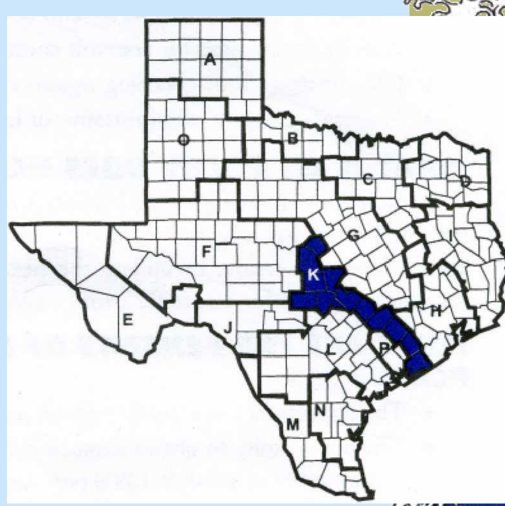
RWPG Planning Efforts

- Regional Water Planning
- Region K Overview
- Population and Water Demand Projections
- Water Supply Estimates
- Water Management Strategies
- Impacts on Matagorda Bay and Natural Resources
- Unique Stream Segments & Reservoirs
- Administrative, Regulatory and Legislative Recommendations
- Public Comment

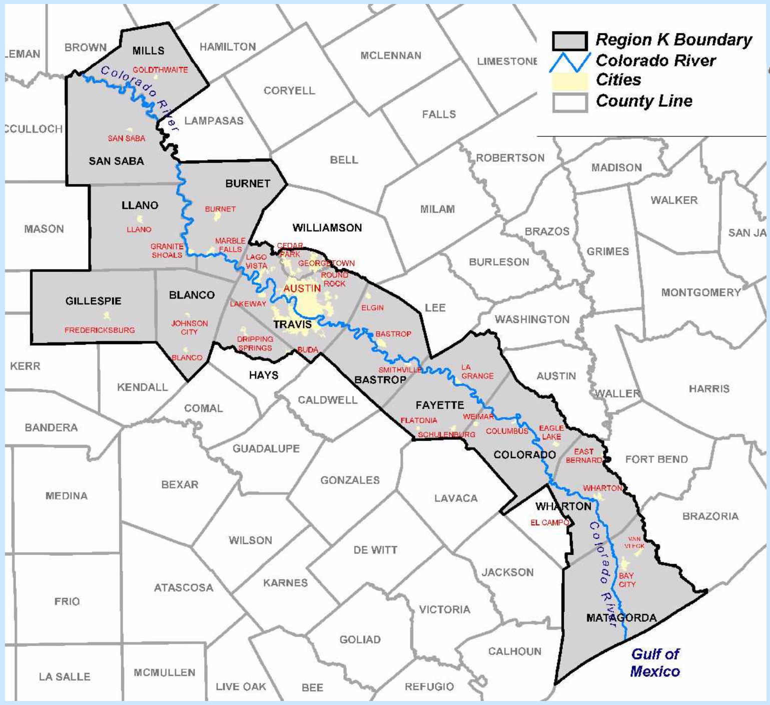
September 7, 2005 RWPG: Regional Water Planning Group 3

Regional Water Plans

- SB1, 75th Legislature
- 16 planning regions
- Each region prepares a 50-year water plan, updated every 5 years
- The State Water Plan lags the Regional Plans by one year
- First plans published in 2001 & 2002



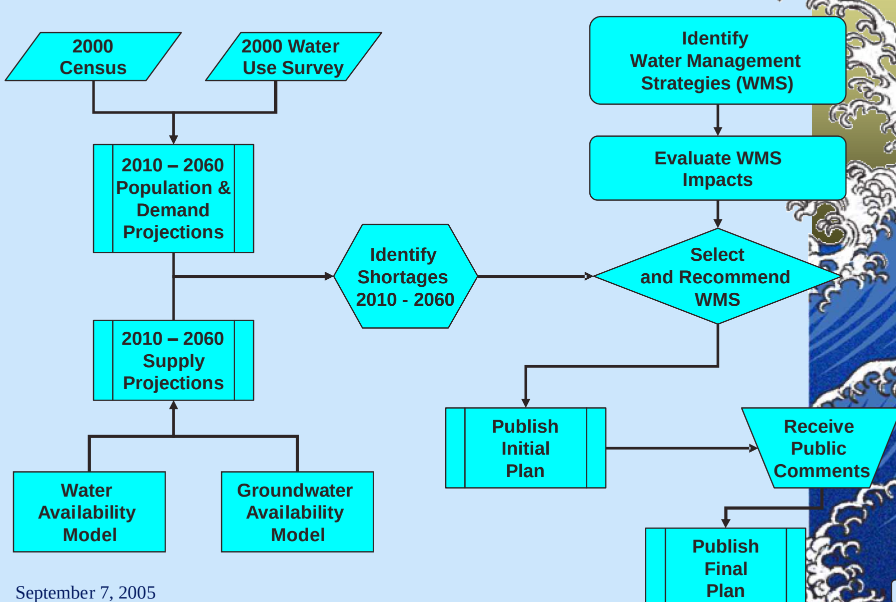
September 7, 2005 4



TCB

5

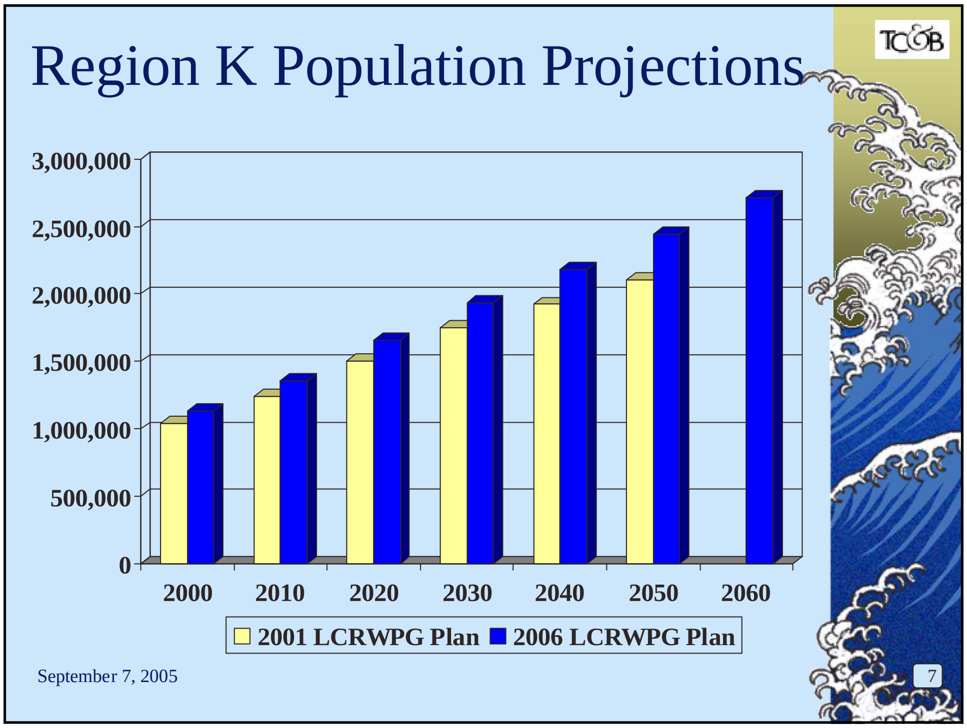
Planning Process

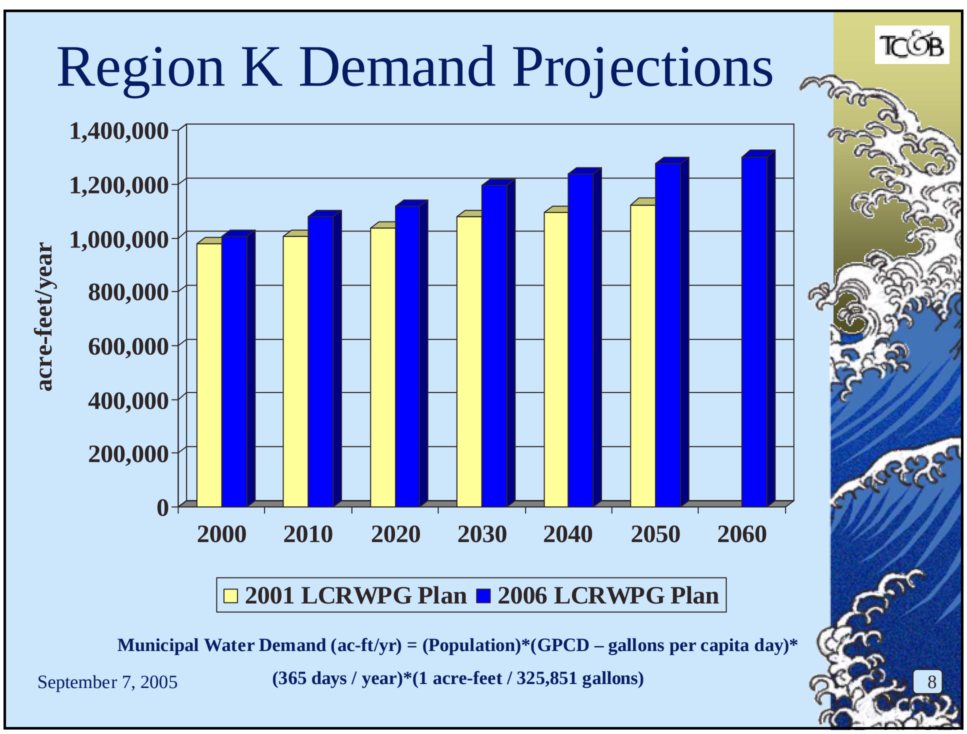


TCB

September 7, 2005

6

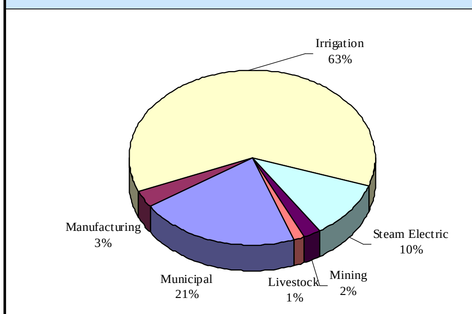

Region K Population Projections
TC&B
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2000
2010
2020
2030
2040
2050
2060
2001 LCRWPG Plan
2006 LCRWPG Plan
September 7, 2005
7

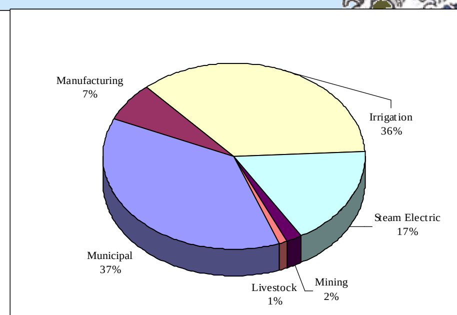

Region K Demand Projections
TC&B
acre-feet/year
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2000
2010
2020
2030
2040
2050
2060
2001 LCRWPG Plan
2006 LCRWPG Plan
Municipal Water Demand (ac-ft/yr) = (Population)*(GPCD – gallons per capita day)*
(365 days / year)*(1 acre-feet / 325,851 gallons)
September 7, 2005
8

Region K Water Demands – Year 2000 and Year 2060

1 million ac-ft/yr

1.3 million ac-ft/yr





September 7, 2005

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Available Water Supply

©*Total Available Supply almost 1.3 million acre-feet*

©*Over 73 percent of total is surface water*

©*Significant differences between 2001 and 2006 plan*

©*Model Adjustments needed*

©*Final difference after "No Call" approximately 30,000 ac-ft*

September 7, 2005

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“No Call” Option For Surface Water

- *Upstream reservoirs in Region F with no firm yield*
- *Water Availability Model (WAM) Run 3 sent water downstream to senior water rights*
- *Model modified to allow water to be held upstream as is more likely to occur during the planning period*
- *Water thus held in upstream reservoirs reduces downstream yield, but supply still above 2001 plan*

September 7, 2005 11

Available Groundwater Supplies

- *Used Groundwater Availability Models (GAMs) as available*
- *In general, used only that amount of groundwater that could be replaced annually*
- *Set controls to maintain 90 percent of spring flows during drought of record and determined availability using that criterion*

September 7, 2005 12

Supply Source	Available Supply (acre-feet per year)		
	Year 2000	Year 2030	Year 2060
Groundwater			
Gulf Coast Aquifer	198,425	198,425	198,425
Carrizo-Wilcox Aquifer	28,400	28,400	28,400
Edwards Aquifer (Balcones Fault Zone)	8,375	8,375	8,375
Trinity Aquifer	16,782	16,440	15,717
Edwards-Trinity (Plateau) Aquifer	1,657	1,657	1,659
Hickory Aquifer	27,380	27,380	27,380
Queen City Aquifer	3,991	3,991	3,991
Sparta Aquifer	9,889	9,889	9,889
Ellenburger-San Saba Aquifer	23,574	23,574	23,574
Marble Falls Aquifer	18,305	18,305	18,305
Other Aquifer [1]	13,558	13,611	13,632
Groundwater Subtotal	**350,336**	**350,047**	**349,347**
Surface Water [2]			
Brazos River Basin	566	566	566
Brazos-Colorado Coastal River Basin [3]	9,649	9,787	9,894
Colorado River Basin [4]	910,730	902,857	904,652
Colorado-Lavaca Coastal River Basin	4,289	4,289	4,289
Lavaca River	4,671	4,671	4,671
Guadalupe River Basin [5]	903	903	903
Surface Water Subtotal	**930,808**	**923,073**	**924,975**
Supplies From Other Regions [6]	**2,127**	**713**	**1,041**
TOTAL LCRWPA Water Availability	**1,283,271**	**1,273,833**	**1,275,363**

[1] Other Aquifer refers to alluvial aquifer water supplies.
[2] Includes local supplies determined from 2001 Plan.
[3] Includes a water right from the San Bernard River with unconfirmed reliability.
[4] Includes firm supplies determined from "No Call" Colorado River WAM for reservoirs and run-of-river water rights.
[5] Includes firm supplies determined from Guadalupe River Basin WAM.
[6] Includes groundwater and surface water from the Brazos, Colorado, and Guadalupe River Basins.

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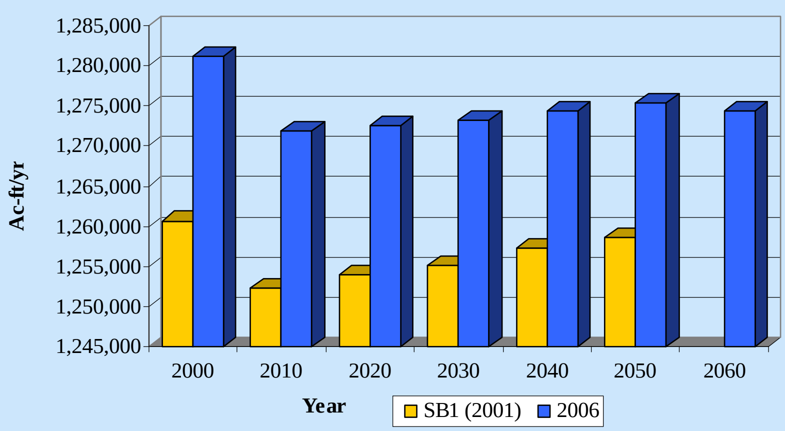
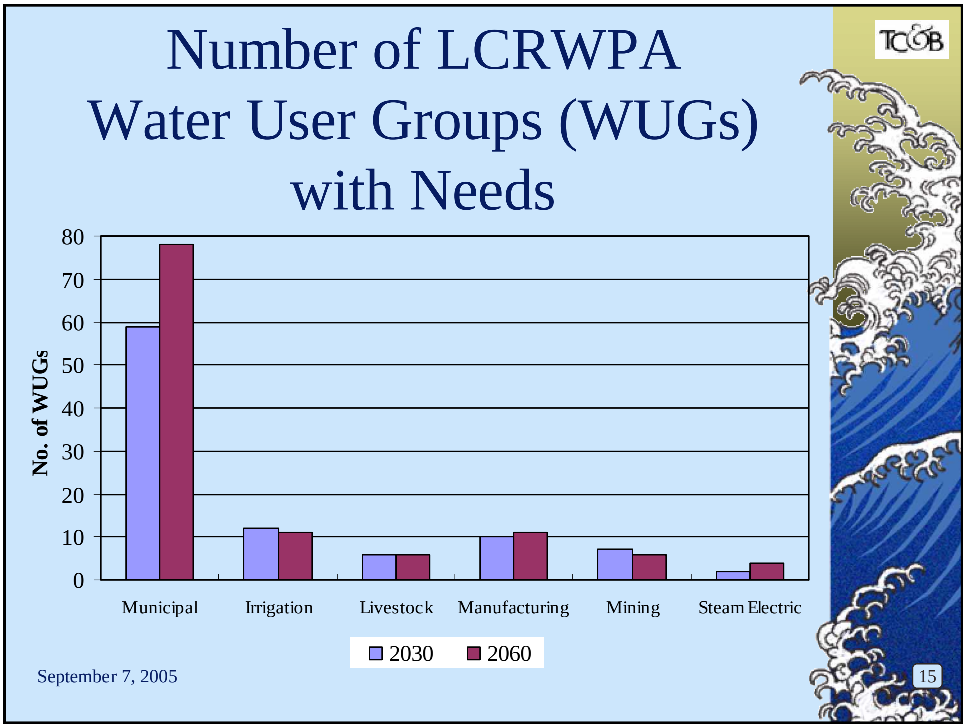
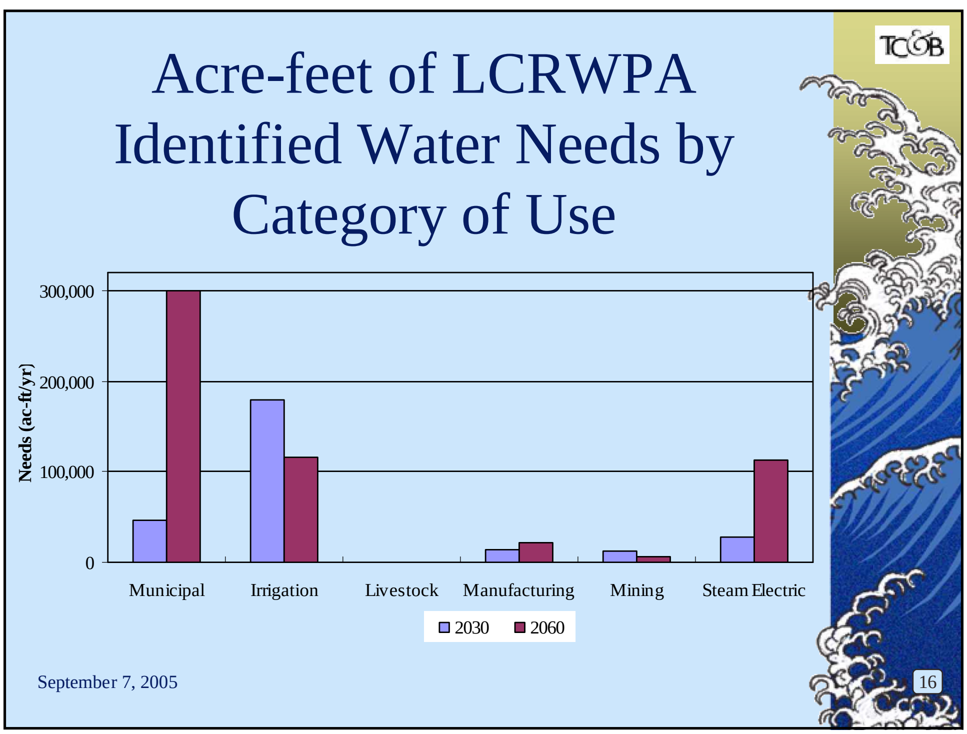
Comparison of Available Supplies with 2001 Plan



September 7, 2005

14


Number of LCRWPA
Water User Groups (WUGs)
with Needs
TC&B
No. of WUGs
0
10
20
30
40
50
60
70
80
Municipal
Irrigation
Livestock
Manufacturing
Mining
Steam Electric
2030
2060
September 7, 2005
15


Acre-feet of LCRWPA
Identified Water Needs by
Category of Use
TC&B
Needs (ac-ft/yr)
0
100,000
200,000
300,000
Municipal
Irrigation
Livestock
Manufacturing
Mining
Steam Electric
2030
2060
September 7, 2005
16

Estimated Return Flows for Water Management Strategies

Return Flows (ac-ft/yr)	2000	2010	2020	2030	2040	2050	2060
Projected COA Effluent minus reuse	96,167	90,701	99,974	102,902	104,423	112,406	117,464
Projected Pflugerville and Aqua WSC Effluent				1,000	4,000	7,500	10,000

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Wholesale Water Provider Strategies

WWP	Strategy	Supply From WMS (acre-feet per year)						
		2000	2010	2020	2030	2040	2050	2060
LCRA [2]	Irrigation Water Right Amendments [1]	(24,000)	(43,000)	(47,000)	(55,000)	(65,000)	(65,000)	(106,600)
	New Contracts (Transfer from COA)	0	0	290	6,833	7,756	8,401	9,115
	Contract Extensions and Amendments [3]	0	7,576	25,974	60,331	108,017	160,296	352,764
	Contract Reductions [4]	0	(22,392)	(22,493)	(22,594)	(22,695)	(22,796)	(27,796)
City of Austin	Conservation	2,000	7,600	13,000	18,800	25,000	29,500	33,537
	Reuse (Municipal & Manufacturing)	2,000	7,600	13,000	18,800	25,000	29,500	33,537
	Reuse (Steam Electric) Fayette	0	9,810	10,004	13,418	21,272	21,386	27,411
	Reuse (Steam Electric) Travis	0	1,680	2,881	7,083	8,285	12,486	13,690
	LCRA Contract Renewal (M&M)	0	0	0	0	0	0	140,323
	LCRA Contract Renewal (SE) Fayette				3,500	3,500	3,500	3,500
	LCRA Contract Renewal (SE) Travis	0	0	0	0	0	0	31,665
	Contract Extensions	0	2,399	2,355	5,557	5,441	5,388	5,388

[1] These amendments are proposed to meet increased municipal and industrial demand within the lower Colorado River Basin and are also a necessary component of the LSWP.

[2] LCRA's irrigation strategies are discussed in Section ES.6.5.

[3] Includes 140,323 and 31,665 ac-ft/yr contract renewals to COA in 2060. These values are also counted below as a COA strategy. Also includes a new contract for Meadow Lakes.

[4] Reduction in LCRA commitments due to improved efficiency at LCRA's Ferguson Plant and COA steam electric power strategies for Town Lake.

September 7, 2005

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Regional Water Management Strategies

- ©*Expansion of Current Groundwater Supplies*
- ©*Development of New Groundwater Supplies*
- ©*Transfers and allocations*
- ©*Temporary Overdraft of Aquifers*

September 7, 2005

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Expansion of Current Groundwater Supplies

Aquifer	Water Management Strategies (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Carrizo-Wilcox	6	4,301	4,644	6,317	3,895	7,991	12,943
Edwards-BFZ	0	17	110	207	305	422	513
Ellenburger-San Saba	19	38	61	90	122	152	243
Gulf Coast	222	4,502	4,277	3,670	2,584	1,212	1,456
Hickory	62	62	62	62	261	261	261
Marble Falls	437	681	756	788	1,010	1,028	1,072
Queen City	321	98	40	40	40	40	40
Sparta	59	188	208	129	129	129	129
Trinity	755	945	1,166	1,423	1,404	1,439	1,393
Other Aquifer	0	0	0	0	0	300	791
TOTAL	**1,881**	**10,832**	**11,324**	**12,726**	**9,750**	**12,974**	**18,841**

September 7, 2005

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Municipal WMS

- ©Conservation required for all WUGs with shortages and per capita use above 140 gpcd (gallons per capita day)
- ©Regional Water Management Strategies
- ©Water Transmission Projects
- ©Off Channel and Channel reservoirs
- ©Recharge Dams
- ©Contracts
- ©Reuse

September 7, 2005

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Municipal Water Conservation by County

County	Supply From Conservation (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Bastrop	0	185	295	481	682	813	991
Burnet	0	265	626	1,041	1,501	2,037	2,676
Fayette	0	21	43	68	81	83	90
Hays	0	105	294	483	558	666	755
Llano	0	279	544	771	906	1,039	1,166
Mills	0	48	94	137	174	206	238
San Saba	0	13	22	19	15	14	15
Travis	0	1,910	4,107	6,166	7,909	9,844	11,843
Wharton	0	41	29	18	8	4	4
Williamson	0	80	50	21	0	0	0
TOTAL	**0**	**2,947**	**6,104**	**9,205**	**11,834**	**14,706**	**17,778**

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Municipal Water Management Strategies

Strategy	WUGs	Supply From WMS (ac-ft/yr)						
		2000	2010	2020	2030	2040	2050	2060
Water Transmission								
Canyon Lake WS to Blanco County	Blanco, Blanco County-Other	225	225	825	825	825	833	863
GBRA Hays County Pipeline	Buda, Hays County-Other		2,800	2,800	2,800	2,800	2,800	2,982
Purchase SW From COA	Hays County-Other		1,100	1,100	1,100	1,100	1,100	1,100
HB 1437	Chisolm Trail SUD, Round Rock	3	36	169	285	376	499	623
Reservoir Strategies								
Goldthwaite Channel Dam	Goldthwaite	0	0	0	0	0	0	0
Goldthwaite Off-Channel Reservoir	Goldthwaite	0	0	0	0	0	0	0
Other Strategies								
Onion Creek Recharge Dams	Hays County-Other				4,000	4,000	4,000	5,043
TOTAL		**228**	**4,161**	**4,894**	**9,010**	**9,101**	**9,232**	**10,611**

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Non-Municipal WMS

- *Non-Rice Irrigation & Manufacturing Strategies*
  - *Expansion of Current Groundwater Supplies*
  - *Transfers and allocations*
  - *Temporary Overdraft*
- *Livestock & Mining Strategies*
  - *Expansion of Current Groundwater Supplies*
  - *Development of New Groundwater Supplies*

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Rice Irrigation Strategies	2000	2010	2020	2030	2040	2050	2060
Continued Use of Austin Return Flows	14,603	17,163	19,723	22,283	24,842	27,402	29,962
Continued Use of Downstream Return Flows [1]	0	0	0	150	600	1,125	1,500
Water Management Plan-Interruptible Water Supply	241,607	238,156	162,892	123,534	84,176	44,819	5,461
On-Farm Conservation			36,480	36,480	36,480	36,480	36,480
Irrigation District Conveyance Improvements			46,220	46,220	46,220	46,220	46,220
Conjunctive Use of Groundwater [2]			95,000	95,000	95,000	95,000	95,000
Development of New Rice Varieties			35,300	35,300	35,300	35,300	35,300
Firm up ROR With Off-Channel Reservoir							47,000
HB 1437 Conservation Strategies	0	4,000	4,000	4,000	4,000	14,700	25,000
Supply Reduction due to LSWP							(106,620)
Transfer ROR Supply to Municipal and Industrial	(24,000)	(38,769)	(42,769)	(50,769)	(58,769)	(68,769)	(88,440)
TOTAL	**232,210**	**220,550**	**356,846**	**312,198**	**267,849**	**232,277**	**126,863**

[1] From Pflugerville and Aqua WSC
[2] Annual Maximum supply

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Steam Electric Power WMS

- *LCRA*
  - *Garwood to Fayette Power Project*
- *STP*
  - *Contract Renewal*
  - *Brackish groundwater desalination*
  - *Rainwater harvesting*
- *COA*
  - *Reuse (direct and indirect)*
  - *Contract Renewal*

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COA Steam Electric WMS

COA SE Strategies	Supply to Meet Shortages (ac-ft/yr)						
	2000	2010	2020	2030	2040	2050	2060
Indirect Reuse [1]		9,810	10,004	13,418	21,272	21,386	27,411
Direct Reuse		1,680	2,881	7,083	8,285	12,486	13,690
LCRA Contract Renewal				3,500	3,500	3,500	35,165
TOTAL	**0**	**11,490**	**12,885**	**24,001**	**33,057**	**37,372**	**76,266**
Town Lake Surplus		(17,392)	(17,493)	(17,594)	(17,695)	(17,796)	(17,796)

[1] Availability of treated effluent could change based on the outcome of pending litigation.

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Inter-Regional Water Management Strategies

- Region L – LCRA-SAWS Water Project
- Region G – HB 1437 water and existing and future contracts
- Region F – Collaboration in modeling to show availability of surface water under the "No Call" planning assumptions

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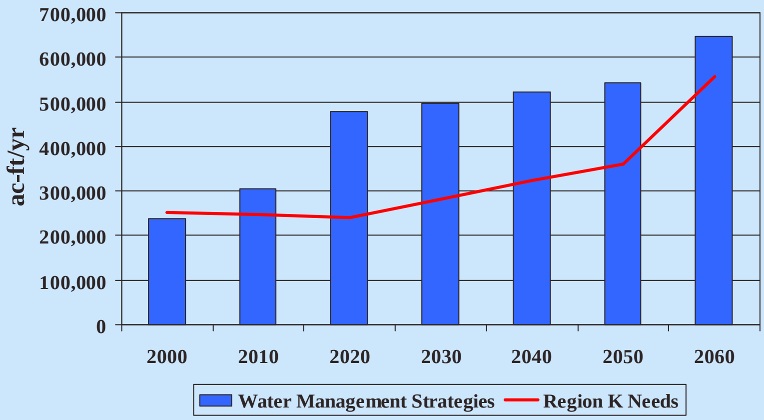
Region K Summary



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Considered Impacts On

- *Water Quality*
- *Existing Water Rights*
- *Instream Flows*
- *Bay and Estuary Freshwater Inflows*
- *Sustainable Aquifer Yield*
- *Agricultural Water Resources*
- *Threatened and Endangered Species*
- *Wildlife Habitat*
- *Public Lands*

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Impact Issues and Considerations

- *Modified "No Call" WAM is of limited use*
- *Instream and Bay and Estuary Flows need further analysis*
- *Existing Conditions "No Call" model does not exist*
- *Better definition and balancing of impacts on downstream rights needed*

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Water Conservation and Drought Management

- *Water Conservation included for all WUGs with shortages and per capita use above 140*
- *Water Conservation recommended for all WUGs with per capita use above 140 but not specified in plan*
- *Model conservation plans included*

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Policy Recommendations

- © *Reaffirmed nine point plan for transfers of water outside the basin*
- © *Recommended development of linked ground and surface water models*
- © *Recommended conjunctive use of ground and surface water to lessen the impact on each and maintain usage at sustainable levels.*
- © *Recommended legislative changes to protect instream flows*
- © *Numerous others*

Ecologically Unique Stream Segments

- © *RWPG considered but did not recommend designation of any segments*
- © *10 segments were listed as deserving further study and consideration for such designation*

TC&B

Public Participation

- *42 open regular meetings during the process*
- *Representatives of each stakeholders group on RWPG*
- *Committees of the group with specific tasks and responsibility for soliciting wider input*
- *Presentations to 20 civic groups*

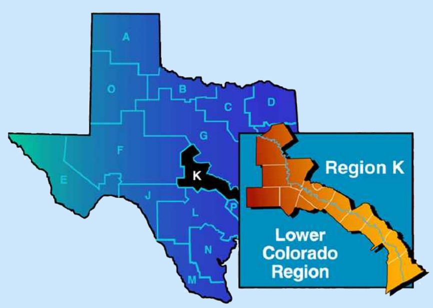
TC&B

Public Participation (cont.)

- *Developed a Web page*
- *Developed a fact sheet for distribution*
- *Participated in radio interview*
- *Issued press releases throughout the process*

Remaining Issues

- *Accuracy of the model*
  - *"No Call" model was introduced late in the process and was not satisfactory to all members*
  - *"No Call" needs much further refinement as a model and the refinement is continuing, it just has occurred too late to be incorporated fully in this effort.*
  - *"No Call" model makes many assumptions for planning purposes that are not reflective of existing legal agreements*
  - *It is the best available for completion of this effort*
- *Other Unresolved Issues*
  - *Many of the strategies are the subject of litigation*



Public Comments

Contact Information

©*Public Comments will be accepted until November 6, 2005*

(verbally at a public meeting/hearing or in writing)

©*Written comments should be mailed to:*

John Burke, Chairman
Lower Colorado Regional Water Planning Group
P.O. Drawer P
Bastrop, Texas 78602
512-303-3943

email: CBraendle@aquawsc.com

website: www.RegionK.org

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APPENDIX 10D

LCRWPG DRAFT PLAN COMMENTS AND LCRWPG RESPONSES

Public Comments

8/23/05 Region K IPP Public Meeting
Two Public Comments/Statements
Herman Brune
Mark Gwin

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PUBLIC COMMENTS

CHAIRMAN BURKE: Okay. **Herman Brune**. Herman? B-R-U-N-E, Herman.

MR. BRUNE: Really I mostly just had questions, but maybe I ought to just go ahead and lay them out there so other folks can hear them and get them answered a little later on, if you-all wouldn't mind.

In the -- in the needs, we're looking at

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the water that's going to be needed in the future, do these needs reflect interbasin transfer to San Antonio? Is that reflected in there in the water needs? So I mean, when we're looking at the water needs that are put on the lower Colorado River, are we in effect considering those water needs as being the needs of San Antonio? That's one of my questions.

CHAIRMAN BURKE: That was included, yes.

MR. BRUNE: Okay. The Region L water district, I went to a meeting down there and listened, and it sounded like San Antonio was kind of backing out on the Guadalupe, that they were not going to look at the Guadalupe. It was not a viable means of gathering water in their SAWS program. And does that put more pressure on us? If they're not going to the Guadalupe, does that put more pressure on the Colorado?

CHAIRMAN BURKE: The only plan right now for water from our basin have been in the SAWS-Alcoa contract and also the Guadalupe-Blanco and right now what we call the LCRA-SAWS diversion is the only demand for Region L on our basin now.

MR. BRUNE: All right. But I mean, having them -- having them say that they're not going to use the SAWS, that they're starting to consider the

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Guadalupe as not being a good source for a reservoir to catch flood waters, does that put more pressure on us trying to supply them?

CHAIRMAN BURKE: No. It's just 150 -- up to 150,000 acre-feet, I believe -- and Karen is back there -- on the LCRA-SAWS diversion, and that's it.

MR. BRUNE: That's it?

CHAIRMAN BURKE: The last time they had 14 different options in our basin, and we've got them down to one, which is the LCRA, and that's a big diversion.

MR. BRUNE: Okay. All right. All right. Let's see, I had another -- oh, all right. One of the -- one of the things here, if we're going to try to keep springs at 90 percent on an average year, am I understanding this correctly that we're going to try to keep our aquifers at a rate where the springs will stay at 90 percent flow? Is that what we just said here?

CHAIRMAN BURKE: That's correct.

MR. BRUNE: All right. And is there not a commission in place that is studying average freshwater inflow into the Gulf for our bays and estuaries? We've got a commission in place that's

studying and trying to put numbers together for each drainage for that, they've got a number on the Sabine, and they're coming down, and they're figuring them all out right now. Well, all right, if we're going to try to have 90 percent flow on the springs, and we come up with an X factor at the Gulf Coast, that leaves very little wiggle room to manage. I mean -- yeah, I'm kind of looking at this going "Where is this coming from?"

If we're looking at the numbers that are saying, you know, our usage is going to go -- in the year 2000 expansion of current groundwater supplies, the total usage in 2000 is 1,881 acre-foot and in 2060 it's 18,841 acre-feet, how are we going to keep 90 percent of our springs flowing and still get freshwater inflow to the Gulf? See?

CHAIRMAN BURKE: You'll have to get a written answer to that one.

MR. BRUNE: All right.

CHAIRMAN BURKE: Okay?

MR. BRUNE: All right. And I guess the

only other question I really -- I had was -- I write for the newspaper, and I write for a Texas fish and game magazine, so sometimes I run into some of these issues. And one thing that kept coming up this year

was impervious cover. And when I talk to the general public, the general consensus is most folks don't know what impervious cover is, but it keeps coming up in proposed legislation. And I just -- I need to know if the small businesses along the river have -- want to comment on how it will affect -- impervious cover will affect them. Or whose responsibility is it to let everybody understand "impervious cover"?

CHAIRMAN BURKE: I'm not sure if it's anybody's responsibility specifically. Impervious cover is -- generally it comes from development, concrete shopping malls, subdivisions, things like that which is -- of course Austin is booming and around Austin is booming, and that's where the highest effect would be, in the Austin area. I don't know whether these towns down here -- how fast they're booming, but up in our area, it's going fast, and that's where most of the impervious cover would be coming from.

And I know Austin and their ETJ has very extensive drainage specifications and detention ponds and all that to help hold water, you know, from the additional impervious cover, but there's nobody that really studies that other than -- I think that's an individual city's -- you know, in their ETJ that they

can do that. But other than that, there's nobody that's in charge of it, just the individual cities and their ETJs, if I'm correct. I don't know of anybody else.

MR. BRUNE: All right. I guess my point is that if we're looking at that much water usage by the year 2060, conservation is going to be one of the key -- key things to save the water for everybody to have enough, and this impervious cover is more than likely going to be one of the key elements to conservation at that point, and people just need to know before they find out that their river authority has management of impervious cover. You know, that was in one of the bills that -- I don't know if it passed or not, but it was certainly proposed to have a river authority manage impervious cover, and people just need to understand what impervious cover is.

CHAIRMAN BURKE: As far as I know, there was no bill passed that gave river authorities -- Karen, was there? She's saying no.

MR. BRUNE: Okay. All right. Well, that will do for me. Thank you-all.

CHAIRMAN BURKE: Thank you. Anybody else want to do a written comment -- verbal comment? This is going to be a short evening if nobody else has

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any questions. Because that's what we're here for, is to get input from you-all. Anybody have any other questions about the plan specifically or anything else?

(No Response)

CHAIRMAN BURKE: If there's no more comments, this thing is going to be over pretty quick. Yes, sir? Come on up, give us your name, and fill out -- yeah, get him a card, and he can fill it out. He's got it? Okay.

MR. GWIN: My name is **Mark Gwin**, and I'm just a little bit curious. I apologize I don't have a better handle on this, but my question is, so this -- you know, San Antonio obviously isn't in this regional, you know, planning group. They're outside, they're in their own group. How is it that you-all work with them? Like how is it that you-all decided -- were you dictated by the state to share water with them? Was that something TWDB said in their state water plan, or is this something that you-all volunteered to do?

CHAIRMAN BURKE: They had a demand over there, and we had a need for additional water for the rice farmers in our region. And through monies expended in the LCRA-SAWS diversion plan -- how much,

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Karen, is that -- I can't remember -- $30 million? It's something like that.

MS. BONDY: Forty-three.

CHAIRMAN BURKE: Forty million dollars in studies that SAWS is paying for. The biggest part of that water comes from conservation in the rice fields, laser leveling, the canals, redoing the canals, the gates that they use to flood with. And, Ronald, if I'm not saying this right, I'll pass it to you, but they use like these little wooden things. You-all have been down there, you've seen the little wooden gates, those will all be automatically telemetered gates that open mechanically, and they can really monitor and get exact amounts of water that are going to those fields when they're laser leveled so it takes a whole lot less water for the rice.

And then the other conservation thing that they have A&M working on now -- and I think I saw a number up there, 35,000 acre-feet, for a new variety of rice that takes less water and --

MR. GERTSON: We're missing one big component here, and that's the off-channel reservoirs that are designed -- the concept is to capture flood flows that are currently not being used. That's probably where the biggest yield would come from in

terms of developing the water that would be needed, and even that water would be shared then between meeting additional needs in this region and meeting needs in Region L.

I think what folks need to keep in mind is that the LCRA-SAWS project, it develops new water, both through the -- well, it both develops new water and makes more water available as a result of conservation. So we're not just taking water out of this basin and sending it to San Antonio and leaving ourselves short. What we're actually doing is creating enough water to meet a part of their demand in addition to the growing demands that we have here in this basin so that we leave both basins better off than they would have been if the project doesn't move forward. That's the goal.

Now, there are certainly a lot of questions about whether or not that can be done, and that is why there's $40 million being spent on studies to see to it that it can be done and be done in a way that it doesn't harm the environment. That's a key element there.

MR. GWIN: So if I'm to understand correctly then, what you're saying is that this region does not have enough water for its own -- within

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itself for its own projected needs, and even if we were to not let any water out of this region, there would still be an ultimate shortfall. And we're preventing that shortfall by developing this, and they're going to protect -- or they're going to gather more -- harvest more water with these instream reservoirs, a portion of that is going to San Antonio, and some of that is coming here, and unless we did that, there would be a shortfall within this region --

CHAIRMAN BURKE: That's correct, yes, sir.

MR. GWIN: -- on the projected demands? Okay. Thank you.

CHAIRMAN BURKE: Anyone else?

(No response)

CHAIRMAN BURKE: You-all are a quiet group tonight. Are you sure? Because this is your chance for public input, because when we close the meeting, comments -- written comments are due November 6th. This is the last day. We have a website. LCRA has a website, John Burke with Aqua Water; it's jburke@aquawsc.com. They can e-mail me or go to the websites with your comments, and I will see that they get to the appropriate place.

(Discussion off the record)

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CHAIRMAN BURKE: You want them to fill out this survey? Okay. They have a survey back here they would like for you to fill out on your way out.

And if there's no other questions, I'm going to close the meeting, and that will end this public meeting. So no one else?

(No response)

CHAIRMAN BURKE: Okay. This meeting is concluded. Thank you very much -- okay. Ron wants to talk. There you go.

MR. GERTSON: I'm sure there are folks here who have further questions who may be a little bit microphone shy. We will hang around here as long as we need to to try and help you get a better understanding of some of these things. So please come forward and ask us what other questions you have, and we'll do our best to answer them. I think if we move into an informal part, you might actually get more satisfaction out of that than this public hearing.

MR. PICKENS: Ron, I'm here locally. I'll be glad to meet with anyone who has further questions. Or as you get into it, now you've heard it, you chew on it, you talk about it, if you have some questions, I'll be glad to meet with you.

MR. GERTSON: I do want to highlight

that once this part of the meeting is closed, if you have questions, we're going to handle that informally. The answers to those questions will not end up in the plan. If you want your questions answered officially in the plan, you need to give us your questions during the -- during the public hearing part. But there are two more public meetings that you can come to. If between now and then you decide you want something officially on the record, you can come to one of those, and you can also do it by sending them in through the written method, the old-fashioned method.

CHAIRMAN BURKE: Okay. Well, with that, this public meeting is concluded. Thank you-all for coming out.

(Proceedings concluded at 6:40 p.m.)

8/30/05 Region K IPP Public Meeting
Six Public Comments/Statements

Bill Pederson
Bob Lanfear
John Graham
Tyson Broad
Tom Weirich
Carter Barcus
John Graham (spoke twice)

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MR. PEDERSON: I'm **Bill Pederson**, and I live in the northeast end of Burnet County and a lot of my groundwater -- I do have a well -- is being

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sucked out by Bell and Coryell County, and I understand that I'm in a different county and a different water district, and hopefully we do get our water district.

And you're talking about giving our water to San Antonio? They're going to pay for it? Well, so they pay for it. Where does that leave me and people like me without water? San Antonio can get their own water from somewhere else. They don't need to take my water. I've got people -- their wells are running dry all around me because of all the subdivisions moving out from Copperas Cove and Killeen.

I want my water. I don't need to be giving it to someone else, selling it to them. It doesn't matter how much money they have. I can't stop somebody from drilling a well, but I feel like I can stop from selling water to Austin and Georgetown and San Antonio. Thank you.

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MR. LANFEAR: I had one question. I'm **Bob Lanfear**. I had one question. Where are they going to get all this new groundwater? You're talking about getting new groundwater. We've got it. We've had it. Where is the new part coming in?

MR. SIMON: Why don't we answer that after we get through with the public statements? We'll get with you on that. Thank you.

MR. GRAHAM: I'm **John Graham** from the

Tow community, top end of Lake Buchanan. My main interest here is the level in Lake Buchanan. I know that you people look at water as a commodity to get rid of it, and I agree with the other speakers that this is something that we don't have to get rid of.

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If you live where I do, I'm the last one to see water, and I'm the first one to lose it.

So I'm looking at it as part of recreational, yet I still use this water for my house. I'm on a well at my house, and I'm like one of these other men that spoke that has problems with his well when the lake starts going down.

Now, I want to say something for the LCRA. This year and the last year, they have done a pretty good job about controlling the level. It's a lot better than it has been in the last ten years that I've been up there, but I would like you to know that there are an awful lot of us that live up to the top end of that lake, and we don't always get a runoff.

Now, the people all around us have got rain, and I'm talking about around us, Llano, across the lake from me, even Paradise Point, which is across a little cove from where I live. They got a half an inch of rain the other day. I got 1/100 of an inch. Today coming over here, it rained on the road coming to my area. It stopped about a half a mile from me.

Now, I know this is not anything that you have control of; the good Lord has still got it, but be careful with our water. We ask you this.

MR. BARHO: I think there's a little bit

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of confusion I would like to try to clear up. I think it's important.

There may be a perception that by the SAWS arrangement, the contract that we have, it's going to affect your groundwater and your other issues in your wells, and let me try to clarify it in a very simple way.

First of all, we have a debt to thank Senator Fraser for some legislation that he passed that assures us that with the sale of water to San Antonio and so forth that our lake levels will not decrease below a certain level. Okay? And he's gotten that written into legislation. That's going to protect the interests of those up here that have a concern or question about lake levels and what we call the surface water.

Most of the water that's going to San Antonio is water that we would not capture in Lake Buchanan or our chain of lakes in the Burnet County area. Most of that water is water that comes from natural rainfall below the last chain of dams in the system. That water now goes through the system and goes out to the Gulf.

So what you're going to see is a scalping of that water, and that's why those

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off-channel reservoirs were placed so far down the Colorado River system, in order to scalp that water that was not being captured up here, was going into those reservoirs, and that's the water that will go to San Antonio.

So that's just a clarification that might help concerns over the well issues and things like that that might put your mind at ease, because if we don't do a deal with San Antonio, then what you're going to find is that the water that's stored in the reservoirs above Austin will have to be used for human consumption here and down below. So you will see a definite decrease if we don't find a solution for it.

MR. SIMON: Tyson Broad?

MR. BROAD: My name is **Tyson Broad**. I'm a resident of Llano. I appreciate the efforts and the long hours this planning group has devoted to developing this plan. Much of this effort has been done without compensation other than a "thank you."

I have not had a chance to review the entire plan. However, I would like to comment about two points. The first point involves population estimates. The 2000 census for Llano County showed a population of 18,034. This plan projects the population for Llano County in 2010 to be 17,360.

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This is also the projected population through 2060. So we're not seeing any increase in population in the next 50 years.

Secondly, the plan has overestimated

water demand by assuming that water use will remain constant even during times of drought. This is not a valid assumption.

Current statute requires all Texas municipalities to implement strategies that curtail nonessential water use during times of drought. For example, LCRA's recently revised water management plan calls for a mandatory curtailment of water supplies of up to 35 percent when the combined levels -- storage levels of Lake Travis and Lake Buchanan fall below 600,000 acre-feet. This 600,000 acre-feet was about the combined storage levels during the drought of record in the '50s.

With such curtailment plans in effect, not only at LCRA but also in all municipalities throughout the region, it makes no sense to assume that water use will remain constant during times of drought. By not incorporating the results of these drought plans into this regional plan, the planning group has created an artificially large demand for water that creates unnecessary planning efforts,

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unnecessary projects and unnecessary expenses. Thank you for your time and your efforts.

MR. SIMON: Thank you, Mr. Broad. That's the only -- end of the comments that people have indicated they would like to make. All these new technical things, on-off switches.

Would anyone else like to make a comment whether or not you filled out a card? Yes, sir. Would you state your name, please?

MR. WEIRICH: My name is **Tom Weirich**. I'm a resident of Burnet County. If the presentation hadn't been so good, I wouldn't have had any questions to ask.

Are there any plans to drill wells from which you can take water out of the aquifers? And if there are plans, along with that plan, are there any -- does it include monitoring wells to know what the recharge rate of an aquifer might be if you take the water out of it? The gentleman back here who first spoke is the one that sort of triggered me to ask this. That may be too detailed a question for you-all to answer, but that's my piece. Thank you very much.

MR. SIMON: Thank you. Since we are apparently getting through quick, if the group would

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like, I would like to answer some of the questions that have been asked, and that is -- we will end the public meeting part of this, and we'll sort of go into an informal session. Can you hear me now?

What I would like to request of the planning group is that we conclude or we adjourn the public meeting part and go into -- while you-all are here and go into informal because I think we can make some comments on some of the comments that have been made. I would like to respond to some so you'll have an answer tonight instead of waiting for the official response on that if that's okay. Yes, sir.

MR. BARCUS: My name is **Carter Barcus**. I said on my card I didn't want to get up here, but since I've heard the plan, I want to say one thing.

I'm very much encouraged about the plans for these off-shore -- I mean, off-channel reservoirs, you know, because since time immemorial all of our flood waters flow out into the Gulf and are wasted, and if San Antonio is willing to build these off-channel reservoirs, that's a Godsend to Burnet County and everybody else upstream.

Now, one thing -- really, the reason I came here to this meeting, I was really concerned with what the plans are for Burnet County and for the

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community of Oatmeal where I live. Who is going to be on our little control board? Is it going to cost us more taxes? If so, how much? You know, Mickey Mouse little questions about -- that I'm selfishly concerned about, those I can put aside and learn about later, but I do want to say I'm very much encouraged by the plans for off-channel reservoirs.

That is the real key to conservation of water in this state. Thank you.

MR. SIMON: Thank you. Anymore, anyone? Have we spurred some discussion? Yes, sir? Would you come up and give us your name, please?

MR. GRAHAM: I meant to ask a question before about it. I'm still **John Graham**. I haven't changed. Have they started building these reservoirs

yet?
MR. SIMON: Why don't we answer that when we -- we'll conclude the public hearing part, then we'll get to that.
MR. GRAHAM: The thing that I heard is that they haven't started building these reservoirs, and the LCRA was supposed to have one down there that they were working on, and someone talked to the LCRA that I know of, and they said they knew nothing about it yet.

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MR. SIMON: Okay. We'll handle that as soon as we conclude the public meeting part.
Okay. Going once, going twice. All right. I would suggest we adjourn the public hearing and meeting, and then I would like to respond to the groundwater questions and some of these others that we have.
MR. BARHO: One of the issues that we have is we have some formalities that we have to follow in regard to the public meetings and so forth.
So what we want to do is retain all the questions and everything, adjourn the official meeting and then answer your questions because we're required to give you a written response back on them, but what we would like to do is have you leave tonight knowing the answer to most of your questions, and we can do that after we adjourn the meeting. So that's where we're at right now. We'll try to address all those questions and open it for anything that we can answer; some we may not be able to. So with that, I'm going to turn it over to Haskell.
Now, we had an issue. I'm sorry.
UNIDENTIFIED SPEAKER: We want to be sure that everybody understands that once the official comment period is adjourned here, we will not be

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responding to questions that you raise informally, but if those questions lead to issues and you want to submit those in writing, then you would still have an opportunity for us to respond.

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(Proceedings concluded at 7:05 p.m.)

9/7/05 Region K IPP Public Hearing
Eight Public Comments/Statements

Daniel Llanes
Margo Clarke
Donna Hoffman
Terry Tull
Ben Vaughan
Dick Kallerman
Jamie Mitchell
Craig Smith

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PUBLIC COMMENTS

CHAIRMAN BURKE: Okay. We don't have a lot of cards. So I'm going to give everybody five minutes and also an egg timer. So when it goes "ding," your time will be up. You can't hear?

(Discussion off the record)

CHAIRMAN BURKE: Okay. I want to give everyone five minutes. I've got a little egg timer. So when you hear it go "ding," your time is up. We may respond -- if you ask questions, if they're simple, we may respond to them. This is not necessarily a dialogue. That is a public hearing, which means it's your time to have input to us and for us to listen. If it's a complex answer, it will be answered in writing later. We won't get into any long dialogues here tonight about any complex issues concerned with the regional plan.

So with those ground rules set out, I have **Daniel** -- is it **Llanes** -- River Bluff Neighborhood Association.

MR. LLANES: Llanes, yes, sir.

CHAIRMAN BURKE: Llanes, okay. Dan, and

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come up. I'm sorry. Come up to the -- come up to the microphone and state your name so the court reporter can --

MR. LLANES: Why do I have to be first?

(Laughter)

CHAIRMAN BURKE: Well, you don't have to be. I can get to you last.

MR. LLANES: Thank you so much. I'm the chair of River Bluff Neighborhood Association, which is on the Colorado River between Longhorn Dam and

Montopolis Bridge. Our association is also part of PODER, which is People Organized in Defense of Earth and her Resources. We are an east Austin environmental justice organization made up of nine neighborhood associations.

I also am the representative for PODER on the Austin-Bastrop river corridor group. I'm not sure what we actually are, but certainly it's everyone interested in preserving the Colorado River.

I'm very happy to be here and to know that there are this many people that care about the water. My families have been here for thousands of years. I am a Mexicano, Azteca/Mexica, Coahuilateca, commonly known as the Mission Indians. So I'm glad to see that in current times people are more interested

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in protecting our brother, the water.

I say this because water is one of the four elements, fire, air, earth and water. Without water we cannot exist. And I'm new to this process so forgive my ignorance or naivete, but one of the first things I'd like to say is that when I look at this pie about need, the stakeholders -- or who is going to get this water? I don't see nature in here. I don't see apportionment for the ecosystem, for the watersheds. And so I made this sign and hope that you will put maybe one of these chairs to represent nature.

It sounds a little dramatic, but it's very real because all of us are a particle of the ecosystem. And as we grow as a population, we can either integrate with nature and perpetuate ourselves into the future or use it all up, turn it into a desert, and we have to move somewhere else.

So I have some notes, and I will happily e-mail you my comments, but I would just like to say that it is important to include apportionments of water for the flowing of the rivers and flowing of the ecosystems for the health of all the waterways which also includes the coast. So if San Antonio is taking water, if Austin is taking water, if the high-tech industry is taking water, if all the population is

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taking water, we make -- we have to ensure that these rivers are going to continue to flow and that we don't apportion out all the water to everybody except the river and the watersheds.

So I would like to see the ecosystems, whatever you want to call it, nature, the watersheds, the bay, the estuaries, the birds, everything else that is part of nature besides us and our concrete, I would like to see that considered in the plan because we're talking about the future. If it's going to 2060 -- I'm 56 years old. I probably won't be around, but hopefully by grandchildren will and my daughter -- and my two daughters. So I see this in a very long term, and having said that, I feel that we're going to have to change a lot of the way that we have been using our water, and that will include, I hear, the idea of conservation.

So like I said, one of my main things here is to say that the natural environment, the ecosystem, must be considered, not a small but a big stakeholder. If 80 percent of the water is used by the municipality in Travis County, this needs to be like 50 percent for the ecosystem. Let us not forget that we are part of the ecosystem. We don't own it.

If I may, there's one thing -- one more

comment about conservation. If there is a conservation strategy in this plan, I would suggest targeting the urban areas. And one of the things -- there's lot of demand, and supply is not happening. In the urban areas, we have an opportunity to capture water and hold it. So if we can in the long term somehow convince municipalities, convince business to use porous parking lots, it would be huge.

I live on the Colorado River, and south of the river is a sea of apartments that have come up in, say, five years. Country Club Creek empties into the Colorado River. Eight years ago the ravine where Country Club entered the Colorado was not much higher than this window here. So in seven years it's 20 feet. See? So the runoff is happening fast, and so that's one way, the pervious cover parking lots.

Also in the urban area, like all over these big buildings and everything and apartment buildings, can all have cistern systems to capture the water. You know, we have ponds to capture the water. We can capture it in the urban area. And as you can see from this, the biggest user is the urban area. So thank you for indulging me, and I appreciate the opportunity.

CHAIRMAN BURKE: Thank you.

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MR. LLANES: If there's any questions, I'd love to answer them.

(Laughter)

CHAIRMAN BURKE: Thank you, Daniel.

(Applause)

CHAIRMAN BURKE: Next is **Margo Clarke**. Did I get that one right? Margo? She represents the public from Austin, Texas.

MS. CLARKE: Good evening. Why do I have to be second?

(Laughter)

MS. CLARKE: I just wanted to reiterate some of the previous comments and just note, first of all, the excellence of effort by the planning group and what a big job we know that you-all have. I used to work for the Lone Star Sierra Club Chapter. So I was involved with the Texas Living Waters project, and so I know a little bit about this planning process and how really arduous it is and how difficult it is to assess all of those factors in trying to plan for our water usage and availability that far into the future. So first of all I wanted to say thank you.

And then I wanted to just go over a couple of things that might not be properly addressed in the plan as it is currently drafted. The LCRA-SAWS

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project, of course, is a really big deal, and we've known about it and talked about it for a few years now already. The fact that the rice farming, agricultural conservation efforts are tied to that project doesn't really make any sense to me. Clearly we need conservation in every way possible. We need to encourage going below the 140 gallons per capita daily limit. We need to, as you have, encourage municipality areas that are not facing shortages to conserve and implement a conservation plan despite the fact that they are not facing a shortage because there's never enough water. There will never be enough water in the way we're using it right now.

And once again, the conservation associated with the rice farming, which is critical because it uses so much water in this area, this regional planning area, being tied to the SAWS-LCRA project is really -- I don't see what the connection has to be. I think that we should approach it with looking for conservation in every way possible and in every place possible and not tie it to a large water project which may have really crippling environmental impacts on the freshwater inflows to our bays and estuaries.

And as has already been mentioned,

maintaining environmental flows in our rivers is just critical. We have water permitted out of our rivers and being taken out of our aquifers that is already -- if it were all being used as it is permitted, we would face crisis across the entire state. And the fact is that our Gulf Coast is a huge part of our economic base and our environmental base of acting as a nursery for our seafood and ocean species.

So you cannot separate the rivers from the Gulf, you cannot separate the springs from the rivers, and you cannot separate conservation from any of it because we have -- water is our most precious resource, and we have come to think of it as free. You still see people sweeping their driveways with a hose. It just -- it makes my heart clinch when I see that, and you just -- we have to remember there is no life without water, not just our life, but the life of the rivers, the life of the wildlife, the life of the ecosystems and, of course, our bays and estuaries.

So I would just encourage you to do strong environmental assessments of such an enormous project as the LCRA-SAWS and stronger emphasis on conservation in all areas and not tied to a particular project. And once again, thank you for your good work, and hang in there. Thank you.

CHAIRMAN BURKE: Margo, if you'd like more information, Mark Jordan up here with LCRA, if you will get with him, he will make an appointment with you, and he can explain the joint sharing plan in great detail that we are not going to go into here tonight.

MS. CLARKE: Okay. I'll do that.

CHAIRMAN BURKE: And also, Daniel, are you still here?

MS. JOHNSON: He left.

CHAIRMAN BURKE: He left, okay.

All right. Next we have Donna Hoffman, Lone Star Sierra Club, wishes to make a statement.

MS. HOFFMAN: Hi. My name is **Donna Hoffman**. I'm here to make comments on behalf of the Lone Star Chapter of the Sierra Club. Before I begin, I'd like to thank the planning group members for all of your hard work and the time spent on updating the regional water plan and also for providing this opportunity for input.

We'd like to commend the planning group for including environmental water demands in the plan and for your recommendation of an advanced conservation plan for water user groups that are expected to have a water shortage in the next 50

years. We feel that these are essential components of a good plan. We also commend the planning group on their policy of sustainable groundwater pumping and working cooperatively with groundwater conservation districts.

Some of our concerns include the following: First, the plan does not recommend drought management strategies to meet projected shortages. Current statute requires all Texas municipalities to implement strategies that curtail nonessential water use during times of drought, and the Texas Water Development Board rules mandate consideration of reasonable levels of drought management in the planning process to meet projected needs.

This regional plan is based on drought of record conditions, and it only makes sense that drought management should be a big part of planning for that drought period. By not incorporating the effects of drought management, the planning group is creating an artificial demand for water that could result in unnecessary planning efforts, unnecessary projects and unnecessary expense. The Sierra Club recommends incorporating drought management as a water management strategy.

Second, the plan did not fully assess

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how environmental flows are affected by current and proposed water supply projects. Texas Water Development Board rules require the planning group to perform a quantitative analysis of impacts to the environment -- to the environment from proposed water management strategies. This analysis should include a comparison of current environmental conditions to future environmental conditions.

Finally, in regards to the LCRA-SAWS project, we are concerned, both about the level of groundwater pumping proposed in the lower counties and the possible harm to the Colorado River and Matagorda Bay and its estuary from a lack of freshwater inflows. Maintaining aquifer levels is essential for the long-term economic viability of that part of the region, and adequate inflows are critical to the health of the bay and tourism and fishing industries along the coast.

We urge the planning group to closely follow the studies that are currently underway as part of the project and to not accept this project if it is determined that it will mine the Gulf Coast aquifer or harm the Colorado River or Matagorda Bay. So the Sierra Club commends the water planning group, yourselves, on aspects of the plan, and we also have

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serious concerns that I've stated that I hope you'll take into consideration. Thank you.

CHAIRMAN BURKE: **Terry Tull**, regional water quality planning project for the Barton Springs zone. Terry?

MR. TULL: I have something I'd like to pass to the committee, if that's okay.

CHAIRMAN BURKE: Sure.

MR. TULL: What I've passed around is the executive summary from something that's called the Regional Water Quality Protection Plan for the Barton Springs Segment of the Edwards Aquifer, and what I'm going to do is make a few observations with a fairly narrow focus relating to water quality issues that I think need to be addressed in the Region K plan.

I hope to do this within the time you've allotted me, but just in case I run out of time, let me jump to the punchline, if you will, first and basically make two points for you. The first being that I think, based on the experiences we've had in developing this plan, that your effort needs to give more focus to the implications of water quality in terms of availability of adequate amounts of water for your needs. I think that the plan very much sort of understates or underemphasizes water quality issues

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and how to protect them.

And then secondly, with the work that's been done in this regional planning effort locally, I think we've given you some very good tools that you can use to draw from to look at some of the issues of water quality that you could embrace within your plan. Now, let me back up and start at the beginning.

Again, my name is Terry Tull, and I've spent the last couple of years as the executive director on this planning effort which was an effort -- a voluntary effort on the part of 13 jurisdictions, three groundwater districts, three counties and seven local municipalities, to look at how we might protect the water in the Barton Springs zone. Mr. Fieseler from Blanco County is one of the members that sat on our oversight committee. So it's good to see you tonight.

MR. FIESELER: It's good to see you.

MR. TULL: Hopefully you've been carrying this message to them through their work.

MR. FIESELER: I think we'll make use of this in the next planning cycle for sure.

MR. TULL: The 13 jurisdictions that I said was funded -- this was a serious effort. It was funded in total of about $420,000, $148,000 from the

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Water Development Board, another $100,000 from LCRA, about $15,000 from local jurisdictions that I mentioned and then another $155,000 in in-kind contributions from people, from municipalities, from companies who all wanted to see this thing succeed.

We hired a consultant, Naismith Engineering, to do the engineering, the research and produce the product which you see here. We organized a stakeholder group of 27 members who represented eight different categories of stakeholders, property owners, developers, local governments, business interests, environmental groups, concerned citizens and others. So it was a real genuine, open, public effort that was soundly based in science and good engineering, we believe. We even had a technical review group, an outside group, to peer review the product.

What did the plan tell us by the time we finished? Well, first of all, that the stakeholders agree on a number of things, and this is, of course, across the whole variety of stakeholders. First of all, some guiding principles: They agree that there's a preeminent need to protect our water resources; that private and public entities have a responsibility to do no harm with their efforts, particularly in

addressing water resources; that those who benefit from some activity should pay the costs; in other words, balance rights with responsibilities; that we should favor actions that minimize risk to our water resources; that we should balance our water regulations with economic incentives; we should discourage exemptions and exceptions; we should be fair to everybody, and no single interest should have a predominant right or control over the process.

The goal in the end should be to maintain or enhance our water quality. We found that uncontrolled urban development can harm water quality and quantity in streams. And when I talk quality, I'm talking about the amount in the streams as well.

Will you bear with me just for another moment or two?

CHAIRMAN BURKE: Another 30 seconds. Go for it.

MR. TULL: Okay. A host of measures were recommended from natural area and conservation, comprehensive predevelopment review, setbacks from streams, density limits and so forth. At the end of this process, we had near unanimous agreement as to the goals and the measures that should be implemented to protect the water quality.

Why this is important, I think, for you is because your plan, at least the draft I reviewed, says 77 percent of your region resides in the Austin-Travis County area. The people are all clumped up there, and your population will double by 2060 with 75 percent of that growth occurring in the same area. Well, that's the same area that we're talking about here. And what we found from our research is that we already got more density in those areas than will allow us to maintain water quality going into the aquifer and down the streams.

Your plan calls for 27 percent of your dependable water supplies during the drought of record to come from groundwater. What we found is that the groundwater already is at risk, and if you look at this kind of growth without implementing some kind of measures to protect the stream flow and the groundwater, then you run the risk of losing that resource which your plan is banking on in the future. So --

CHAIRMAN BURKE: One more closing thing.

MR. TULL: Okay.

CHAIRMAN BURKE: Okay.

MR. TULL: I think I'll leave it there. I will give you a copy of my outline of remarks.

CHAIRMAN BURKE: Okay. And we'll put that in the record.

MR. TULL: I appreciate you considering those. I do want to say as others have said, thank you very much for what you're doing. I think it is very important for all of us. Plans are important -- as we saw in the Gulf Coast, plans are important, but what's even more important is if we implement the plans we've got in place. Thank you very much.

CHAIRMAN BURKE: Thank you. Next, **Ben Vaughan**, Coastal Conservation Association.

MR. VAUGHAN: Good evening. I am Ben Vaughan here on behalf of the Coastal Conservation Association, which is a group of about 50,000 members who have been intensely interested in maintaining the salubrity of the bays and estuaries of the coast of Texas.

Several comments: Again, thank you for all of your effort that would be directed to the study. I would suggest one, that Region K not sacrifice its bays and estuaries in the interest of a dubious assistance to Region L's problems, to solving Region L's problems. I think that studies will show and they have studies that have shown that with well-considered management of the Edwards and other

resources available to Region L that they can handle their water problems. It's not clear that the LCRA-SAWS project is in San Antonio's best interest. Likewise, it is not clear what the ultimate cost of the LCRA-SAWS enterprise would be. I could suggest that the cost of pumping water 150 miles uphill with 11-dollar gas is different than it is at $2 in MCF gas.

The studies for maintaining bay health are ongoing. Take advantage of those studies. You have them both in the efforts being made by the study -- the engineering study committee for the LCRA-SAWS project by The University of Texas Marine Science Institute.

With respect to interbasin transfers, in order to avoid damaging the basin of origin, these transfers should be limited to the consumed amounts under the permits, not simply the stated paper amounts of the permits.

My suggestion also is that you might think again about the water demand as a function of the estimated water cost. I submit to you that St. Augustine grass will not grow on $1,000 an acre-foot water.

Let's see. There's -- I suggest that

you include instream flows and bays and estuaries as a water user group. Support in your program, if you can, the public purchase of water rights for the Texas water tranche (phonetic) to be sure that there is water running into the bay. It's a shame to think that the state of Texas has got to buy back water that it already owns because water that's flowing in that river is supposed to belong to the state. But as one rather sage gentleman once told me, "The problem with Texas water policy is original sin, we didn't do it right to start with, and there was no reservation in these permits at the outset."

Again, thank you so much for your efforts. This type of service is -- of yours is indispensable to the maintenance of a regional water policy. Thank you.

CHAIRMAN BURKE: Okay. I have one last card. If anybody else wants to fill one out, this is the last one I have.

So, Dick -- is it Kallerman -- from Austin.

MR. KALLERMAN: Thank you. My name is **Dick Kallerman**, and I'd just like to speak for the Save Our Springs Alliance. The Save Our Springs Alliance, our concern is with the Barton

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Springs/Edwards Aquifer, and we also are concerned with the Edwards Aquifer itself as a great water resource.

I just noticed in the groundwater supply chart that there's a projection that the groundwater supplies by 2060 will be capped about ten times what they are in the year 2000, and I'm assuming that you've all looked at all these groundwater resources and that ten times more drawing down of those aquifers is not nearly bringing them near someplace where they might be damaged or hurt permanently by that kind of a drawdown.

Also the -- I've noticed that water into the Matagorda Bay will be supplemented with the -- by the drawdown of the Gulf Coast aquifer. That sounds like -- a little like wishful thinking, that if the Colorado River begins to run down and run dry, that the freshwater into Matagorda Bay can be drawn out of an aquifer, the Gulf Coast aquifer.

This is a marvelous job. There's lots and lots of information. I'm sure I'll read myself to sleep many nights trying to go through all of this.

(Laughter)

MR. KALLERMAN: And I'm looking forward to the future information coming from you in terms of

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newsletters and so forth, but Save Our Springs Alliance is concerned that the aquifer -- the aquifers that are part of this water plan be very, very carefully watched so that no damage be done. Thank you very much.

CHAIRMAN BURKE: Okay. Thank you. Jamie Mitchell, Austin, Texas.

MR. MITCHELL: Thank you, Mr. Chairman, Members of the Committee. My name is **Jamie Mitchell**, and I just dropped my notes.

(Laughter)

MR. MITCHELL: I'm representing the Surfrider Foundation, Central Texas Chapter. The Surfrider Foundation is an international nonprofit forum. Obviously originally it was started by surfers. Now it's mostly families and fishermen especially here on the Gulf Coast.

And what I just wanted -- I know you-all have done a lot of work going back and forth on whether or not you've -- how much conservation you encourage to municipalities and to agriculture. We'd really like to stress that as much as you can do and that 140 gallons per day -- I think you can do a lot better than that. In fact, I know other cities have done it. You-all have heard all the numbers on that.

But one of our main concerns -- we work a lot with the General Land Office where they're spending several million dollars a year of Texas taxpayer money and also several million dollars a year in federal money on beach erosion and helping -- trying to prevent the effects of hurricanes. And sadly, you know, we have a very good example of what hurricanes do now in New Orleans, and nobody needs to be reminded of that and how terrible it is.

There's some real interesting articles in the New York Times, especially an editorial on the 30th of last week -- the 30th of last month, a few days ago, where they start discussing -- you know, all the levy building on the Mississippi River was stopping sediment from getting to the area that was forming the Mississippi Delta, and I think a lot of us know that, are about to learn more about it. So even though it was already low, it sunk even lower. So the effects that would have been catastrophic are even more catastrophic now because the land has sunk lower.

Now, we've already built a lot of dams here in Texas, and there are very few rivers that are actually depositing sediment to the beaches, which is another reason why most of our beaches in Texas are eroding at five to ten feet per year. The beach down

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in Matagorda, they spent over a million dollars per mile, and I'm not quite sure how long it is -- for Sargent Breach -- excuse me -- Sargent Beach in Matagorda County -- several million dollars, maybe even in the billions, on a big seawall there to help protect the Intracoastal Canal for commerce.

So the more you can do in conservation, you eliminate the need for -- what I think is a very innovative project, it still concerns us, the LCRA-SAWS project. And the very reason it concerns us is it's catching floodwater events, which sounds great, that water is all "being wasted." Some people say that. I think you-all have been well educated enough to know that there are benefits for the fisheries on that because they thrive on the sediment. But also that sediment helps prevent -- helps build up our beaches, prevent them from erosion, and also the wetlands and the sediment help reduce your coastal subsidence that you've seen a lot of. New Orleans is a prime example now. Houston-Galveston has seen a whole lot of that. It's not in this region, but Carol Baker at the Galveston Area Subsidence District, you've heard her talk, I'm sure, about water conservation and how important it is.

So I'd just really like you to -- it's

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probably not even in your legislative directive to look at that, but just think about it as, you know, public servants that you are. I know a lot of you are volunteering your time on this, but in this role you're public servants. So we'd really like to work more with you-all to stress that, the conservation and think about not only the effects to the fisheries but the effects to the beaches and coastal subsidence. So I think it would save us a lot of money in the long run. Thank you very much.

CHAIRMAN BURKE: Thank you, Jamie. I'll also introduce you to Mark Jordan, if you'd like.

MR. MITCHELL: Mark, it will be a pleasure.

(Laughter)
CHAIRMAN BURKE: If you'd like to make an appointment -- make an appointment with him and come into his office, he can explain to you in great detail how the --
MR. MITCHELL: No, I'd really like to do that.
CHAIRMAN BURKE: -- the water and -- because we don't have time to go through that.
MR. MITCHELL: Obviously. I mean, everybody wants to eat.

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CHAIRMAN BURKE: I mentioned it to the lady earlier, but they can go into great detail. It will probably take an hour or two in his office, and he can go into a lot more detail than we can.
(Laughter)
MR. MITCHELL: Well, we'll get all us crazy enviros in one room, and we'll all get together with him.
CHAIRMAN BURKE: There you go. All right.
MR. MITCHELL: Thank you very much.
CHAIRMAN BURKE: I thank you.
I have Craig Smith. Anybody else? There's a gentleman in the back that came in late. If you want to speak, fill out a card. If not, Craig is the last one that I have. You-all have until November the 6th to get your written comments in, and then it will be final, and we will respond to your comments in our plan.
MR. SMITH: Hi. I'm **Craig Smith**, and I'm on the board of directors of the Barton Springs/Edwards Aquifer Conservation District, and I want to say that I was proud to serve with Ron Fieseler and under the direction of Terry Tull here in the regional planning process for the Barton

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Springs/Edwards Aquifer, which I would like to commend to this group as a model for achieving consensus, solution to water quality problems in our aquifer and that could be a model for throughout the entire watershed.
But tonight I'd like to mainly talk

about the Barton Springs/Edwards Aquifer, which is one of the groundwater components of the water resources in the Region K area and to tell you that the -- our aquifer district has engaged in a long scientific investigation to determine the sustainable yield of our aquifer; that is, how much water it can produce on a sustainable basis measured against the drought of record and still maintain spring flow at the springs for the endangered species that live there and the people that swim in the springs and also for well owners over 50,000 of which draw their drinking water from the aquifer.

And after our scientific determination, measuring well levels and rainfall events and recharge to the aquifer, we determined that the sustainable yield, in rough terms, amounts to ten cubic feet per second equivalent -- the equivalent of ten cubic feet per second, which we were disturbed to find out is more -- is actually -- excuse me -- less than we have

currently permitted. So that in a drought of record, we would not be able to sustainably produce as much groundwater as we currently permit.

Well, we're not in a drought of record, and so we don't face that crisis yet, but recognizing the realities of those facts, we have amended our rules to provide that all new permits for groundwater withdrawals will be conditional permits that can be curtailed or even completely suspended during periods of severe drought, and we feel that this is a responsible way to address the drought situation or the potential drought situation in our area and continue to maintain the aquifer as a sustainable water supply for its existing users.

And I would suggest that the other groundwater conservation districts in the Region K area could emulate the process that we went through to scientifically determine what was our sustainable yield and to implement that finding through making subsequent withdrawals of groundwater conditional upon actual conditions. Thank you.

CHAIRMAN BURKE: Thank you, Craig. He's the last card. If anybody else has a second thought, we'll give you about 30 seconds. Craig, just so you will know, we preferred -- any groundwater district

that was in place like yours, we prefer their data to no data or to the state studies. So if any groundwater district submitted their data of drawdowns and availability, that's what we used in our plan.
MR. SMITH: We'll be proud to submit to you our entire sustainable yield study.
CHAIRMAN BURKE: Well, this is the end of this cycle, and we're going to start again in a year on a new cycle, and we could look at it then. We're ending up this cycle, but what I was telling you --
MR. SMITH: I'd be surprised if you don't have it already.
CHAIRMAN BURKE: We do use the data that are submitted to us from the groundwater districts in our region, and that's the groundwater data that we used, where there are groundwater districts. Now, not every replace had a groundwater district, but where they were available, that's what we used.
MR. SMITH: Okay. Thank you.
CHAIRMAN BURKE: Okay. Anybody else? Going once, twice.
(No response)
CHAIRMAN BURKE: Okay. Thank you-all for coming out on this hot summer evening, and this

will conclude our public hearing. Thank you.
(Proceedings concluded at 7:05 p.m.)

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CAROLYN AHRENS
OF COUNSEL

September 14, 2005

John Burke, Chairman
Lower Colorado Regional Water Planning Group
P.O. Drawer P
Bastrop, TX 78602

RE: July 2005 Preliminary Lower Colorado Regional Water Planning Group ("LCRWPG") Draft Plan

Dear Mr. Burke:

Because my firm represents a number of water suppliers throughout the State, and because I was closely involved with the Water Conservation Implementation Task Force ("Task Force") through the last interim, I feel compelled to comment on changes made to the Preliminary LCRWPG Draft Plan this past July.

In reviewing the Draft Plan, it is my understanding that Scenario 1 calls for a .25 percent reduction in per capita water use for all water users with a per use above 140 gallons per capita per day ("gpcd"). Scenario 2 would show a .5 percent savings per year for all municipal users with a demand over 140 gpcd, and a .25 percent savings for municipal users with a per capita demand between 100 and 140 gpcd.

The majority of the testimony presented to the Task Force would show these savings to be unrealistic in most cases. The City of El Paso, for example, presented evidence to the group that said their community, despite all its efforts in a desert climate, would not be able to reach 125 gpcd consumption. If El Paso cannot reach such a number, it is completely realistic to assume that communities in the LCRWPG could do so. Even if we assume that a community in this region were to reach such a goal, to show a savings of .25 percent each year when that community's consumption is down to 125 or 130, would be impossible, according to El Paso's testimony. In other words, at some point, well above the 100 gpcd level, a community can no longer continue to reduce consumption by the levels predicted in the Draft Plan.

In other areas of the region, additionally, it may be unrealistic for communities to show a savings at all. Certain communities, which have a large percentage of retail or commercial users, may not be able to lower per capita consumption because they do not have the corresponding population by which to divide water consumption. If the retail areas, in particular, are growing at rates higher than the residential areas, the best those municipal users may be able to do is to lessen the increase in per capita consumption. Projecting a reduction of .25 or .5 percent per year would be completely unrealistic in those areas.

The bottom line is the projected savings in water consumption contained in the LCRWPG Draft Plan create a flaw in the assumptions of the Draft Plan. Although most of us agree that water conservation is a worthy goal and most communities strive to conserve more water, it is completely unrealistic to assume that consumption can be lowered beyond a certain level or that every community will be able to reduce consumption when their growth rates and economic development would dictate otherwise. I would urge the LCRWPG to revisit these assumptions and make appropriate adjustments in the Draft Plan so that accurate demand figures can be estimated and, therefore, accurate projections for sources can be identified for users facing water shortages.

Thank you for consideration of my comments. If you have any questions or would like to discuss this issue further, please feel free to contact me.

Very truly yours,

Michael J. Booth

Michael J. Booth

MJB/db
117-050914-LCRWPG-Comments-Burke-ltr

18113 Kingfisher Ridge Drive
Lago Vista, Tx 78645
September 12, 2005

John Burke, Chairman
Lower Colorado Regional Water Planning Group
C/oAqua Water
P.O. Drawer P
Bastrop, Texas 78602

Dear Chairman Burke,

I am writing to you in regard to the Region K water plan for Texas. The Region K plan does not include an adequate quantitative assessment of how environmental flows would be affected by the proposed water projects in the plan. Ensuring that the Colorado River maintains adequate instream flows and that Matagorda Bay receives adequate freshwater inflows from the Colorado, is critical to the health of the fish and wildlife of the region.

Board rules mandate consideration and inclusion of drought management as water management strategies, however, the Region K plan does not even consider drought management as a water supply strategy. Reduction of non-essential uses of water in time of drought instead of spending vast sums of money to develop new supplies only makes sense.

The Region K plan also includes a level of groundwater pumping from the Gulf Coast Aquifer that is not sustainable. This must be revised.

Sincerely,

Sharon Killough

Sharon Killough

RECEIVED
SEP 13 2005
Aqua Water Supply Corp.

Lien, Rebeka

From: Cynthia Braendle [CBraendle@aquawsc.com]
Sent: Monday, September 12, 2005 8:16 AM
To: Lien, Rebeka; Lowry, Mark
Subject: FW: Region K Comment

From: neal cook [mailto:nealcook2000@yahoo.com]
Sent: Saturday, September 10, 2005 11:38 AM
To: Cynthia Braendle
Subject: Region K Comment

This is to ask that my comments be included for the new plan

I own a canoe/kayak rental on the River below Austin; therefore, I have vested interest in the plan.
I ask that use of the River for recreation- including fishing, boating, eco-tourism (birdwatching), camping be included in the plan--the economic impact of this will surpass mining for water usage.
I also ask that control of pollution from strip mines entering the aquafer by seepage through the underground water or because of periodic flooding and breaks in their levees.
I also ask for more protection of the springs and seepages into the River. These are being heavily impacted by wells

Neal Cook
22919 Beth
Elgin TX 78621
512-461-7139

From: Cynthia Braendle [CBraendle@aquawsc.com]
Sent: Friday, September 02, 2005 9:17 AM
To: Lien, Rebeka; Lowry, Mark
Subject: FW: Region K Water Plan

John asked that I forward these comments to you.

Cynthia

-----Original Message-----
From: David Todd [mailto:dtodd@wt.org]
Sent: Wednesday, August 31, 2005 11:47 AM
To: John Burke; Cynthia Braendle
Subject: Region K Water Plan

Dear Mr. Burke,

As a landowner and cattle operator on the Colorado River segment between La Grange and Columbus, I am alarmed at the proposal to send close to 50 billion gallons of water per year from the River to San Antonio.
Consideration appears to have been given to the downstream needs of rice farmers through groundwater withdrawals, and to the upstream users near Austin, who have access to the Highland Lakes. However, those users in the middle segment of the river appear to be given little in this proposal, as well as those natural systems and communities dependent on the estuary.

I urge that further consideration be given to the inequities among upstream, midstream, and downstream users, as well as the long-term, and drought-condition environmental impacts on the bay. As you surely know, the diversions being contemplated are without precedent, and need to be reviewed extremely carefully, if they need to be adopted at all, given the many cost-effective conservation and efficiency options.

Thanks for considering my views.

David Todd, Treasurer
Wray-Todd Ranch, LLC
SWT Cattle, LLC
1304 Mariposa Drive, #211
Austin, Texas 78704-4404
512-416-0400

Lien, Rebeka

From: Gene Hall Miller [gmiller@moment.net]

Sent: Saturday, August 20, 2005 7:39 PM

To: Lien, Rebeka

Subject: Re: Draft Region K Presentation

Rebeka,

Bill Stewart, a past voting member of the LCRWPG, saw the final draft in the Llano Library this past week and noticed that Stanley Reinhardt, a deceased member of our group, was not listed as a voting member. Bill and I feel he should be listed as a voting member as he was a part of the original planning group. Please take this recommendation to whomever you think it should go. If you have further questions, please contact me.

Sincerely,

Bill Miller
Llano County

----- Original Message -----
From: Lien, Rebeka
To: Cynthia Braendle ; Barbara Johnson ; Bill Miller ; Bill Neve ; Del Waters ; Harold Streicher ; Haskell Simon ; James Sultemeier ; Jennifer Walker ; Jim Barho ; John E. Burke ; Julia Marsden ; Mark Jordan ; Mayor Jones ; Paul Tybor ; Rick Gangluff ; Ronald G. Fieseler ; ronaldg@elc.net ; Roy Varley ; Teresa Lutes ; W.R. Bob Pickens ; Dan Strub ; David Bradsby ; David Meesey ; Jock Davis ; Joe McCarley ; Lowry, Mark ; Robena Jackson ; Steve Coonan, P.E. ; Teri Waters ; Terry Bray
Sent: Tuesday, August 16, 2005 2:50 PM
Subject: Draft Region K Presentation

Please provide comments on the Draft Region K Presentation to me by Friday August 19 at 10 am. I will incorporate the changes into the presentation and have a revised version for the August 23, 2005 Public Meeting.

Thanks,
Rebeka Lien, PE
Project Engineer, Water Resources
Direct 512.457.7741
E rebeka.lien@tcb.aecom.com

Turner Collie & Braden
400 West 15th Street, Suite 500
Austin, TX 78701
T 512.472.4519 F 512.472.7519

Lien, Rebeka

From: Lowry, Mark
Sent: Tuesday, August 16, 2005 9:42 AM
To: Lien, Rebeka
Subject: FW: HB 1437 and Region K

Lowry Mark.vcf (4 KB)

Rebeka: Please note Mark's comment. I thought we had made them all consistent, but apparently we had not.

Mark V. Lowry, P.E.
Associate Vice President
713/267-3293

Turner Collie & Braden Inc
P.O. Box 130089
Houston, Texas 77219-0089
5757 Woodway
Houston, Texas 77057-1599
713/267-3293 (voice) 713/267-2808 (fax)
email: mark.lowry@tcb.aecom.com

-----Original Message-----
From: Mark Jordan [mailto:Mark.Jordan@lcra.org]
Sent: Tuesday, August 16, 2005 9:37 AM
To: Lowry, Mark
Subject: HB 1437 and Region K

Mark - I found this language at the end of Chapter 7 and thought that it had been deleted or revised to be consistent with the assessment of environmental impacts of HB 1437 found on pages ES-17 and 4-97. Thanks

"The loss of return flows associated with the transfer of water to the Brazos River basin recommended in the HB1437 strategy is expected to negatively impact freshwater inflows to Matagorda Bay. By the year 2060, this transfer could result in as much as 25,000 acre-feet of water being withdrawn from the basin that would normally produce instream flows in the form of return flows as large as 15,000 acre-feet per year. On-farm conservation, a portion of the LCRA-SAWS water management strategy, was found to have potential negative impacts on instream flows which would eventually lead to reduced bay and estuary inflows at certain times of the year. Although on-farm conservation would result in lower average diversions throughout the year and greater average instream flows, the practice would result in a net reduction in instream flows during the summer when flows are typically at their lowest. Additionally, the water conserved on an annual basis would be diverted for use outside of the basin before it could make a positive impact on instream flows in the lower basin and bay and estuary freshwater inflows."

Lien, Rebeka

From: Bobby Rountree [bobbyr@centex.net]
Sent: Thursday, August 11, 2005 3:00 PM
To: Lien, Rebeka
Subject: RE: Region K IPP

Rebeka, if changes can be made, please make the following change in Chapter 4:
4.8.6 Construct Additional Goldthwaite Off-Channel Reservoir in Mills County

Opinion of Probable Cost

The reservoir should have been completed in July,
Change to:
The reservoir was completed in July,

Thanks
Bobby

-----Original Message-----
From: Lien, Rebeka [mailto:Rebeka.Lien@tcb.aecom.com]
Sent: Thursday, August 11, 2005 9:35 AM
To: bobbyr@centex.net
Subject: Region K IPP

Bobby,
The Initially Prepared Lower Colorado Regional Water Plan can be found on the TWDB website (under Region K):
http://www.twdb.state.tx.us/rwpg/main-docs/IPP-index.htm

You can also get to this link through the Region K website: http://www.regionk.org/

The information about concerning the Mills County and City of Goldthwaite strategies are located in Chapter 4 of the report.

There are also hard copies of the report at the Mill's County Clerk's office and at the Jenny Trent Dew Library in Goldthwaite.

If you have any questions let me know.

Thanks,
Rebeka Lien, PE
Project Engineer, Water Resources
Direct 512.457.7741
E rebeka.lien@tcb.aecom.com

Turner Collie & Braden
400 West 15th Street, Suite 500
Austin, TX 78701
T 512.472.4519 F 512.472.7519

ALCOA

Alcoa Primary Metals

Energy Division-Sandow Mine
3990 John D. Harper Road
PO Box 1491
Rockdale, TX 76567-1491 USA

SEP 19 2005

September 14, 2005

John Burke, Chairman
Lower Colorado Regional Water Planning Group
P.O. Drawer P
Bastrop, Texas 78602

Re: Comments on Initially Prepared 2006 Lower Colorado Regional Water Plan

Dear Chairman John Burke and Lower Colorado Regional Water Planning Group Members:

Enclosed are Alcoa, Inc.'s (Alcoa) comments to the Initially Prepared 2006 Lower Colorado Regional Water Plan (IPP). Our comments relate to the current and projected water demands for Bastrop County and any related water supply strategies as described in the IPP.

Alcoa's Rockdale Operations in Central Texas would submit the following comments to the IPP.

- On page 2-15, Section 2.3.5.2 of the IPP, mentions the new Three Oaks Mine which will be operational during a majority of the future planning period. It further states that the mine will close before 2040. Current mine plans and production levels indicate the mine may be operational for 30-35 years depending on the amount of lignite deposits in the mine area. On page 2-16, Table 2-12 provides the current and future water demands for Bastrop County for the 2010-2030 timeframe as a range of 5033-5036 acre-feet and a range of only 37-39 acre-feet for the 2040-2060 timeframe.
  Alcoa's Comment- Alcoa's maximum anticipated depressurization during the life of the Three Oaks Mine based on current mining plans is stated in Alcoa's current Railroad Commission of Texas (RCT) permit to be 10,889 acre-feet in Lee and Bastrop Counties. It is hard to estimate exactly how much of the groundwater will be withdrawn from Lee County or Bastrop County. For planning purposes, Alcoa would suggest that the total amount be equally split between Lee and Bastrop Counties. Table 2-12 should be amended to reflect projected mining use in Bastrop County of at least 5,450 acre-feet in years 2010-2040. Alcoa has provided a written comment similar to this to the Region G Water Planning Group.

  In regards to the projected demands for Bastrop County after lignite removal has ceased at the Three Oaks Mine, currently Table 2-12 shows that a range of only 37-39 acre-feet is anticipated for mining use in the 2040-2060 timeframe. It appears that Region K has assumed that once lignite removal has ceased that all depressurization activities will cease immediately. Depressurization will continue

> *to occur at the Three Oaks Mine for a number of years after the removal of lignite at the mine has ceased. There is a period after cessation of lignite removal where Alcoa is required under its Railroad Commission of Texas (RCT) permit to reclaim all the lands that were mined by Alcoa at the permitted site. After RCT has been satisfied that the land has been fully reclaimed and is as productive or more than it was before it was mined, the RCT will release Alcoa from its reclamation bonding obligations. This process usually takes approximately 7-10 years. Sometimes it takes more time than that, sometimes less. During this reclamation phase and bond release period, Alcoa may have to continue depressurization activities to comply with it RCT permit obligations. Table 2-12 should be amended to reflect projected mining use in Bastrop County of 2250 acre-feet for 2050 & 2060. This would reflect the on-going reclamation activities after closure of the Three Oaks Mine in Bastrop County.*

I appreciate the opportunity to provide these comments to the Lower Colorado Regional Water Planning Group. If you are your consultants have any questions or wish to have any further explanation or information provided, please do not hesitate to contact me.

Sincerely,

R. L. Burns

Richard L. Burns, P.E.
Reclaim and Resource Supervisor
Alcoa Sandow and Three Oaks Mines

cc:
Carolyn Brittin, TWDB
Director, Water Resources Planning Division
Texas Water Development Board
P.O. Box 13231
Austin, TX 78711-3231

Lost Pines Groundwater Conservation District
123A Old Austin Highway
Post Office Box 1747
Bastrop, TX 78602

512-581-9056
FAX: 512-581-9058
Email: jcooper@lostpineswater.org
Web Site: www.lostpineswater.org

Joe Cooper, General Manager

September 26, 2005

VIA CERTIFIED MAIL #7003 3110 0001 6516 3520
RETURN RECEIPT REQUESTED

RECEIVED
SEP 28 2005
Aqua Water Supply Corp.

Lower Colorado River Regional Water Planning Group
Attention: John Burke, Chairman
Aqua Water Supply Corporation
P O Drawer P
Bastrop, TX 78602

RE: Removal of SAWS/Alcoa Project from Region K Water Plan

Dear Mr. Chairman and Region K Members:

As many of you are aware, the San Antonio Water System ("SAWS") Board of Trustees recently approved a new 50 year water plan for SAWS by a unanimous vote. The SAWS trustees made several significant and long term policy decisions in SAWS' 50 year water plan including a determination that SAWS should drop its Simsboro aquifer groundwater transportation and pipeline project that SAWS had launched with Alcoa. Based on the actions of the SAWS trustees, I believe that Region K's 2005 Initially Prepared Regional Water Plan which has been submitted to the Texas Water Development Board ("TWDB") should be amended to remove all references to the SAWS/Alcoa Simsboro aquifer project and that the technical information included in the Region K plan be revised to reflect the termination of the SAWS/Alcoa project.

If the Region K members vote to revise the Region K water plan, the amendment process will include submitting a request to the TWDB to change Region K's plan to reflect the discontinuance of the SAWS/Alcoa project. While a revision of the adopted Region K plan will require some additional time and effort on behalf of the Region K members, the Region K plan is an important water planning document which will have a substantial impact on the decision-making in our area for many years and we should strive to create a plan that reflects the most current political and environmental developments.

Lost Pines Groundwater Conservation District
123A Old Austin Highway
Post Office Box 1747
Bastrop, TX 78602

512-581-9056
FAX: 512-581-9058
Email: lpgcd@lostpineswater.org
Web Site: www.lostpineswater.org

Joe Cooper, General Manager

I think the SAWS trustees made a profound and well-researched decision to drop the SAWS/Alcoa Simsboro aquifer project for both economic and hydrogeological reasons. The citizens who live within Region K will benefit from the decision of the SAWS trustees for many years to come. It is important that the Region K plan is amended to reflect the action taken by the SAWS trustees or otherwise the current Region K water plan could be considered inaccurate.

Thank you for your consideration of my request and I look forward to continuing to work with Region K to plan for the future of Texas.

Sincerely,

Joe P. Cooper

Joe P. Cooper, General Manager

Texas Wildlife Association
"Working for tomorrow's wildlife ... TODAY!"
401 Isom Rd., Suite 237 › San Antonio, TX 78216 › 210/826-2904 › 800/839-9453 › FAX 210/826-4933

SEP 27 2005
Aqua Water Supply Corp.

September 21, 2005

Mr. John Burke
Chairman, Region K Water Planning Group
Aqua Water Supply Corporation
P.O. Drawer P
Bastrop, Texas 78602

Dear Mr. Burke:

Thank you for leading Texas' vital water planning efforts. At the Texas Wildlife Association (TWA), we support customized solutions created as close to the affected resource as possible; therefore, we appreciate your planning committee's ongoing commitment to the resources in your care.

The TWA is a non-profit organization representing private land stewards, land managers, hunters and anglers from across the state of Texas. Our members care for and control more than 30 million acres of rangeland and wildlife habitat that are key components of Texas' upstream watersheds. The involvement of private land stewards is critical in establishing Texas' long-term water policies.

As you finalize your regional plan, we would be remiss if we did not bring voluntary land stewardship to your attention again. The relationship between the land's condition and the quality and quantity of water available to Texans is inextricably linked. In fact, good land stewardship encompasses a myriad of activities far beyond brush control. (For an all-encompassing definition and discussion of land stewardship, please see the attached Handout A and the November 2005 edition of "At Issue" written by Robert L. Cook, Executive Director of the Texas Parks & Wildlife Department.) Private landowners who optimize the condition of their land are effectively engaged in water ranching, in addition to the more visible activities of raising cattle or managing wildlife.

Open space land is Mother Nature's sponge, capturing water for both our underground and surface supplies. The land's condition determines how much water is captured for our aquifers, rivers, lakes, streams, bays and estuaries or how much water is lost to detrimental run-off and evaporation.

Incorporating good land stewardship into any water plan makes sense because, voluntary land stewardship is:

***Complementary:** Optimizing the condition of Texas' rural water catchments (also known as watersheds) ensures the increased effectiveness of any other water supply strategies that may be implemented. Years of scientific research has shown that effective, efficient rural water catchments will provide more water, better water and more options for water planners. Good land stewardship is the foundation upon which all other water supply strategies should rest.

***Cost-effective:** Improving the condition of the state's rural water catchments is relatively inexpensive. The cost for generating additional water through voluntary land management practices is dozens of dollars per acre-foot, and sometimes it's no-cost. Other proposed methods generate additional water at the cost of hundreds or thousands of dollars per acre-foot.

***Sustainable:** Responsible, voluntary land stewardship is a sustainable practice. Once people begin to implement the best management practices necessary to optimize the range in their particular location, those practices can continue uninterrupted.

***Efficient:** Good, voluntary land stewardship does not make more rain; it just makes the most of what we receive. Obviously, a well-managed landscape with 75 percent rainfall efficiency captures more usable water than a poorly managed one with 25 percent efficiency. With 75 percent rainfall efficiency, the landscape could benefit from increased water percolation and vigorous plant performance. With 25 percent rainfall efficiency, the landscape will operate under drought conditions even in years with normal rainfall.

***Environmentally Sensitive:** Good, voluntary land stewardship practices not only optimize the rural water catchments, but also provide exceptional wildlife habitat while conserving our state's remaining open space land. Good, voluntary land stewardship solves problems rather than creates them.

***Multi-faceted**: Good, voluntary land stewardship practices are not a "one size fits all" proposition. Each ecological region may require a different set of management practices to achieve the best results, and we will see more immediate results in some ecological regions than in others. Fortunately, this creates a great deal of flexibility, allowing prioritization and long-term planning.

While brush management can be part of good land stewardship, it is not the only option for rangeland management and improvement; therefore, Best Management Practices (BMPs) should be part of any cost-share, public-private program and/or contract. The BMPs should consistently include range re-seeding and livestock deferment to successfully establish native vegetative stands as well as good follow-up grazing management.

***Governable:** In order to promote even better land stewardship, policy makers should consider implementing Best Government Practices (BGPs). BGPs, as used in other states, provide a wide range of options that might include: increased cost-shares at targeted, prioritized water enhancement sites; increased technical assistance in range and wildlife management planning; a system of Purchases of Development Rights to keep priority properties together under good management; and reduced valuations, tax breaks, or other incentives for participation in water enhancement management practices.

Voluntary land stewardship is the logical place for water management to begin because land stewardship affects the water supply at its origins, not just at its destination. We find it difficult to understand why people charged with water management focus their efforts on destination and demand, while virtually ignoring the issues of origination and supply. If we maximize the effects of the rainwater that falls from the sky, then the answers to questions of demand are much more easily answered.

Water harvesting provides one example of water-induced tunnel vision. In most water plans, a great deal of space is dedicated to water harvesting, collecting the rainwater that falls on roofs – roofs that are generally measured in square feet. But yet, these same plans ignore the millions of acres of "unroofed" rangeland that are the foundation for the region's water catchment. Why? The rainwater harvested from rural grasslands, savannahs, forests, and wetlands is not as easily visible as that collected from urban rooftops.

Ground and surface water supplies originate with the rain that falls on the land and is captured by a complex, large-scale process involving plants, soil and animals. When the process functions optimally, floods are reduced, aquifers are replenished, and water is released more slowly and steadily into streams, rivers, lakes and eventually our bays and estuaries. If the land is in good condition, the quality and quantity of water – both surface and underground – available to citizens reflect that condition. When the process is working well across millions of acres of open, rural land the contribution to the state's water supply can be tremendous.

Interestingly, when conscientious land stewards ably manage their resources as they do every day, they are ranching water just as surely as they are ranching cattle, sheep, goats or wildlife. Unfortunately, this contribution is overlooked or misunderstood. We must include voluntary land stewardship – on a grand scale – as one of the foundation solutions for water issues in Texas.

When it comes to water policy, good land stewardship is like the first step on a staircase. The staircase will stand if you remove the last step, a middle step or even the second step, but the staircase will come crashing down if there is no first step. Please help Texas ensure that this very vital first step is in place as the foundation of planning for our future.

To help you incorporate voluntary land stewardship into your plan, we have taken the liberty of enclosing our report, "Texas' Looming Water Crisis: Recognizing Land Stewardship's Untapped Potential," which we believe would fit your purposes well. Please use the information to help Texans secure their future.

If you have any questions, please do not hesitate to contact us using the information below.

Yours for a clean and enjoyable outdoors,

Kirby L. Brown
Executive Vice President
Texas Wildlife Association
401 Isom Road, Suite 237
San Antonio, Texas 78216
Office: 800/839-9453 x 125
Email: k_brown@texas-wildlife.org
Website: www.texas-wildlife.org

David K. Langford
Vice President Emeritus
Texas Wildlife Association
P. O. Box 1059
Comfort, TX 78013-1059
Mobile: 210/827-0306
Email: dkl@texas-wildlife.org

Handout A

What is Voluntary LAND STEWARDSHIP?

(It's a lot more than just brush control...)

- Absorbing Rainfall/Reducing Run-Off/Increasing Base-Flow
- Using Prescribed Fire Properly
- Planning and Managing Grazing (Including Deferment...)
- Managing Brush Appropriately (It's never controlled, and some of it's important for wildlife!)
- Managing Erosion
- Reseeding With Natives (As Necessary...)
- Wildlife and Habitat Management Plans
- Managing and Restoring Riparian Areas
- Protecting Springs and Creek Banks
- Increasing Bio-Diversity
- Conserving Rare Species
- Limiting Habitat Fragmentation with Appropriate Estate Planning
- Being a Good Neighbor
- Contributing to Your Community
- Conserving Aquifer Recharge Areas
- Managing Exotic Species (Flora and Fauna) as Appropriate
- Investigating Existing and New Incentive Programs (PDRs, CRP, GRP, LIP, etc.)
- Being Open to New Ideas, Constantly Evaluating Plans/Methods, and Adjusting as Indicated
- Getting Informed, Getting Involved, VOTING, etc.

Land stewardship shifts thinking and vocabulary because good land stewardship allows the land to catch water instead of shed it.

Rural land is a water CATCHMENT not a waterSHED!!!!

David K. Langford • Vice President Emeritus • Texas Wildlife Association
P. O. Box 1059 • Comfort, TX 78013-1059 • Office: 800/839-9453 • Mobile: 210/827-0306
Email: dkl@texas-wildlife.org • Website: www.texas-wildlife.org

AT ISSUE

FROM THE PEN OF ROBERT L. COOK

Land. They say they're not making any more of it, you know, and they say there is less and less of it everyday. If you love the outdoors, and nature, and seeing critters and beautiful sunsets, and hearing bullfrogs and katydids, you know what I mean. People have fought and died over land, and ranched and plowed and lived off the land since the beginning of time. Every day, more land washes downstream to the oceans, the mountains become a little less rugged, and we who cherish the land so deeply pave over and build homes and offices atop another 2,800 acres of land in Texas every single week. The folks at the United States Department of Agriculture tell us that between 1982 and 1997, 2.2 million acres of rural land in Texas were converted to "urban uses." You can bet it is worse today. I'm scared to ask.

I reckon that some folks think that the only things that land is good for is either cows or some undistinguishable crop of who knows what, or for folks like me who love to tromp around in the brush and breathe fresh air. Who needs all that, right? Take a wild guess where that rib-eye and baked potato that you eat tonight comes from, or how that cotton that you wear on your back got there. Whichever it was that came first, both the chicken and the egg were produced on the farm and both required a lot of cracked milo and corn before they reached your refrigerator. And for those of you who sneer at us meat-eaters, I hope that you will pause momentarily to consider what an immense effort and expense is required to produce your diet of whole grain, granola bars, fresh fruit and "farm-raised" vegetables.

Private landowners in Texas are critical to our livelihood, our lifestyle and our welfare. Land conservation programs are essential to our food and water supply.

Maybe if we realized how dependent we all are on rural, undeveloped land, it would help us understand the need to preserve and protect that land. OK, try this: "the land" that we're talking about here is where your water comes from! That's right, the water that you drink, and bathe in, and wash your dishes with is produced on our land. Since water initially falls from the sky, some folks don't see how land fits into the equation. Unless you've got a cistern to catch the water that runs off your roof, your water comes from the land. Every drop of water that we require in our homes, industry, agriculture and for fish and wildlife falls back to earth in the wonderful cycle of evaporation, rainfall and snow. Some of it soaks deep into the soil to replenish our aquifers; some of it filters through the grasslands and then flows down our rivers and through our lakes where we harvest it and use it. Then the cycle starts all over again. We all need, use and benefit from "the land".

Private landowners in Texas are critical to our livelihood, our lifestyle and our welfare. Land conservation programs and agricultural conservation easements that keep rural land in farm and ranch production are essential to our food and water supply. The Texas Farm and Ranchland Conservation Program, which was recently enacted by the Texas Legislature to help keep rural land in the hands of farmers and ranchers in Texas, and to encourage, support and reward good land stewardship, is a great new program for our state. In addition, it is important to remember that Texans need more rural, undeveloped parkland and wildlife lands where public access for hiking, camping, boating, biking, hunting, fishing and outdoor recreation use is welcomed and encouraged for current and future generations.

You know what they say: Life is better outdoors.
Get outdoors, enjoy.

Robert L. Cook

EXECUTIVE DIRECTOR

Texas Parks and Wildlife Department mission statement:

To manage and conserve the natural and cultural resources of Texas and to provide hunting, fishing and outdoor recreation opportunities for the use and enjoyment of present and future generations.

Lien, Rebeka

From: Cynthia Braendle [CBraendle@aquawsc.com]
Sent: Monday, October 03, 2005 11:21 AM
To: Lien, Rebeka; Lowry, Mark
Cc: Barbara Johnson; Bill Miller ; Bill Neve; Chris King; Del Waters; Harold Streicher; Haskell Simon ; James Sultemeier; Jennifer Walker; Jim Barho; John E. Burke; Julia Marsden; Mark Jordan ; Mayor Jones; Paul Tybor; Rick Gangluff; Ronald G. Fieseler; ronaldg@elc.net; Roy Varley; Teresa Lutes; W.R. Bob Pickens; Dan Strub; David Bradsby; David Meesey; Jock Davis; Joe McCarley; Robena Jackson; Steve Coonan, P.E.; Teri Waters; Terry Bray
Subject: FW: RegionK Water issues

greywater.doc (30 KB)

-----Original Message-----
From: ValÃ©rie Chaussonnet [mailto:vchaussonnet@earthlink.net]
Sent: Sunday, October 02, 2005 5:40 PM
To: Cynthia Braendle
Subject: RegionK Water issues

To: Mr. John Burke, Chairman

Dear Mr. Burke:

Please find attached my comments about an under-utilized source of water.

Sincerely yours,
Hal Strickland
2328 Westforest Dr.
Austin, TX 78704
512-441-1284

New "Source" of Water Promises Billion-gallon Savings
By Hal Strickland

Picture this: it's a hot summer day in Austin---no rain for forty days—and my plants are wilted of thirst. Mandatory water rationing helps stretch municipal supplies to meet high demand. I hop into the shower and turn on the water. From the instant water exits my low-flow showerhead til it splashes down the drain, I have the utility of that water for about two seconds and it's gone! Moreover, I'm paying the city about 30% more per gallon to get rid of that "wastewater" than I'm paying for the same water in the first place, more than doubling its cost! What's wrong with this picture? Fact is, I'd like to capture that shower water and give it to my thirsty plants.

All our regional plans for dealing with future water needs pay lip service to conservation, but there's been no official recognition of the huge potential of on-site greywater reclamation.

What's greywater?

The flush from our water-conserving toilets, at the rate of 1.6 gallons per, is dubbed "blackwater". I am not talking here about toilet water. Other sources of waste(d)water---lavatories, showers, bathtubs, washing-machines---are "greywater", and greywater is much the preponderance of our household wastewater production. So how could we possibly go about capturing and reclaiming our greywater? From a physical standpoint we need only to alter slightly the way our household plumbing is arranged: blackwater and greywater sources need to be connected in parallel (that is, separated from one another) and not joined until the two parallel lines exit the house. Then the greywater can be isolated and available for other uses, like landscape irrigation and recirculation ponds and fountains, or, if not needed, it could be shunted away with blackwater to the municipal treatment facility, as now.

Who could feasibly capture greywater? This parallel wastewater plumbing could readily be installed with almost any new construction. Furthermore, many existing houses with pier-and-beam structure allow access below the floor to most, if not all, of the wastewater lines. There is much opportunity for consolidation and reclamation of greywater here. Moreover, some slab foundations, such as my own, where both upstairs and downstairs bathrooms share an exterior wall chase for plumbing, also present opportunities for greywater reclamation.

Consolidation of household greywater sources is the first stage of onsite reclamation; treatment and distribution is the second. In Appalachia, remote and isolated locations and challenging topography preclude the linking up of many dwellings to central or even community wastewater systems. In its efforts to help curtail direct effluent dumping and infiltration from failing septic systems into streams, the Environmental Protection Agency has funded many experimental onsite treatment projects. One such plan has proven to be a resounding success, the "subsurface flow constructed wetland". This is a lined, outdoor basin about two feet deep, backfilled with gravel. The outflow drain is arranged so that the level of water stays six inches below the top of the gravel. Mosquitoes cannot access the water. Water-loving wetland species are planted in the gravel basin, where their roots support a healthy bacterial population which feeds off the nutrient flow of greywater and thereby cleans it. But Appalachia's thirst for more water is not quite up to ours. Here in Texas we can put a heap-big gulp of greywater right back to good use and ease the demand of an increasing human population on our precious-–but limited by Nature—water resources.

Well, why not?

The main obstacle to onsite greywater reclamation is just inertia—our prevailing mindset and built-up infrastructure that makes no allowance for re-using "waste" water. In a sustainable economy, "waste" is just an under-utilized resource. Forced to deal with water scarcity issues a few years ahead of us, our two more arid neighbors to the west, New Mexico and Arizona, have recently approved onsite greywater reclamation, with allowances. Here in Austin our city building code does not allow greywater reclamation. With a mere change in that code, we can permit trial models and monitor their performance. Those that work well can be models for widespread adoption. Let's get on with it. It's non-sensical to pay a premium price to "waste" a precious resource. The time to begin onsite greywater reclamation is now.

The author is an Austin-based permaculturalist and plumber.

Pines and Prairies LAND TRUST

Mr. John Burke
C/o Aqua Water
PO Drawer P
Bastrop, TX 78602

Dear Mr. Burke,

On behalf of the Pines and Prairies Land Trust board of directors, I appreciate the opportunity to comment on the 2006 Region K Plan.

We are pleased to note the Plan's emphasis on municipal water conservation, however, it needs to incorporate a target for per capita consumption below 140 GPCD. Curtailing the waste of water by unattended automatic sprinklers, especially at commercial establishments, is an obvious first step.

Senate Bill 2 and Texas Water Development Board rules mandate consideration of and inclusion in regional plans strategies for reasonable levels of drought management as water management practices. Droughts appear to be an increasing fact of life in our region and we are surprised that your Plan does not incorporate any strategies for dealing with them. We urge you to include "drought management plans" for each water user group.

The LCRA/SAWS Project would require large and unsustainable withdrawls from the Gulf Coast Aquifer. We believe the Plan must address the effects this pumping will have on the base flow of the Colorado River.

Our most important concern is with the lack of adequate analysis of the effects of current and proposed projects and permits on the environmental flows of the Colorado River. Adequate flows are not only essential to the health and economy of Matagorda Bay, they are also critical to the fish, wildlife and recreational tourism industry along the free-flowing stretch of river between Austin and the coast. You must include water for environmental flows in this Plan. This is a remarkable oversight that must be corrected. Further, the Plan lacks information on the hundreds of springs that support habitats and river levels in the region. This is where much of the water in the river comes from.

Please contact me at 830-839-4628 if you have any questions or comments.

Sincerely,

Carrie F. Knox

Carrie F. Knox, president PPLT

RECEIVED
OCT 19 2005
Aqua Water Supply Corp.

August 24, 2005

Lower Colorado Regional Water Plan

From: John M. Fink, MD FACOG - Wharton County

Dear Water Plan,

I have seen some particulars about the 55 year water plan that is proposed. I have grave misgivings about 49 billion gallons of water from the Colorado river going to San Antonio every year, living within a stone's throw of the Colorado river. I think that is going to make it tremendously changed as far as a safe lesser pollution recreational and fishing river. I also have grave misgivings about that amount of water that will not get to Matagorda Bay and will have tremendous impact, negative, on the quality of the estuary waters in Matagorda Bay. This certainly can impact recreational activities, sport and commercial fishing. I truly think that San Antonio is going to have to come up with a better plan for getting its water rather than sucking off the 12 counties below it just because it is a big city and wants to grow faster. I suggest you tell the city of San Antonio it should curtail its water use and not allow further people to move into the area that is starved for water. Has anyone ever considered that desalinization plant that would pump water uphill to Austin and San Antonio.

I quite probably will not be around by the year 2060 but I feel very strongly for my children, their children and the state of Texas in general. Every time we rape the environment for our own personal wants and needs, not only our generation but everyone to follow will suffer. Let us please have some further consideration of the gross misuse of the Colorado river.

Yours truly,

John M Fink, MD

John M. Fink, MD FACOG/jlp

NANCY ESKRIDGE
2304 Standish Dr.
Austin, TX 78745
(512) 447-6933 nancyesk@austin.rr.com

October 20, 2005

John Burke, Chairman
Lower Colorado Regional Water Planning Group
c/o Aqua Water
P.O. Drawer P
Bastrop, TX 78602

Dear Mr. Burke:

Several years ago, I read in the newspaper that an environmental group had tried to buy water rights to a sufficient quantity of one of our Texas rivers to ensure the health of our bays and estuaries. They were refused--possibly even in subsequent court action. I was appalled at the short-sightedness of such crass commercialism at the time. I am disturbed now that the proposed Region K water plan doesn't ensure that the Colorado River will carry freshwater to the Matagorda Bay area.

I am writing to urge you to adjust the Region K Water Plan to include a scientific assessment of the effects of proposed water projects. We don't need another Rio Grande in Texas--a river that up until recently, was unable to make it all the way to the sea.

I also urge you to include measures to stem non-essential uses of water during droughts and to reject the LCRA-SAWS Water Development Project that includes a level of pumping that is not sustainable.

Thank you for your consideration of these issues.

Sincerely,

Nancy L. Eskridge

Nancy L. Eskridge

Ms Ilse P Munyon
6810 Deatonhill Dr Apt 215
Austin TX 78745

Nov. 2, 05

AUSTIN TX 787
PM
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2005

Dear Mr. Burke:
There is nothing I can add to what the people who verbalized their thoughts re: The Region K Water Plan at the Sept. 7 Hearing. I agree with all they said - We must remember above all, that we humans are part of the environment. Ilse P. Munyon

John Burke, Chairman
LCR Water Planning Group
c/o Aqua Water
P.O. Drawer P
BASTROP, TX
78602

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November 4, 2005

John Burke, Chair
Region K Water Planning Group
c/o Aqua Water Supply
P.O. Drawer P
Bastrop, Texas 78602

Re: Comments on Initially Prepared 2006 Regional Water Plan for Region K

Dear Mr. Burke and Planning Group Members:

The National Wildlife Federation, Lone Star Chapter of the Sierra Club, and Environmental Defense appreciate the opportunity to provide written comments on the Initially Prepared Regional Water Plan for Region K. We consider the development of comprehensive water plans to be a high priority for ensuring a healthy and prosperous future for Texas. We recognize and appreciate the contributions that you have made towards that goal. As you know, our organizations have provided, either individually or collectively, periodic input during the process of developing the plan. These written comments will build upon those previous comments in an effort to contribute to making the regional plan a better plan for all residents of Region K and for all Texans.

We do recognize that the draft Plan is subject to revision prior to adoption and is subject to continued revision in the future and provide these comments with such revisions in mind. Our organizations appreciate the amount of effort that has gone into developing the draft Plan for Region K. Your consideration of these comments will be appreciated.

I. BACKGROUND AND OVERVIEW

Our organizations support a comprehensive approach to water planning in which all implications of water use and development are considered. Senate Bills 1 and 2 (SB1, SB2), and the process they established, have the potential to produce a major, positive change in the way Texans approach water planning. In order to fully realize that potential, water plans must provide sufficient information to ensure that the likely impacts and costs of each reasonable potential water management strategy are described and considered. Only with that information can regional planning groups ensure compliance with the overarching requirement that "strategies shall be selected so that cost effective water management strategies which are consistent with long-term protection of the state's water resources, agricultural resources, and natural resources are adopted." 31 TAC § 357.7 (a)(9). Complying with this charge is essential in order to develop true plans that are likely to be implemented.

This document includes two types of comments. We consider the extent to which the initially prepared plan complies with the requirements established by SB1 and SB2 and by the Texas Water Development Board (TWDB) rules adopted to implement those statutes. In addition, our comments address important aspects of policy that might not be controlled by specific statutes or rules.

We do recognize that the financial resources available to the planning group are limited, which may restrict the ability of the group to fully address some issues as much as you would like. These comments are provided in the spirit of an ongoing dialogue intended to make the planning process as effective as possible. We strongly support the State's water planning process and we want the regional water plans and the state plan to be comprehensive templates that can be endorsed by all Texans.

Section II of the letter summarizes key principles that inform our comments and how they relate to the Initially Prepared Plan (IPP). The last section of the letter, Section III, consists of page-specific comments on the Initially Prepared Plan.

II. KEY PRINCIPLES

A. Maximize Water Efficiency

We strongly believe that improved efficiency in the use of water must be pursued to the maximum extent reasonable. New provisions included in SB2 and TWDB rules since the first round of planning mandate strengthened consideration of water efficiency. Damaging and expensive new supply sources simply should not be considered unless, and until, all reasonable efforts to improve efficiency have been exhausted. In fact, that approach is now mandated. Consistent with TWDB's rules for water planning, we consider water conservation measures that improve efficiency to be separate and distinct from reuse projects. We do agree that reuse projects merit consideration. However, the implications of those projects are significantly different than for water efficiency measures and must be evaluated separately.

The Texas Water Code, as amended by SB1 and sb2, along with the TWDB guidelines, establishes stringent requirements for consideration and incorporation of water conservation and drought management. As you know, Section 16.053 (h)(7)(B), which was added after completion of the first round of regional planning, prohibits TWDB from approving any regional plan that doesn't include water conservation and drought management measures at least as stringent as those required pursuant to Sections 11.1271 and 11.1272 of the Water Code. In other words, the regional plan must incorporate at least the amount of water savings that are mandated by other law.[1]

In addition, the Board's guidelines require the consideration of more stringent conservation and drought management measures for all other water user groups with water needs. Section 31 TAC § 357.7 (a)(7)(A) of the TWDB rules sets out detailed requirements for evaluation of "water conservation practices." Section 357.7(a)(7)(B) addresses drought management measures. The separate evaluation of reuse is mandated by 31 TAC § 357.7 (a)(7)(C).

We acknowledge the effort made by Region K in incorporating water conservation into the initially prepared regional plan. We believe more progress is possible in this area, particularly as it relates to the City of Austin's water conservation programs.

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[1] This is a common-sense requirement. We certainly should not be basing planning on an assumption of less water conservation than the law already requires. TWDB guidelines also recognize the water conservation requirements of Section 11.085 for interbasin transfers and require the inclusion of the "highest practicable levels of water conservation and efficiency achievable" for entities for which interbasin transfers are recommended as a water management strategy.

B. Limit Nonessential Use during Drought

Drought management measures aimed at reducing demands during periods of unusually dry conditions are important components of good water management. As noted above, SB2 and TWDB rules mandate consideration and inclusion in regional plans of reasonable levels of drought management as water management strategies. It just makes sense to limit some nonessential uses of water during times of serious shortage instead of spending vast sums of money to develop new supply sources simply to meet those nonessential demands during rare drought periods. Because drought management measures are not included as water management strategies, the initially prepared plan does not comply with applicable requirements.

C. Plan To Ensure Environmental Flows

Designing and selecting new water management strategies that minimize negative impacts on environmental flows is critically important. New rules applicable to this round of planning require a quantitative analysis of environmental impacts of water management strategies[2] in order to ensure a more careful consideration of those impacts.

If existing water rights, when used as projected, would cause serious disruption of environmental flows resulting in harm to natural resources, merely minimizing additional harm from new strategies would not produce a water plan that is consistent with long-term protection of natural resources or that would protect the economic activities that rely on those natural resources.

In addition, environmental flows should be recognized as a water demand and plans should seek to provide reasonable levels of environmental flows. Environmental flows provide critical economic and ecological services that must be maintained to ensure consistency with long-term protection of water resources and natural resources.

We acknowledge and commend the planning group for recognizing environmental flows as a water demand to be met. However, the lack of substantive evaluation of environmental flow impacts of water management strategies is a serious deficiency in the initially prepared plan. We acknowledge the limitations resulting from the planning group's decision to pursue use of the "No-call WAM" for planning purposes. However, meaningful evaluations are required and currently are lacking. Accordingly, we urge the planning group either to provide such evaluations or explicitly to condition its recommendation of major surface water projects on a future review and approval by the planning group of those projects following the completion of quantitative evaluations of environmental flow impacts. Given the limitations of the "No-call WAM", that type of approach appears to be the only way for the planning group to move forward now while also ensuring that it avoids approving projects that don't adequately provide for environmental flows and that are not consistent with long-term protection of the state's natural resources, water resources, and agricultural resources.

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[2] The rules require that each potentially feasible water management strategy must be evaluated by including 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." 31 TAC § 357.7 (a)(8)(A)(ii).

D. Minimize New Reservoirs
Because of the associated adverse impacts, major new reservoirs should be considered only after existing sources of water, including water efficiency and reuse, are utilized to the maximum extent reasonable. When new reservoirs are considered, adverse impacts to regional economies and natural resources around the reservoir site must be minimized. Reservoir development must be shown to be consistent with long-term protection of the state's water, agricultural, and natural resources.

E. Manage Groundwater Sustainably
Wherever possible, groundwater resources should be managed on a sustainable basis. Mining groundwater supplies will, in many instances, adversely affect surface water resources and constitute a tremendous disservice to future generations of Texans. Generally speaking, depleting groundwater sources will not be consistent with long-term protection of the state's water resources, natural resources, or agricultural resources. We commend the Region's stated long-term goal of sustainable groundwater withdrawal.

F. Facilitate Short-Term Transfers
Senate Bill 1 directs consideration of voluntary and emergency transfers of water as a key mechanism for meeting water demands. Water Code Section 16.051 (d) directs that rules governing the development of the state water plan shall give specific consideration to "principles that result in the voluntary redistribution of water resources." Similarly, Section 16.053 (e)(5)(H) directs that regional water plans must include consideration of "voluntary transfers of water within the region using, but not limited to, regional water banks, sales, leases, options, subordination agreements, and financing arrangements…." Thus, there is a clear legislative directive that the regional planning process must include strong consideration of mechanisms for facilitating voluntary transfers of existing water rights within the region, particularly on a short-term basis as a way to meet drought demands.

In addition, emergency transfers are intended as a way to address serious water shortages for municipal purposes. They are a way to address short-term problems without the expense and natural resource damage associated with development of new water supplies. Section 16.053 (e)(5)(I) specifically directs that emergency transfers of water, pursuant to Section 11.139 of the Water Code, are to be considered, including by providing information on the portion of each non-municipal water right that could be transferred without causing undue damage to the holder of the water right. Thus, the water planning process is intended as a mechanism to facilitate voluntary transfers, particularly as a means to address drought situations, by collecting specific information on rights that might be transferred on such a basis and by encouraging a dialogue between willing sellers and willing buyers on that approach.

The Region K plan has incorporated this with its "Transfer/Allocate Water from WUG's with a Surplus," management strategy, albeit on a small scale. We urge additional consideration of the potential for voluntary transfers, particularly on a temporary basis.

III. PAGE-SPECIFIC COMMENTS
We have identified individual comments with a number enclosed in brackets "[1]" for ease of tracking.

[1] There is no Table of Contents for the overall plan included in the initially prepared plan (IPP). For such a large and complex document to be reasonably accessible to the general public, a good table of contents that will provide a good overall sense of the content of the plan is essential.

EXECUTIVE SUMMARY

ES.4 Water Supplies

[2] (**Page ES-5**). The second paragraph in this section, which introduces the concept of the "No-call WAM," needs to be expanded. This is an extremely important concept for understanding the overall plan. The information set out here simply is not adequate to provide an understanding of what was done or why. For example, few readers can be expected to understand the significance of the phrase "downstream water rights holders would not call on inflows from Region F." In this instance, brevity, even for the executive summary, is less important than clarity. In addition, the following statement merits clarification: "This 'No Call' assumption does not have legal standing and does not impact the seniority of owner's rights, but simply is a more accurate reflection of how water is managed in the basin." The simple reality is we don't know how water will be managed with future demands and a recurrence of critical drought conditions. According to the text, lower basin water right holders have indicated they are not willing to forego legal rights to call for water to be passed downstream. The "No Call" assumption may match how supplies have been managed in the absence of large unmet downstream demands, but it seems to be a bit of a leap to characterize that as reflecting future management in the absence of a willingness of water rights holders to enter into subordination agreements. At any rate, this uncertainty should be explicitly acknowledged.

[3] Presumably, the reference in the second to last sentence in the second paragraph to "WAM runs" for other basins is intended to refer to standard WAM Run 3 results. However, that is not clear from the current text.

[4] (**Page ES-5**). Figure ES.2. This Figure would be more useful if the amounts of water corresponding to each of the categories were reflected in addition to the percentages. That would allow for a better understanding of the changes predicted between 2000 and 2060 conditions.

ES.5 Identified Shortages

[5] **(Page ES-7).** The first paragraph on this page is confusing. The water supply for a WUG is not limited by "current needs." This term should be eliminated because it causes undue confusion. As we understand the concept being addressed here, the point is that the amount of water available to individual WUGs is less than the total available in the region because of infrastructure limitations and/or contractual limitations. If that is correct, the concept needs to be conveyed clearly. At present, the message is garbled.

[6] **(Page ES-7). third paragraph** The return flows included in the plan are not just from Austin; they are from Aqua WSC and Pflugerville also. The issue of "paper shortages" which exist only because of contract renewal issues merits further discussion here. Neither Section ES.5 nor Section ES.6 provides any information about the amount of the projected shortages that are expected to be addressed through contract extensions. Because of the fundamental difference

in the type of action required to meet the need, that basic information should be included here in a format similar to the section on return flows.

ES.6.2.1 LCRA Management Strategies
[7] **(Page ES-10). End of first paragraph** – To provide more context for appreciating the length of the commitment, the phrase "until 2090" should be added after "on a temporary basis." Because the term "excess flows" is ambiguous and incorrectly suggests the flows serve no purpose, the text in the last sentence should be modified to read "the LCRA is seeking a permit for the remaining unpermitted portion of Colorado River flows to help meet future water needs in this basin and in San Antonio."

ES.6.3 Regional Water Management Strategies
[8] **(Page ES-11)**. In the first sentence, the amount of the savings from water conservation should be listed just as for the other water management strategies discussed in this section or a cross-reference to Table ES.10 should be added.

[9] **(Page ES-12).** The 3rd sentence in the 3rd paragraph indicates that use of groundwater in excess of sustainable yield "would not pose a long-term impact to the aquifer." It appears, from other information in the initially prepared plan, that persistent aquifer level declines are predicted at least in parts of Hays and Matagorda Counties. See, for example, pages 1-43 through 1-44. Accordingly, the basis for the contention of an absence of long-term impacts is unclear. Further explanation is needed.

ES.6.4 Municipal Water Management Strategies
[10] **Page ES-13 -** We commend the planning group on its inclusion of municipal conservation as a strategy. A 1% reduction per year in water usage is an achievable goal. However, the calculations of savings are incomplete. The figures in Table ES.10 only include water savings achieved until the point that the various WUGs reach a usage rate of 140 gpcd. We believe additional savings are possible and urge the planning group to include a .25% gpcd reduction once the WUG reaches 140 gpcd that continues until it reaches 100 gpcd.

[11] The group has considered, but not recommended and counted towards meeting goals, water conservation for WUG's that have a need that are between 100 an 140 gpcd. Water conservation often is the cheapest source of water and should be employed as extensively as possible in the Region K plan. We request that these savings be counted towards meeting the needs of these WUG's.

ES.6.5 Irrigation Water Management Strategies
[12] **(Page ES-15).** It would be helpful to include a row in Table ES.12 that indicates the projected irrigation shortages. This kind of information would provide a concise and useful picture for the reader of how the strategies match up with demands. That type of information should be included in other tables throughout the plan.

ES.7 Management Strategy Impacts
[13] **Page ES-17, second full paragraph** – Additional explanation is needed regarding the characterization of municipal return flows as being available only on an interruptible basis.

[14] As discussed further below, analysis of environmental flow impacts is lacking from the initially prepared plan. Although we acknowledge that there may be uncertainty about specifics of return flow amounts and downstream diversions, that type of uncertainty exists for all strategies and for all of the regional plans. It is not a sufficient reason for failing to undertake the assessments required by TWDB rules, which, of necessity, would be based on reasonable assumptions regarding the areas of uncertainty.

[15] **Page ES-17, fourth full paragraph** – Regarding the possible impacts from the HB 1437 water transfer, there is no real doubt that there would a reduction in instream flows from the diversion point downstream at least to the point at which the Ag Fund strategies are put in place. In addition, it is far from clear that the Ag Fund strategies would actually have the effect of fully offsetting the decrease in instream flows. Again, reasonable assumptions should be used about the potential diversion point and an assessment undertaken, as required by Section 357.7 (a)(8)(A)(ii) of the Board's rules.

[16] (**Page ES-18**). The first sentence of the paragraph that carries over from page ES-17 states: "However, LCRA will continue to meet all environmental flow requirements as provided by its Water Management Plan (WMP)." That language suggests that the WMP somehow will serve to replace the lost flows. However, nothing in the WMP indicates that. The WMP allocates a limited commitment of firm water and a declining supply of interruptible water towards helping to meet environmental flow targets. There is no mechanism in the WMP, as it currently exists, to increase the commitment of firm or interruptible water to make up for any environmental flows lost as a result of a HB 1437 transfer. We suggest the IPP text be supplemented to clarify this.

[17] **(Page ES-18).** It is our understanding that the LCRA-SAWS project is still being designed, based on the results of the extensive studies currently underway. Although we certainly understand the intent is to develop a project that is "designed to have minimal detrimental environmental, social, economic and cultural impacts and provides benefits to lake recreation over what would occur without the project," it is premature to characterize the project as already having been designed to achieve that or any other goal. We recommend changing the last sentence of the last full paragraph to reflect the absence of an actual project design by characterizing the various listed attributes as project goals, including the goal to "design a project that will have minimal detrimental environmental … impacts…."

ES.8 Water Conservation and Drought Management

[18] **(Page ES-19).** Generally, we support and commend the water conservation recommendations in the plan. However, we are disappointed that the group has rejected consideration of drought management as a water management strategy. As required by 357.7 (a)(7)(B) of TWDB's rules, drought management is a water management strategy that must be evaluated. That provision, along with Section 16.053 (h)(7)(B) also requires that drought management be included as a water management strategy for each entity required to prepare a drought management plan pursuant to Section 11.1272 of the Water Code. Although the planning group may decide, provided it documents the basis for that decision, not to include drought management as a water management strategy beyond those measures specifically required by Section 11.1272, it must include at least the Section 11.1272 level of drought management as a water management strategy. S.B. 2 made inclusion of drought management measures at least at the level required by Section 11.1272 a mandatory prerequisite for approval by TWDB of a regional water plan. See Tex. Water Code Ann. § 16.053 (h)(7)(B). The initially

prepared plan does not comply with that requirement. For each entity required to prepare a drought contingency plan pursuant to Section 11.1272 the water plan must include a water management strategy reflecting the drought period savings from that drought plan.

[19] In explaining the rationale for the decision not to include drought management as a strategy, the draft seems to suggest that drought management is not appropriate as a "long-term" management strategy. Certainly, it is true that drought management should be relied upon only during droughts rather than all of the time. Senate Bill 1 established a system of drought-based planning designed to address drought conditions. Water is in short supply during drought periods. If measures can be taken during the worst of those drought periods to limit water demands, it may not be necessary to develop expensive projects to supply additional water that would be needed only during the worst of the drought periods. We agree that it would not be appropriate to impose drought management measures on an ongoing, long-term basis. That isn't what drought management is designed to do. Rather, it is designed to limit non-essential uses of water on a short-term basis during drought periods. The concept is based on the recognition that it may make more sense, in terms of economic and environmental impact, to temporarily limit some non-essential uses rather than to expend the money and resources necessary to develop additional water supply that would only be needed during those rare drought periods to meet non-essential uses of water. We urge the planning group to give the concept further consideration.

ES.9 Policy Recommendations
[20] **(Page ES-19).** Many of the policy recommendations here appear to be overly simplified compared to the full version in Chapter 8. We suggest that the planning group consider reproducing the full text of key policy recommendations here to avoid creating unnecessary ambiguity, especially for readers who may not reach Chapter 8. If summary versions are used, we urge the planning group to word the summaries carefully and offer the following suggestions for making them more consistent with Chapter 8.

ES.9.2 Environmental Flows
[21] **(Page ES-20).** In the 3rd sentence, delete "ensuring that proper mitigation is performed in areas where the addition of new permitted shares could be detrimental to critical flow conditions" and replace it with "issuing permits with thorough mitigation plans that would assure the maintenance of appropriate environmental flows."

[22] **(Page ES-20).** In the last sentence of this sentence under this heading, delete "set restrictions on future permits to protect these surface water supplies" and replace it with "include provisions in all new permits that would further protect these flows."

ES.9.3 Environmental-Sustainable Growth
[23] **(Page ES-20).** This summary is not very clear and does not seem to convey the intended message from the policy committee. Again, we believe the full text from page 8-8 should be used here.

ES.9.11 Recommended Improvements to the Regional Planning Process
[24] (Page ES-22). In the second bullet item, delete "continue to consider environmental water needs throughout the planning process" and replace it with "structure the planning process to

include and plan for environmental needs." This will make this statement consistent with the actual recommendations in Chapter 8.

CHAPTER 1.0: INTRODUCTION AND DESCRIPTION OF THE LOWER COLORADO REGIONAL WATER PLANNING AREA

1.2.1.4. Water Resources

[25] **(Page 1-18).** There is no discussion of major springs as required by 31 TAC § 357.7 (a)(1)(D). Major springs that are important for water supply or natural resource protection purposes must be described.

There is no reference to springs in the plan other than San Saba Springs and Barton Springs and a description even of those springs is lacking. There is no description of any known springs or their related aquifer source although reference works such as Brune's *Springs of Texas* or TWDB Report 189 list known springs in all but two counties of Region K.

1.2.1.6 Wildlife Resources

[26] **(Page 1-23).** The description of wildlife resources in the region is lacking. Simply listing the states threatened and endangered species leaves a lot of species out. For example, species that are economically significant or that require special management should be acknowledged. Waterfowl hunting, wildlife viewing, and coastal fishing are important activities that depend on healthy populations of fish and wildlife. Those key fish and wildlife species should be acknowledged.

1.2.2.2 Primary Economic Activities

[27] (**Page 1-28**). Table 1.4 acknowledges that tourism and hunting are important economic activities in many counties. Fishing probably should be added as well. In addition, some discussion of tourism and fishing activities, along with other "businesses dependent on natural water resources" should be added as required by Section 357.7 (a)(1)(G) of the Board's rules.

1.2.2.3 Historical Water Uses

[28] **(Page 1-34).** A reference should be added here to the almost completed, but ongoing, revision of the freshwater inflow needs study and to the draft results indicating a need to increase the target and critical inflow numbers.

[29] The reference to water quality conditions in footnote 1 to Table 1.7 is confusing. It is not our understanding that the critical inflow number is a "water quality consideration" in the traditional sense of complying with water quality requirements. It is officially defined as the inflow sufficient to maintain a "sanctuary habitat during the most severe droughts."[3]

[30] **(Page 1-43).** In the first full paragraph, information is lacking about the role of "critical" instream flows and about the role of critical and target freshwater inflows. Discussion is provided regarding the goal of target instream flows but not regarding the goal of critical instream flows, which are also referred to, in the WMP, as "subsistence flows." On page 2-26, the initially prepared plan describes the critical instream flows as being "those necessary to

[3] See page VII-22 in Lower Colorado River Authority, 1997, Freshwater Inflow Needs of the Matagorda Bay System.

maintain species population during severe drought conditions." Some definition also should be provided here.

Although freshwater inflows are mentioned in the first sentence of this paragraph, no substantive discussion of issues related to critical and target freshwater inflows is provided. Discussion at least comparable to that provided for instream flows should be included.

[31] **(Page 1-43).** The last full paragraph acknowledges issues related to flows from Barton Springs as they relate to the Barton Springs salamander. However, it seems that the potential for the loss of springflows from Barton Springs and other springs in the region also would adversely affect water availability downstream. Because the WAMs inherently assume the continued contributions of historical springflows, a loss or significant reduction in flows from springs and seeps would adversely affect water supplies downstream. That issue should be acknowledged here and discussed.

[32] **(Page 1-44).** The first full paragraph on this page acknowledges the potential for groundwater withdrawals to adversely affect surface flows in some rivers in the planning area. The last sentence sounds ominous: "Increased pumping during drought conditions will decrease the base flow of the rivers that cross the Trinity Aquifer; however, the groundwater flow model suggests that **these rivers will continue to flow seasonally**." (Emphasis added.). This could be a significant issue not only for wildlife resources, but for domestic and livestock users. Further discussion is needed about the extent, and likelihood, of these impacts.

[33] **(Page 1-46.)** The discussion regarding water conservation plans should be updated to note the recent amendments to Chapter 11 of the Water Code requiring revisions to conservation plans, including the development of specific, quantified targets for water savings. Table 1.11, on page 1-48, reflects the status of water conservation plans prior to the updates, which were required to be filed no later than May 1, 2005. Similarly, Table 1.12a should be updated to reflect the required filing of updated drought contingency plans.

CHAPTER 2: POPULATION PROJECTIONS AND WATER DEMAND PROJECTIONS

2.2.1 Methodology (Population Projections)

[34] **(Page 2-3).** The first full paragraph on this pages notes that TWDB population projections were adjusted in some situations. It would be informative to have a summary table of those adjustments, as was done, for example, in the Region C plan.

2.3.1.1 Methodology (Municipal Water Demand Projections)

[35] **(Page 2-6).** We urge the planning group to include information on baseline municipal demand projections in gallons per capita per day (gpcd) for individual WUGs, either in this chapter or in Appendix 2A. That information, including the adjustments for efficient fixtures, would be useful for assessing and understanding the water conservation management strategies discussed in Chapter 4 and for understanding the projected impact of the plumbing fixtures code over the coming decades. This is a fundamental statistic for municipal demands, the dominant type of demand in terms of growth. It also would provide further insight into the calculation of the projected municipal demands, which are based on population and per person demands.

[36] **(Page 2-7).** Were the demand projections for the City of Austin also developed from the year 2000 base year? We are under the impression that the City developed its projections differently. If that is true, the City's approach should be explained here. It represents a huge piece of the projected water demands for the region.

2.3.3.1 Methodology (Irrigation Water Demand Projections)
[37] **(Page 2.11).** The text indicates the options that were available to the planning group for calculating irrigation demand, such as the choice of one of several base years. However, that discussion does not indicate how the demand was actually calculated. That information is needed. For example, what year was used as the base year for irrigation projections and why was that year chosen as being appropriate?

[38] **(Page 2.13).** In Section 2.3.4.2, it appears that the "130,875" acre-feet figure should be changed to 103,875 to match the amounts given on page 2.14.

2.4 Environmental Water Needs
[39] **(Page 2-19).** We acknowledge and commend the planning group for recognizing environmental water demands as a use category. We agree that supplying those demands is necessary to preserve the aquatic ecosystem within the region and believe that it also is necessary to support significant economic activities, such as commercial and recreational fishing and tourism, in the region. The third sentence under the "Environmental Water Needs" heading appears to be missing some text. The sentence would read better as follows: "In particular, planning for and meeting environmental water demands have been determined necessary to protect the habitat associated with the Colorado and Colorado-Lavaca estuary."

[40] **(Page 2.20)**. The fourth full paragraph includes a confusing statement. The second sentence, referring to the potential reopening of Parker's Cut, notes the claim of some that such a reopening might benefit fisheries production. The next sentence seems to say that resource agencies oppose reopening the cut because it might benefit fisheries production. That seems unlikely as a reason for such opposition. Some clarification is needed.

[41] In the fifth full paragraph, there is a reference to the bay reaching a point of receiving "practically zero discharge" from the river. It has been our understanding that while the total percentage of river discharge reaching Matagorda Bay certainly has varied, it has always been significant. We would appreciate some clarification of that issue, as well.

[42] **(Page 2-28).** The second to last paragraph presents the critical and target freshwater inflows. Some reference would be appropriate here, and on page 2-30, to the draft results of the revision to the freshwater inflow needs study for Matagorda Bay.

[43] **(Page 2-30).** Both the Study Commission on Water for Environmental Flows and the Senate Committee on Water Policy have completed their work. The references to those entities either should be deleted or updated to reflect the current status and the availability of reports generated.

[44] **(Pages 2-35 and 2-36)**. The reference in the second sentence on page 2-35 to Table 2.19 should be changed to a reference to Table 2.20.

Appendix 2A: LCRWPG Population and Water Demand Projections
[45] **(Page 2 of 8)**. In the table titled *Region K Water Demand Projections by Water User Group* on page 2 of 8, change "Blanco County Total Water Demand" to "Burnet County Total Water Demand" the second time it appears, on line 37.

CHAPTER 3: IDENTIFICATION OF CURRENTLY AVAILABLE WATER SUPPLIES

[46] **(Page3-2).** In the 1st bullet point of the two at the bottom of the page, the text should clarify that a "run-of-river" right may not be able to divert even if there is water in the river or stream due the constraints of the prior appropriation system or environmental flow limitations.

[47] **(Page 3-4).** The last sentence in the third paragraph is unclear. What is meant by the statement that the WMP does not take return flows into consideration? Is it intended to mean that return flows are assumed to be present or are assumed to be absent? That point should be clarified.

[48] **(Page3-4).** More explanation is needed in the last paragraph regarding which model results were actually used in developing the initially prepared plan. In our April 11, 2005 letter to Mr. Burke and Mr. Grant, we noted our concern about the potential for confusion and uncertainty created by the use of this "No-call" WAM scenario and proposed, instead, that the planning groups use a subordination strategy to address the need for providing reasonable supplies for Region F. However, given that the planning group has chosen to use the "No-call WAM," we believe great care must be taken to carefully explain what has been done. Because of this complication, the initially prepared plan is extremely confusing, even for readers with significant familiarity with water availability modeling. We suggest adding to this paragraph language explaining which results were actually used in the planning process: "The surface water availability amounts developed through the no-call model are the amounts actually used in developing this plan. These availability numbers are presented starting on page 3-15."

[49] **(Page3-4)**. Also in the last paragraph on this page, we suggest revising the existing second sentence to read: "The No Call WAM was developed as a result of a request from the Region F Planning Group. The November 2004 WAM indicated a lack of water available on a firm yield basis in a number of Region F's reservoirs as compared to the last planning cycle." We believe that is more informative, and accurate, than the existing language: "The No Call WAM was developed as a result of the lack of available water in a number of Region F's reservoirs."

[50] **(Page 3-5)**. The first sentence of the third paragraph creates confusion. As we understand it, the firm yield results described here were NOT used for purposes of this plan. Instead, the results set out beginning on page 3-15 were used. Some clarification is needed.

[51] **(Page 3-7).** In the paragraph on Instream Flow Requirements, the explanation of how these amounts were determined is quite unclear. The LCRA WMP lays out the several reaches and their respective Critical flows by month, but the rationale for apparently subtracting one from the other is unclear. The significance of "Ins" and "Outs" and how they are derived from the Critical values is unexplained. Finally, it is not at all clear that these individual averages by reach can then be added. There would seem to be potential duplication and overlap.

[52] **3.2.1.2 Colorado River Availability Adjustments for Planning Purposes**
We believe that the use of the "No-call WAM" is an ill-conceived approach to planning for the future of both Region F and Region K. It produces unnecessary uncertainty and confusion. The calculation of the amount of water available is a critical component of the planning process. As acknowledged in the initially prepared plan, at page 3-15, this approach represents a "quick fix." Unfortunately, the use of this quick fix results in a lack of confidence in the modeling results. It also results in a plan that does not appear to comply with applicable requirements. As we understand the Board's rules, needs are to be identified based on "current water supplies legally and physically available to the regional water planning area for use during drought of record." 31 TAC § 357.7 (a)(3). As acknowledged in several places in the initially prepared plan, the "No-call WAM" does not portray the water supplies legally available to Region K. Instead, it portrays only a subset of those rights. In addition, estimates of surface water availability are to be based on information from TCEQ[4] in the absence of "better site-specific information." 31 TAC § 357.7 (a)(3). Nothing in the initially prepared plan suggests that the "No-call WAM" provides better information about surface water availability. Instead, the "No-call WAM" appears to provide questionable information about the impacts of embedded management strategies.

[53] We continue to believe that the planning process and the general public would be better-served by using an explicit subordination approach, analyzed as a Water Management Strategy. This approach would provide the most transparency and it would avoid the use of a quickly put together surface water model with only questionable accuracy as the basis for the entire planning exercise.

[54] We do appreciate that a lot of hard work went into putting all the information together. We also acknowledge the efforts to present the availability results from both the Nov 2004 WAM3 run and the "No-call WAM" run. Although we believe further clarification is needed about which numbers were actually used, providing both sets of numbers does allow experienced reviewers to compare the two sets of results. Unfortunately, those not well-versed in water availability modeling are likely to have a difficult time understanding the complexities of the information provided.

3.2.1.2.1 Other Considerations Regarding Adjustments to Availability
[55] **(Page 3-16)**. Regarding point 1, we agree with the decision of the regions to coordinate to address this issue. However, as noted above, we believe a subordination approach would be preferable.

[56] **(Page 3-16)**. Regarding point 2, there are numerous assumptions embedded here. If a subordination strategy were used, supply shortages resulting from such subordinations could have been identified. Also, it is not clear, at this point, that the shortages identified in the "No-call WAM" results for Region K are real shortages, particularly in the absence of any commitment by downstream water rights holders actually to subordinate their water rights, even temporarily.

[57] **(Page 3-16)**. Regarding point 3, the same comments as made for point 2 apply. The relevant question is whether the indicated shortages are real. Although this certainly may not be the

[4] The Board's rules refer to the Texas Natural Resource Conservation Commission, but the name of that agency has since been changed.

intent, as currently drafted, this language suggests that the purpose of the planning exercise is to justify the permitting of potential management strategies rather than to identify and address supply shortages.

[58] (**Page 3-16**). Regarding point 4, see comments above regarding point 3.

[59] (**Page 3-16**). Regarding point 5, the assumption of the absence of a need to make a priority call should be reflected through an overt acknowledgement of willingness to subordinate rights, at least on a conditional or temporary basis.

[60] (**Page 3-16**). Regarding point 6, this statement seems to be inconsistent with the basic intent of the planning process. The Legislature has expressly directed that consistency with regional water plans is a significant consideration in water rights permitting decisions.

3.2.1.2.3 Highland Lakes System Availability After Implementing the No-Call Assumption

[61] **(Page 3-20).** In Table 3.1a and footnote 6 to the table, an explanation is needed regarding why it is appropriate to remove yield impacts of the O.H. Ivie Reservoir from this determination.

[62] **(Page 3-20).** In Table 3.1a and footnote 8 to the table, further explanation is needed regarding what happens to the approximately 7,000 ac-ft/yr of contractual obligations in this "No-call" WAM alternative supply determination.

[63] **(Page 3-20).** In Table 3.1b, the difference given here is based on the firm yields for the Highland Lakes from Table 3.2 and 3.1a. However, the firm yield listed in Table 3.1 for the lakes was over 521,000 ac-ft/yr since it included Ivie reservoir. Discussion of this apparent extra loss of some 85,700 ac-ft of firm yield for Ivie reservoir (Table 3.1) should be provided.

[64] **(Page 3-21).** In the 1st paragraph on Instream Flow Requirements, it is not clear what was done or why. There is no explanation for how these numbers were arrived at. The terms, such as IFCA-IN and IFCC-OT are not adequately defined. It is not apparent that this determination correctly relates to the Critical flows of the LCRA WMP and how often they are met in the drought of record.

[65] **Page 3-21, second paragraph on Instream Flow Requirements** – It is unclear why the 2nd paragraph beginning with "The 1999 LCRA Water Management Plan states:" is included. Additional explanation is needed regarding how the listed constraints affected the modeling results.

[66] **(Page 3-28).** As implicitly acknowledged in paragraph number 3, the use of the "No-call WAM" precludes the ability of the planning group to undertake the required quantitative evaluation of environmental flow impacts. Although we appreciate the acknowledgement of the need to have this information, the required information is missing. Accordingly, as noted above, we believe the planning group, at minimum, must explicitly condition its recommendations to require future review and approval by the planning group once that information becomes available.

3.2.2.1 Major Aquifers

[67] **(Pages 3-32 and 3-33).** We commend the planning group on working collaboratively with the Groundwater Conservation District's in the region. This is a necessary partnership. We also commend the group on their method for determining the availability in aquifers in the region that were not included in groundwater conservation districts. Sustainable groundwater management goals are an important component of sound planning. In particular, we commend the planning group for recognizing the need to maintain surface flow contributions that depend on groundwater sources.

We realize that the predictive models for the Central Gulf Coast Aquifer were not completed in time to be used for this report. That is unfortunate. Because that Aquifer is such a major water supply component in the region, this represents a significant information shortfall. We look forward to seeing that information in the next version of the Region K plan.

[68] **(Page 3-40)**. The second full paragraph indicates that water availability for the Barton Springs segment of the Edwards (BFZ) aquifer was based on maintaining "a mean monthly spring flow of approximately 1 cubic foot per second (cfs) at Barton Springs." This amount of flow appears to be potentially inadequate for protection of the Barton Springs salamander. According to the Recovery Plan for the salamander, the lowest recorded short-term flow at Barton Springs was 9.6 cfs in March of 1956. (*Barton Springs Salamander Draft Recovery Plan*, page 1.6-31 (U.S.F.W.S. Jan. 2005)). At any rate, additional analysis should be provided to demonstrate consistency with long-term protection of natural resources.

[69] **(Page 3-60)**. A more explicit statement should be included in Table 3.24 to indicate that the Colorado Basin surface water availability numbers are based on the "No-call WAM."

[70] **(Page 3-67).** The first sentence of the first full paragraph on this page is confusing. The statement that water availability for WUGs is limited by current needs doesn't seem to make sense. Even if a WUG doesn't currently need the water, it still may be available if the infrastructure is in place to deliver it when the need arises. If availability numbers actually were adjusted on the basis of the absence of a current need, the numbers should be revised. If the numbers weren't adjusted in that way, then the sentence should be corrected to accurately reflect what was done.

CHAPTER 4: IDENTIFICATION, EVALUATION, AND SELECTION OF WATER MANAGEMENT STRATEGIES BASED ON NEED

Quantitative Environmental Analysis: general comments on Chapter 4

[71] In general, there is a lack of quantitative environmental analysis of individual water management strategies as required by TWDB rules. The rules require an analysis of impacts to environmental water needs as well as wildlife habitat and cultural resources. 31 TAC § 357.7 (a)(8)(A)(ii). This analysis should include a comparison of current environmental conditions to future conditions.

[72] We recognize the modeling limitations resulting from the planning group's decision to use the "No-call WAM" that was developed for this process. However, at minimum, a basic analysis

should be preformed for each strategy proposed for inclusion in the plan. This analysis should be performed using the current water usage levels and return flows as its baseline. We can see these conditions in our rivers and streams every day and under those conditions we know that there are fish in the water and wildlife along the shore. We do not know the condition of the river under the "No-call WAM" full use-no return flows scenario. Comparing future conditions to current conditions or some biologically sound targets is the only way to get meaningful results.

[73] All but two of the analyses that are included are largely qualitative. TWDB rules require a quantitative analysis for each strategy. The Region K plan should provide the required quantitative environmental analysis of each water management strategy.

4.1 Identification of Water Needs
[74] **Page 4-1, second paragraph** – It is not clear why municipal return flows are characterized as "interruptible." At least within the planning period, we understood, from earlier discussion in the plan, that specified quantities of return flows were expected to be available on a consistent basis. Although we realize that the City of Austin is planning on reusing a portion of its return flows during the planning period, it appears that specific amounts of return flows would be expected from the city on a reliable basis. The use of the term "interruptible" also is problematic because "interruptible supplies" have a specific meaning in the context of the LCRA WMP.

The discussion of "conservative estimates" in this paragraph fails to acknowledge the major impact of treating contract rights as not being available if the current contract will expire during the planning period. That impact should be clearly acknowledged here so that readers will understand that significant amounts of the projected needs can be met through simple contract renewals.

[75] **Page 4-3, fourth paragraph, last 2 sentences** – These sentences state that LCRA will fund several strategies through "leveraging the sale outside of the region of any **surplus water** made available through these measures. LCRA believes that this funding mechanism will also provide a significant cost savings to the customers of LCRA…" (Emphasis added). A critical issue here is the definition of "surplus water." When is water going to be considered to be surplus? Even without quantifying the amounts needed for protecting environmental flows and the economic activities dependent on this flows, there are large predicted shortages in the region. Discussion of that issue is needed.

4.2 County Summaries of Water Needs
[76] **(Page 4-4).** We support and appreciate the effort to highlight those projected needs that are expected to be met through contract extensions. It would be even more informative if a row were added to the various tables to reflect the amount of the total needs expected to be met in that way.

[77] **(Page 4-5).** In Section 4.2.4 and Table 4.4 (Colorado County Needs), the discussion should explicitly acknowledge the needs that are projected primarily as a result of the use of the "No-call WAM." By comparing the results of availability determinations for run-of-river rights with and without the No-call assumption (shown in Tables 3.3a and 3.3, respectively), it appears that approximately 97,000 ac-ft/yr less water is available due to this assumption alone among the four large irrigation rights in the lower basin. The change in availabilities are, respectively,

Garwood: -21,300 ac-ft/yr; Lakeside: -15,800 ac-ft/yr; Gulf Coast: - 48,500 ac-ft/yr; Pierce Ranch: - 11,400 ac-ft/yr.

[78] **(Page 4-7).** As noted above for Colorado County, in Section 4.2.9 and Table 4.8 (Matagorda County Needs), the text should explicitly acknowledge that a good portion of the "need" in the irrigation category is potentially due to the adoption of the "No-call" WAM alternative supply determination.

[79] **(Page 4-9). Section 4.2.12 and Table 4.11, Travis County Needs** – In the interests of clarity, the text should note that a good portion of the apparent "need" for the City of Austin is potentially due only to the adoption of the "No-call" WAM alternative supply determination. By comparing the results of availabilities for run-of-river rights with and without the No-call assumption (shown in Tables 3.3a and 3.3, respectively), it appears that approximately 45,700 ac-ft/yr less water is available due to this assumption alone for the City's rights.

[80] **(Page 4-10). Section 4.2.13 and Table 4.12, Wharton County Needs –** As noted above for Colorado and Matagorda counties, it should be stated here that a good portion of the apparent "need" in the irrigation category is potentially due only to the adoption of the "No-call" WAM alternative supply determination.

[81] (**Page 4-11**). We commend the planning group for including information to allow comparison of projected water supply surpluses with needs. The sixth sentence in the first paragraph under Section 4.2.15 indicates that "additional water" must be developed because region-wide needs on a county-by-county basin exceed surpluses. Although we support the inclusion of this comparison in the plan, the use of the term "additional water" seems to ignore the potential for water conservation strategies and drought management strategies to address some of the identified needs.

[82] (**Page 4-17**). We agree that LCRA's role in helping to meet environmental flow needs should be acknowledged. However, it would be more accurate to state that LCRA provides water that goes towards meeting environmental flow needs. The current language seems to suggest that the environmental flow needs are fully met by LCRA. That is not accurate.[5] In addition, from a review of the two tables on this page and the referenced sources for those tables, it does not appear that any commitment of water towards meeting environmental flow needs actually is reflected in the listed totals.

4.5 Evaluation and Selection of Water Management Strategies

[83] **(Page 4-19).** The 3rd full paragraph under this heading discusses the "No-call WAM" and its use. It is very disquieting to read that the results of those analyses should be "considered unreliable" for assessing impacts. Basically, this result indicates that key requirements for development of the regional water plan have not been met. For many proposed strategies, there is no substantive effects analysis, much less the type of quantitative analyses required by 31 TAC §

[5] For example, LCRA previously calculated that under its 1999 Water Management Plan, Matagorda Bay Target Flows were only projected to be met in 38% of years. Attachment to April 17, 2002 letter from Quentin Martin (unpublished 11x17 tables of impacts of various Water Management Plan alternatives titled "Preliminary Impact Assessments of Additional Alternatives with Revised Parameters for 12/03/01 meeting).

357.7 (a)(8)(A)(ii). The qualitative analyses that are provided for some strategies are lacking in substance. The decision of the planning group to rely on this model has created serious deficiencies in the regional plan. As noted above, we believe the only feasible approach[6] available at this juncture for addressing these deficiencies is to qualify the recommendations in the plan to explicitly state that large surface water management strategies could be considered consistent with the plan only if the planning group, after later review of impacts, determines the impacts are reasonable and approves the strategy as being consistent with protection of environmental flows and with long-term protection of the state's water resources, natural resources, and agricultural resources.

4.5.1.1 COA Return Flows

[84] **(Page 4-20).** The last sentence of the first paragraph in Section 4.5.1.1 is unclear. This language seems to suggest that the amount of return flows assumed may have been somewhere between 100,000 and 150,000 acre-feet. However, the precise assumptions are not explained.

[85] The first sentence of the second paragraph of this section indicates that projected return flows were allocated according to priority. Some explanation is needed for how environmental demands, which don't carry an actual priority, were addressed in that allocation.

[86] **(Page 4-21).** In Table 4.26, a footnote states that some of the figures in the table represent increases in firm supply. Other footnotes do not indicate whether the indicated numbers represent firm availability or something else. That information should be provided, particularly for the listed "benefits" to Matagorda Bay.

[87] The required evaluation of environmental factors is lacking for Sections 4.5.1.1 and 4.5.1.2. The strategies evaluated here are the use of return flows to meet various water needs. The use of those flows will have adverse impacts on environmental water needs. Those impacts are required to be evaluated pursuant to 31 TAC § 357.7 (a)(8)(A)(ii). The last row of Table 4.26 seems to conflict with the strategy being considered. The information in that row assesses the strategy as though return flows were being added to the river. However, the strategy actually involves taking return flows out of the river. Accordingly, rather than an overall benefit to Matagorda Bay, the net effect of the strategy is to reduce inflows to the Bay. That effect must be evaluated.

4.6.1 LCRA WATER MANAGEMENT STRATEGIES

4.6.1.1 General LCRA Strategy – LCRA System Operation

[88] (Page 4-23). The last sentence on this page introduces confusion because it refers to the "overall management plan" rather than the overall system operation. The existing water management plan does not address either the LSWP or HB 1437.

4.6.1.2 Amendments to Water Management Plan

[89] **(Page 4-24).** The 2nd and 3rd paragraphs are in conflict with one another. One describes the additional commitment of 17,000 acre-feet of water to environmental flows as involving "firm" supplies and the other describes it as a commitment of "interruptible" supplies. The proper

[6] Obviously, if the required analyses could be undertaken in a reliable and timely manner, the explicit qualification called for here would not be necessary. However, we understand the initially prepared plan to indicate that the analyses simply cannot be done in a timely manner.

characterization of that commitment is very significant, particularly for the 2060 time frame, when, as noted in Table 4.28, very little interruptible supplies are projected to be available.

[90] **(Page 4-24).** The last sentence of the 2nd paragraph is very significant. Basically, it indicates that target instream flows would almost never be met under 2060 conditions and target freshwater inflow flows would only be met very rarely. Those changes to the WMP would result in large impacts on environmental flows. The potential impacts of not providing those target flows are not analyzed here.

[91] (**Page 4-24**). The "issues and considerations" discussion is very confusing. The referenced "minimum amounts currently included in the LCRA's systems operations model" need to be explained. The last sentence which talks about derivative benefits to environmental flows from meeting irrigation demands is particularly confusing because the strategy being evaluated involves making less water available both for direct provision of environmental flows and for irrigation demands.

[92] (**Page 4-26**). Table 4.28 should be clarified to make clear if it indicates the total amount of interruptible water expected to be available, as the title indicates, or only the amount of interruptible water expected to be available to meet irrigation needs, as the text at the bottom of page 4-25 indicates. If it is the latter, then information is needed about the amounts of interruptible water projected to be available to meet environmental demands.

[93] (**Page 4-26**). The discussion under the "Environmental and Other Impacts" heading is extremely inadequate for purposes of providing a meaningful evaluation, much less a quantitative reporting, of environmental factors as required by 31 TAC § 357.7 (a)(8)(A)(ii). Again, the strategy being evaluated involves changing the WMP with the effect of making less interruptible water available for irrigation and less water available for environmental flows. The impacts of those changes must be assessed. No such assessment results are provided. The discussion includes a confusing reference to increased use of groundwater for rice irrigation. Increased use of groundwater is not part of this strategy.

4.6.1.3 Amendments to ROR Rights

[94] **(Page 4-26).** The last sentence of the first paragraph under this heading refers to a 10,000 afy demand reduction due to operational efficiencies that will be used as a supply strategy. Where is that strategy discussed? If it is proposed as part of this strategy, more information and discussion is required.

[95] (**Page 4-27**). The second full sentence on this page refers to the use of about 150,000 to 200,000 acre-feet of water from the Lakeside, Gulf Coast, and Pierce Ranch water rights for irrigation to meet 2060 demands. However, Table 3.24 (on page 3-60) seems to indicate that only about 115,000 acre-feet is projected to be available in 2060 from those water rights. That apparent discrepancy should be explained.

[96] **(Page 4-27).** The 2nd sentence of the 2nd full paragraph on this page refers to "LCRA's 'flood flow' permit application." That application does not purport to seek only "flood flows." The reference would be more accurate if it referred to "LCRA's permit application for the remaining unappropriated water in the Lower Colorado River Basin."

[97] **(Page 4-28).** The "Issues and Considerations" discussion is extremely general and borders on being misleading. The discussion does not seem to provide a fair consideration of environmental flow impacts because it never acknowledges, as a starting point for discussion, that the conversion of irrigation rights to other uses means that the water would be diverted out of the river far upstream of the current diversion points. Although the use of the converted rights **could** result in somewhat increased return flows compared to those without the conversion, the overall amount of flow in the river most of the time still would be significantly reduced. Moreover, the discussion of return flows ignores the increase in reuse discussed elsewhere in the plan. In general, this text reads more like an attempt to paint a rosy picture than an attempt to provide a clear discussion of the issues. In addition, it does not come close to presenting a quantitative presentation of the issue.

4.6.1.4 LCRA Contract Renewals and Amendments

[98] **(Page 4-31). The discussion under the "Issues and Considerations" heading probably should be retitled something like** *Environmental Impact.* Regardless, however, that discussion is, at best, a very broad qualitative discussion of impacts and does not constitute a reasonable attempt at the quantitative analysis required by 31 TAC § 357.7 (a)(8)(A)(ii).

4.6.1.5 LCRA New Water Sale Contracts

[99] **(Page 4-32).** The title of the "Issues and Considerations" discussion probably should be changed to *Environmental Impact* because that appears to be what is discussed.

4.6.1.8 Excess Flows and Off Channel Storage

[100] **(Page 4-33).** As noted above, we do not believe the term "excess flows" is accurate or appropriate. It connotes flows that perform no function. Much of the "excess flow" that is potentially proposed for capture provides important services to the environment and to the human economy, particularly along the coast. A title such as "Application for Unappropriated Flows and Off-Channel Storage" would be more appropriate.

There does not appear to be any analysis of the amount of water expected to be available from this strategy or of the approximate unit cost for the water. Those analyses are required pursuant to Section 357.7 (a)(8)(A)(i) of the Board's rules. Although no quantitative environmental analysis is provided, the text seems to indicate that the project was assumed to be subject to a limitation only allowing diversions when flows below the diversion point equaled or exceeded the target instream and target freshwater inflows established in the LCRA Water Management Plan. That type of limitation would be very helpful in minimizing adverse impacts. As discussed elsewhere, the draft revision of the freshwater inflow needs study recommends a sizeable increase in the target freshwater inflow amount. Some explanation of what value was used for purposes of this analysis would be helpful. In addition, analysis is needed regarding the potential impacts from construction of the off-channel reservoirs and associated facilities. See 31 TAC § 357.7 (a)(8)(A)(ii). No information is provided about the calculation of potential yield or unit cost in this discussion, as required by Section 357.7 (a)(8)(A)(i) of the Board's rules. We did not find that information elsewhere in the initially prepared plan.

4.6.1.9 LCRA-SAWS Water Sharing Project (LSWP)
[101] **(Page 4-34). We suggest changing language in the last sentence of the 1st paragraph** from "the *project is designed* to have minimal detrimental environmental … impact" to "the *goal is to design a project that will have* minimal environmental, social … impacts." It is our understanding that the project has not yet been designed.

[102] (**Page 4-34**). Under the opinion of probable cost paragraph, there appears to be a typographical error resulting in three missing zeroes. The projected cost of the LSWP elsewhere in the initially prepared plan is listed as $1,704,473,000. This cost estimate does not provide the specific unit cost information required pursuant to Section 357.7 (a)(8)(A)(i) of the Board's rules.

SECTION 4.6.2 CITY OF AUSTIN WATER MANAGEMENT STRATEGIES

4.6.2.1 Water Conservation
[103] **(Page 4-35).** Contrary to the last sentence of the 1st paragraph on this page, we had understood that the City of Austin did not use 2000 as the base year for its water demand calculation because of summer water use restrictions during that year.[7] We would appreciate clarification of that issue. Further explanation is needed regarding the statement that recorded usage was increased "to reflect actual contracted amounts." Contracted amounts do not reflect actual usage and it is not clear why it is appropriate to include them in base year demands.

[104] **Pages 4-35 through 4-36** – While we commend the planning group for including fairly substantial levels of savings for water efficiency measures, the goals for the City of Austin, which represents by far the largest municipal demand amounts, are disappointing. We believe that the City could do much better than the proposed savings of 33,537 ac-ft/yr. As shown in the following table, this would still leave the City's per person demand at 151 gpcd after nearly 60 years of effort. As you know, the recent report of the Water Conservation Implementation Task Force recommended a long-term goal of 140 gpcd for municipal users.

Table K-IPP-1 – Calculation of City of Austin net water use rate at 2060 time frame with water efficiency measures in Initially Prepared Plan.

Region K IPP proposed water use and water efficiency data, City of Austin, Year 2060					
Popula-tion	Portion of region (%)	IPP total demand of WUG (ac-ft/yr)	base TWDB use rate (gpcd) [includes plumbing code]	addtnl. water effi-ciency sav.* (ac-ft/yr)	net water use rate with efficiency measures (gpcd)
1,634,578	60.2%	309,433	169	33,573	151

[7] We certainly do not believe that the use of summer water restrictions should result in the rejection of that year as the base year for calculations. Drought contingency measures need to be accounted for. That can be done either by including it in a base year or by applying drought contingency measures as a water management strategy. Regardless, it needs to be included. Unfortunately, it does not appear that limitation of demand through use of drought contingency measures has been included for any water user group.

[105] **Pages 4-35 through 4-36** – The following table illustrates that the City of Austin could save an additional 19,525 ac-ft/yr through reasonable levels of effort to achieve improved water efficiency.

Table K-IPP – 2 Illustration of potential additional water efficiency savings that the City of Austin could attain by 2060.

	Region K IPP proposed water use and water efficiency data, City of Austin, Year 2060					environmental community proposed savings		
Year 2000 use rate (gpcd)	Popula-tion	IPP total demand of WUG (ac-ft/yr)	TWDB base use rate (gpcd) [includes plumbing code]	addtnl. water effi-ciency sav.* (ac-ft/yr)	net water use rate with efficiency measures (gpcd)	use rate** (gpcd)	revised total demand (ac-ft/yr)	addtl. savings (ac-ft/yr)
175	1,634,578	309,433	169	33,573	151	140	256,327	19,525

NOTES:*Reg K IPP proposed savings from Section 4.6.2 for City of Austin
** proposed water use rate is based on 1% per year reduction from year 2000 water use, but no less than 140 gpcd.

We know that this suggested municipal water use rate of 140 gpcd is not unreasonable for Texas. San Antonio provides a real world example of the potential of improved water efficiency. Through a concerted effort, San Antonio has reduced its municipal water use to about 132 gpcd from a use level of about 213 gpcd in a period of around 20 years. This reduction was achieved through water efficiency measures without accounting for reuse.

The South Central Texas Regional Water Planning Group (Region L), in its initially prepared plan, has established water efficiency goals as follows:

> "For municipal water user groups (WUGs) with water use of 140 gpcd and greater, reduction of per capita water use by 1 percent per year until the level of 140 gpcd is reached, after which, the rate of reduction of per capita water use is one-fourth percent (0.25) per year for the remainder of the planning period; and
>
> For municipal WUGs having year 2000 water use of less than 140 gpcd, reduction of per capita water use by one-fourth percent per year."

These excerpts are from Initially Prepared 2006 South Central Texas Regional Water Plan at p. 6-1.

[106] (**Page 4-36**). Although a range of costs is noted for conservation programs, an average cost for achieving the estimated savings also should be provided in order to allow for better comparison with other management strategies.

[107] (**Page 4-36**). The discussion of "Environmental and Other Impacts" also should note that water conservation generally does not result in adverse impacts to environmental flows or other environmental considerations.

4.6.2.2 Reclaimed Water Initiative

[108] (**Page 4-36**). The fifth sentence in the first paragraph of this section refers to "developing water factories." That is a fairly unusual term and some explanation is needed regarding what is actually intended by that reference. It seems unlikely that the City actually will be making water at those locations.

[109] (**Page 4-38**). The last sentence indicates that no cost is associated with the proposed indirect reuse for the Fayette Power Project. That contention should be explained. It seems likely that some costs would be incurred for increased pumping and pipeline capacity and increased operating costs. If no such costs are anticipated, the basis for assuming the absence of such costs should be explained.

[110] **(Pages 4-39 to 4-46).** We are pleased to see an actual quantitative environmental analysis for this strategy. As noted elsewhere in these comments, the absence of quantitative analyses for almost all strategies is a significant deficiency in the plan. Unfortunately, because of the limitations resulting from use of the "No-call WAM," this analysis is, as the plan acknowledges, not reliable. In addition, the instream flow impacts are only evaluated against 7Q2 values, which is a limited water quality parameter. It is the amount of flow expected during an extremely dry period below which serious water quality impacts are predicted. Accordingly, it does not appear appropriate to compare a **median** flow value to the 7Q2 standard.

The LCRA WMP has specific values reflecting instream flow needs in the Colorado River that should be used in these impact evaluations. The WMP inflow values are used in assessing freshwater inflow impacts and the WMP instream values should be used in assessing the instream flow impacts.

[111] There is no discussion indicating that the water management strategy was adjusted to account for environmental water needs. See 31 TAC § 357.5 (e)(1). Again, the values included in the WMP, which are site-specific, would be appropriate for that consideration.

[112] (**Pages 4-44 and 4-45**). The results shown in Figure 4.5 and Figure 4.6 are sobering. They show median inflow values far below the target freshwater inflow values for most of the year. They also show **median** inflow values falling below critical freshwater inflow values for several consecutive months of the year. Those critical inflows are intended to provide a fishery sanctuary habitat during droughts from which species could recover to repopulate the bay during more normal weather conditions.[8] As such, the amounts needed to support those sanctuary flows should be compared to drought period inflows not median inflows. These results are particularly troubling because the critical inflow value included in the proposed revision to the inflow needs study is much higher than the value reflected in these figures. Although we acknowledge the uncertainty about the accuracy of the underlying WAM analysis, the picture painted here is pretty dire. Again, we believe the planning group needs to qualify its recommendations of this and other significant surface water strategies by making them contingent on future evaluation and approval after better environmental analyses are undertaken.

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[8] Water Management Plan for the Lower Colorado River Basin (including amendments through March 1, 1999), LCRA at p.35.

4.7.1.2 Edwards BFZ Aquifer
[113] (**Page 4-49**). There does not appear to be any discussion of the environmental impacts of increased pumping from this portion of the Edwards Aquifer. In fact, the text does not even explicitly indicate which section of the aquifer the additional pumping would impact. It appears, however, that it would impact the Barton Springs segment. As noted above, if that is correct, the potential for springflow impacts are significant and require discussion in accordance with Section 357.7 (a)(8)(A)(ii). At any rate, the issue must be acknowledged and discussed.

4.7.4 Temporary Overdraft of Aquifers
[114] **(Page 4-73).** The last sentence of the 5th paragraph states that the Gulf Coast Aquifer will recover from temporary overdrafting. However, table 4.97 on page 4-108 shows that there will be a maximum long-term drawdown of up to 60 feet. That apparent inconsistency should be addressed, particularly given the absence of GAM results adequate to provide good information about water availability from this aquifer.

4.8.1 Water Conservation and 4.8.1.1 Additional Conservation
[115] **(Pages 4-75 to 4-79).** We commend the planning group on its inclusion of municipal conservation as a strategy. A 1% reduction per year in water usage is a good and attainable goal that should be applied region-wide.

[116] **(Page 4-75).** The savings calculations reflected in Table 4.74 are somewhat incomplete. The group has also recommended a .25% reduction per year for WUG's with a usage rate in the 100 – 140 gpcd range. The calculations in Table 4.74 only include water savings until the WUG reaches 140 gpcd. These entities will already have conservation programs in place and it only makes sense for those conservation practices to be continued. Accordingly, the table should be updated to reflect the additional savings from a .25% reduction per year for those WUGs that reach the 140 gpcd goal and still have a remaining need. Table 4.76 reflects the potential savings from other WUGs starting with a gpcd of 140 or below. Unfortunately, it does not appear that the potential savings shown in Table 4.76 are included as a water management strategy.

[117] There are significant additional water conservation savings that could be realized. For many WUGs, their projected per capita water use, even at the 2060 time frame, is well above the usage levels that can reasonably be achieved today with a concerted effort. We have attached a document, labeled as Table K-IPP – 3, that reflects our calculations of additional savings of 23,531 ac-ft/yr that could be achieved if these WUGs were to reduce their usage levels to 140 gpcd. As reflected in our comments above, the majority of this savings are for the City of Austin. Approximately 4,000 ac-ft/yr would be from other WUGs as indicated in the table.

[118] **(Page 4-77).** ***Opinion of Probable Cost*** – We appreciate the efforts of the Region K consultants to develop good cost estimates for these water conservation strategies. The information from the TWDB/GDS report provides a good basis for those estimates. We request that the planning group reference TWDB Report 362 – *Water Conservation Best Management Practices Guide* as a resource for WUGs to use in developing their specific water conservation programs.

[119] **(Page 4-77).** Under the "environmental impact" heading the discussion of environmental flow impacts from improved water use efficiency seems a bit over-simplified. Improved water

use efficiency for groundwater sources, even through in-home measures, likely would not adversely affect stream flows if the source aquifer directly contributes to flows through springs or seeps.

[120] **(Page 4-78).** As noted above, Table 4.78 reflects savings that could be achieved through improved water use efficiency for WUGs that have a need and that have usage rates between 100 and 140 gpcd. However, these savings are not reflected in a recommended water management strategy. Water conservation generally is the cheapest source of water, particularly when environmental and other impacts are included, and should be employed as extensively as possible in the Region K plan. We urge the planning group to include this additional water conservation as a recommended water management strategy.

4.8.4 Recharge Edwards BFZ with Onion Creek Recharge Structure for Hays County
[121] **(Pages 4-84 to 4-86).** The discussion of this strategy does not indicate which WUGs or water needs this strategy is intended to serve. More information is needed about the strategy (e.g., size and type of impoundments), the potential impacts of the strategy, and the potential water supply produced by each proposed structure.

[122] The data from the dye tracing studies performed by the BSEACD make this strategy look quite unreliable. Given those results, there does not appear to be any justification for including an estimated firm annual recharge figure for the structures. More discussion is needed about the basis for assuming that drought period supplies would be available.

4.8.5 Obtain Surface Water from the COA for Hays County
[123] **Page 4-86** - This strategy does not have a user identified and no amount is given for the amount of water to be developed from the strategy. A table should be included in this section that provides the information, as is done for other strategies.

4.8.8 HB 1437 (Region G) for Williamson County
[124] **Page 4-97, *Environmental Impact*** – Regarding the possible impacts from the HB 1437 water transfer, there is no real doubt that there would a reduction in instream flows from the diversion point downstream at least to the point at which the Ag Fund strategies are put in place. In addition, it is far from clear that the Ag Fund strategies would actually have the effect of fully offsetting the decrease in instream flows. Reasonable assumptions should be used about the potential diversion point and an assessment undertaken, as required by Section 357.7 (a)(8)(A)(ii) of the Board's rules.

[125] **(Page 4-97)**. The second to last sentence of the last paragraph in Section 4.8.8 states: "However, LCRA will continue to meet all environmental flow requirements as provided by its WMP." That language suggests that the WMP somehow will serve to replace the lost flows. However, nothing in the WMP indicates that. The WMP allocates a limited commitment of firm water and a declining supply of interruptible water towards helping to meet environmental flow targets. There is no mechanism in the WMP, as it currently exists, to increase the commitment of firm or interruptible water to make up for any environmental flows lost as a result of a HB 1437 transfer. In the absence of an explicit commitment by LCRA to replace any such reduced flows, the text should be corrected to accurately reflect that reality.

4.9 Irrigation Water Management Strategies

Page 4-99, Table 4.89 – Two of the listed strategies in this table need further explanation in the text. We were unable to locate any description of these strategies in Section 4.9:

[126] The strategy 'Firm up ROR with Off-Channel Reservoir, 47,000 afy in 2060' has no meaningful explanation in the text. Appropriate discussion should be added. A brief reference on page 4-100 represents that a discussion of the strategy can be found in Section 4.6.1. However, no "discussion" is found in that Section. Rather, there is only a statement that such a strategy is being considered. The information included does not comply with applicable requirements for evaluation of water management strategies.

[127] The strategy 'Supply Reduction due to LSWP, 106,620 afy on 2060' has no explanation in the text. Appropriate discussion should be added. Again, a brief reference on page 4-100 represents that a discussion of the strategy can be found in Section 4.6.1. Again, that "discussion" is not to be found.

[128] The approach used in the initially prepared plan for evaluating components of the LSWP results in an incomplete and potentially even misleading portrayal of environmental impacts. The impacts of a few components of the LSWP are evaluated separately, although those evaluations are only very general qualitative evaluations. Thus, for example, the impacts of "on-farm water conservation" on environmental flows are only characterized as though that practice would be undertaken in a vacuum. However, it would not. As the "opinion of probable cost" discussion and the "Social/Economic" entry in Table 4.91 make clear, that conservation is not proposed as a stand-alone project. It is proposed only as part of the LSWP. However, the impacts of the overall LSWP, including the impacts of sending 150,000 acre-feet of water out of the basin, are never evaluated. The LSWP is included as a recommended water management strategy but it is not evaluated as required by Section 357.7 (a)(8)(A)(i) and (ii). This is a huge project with potentially huge environmental impacts. The failure to provide meaningful evaluation is a major inadequacy of the initially prepared plan.

4.9.1 On-Farm Water Conservation

[129] In general, we are very supportive of agricultural water conservation. However, as noted above, the impacts of these conservation measures must be assessed in the context in which the measures are proposed for implementation. That is, they must be assessed as part of an evaluation of the overall LSWP. The required assessment is lacking.

Page 4-101 to 4-103, *Environmental Impact*:

[130] This evaluation seems to assume that the amount of surface water available at the diversion point for rice irrigation is a constant value. In other words, the evaluation fails to acknowledge the role of releases of interruptible stored or storeable water from the Highland Lakes. If, as a result of implementation of conservation practices, less water is released from or passed through the Highland Lakes, that also will have the effect of reducing environmental flows throughout the lower river system. Those impacts are not acknowledged here. The need for a comprehensive evaluation is illustrated by the discussion of impacts related to return flows from second crop rice. Another aspect of the LSWP involves introduction of a new rice variety that would result in cessation of the production of a second crop. The absence of a comprehensive evaluation makes a meaningful understanding of impacts virtually impossible.

[131] **(Page 4-103).** The 1st full paragraph on this page indicates that reduced return flows may improve water quality because fewer contaminants would be washed off of fields. It also seems possible that the effect would be to increase the concentration of contaminants in the return flows that do occur.

4.9.2 Irrigation District Conveyance Improvements

[132] **(Page 4-105).** The "Environmental Impact" discussion alludes to the potential for water to be transferred out of the basin. As noted above, that seems as close as the initially prepared plan comes to "evaluating" the impacts of the LSWP. This discussion again fails to consider how environmental flows might be affected by changes in delivery of water from the Highland Lakes as a result of conveyance improvements.

4.9.3 Conjunctive Use of Groundwater Resources

[133] **(Page 4-107).** Generally, we support the concept of conjunctive use of surface water and groundwater. The second paragraph under the "LSWP 2004 PVA Performed by CH2M Hill" heading states that 95,000 afy of groundwater can be pumped reliably with "no significant long-term impacts." By contrast, Table 4.97 on page 4-108 indicates long-term drawdowns for the Chicot and Evangeline formations of the Gulf Coast Aquifer. More discussion is needed about the "significance" of these impacts and about the definitions used for identifying short-term and long-term impacts. Are there potential impacts on local wells, particularly those used for livestock watering? More information about the areal extent of both short-term and long-term drawdowns is needed for a meaningful assessment.

[134] **Page 4-110, *Environmental Impact*** – According to the second bullet point, decreased springflow would not be an issue since there are no known flowing springs in the area. There is, however, a known interaction between the Gulf Coast Aquifer and the Colorado River as well as Matagorda Bay. Accordingly, potential impact to baseflows to the Colorado River and also to Matagorda Bay needs to be addressed.

4.9.4 Development of New Rice Variety

[135] **(Page 4-110).** The 1st paragraph under the "Analysis" heading indicates that the 2004 LSWP viability assessment estimated a potential savings of about 26,000 acre-feet from this strategy. Table 4.99, by contrast, lists over 35,000 acre-feet. There is a cryptic reference to recent changes to the conservation estimate but no explanation of the basis for the 35,000 acre-foot figure.

4.9.5 HB 1437

[136] **(Page 4-112).** The information regarding this strategy should be presented in the same standard format used for most other strategies: Analysis, Opinion of Probable Costs, Issues and Considerations, Environmental Impact. Use of a consistent presentation format would greatly improve the presentation of information by making it easier to read and understand.

[137] **(Page 4-113). The "*Environmental Impact*"** discussion assumes that a given amount of flow is available at the diversion points for rice irrigation and assesses how improved conservation measures might affect environmental flow levels. However, the underlying concept of this strategy is to remove surface water from the upstream portions of the basin and provide improved conservation in the lower counties. This qualitative analysis never even acknowledges,

much less evaluates, the impact on environmental flows of the removal of those surface flows from the basin. The evaluation must address the overall strategy and not just one component of it. Again, the quantitative evaluation required pursuant to 31 TAC § 357.7 (a)(8)(A)(ii) is missing.

[138] **(Page 4-112).** Some explanation is needed regarding the relationship of the on-farm conservation proposed here and the on-farm conservation proposed in Section 4.9.1 (page 4-100) of the initially prepared plan. LCRA's draft HB 1437 report indicates that the total estimated amount of water that can be developed on a consistent basis in Region K's lower counties through on-farm conservation is 35,811 acre-feet per year.[9] Section 4.9.1 proposes 36,480 acre-feet per year of on-farm conservation and this section proposes 24,200 acre-feet per year of on-farm conservation. Obviously, those combined totals greatly exceed the estimated amount that can be achieved on a consistent basis. Some justification is needed for the apparent assumption that over 60,000 acre-feet per year of water reasonably can be expected to be saved through on-farm conservation measures for rice irrigation in these counties.

4.11 Manufacturing Water Management Strategies

[139] **(Page 4-114).** The planning group should recommend conservation as a strategy for meeting manufacturing needs. Particularly to the extent that surface water supplies are used, a base level of water conservation is required pursuant to Section 357.7 (a)(7(A)(i) and consideration of additional measures is required pursuant to Section 357.7 (a)(7(A)(ii).

4.13.2 COA Steam Electric Water Management Strategies

[140] **(Page 4-115).** The section for this strategy does not include the standard sections that are included for most other strategies: Analysis, Opinion of Probable Costs, Issues and Considerations, Environmental Impact. Maintaining a consistent format would make the sections easier to read and understand.

4.13.3 STP NOC Water Management Strategies

4.13.3.1 Desalination

(Pages 4-118 through 4-121).

[141] Seawater and brackish water desalinization certainly are worthy of consideration as potential water supply strategies for the state of Texas. However, there are many environmental and energy implications that need to be carefully considered.

[142] It would be helpful to have information about the potential timing of when water supplied by such a project might be available.

[143] The proposed withdrawal of 50 mgd for the desalination process is 4600 ac-ft/month and 35,000 gpm. Some discussion should be provided regarding the potential impact of the withdrawal of this amount of water from the Colorado River or the bay. If water is diverted from lower salinity areas, particularly during low flow situations, flow patterns and salinity patterns could be affected. In addition, because low salinity areas are acknowledged as providing important sanctuaries for species during low rainfall periods, diversions also would have the

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[9] Draft Report House Bill 1437 Implementation Study, prepared for LCRA by LBJ School of Public Affairs and CH2MHILL (June 2005) at Chapter 2, page 6.

potential for significant impacts as small organisms are sucked into the diversion pipe.

[144] More discussion about potential groundwater impacts also is needed.

[145] **(Page 4-120).** The location of the discharge from such a facility is a major concern. The potential near-shore discharge of reject water raises significant issues that merit careful discussion.

4.13.3.2 Rainwater Harvesting

[146] **(Page 4-122).** Rainwater harvesting is a concept that makes sense in many settings. However, this seems to be a fairly unique approach. Frankly, it is not at all clear what change actually is being proposed and what impacts might result. Further explanation is needed.

4.15.1 Potential Conservation

[147] **Page 4-125** - The planning group is to be commended for its evaluation and recommendation of water conservation for WUGs that do not have a need during the planning period. Water is a limited resource and using it efficiently is of critical importance.

4.15.2 Brush Management

[148] We believe the concept of land stewardship is a more inclusive and appropriate term than brush management. Simply removing brush does not guarantee positive results for water quality or quantity. The overall balanced management of the land is critical for positive results.

CHAPTER 5: IMPACTS OF RECOMMENDED WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY AND IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS

5.2.1 Surface Water

[149] **Page 5-1 and 5-2** – This section lists the key water quality parameters that Region K is evaluating, however the evaluations of the water management strategies that follow are purely descriptive and do not address these individual parameters at all.

5.2.3 Management Strategies

[150] **(Page 5-4). second full paragraph, last line** – It appears that the assertion about a return to 'normal levels' should be qualified. Table 4.97 shows that the Gulf Coast aquifer will not return to normal levels with the amount of pumping proposed in the plan.

[151] **Page 5-5, fourth full paragraph** – The description of the possible water quality impacts from the COA Reclaimed Water Initiative does not actually address water quality impacts at all.

[152] **(Page 5-5).** The last paragraph fails to acknowledge the proposal for increased reuse of return flows, which would be expected to significantly change the overall return flow percentage.

[153] **(Page 5-6).** The paragraph labeled "LCRA Water Management Plan for Interruptible Supplies" seems to suggest that the provision of groundwater to irrigators is part of the WMP strategy. That is not accurate based on the descriptions included in the plan.

[154] **(Page 5-6).** As drafted, the fourth sentence in the paragraph labeled House Bill (HB) 1437 suggests that no decrease in instream flows and freshwater inflows would be expected. As discussed above, the text should be revised to reflect the reality that the amount of water available under the WMP for those purposes is limited. The paragraph should acknowledge the probability that the project would result in a reduction in instream flows over a large stretch of the lower Colorado River and likely in a reduction of inflows as well.

5.3 Impacts of Moving Water From Rural and Agricultural Areas

[155] **(Page 5-7)**. This discussion is very incomplete. TWDB rules require evaluation of "third party social and economic impacts resulting from voluntary redistributions of water, including analysis of third-party impacts of moving water from rural and agricultural areas." 31 TAC § 357.7 (a)(8)(G). Among those third-party impacts would be adverse impacts on recreational and commercial fishing and tourism as a result of reduced instream flows or freshwater inflows. However, that issue is not even acknowledged here. The reduction in environmental flows is a loss of water from rural areas with very real impacts. Those losses must be acknowledged and discussed.

[156] Two of the three strategies listed in the last sentence of the second paragraph under this heading actually are continuations of existing practices: use of interruptible supplies and COA return flows. Those strategies do not offset impacts from moving water to other uses or urban areas. Because interruptible water is used today and because the quantity of interruptible water is expected to decrease, it simply is not accurate to characterize it as a strategy to "offset losses." With respect to COA return flows, those return flows are being relied upon today. There is a small projected net increase in return flows over the planning period, but it is much smaller than the projected loss of flows.

[157] **(Page 5-8)**. The last sentence of the first paragraph on this page describes the LCRA-SAWS project as an excellent example of implementing strategies with mutual benefit to meet both urban and rural needs. That may prove to be true. However, it has not yet been shown to be true, especially with respect to the impact on environmental flows and the economic activities dependent on those flows. The failure even to acknowledge those impacts is a major deficiency in this discussion.

CHAPTER 6: WATER CONSERVATION AND DROUGHT MANAGEMENT PLANS

[158] **(Page 6-1).** As summarized in the first sentence, this chapter "presents the minimum necessary requirements for conservation plans and drought contingency plans for the various water user categories." Although we certainly acknowledge that such a summary is of some value, it does not comply with the requirement for including a chapter "consolidating the water conservation and drought management recommendations of the regional water plan." 31 TAC § 357.7 (a)(11). Most of the required information is missing.

[159] There is no specific information pertaining to the planning group and its recommendations for conservation and/or drought management. This information needs to be provided before the plan is finalized.

[160] The templates included in the appendices are logically constructed. They do not, however, constitute the "model" water conservation plans and drought contingency plans that had been anticipated based on the Water Development Board's outline of sections of a regional water plan for this second round of planning. We appreciate the potential complexity of trying to provide even a model municipal water conservation plan for retail water suppliers that may vary widely in size of population served and other factors. However, the effort to promote and facilitate municipal water conservation, for example, would be enhanced by actual ***model*** conservation plans that would incorporate the most effective best management practices, particularly those recommended by the planning group, reflect the lessons learned by municipal suppliers implementing conservation programs, and go beyond reproducing a basic form.

CHAPTER 7: REGIONAL PLAN CONSISTENCY WITH THE STATE'S LONG TERM PROTECTION GOALS

[161] One of the key changes that SB2 made to the water planning process was to create a specific statutory criterion mandating that a regional water plan may not be approved by TWDB unless it is shown to be consistent with long-term protection of the state's water resources, agricultural resources, and natural resources. As noted above, the initially prepared plan simply does not provide the level of assessment needed to support such a determination. There simply is no cumulative look at the impacts of the plan. In fact, the proposed diversion of water to San Antonio is not even mentioned in this chapter until the very last sentence. Even then, no meaningful analysis is provided.

[162] Unquestionably, the planning group's decision to rely upon the "No-call WAM" has left the planning group with virtually no ability to perform a comprehensive quantitative assessment of the impacts of the plan. As a result, the planning group simply cannot make the requisite showing of consistency needed to provide final project recommendations for major surface water projects. Accordingly, in order to allow the planning group to proceed, the recommendations should be conditioned upon later review and approval by the planning group once adequate analyses have been performed and made available to allow a reasoned determination of whether the requisite level of protection for the state's water resources, agricultural resources, and natural resources has been provided.

[163] In terms of a cumulative assessment to be used for comparison purposes, the Region L plan provides a good example. We currently are working with that planning group to include additional evaluation of impacts to freshwater inflows on the Guadalupe estuary.

CHAPTER 8: ADDITIONAL RECOMMENDATIONS (UNIQUE STREAM SEGMENTS AND RESERVOIR SITES, LEGISLATIVE ISSUES AND REGIONAL POLICY ISSUES)

8.2 Summary of Policy Recommendation

[164] **(Page 8-3 through 8-18).** It is obvious that much effort was put into the development of these policy statements and we commend the planning group. We are generally supportive of the policy recommendations and particularly commend the planning group for its statements on Environmental Flows, Sustainable Growth, Groundwater and Public Involvement and Education.

[165] **(Page 8-19).** We had understood that funding for additional work on designation of unique stream segments was available but was later moved to additional assessment of water

conservation. However, ultimately, it appears that the money was used elsewhere. We are disappointed that, in the end, no additional work was undertaken on potential recommendations for designation of unique stream segments and no additional work was undertaken on assessing water conservation potential. We do appreciate the inclusion in the initially prepared plan of information about the segments considered for such recommendations.

[166] **Page 8-39 through 8-41** – The discussion of Unresolved Issues identified by the planning group is thoughtful and insightful. We appreciate the work of the planning group members in examining these issues.

CHAPTER 9: INFRASTRUCTURE FINANCING (NOT INCLUDED IN THE IPP)

CHAPTER 10: PUBLIC INVOLVEMENT ACTIVITIES

We appreciate the public participation efforts of the planning group. We also appreciate the willingness that the planning group has shown to receive and consider our input throughout the planning process.

Sincerely,

Myron J Hess   Mary E Kelly   Jennifer Walker

Myron Hess	Mary Kelly	Jennifer Walker
National Wildlife Federation	Environmental Defense	Sierra Club, Lone Star Chapter

cc: David Meesey, Region K liaison, TWDB
Bill Mullican, TWDB
Kevin Ward, TWDB
Cindy Loeffler, TPWD
Rebeka Lien, Turner, Collie and Braden
Mark Lowry, Turner, Collie and Braden

Table K-IPP-3 – Calculation of additional savings through municipal water efficiency measures for Water User Groups with net water use >140 gpcd at the 2060 time frame

			Region K IPP proposed water use and water efficiency data, Year 2060						environmental community proposed savings, Year 2060		
	Water User Group (WUG) name	Year 2000 use rate (gpcd)	Popula-tion	Portion of region (%)	IPP total demand of WUG (ac-ft/yr)	use rate (gpcd) [includes plumbing code]	addtnl. water effi-ciency sav.* (ac-ft/yr)	net water use rate with efficiency measures (gpcd)	use rate** (gpcd)	revised total demand (ac-ft/yr)	addtl. savings (ac-ft/yr)
1	AUSTIN	175	1,634,578	60.2%	309,433	169	33,573	151	140	256,327	19,525
2	FREDERICKSBURG	246	12,349	0.5%	3,223	233	0	233	140	1,937	1,286
3	CO.--OTHER_WILLIAMSON	175	23,609	0.9%	4,469	169	0	169	140	3,702	767
4	CO.--OTHER-TRAVIS	175	12,636	0.5%	2,392	169	0	169	140	1,982	410
5	COLUMBUS	230	4,333	0.2%	1,048	216	0	216	140	679	368
6	SAN SABA	302	2,654	0.1%	856	288	0	288	165	491	365
7	SCHULENBURG	186	5,282	0.2%	1,012	171	0	171	140	828	184
8	JOHNSON CITY	216	2,264	0.1%	512	202	0	202	140	355	157
9	BURNET	160	11,154	0.4%	1,849	148	0	148	140	1,749	100
10	MANOR	197	1,895	0.1%	388	183	0	183	140	297	91
11	LA GRANGE	160	10,057	0.4%	1,656	147	0	147	140	1,577	79
12	MUSTANG RIDGE	220	874	0.0%	205	209	0	209	140	137	68
13	SUNRISE BEACH VILLAGE	219	717	0.0%	167	208	0	208	140	112	55
14	BLANCO	166	2,611	0.1%	445	152	0	152	140	409	36
15	FLATONIA	200	2,247	0.1%	468	186	90	150	140	352	26
16	WHARTON	155	10,782	0.4%	1,703	141	4	141	140	1,691	8
17	CHISHOLM TRAIL SUD	113	553	0.02%	94	152	0	152	140	87	7
	Totals		**1,738,595**	**64.1%**	**329,920**					**272,713**	**23,531**

notes:*Reg K IPP proposed savings from Table 4.74 and from Section 4.6.2 for City of Austin ** proposed water use rate is based on 1% per year reduction from year 2000 water use, but no less than 140 gpcd unless the WUG was already at that level in year 2000.

From: Cynthia Braendle [CBraendle@aquawsc.com]
Sent: Monday, November 07, 2005 8:38 AM
To: Barbara Johnson; Bill Miller ; Bill Neve; Chris King; Del Waters; Harold Streicher; Haskell Simon ; James Sultemeier; Jennifer Walker; Jim Barho; John E. Burke; Julia Marsden; Mark Jordan ; Mayor Jones; Paul Tybor; Rick Gangluff; Ronald G. Fieseler; ronaldg@elc.net; Roy Varley; Teresa Lutes; W.R. Bob Pickens; Dan Strub; David Bradsby; David Meesey; Joe McCarley; Lowry, Mark; Lien, Rebeka; Robena Jackson; Steve Coonan, P.E.; Teri Waters; Terry Bray
Subject: Comments from Jack Fairchild.

-----Original Message-----
From: Jack Fairchild [mailto:jfairchild1@austin.rr.com]
Sent: Sunday, November 06, 2005 4:08 PM
To: Cynthia Braendle
Subject: SMRF Comments on Water Plan

November 6, 2005

Mr. John Burke, Chairman
Region K Water Planning Group

Thank you for considering our comments on the 2006 Water Plan for Region K, and for the many hours you have devoted to the plan.

WATER CONSERVATION: Thank you for emphasizing water conservation to an extent, but we feel that Region K needs to go a little further. It should be mandatory that all communities, cities, river authorities and water suppliers use advanced conservation as a tool to provide water supplies for the future. There should not be areas that continue to water lawns and golf courses during drought, or waste water in a region where water is so precious.

DROUGHT MANAGEMENT: Drought management plans for pumping both surface and ground water are tools that we believe should be essential to every city, community, river authority and water supplier. These drought management plans should be a management strategy in the Region K plan. In central Texas, there are extremes of rainfall, both low and high, and some areas are growing beyond the ability of their water resources to support that growth. If drought management is not done, then even the springs, rivers, creeks of other areas will be damaged to supply central Texas, when piping in water for long distances to reach population centers. That would not be a good plan for anyone.

LEARN FROM MISTAKES: It goes without saying that without strict drought management plans in every part of the region, that springs, rivers, and creeks will be doomed as well as the aquatic life and riparian habitat they support. In California, the Los Angeles area has damaged not only its own resources, even causing saltwater intrusion into its groundwater stores, but also severely damaging communities and regions of many states surrounding them. Texas can learn from others and try not to make the same mistakes. We need to limit non-essential water use during drought, at the very least, and maybe we need to think about year round water conservation rules to get people into the habit of conservation.

We believe that SUSTAINABILITY is the #1 concept that our water plans should be built on. Groundwater must be preserved in sufficient amounts to keep springs flowing, throughout central Texas and the region. The rich and diverse ecology of the hill country is highly dependent on the water in, and the riparian habitats associated with, the streams of the hill country. The coastal areas have evolved to depend on this steady spring flow even during droughts, and to wipe out springs will mean wiping out large segments of Texas' heritage. Groundwater districts should be listened to when they try to preserve the sustainability of their district's groundwater supplies.

REPRESENT ALL AREAS FAIRLY: Good quality water resources currently make central Texas economically viable and provide good quality of life for all of us. It is necessary to preserve sufficient groundwater from pumping or shipping away, to keep the hill country springs flowing. Coastal regions have springs as well that feed their creeks, which are essential to the estuaries. We expect any water plan that represents all the counties of the region fairly, to spell out sustainability of both ground and surface water clearly and make it the cornerstone of the plan and every project, including those involving other regions.

We are concerned about the Region K plan, first because it is NOT clear that serious environmental damage can be avoided by piping Colorado water to San Antonio. We know that reservoirs are planned, capturing Colorado river water during high flow periods and supplementing it with pumped groundwater. In general, reservoirs can cause great damage and need to be evaluated carefully to avoid that damage. The impact of taking water which formerly went to the Colorado's coastal estuaries also must be evaluated carefully. The Region K plan is not evaluating the impacts of its chosen water management strategies on the environment, which is a requirement of the plan.

HILL COUNTRY CONCERNS: We also are very concerned that the Region K water to San Antonio may be piped from the Highland Lakes, in order to make a second use of the pipeline by crossing the Hill Country with it, to provide new development with water in those areas where water has not been plentiful naturally. This will certainly damage the recharge zone of the Edwards Aquifer, which is so important to the springs and their continued flow. It will speed up development there as well, which can cause rapid damage.

When development covers recharge zone land with buildings, parking lots and roads, the speed of runoff increases, which tears away banks of streams, causing sediment and pollution from roads and lawns to enter the aquifer directly. Eventually this rapid runoff can cause the base flow of creeks to be diminished and polluted, as vegetation is ripped away and the soil cannot hold moisture that used to be released more slowly. Creeks in the recharge zone are the places that about 90% of the aquifer water enters the aquifer storage areas. Building heavily on the recharge zone will mean that less water is stored in the aquifer in the long run, further damaging the long term viability of the region, the rivers and springs, and thus the bays and estuaries.

FLOODING: We also believe that the trend of increasing development in this region of the recharge zone coupled with inadequate impervious cover limits for development will result in more severe flooding of downstream communities and riparian areas (Texas law establishes riparian water rights as the most senior), causing more flood damage with the attendant human and economic losses.

GRID OF PIPELINES: River authorities and development interests would prefer a grid of pipes allowing full development of the recharge zone. This is causing a fantastic rise in land prices, which then impedes the many groups working on preserving some of the critical recharge zone features of the hill country. The Region K plan to provide water to San Antonio needs to be discussed openly and in public, if this "grid" plan for the hill country is involved in this project's pipelines, and the damage must be considered since it can reduce the amount of water recharged in the aquifers central Texas depends on.

DEDICATE GROUNDWATER: We propose that any land that receives surface water via pipeline should have mandatory preservation and dedication of groundwater resources on that land to preserve the springs of the area and base flows of the streams. If the object of the surface water suppliers is really to preserve the springs, as some water developers claim, then that should be easy for them to support, and they have several votes on the Region K board.

WASTEWATER RETURN FLOWS: We are also concerned that returns of clean treated wastewater are not always clearly defined in water planning projects. This is increasingly very important to the flows of rivers in the region, and must be discussed openly. Amounts should be included in any discussion of a water development project from the very beginning. The proliferation of bed and banks permits will only serve to deteriorate water quality while reducing flows of the region's rivers.

OVER-APPROPRIATED RIVERS: Especially because the state is continuing to consider water right applications in over-appropriated areas, we are alarmed about the impact that granting such permits would have on river flows. Rivers must have adequate flows to dilute wastewater and other pollution, to remain of good quality for downstream communities and the fish and wildlife depending on this water.

ENVIRONMENT AS A USER: We are disappointed that the adequate flows needed in springs, rivers and to reach coastal estuaries is not considered a user group in the water plan. This would seem to be the most basic way that the economic future of many counties in the region could be protected. Continuing to parcel out water without setting a sensible amount aside for rivers to continue to flow to the coast is only asking for a sure disaster in the next drought. Already many aquifers in central Texas are known to have more wells drilled than can be supported in a record drought. Springs will be going dry, rivers and lakes will be drawn down to empty or near empty during drought, because of the growth this region has already absorbed, and the increased demand on water resources by all the new residents and industries. The rivers have been appropriated to an extent that if all the water rights are drawn out, as they will be during drought, the rivers and estuaries will go for an indefinite length of time without adequate fresh water flows. The coastal fishing, shrimping, and recreational industries, plus the economic viability of countless communities in the region, even in the hill country, will be decimated by the damage that we already know will occur. We cannot allow the damage to be compounded by continuing to ignore this "user group".

PUBLIC MUST HEAR: To continue down this road without evaluating the water strategies' impact on the environment, and letting the public know what is going to occur, is only going to make the eventual drought more economically devastating to the region. All user groups should be required to use advanced water conservation to plan for the drought, and serious discussion of what uses will be curtailed completely during drought must happen now. If there is not going to be sufficient water, now is the time for all to understand that---before more industries are given assurance that water is plentiful, and before more people are encouraged to move to this region. Making up plans that will only widen the circle of damage is not a viable option, though we know it is hard to face the seriousness of the situation publicly.

Thank you all for your service to the Region and future generations and please know that we wish to assist you in any way that we are capable. Water is the most critical issue facing us all, because without sufficient water, both the human residents and fish and wildlife resources cannot live. I hope that you are all thinking about what your grandchildren will think about the Texas that they live in, 50 years from now, and what we must do to move forward to protect them and the natural world from harm.

Sincerely,

Jack E. Fairchild, Ph. D., P.E.
Chairman of the Board
San Marcos River Foundation
P. O. Box 1393, San Marcos TX 78667-1393

Lien, Rebeka

From: Cynthia Braendle [CBraendle@aquawsc.com]

Sent: Monday, November 07, 2005 8:39 AM

To: Barbara Johnson; Bill Miller ; Bill Neve; Chris King; Del Waters; Harold Streicher; Haskell Simon ; James Sultemeier; Jennifer Walker; Jim Barho; John E. Burke; Julia Marsden; Mark Jordan ; Mayor Jones; Paul Tybor; Rick Gangluff; Ronald G. Fieseler; ronaldg@elc.net; Roy Varley; Teresa Lutes; W.R. Bob Pickens; Dan Strub; David Bradsby; David Meesey; Joe McCarley; Lowry, Mark; Lien, Rebeka; Robena Jackson; Steve Coonan, P.E.; Teri Waters; Terry Bray

Subject: Comments from Don Trepagnier

From: Don Trepagnier [mailto:riosverdes@ev1.net]
Sent: Sunday, November 06, 2005 1:27 PM
To: Cynthia Braendle
Cc: jennifer.walker@sierraclub.org; riparian@lists.cc.utexas.edu
Subject: John Burke Region "K" Water Plan Comment Letter

November 6. 2005

John Burke, Chairman
Lower Colorado Regional Water Planning Group
c/o Aqua Water
P.O. Drawer P
Bastrop, Texas 78602

cbraendle@aquawsc.com

CC. jennifer.walker@sierraclub.org, riparian@lists.cc.utexas.edu

RE: Region "K" Water Plan Comments

Dear Mr. John Burke, Chairman,

I am opposed to the Colorado River out of basin water transfer to satisfy a contract of intent between Lower Colorado River Authority and the San Antonio Water System known as the LCRA/SAWS Region "K" proposal for the following reasons:

1.) River inflow requirements are not scientifically demonstrated to maintain healthy riparian ecosystems. 2.) Matagordo Bay freshwater inflow requirements have not been scientifically demonstrated to maintain healthy estuaries. 3.) Instream flows necessary to deliver enough sediment to maintain the river delta, barrier islands and marsh grasses to maintain proper saline/fresh water balance to support sea life, waterfowl and seafood industries on the delta/bay complex have not been identified.

The Colorado River is burdened with 11 dams which have limited if not lowered the necessary historical inflows to the point where all of the above stream inflow requirements can not be met. Oddly, the science to prove otherwise has not been done.

So, my argument is easy to understand. While we have no pre-European arrival data available, we can safely say that every drop of water that has gone toward municipal, suburban, sprawl, industrial and agricultural use has obviously lowed the annual river flow that reaches the coast.

If we add them all up at the current rate of use, I would say that that total would be a back door approach to estimate how much water we would have to make up because of these uses, if we strive to reach pre-historic flows now missing at the mouth of the river.

Instead of trying to restore the river to its natural flows, the LCRA wants to supply Colorado River water to San Antonio by the exact amount that Austin has contracted for over the next 50 years, 150,000 acre feet a year, and extend the time period out to 70 ears for San Antonio. Also, you as chairman of Region "K" remain mute about the application that Corpus Christi has filed asking for an additional 70,000 acre feet a year of Colorado River water: an unmentioned 220,000 acre feet a year.

This total amount of water does not allow any water to accommodate Austin's future water needs or upriver needs above the Highland Lakes. It appears to me that Region "K" has made a big mistake aligning itself with Region "L" and SAWS and possibly Corpus Christi. Not only does it demonstrate no loyalty to Austin but "K" find itself under pressure to perform better at supplying Colorado River water to those who are willing to pay LCRA $1.9 Billion dollars rather than supplying water to your historical users.

Does the LCRA and Aqua Water really think it can maintain its own autonomy and historical instream flows if this plan succeeds? I think not. We all know how money works. You are setting up a situation where your out of basin revenue stream will become more important than serving your customers/ratepayers within the basin.

Rice farmers will have to appear before SAWS meetings to beg for water you have committed to San Antonio and whoever runs the water department of Corpus Christi. Shrimpers, duck hunters, sport and commercial fisherman will have to do the same thing because there will be more water customers outside of the basin than within it. Who will speak for Matagorda Bay? LCRA? Aqua?

Industrial users and even the City of Austin will be at the mercy of San Antonio, not the LCRA. Why would you have us give up our power over our own water?

I also think that we can not trust whatever, San Antonio says. Why Region "L" now says it will give up its Lower Guadalupe River project if this deal goes through, can we believe them? Can they legally contract not to do something they are not doing now? How would you guarantee that and why should that be any of the LCRA's business in the collective mind of Region "L"?

I fear your desire to sell our water to San Antonio is developer driven since your current water policies within the basin are developer driven. This plan will jeopardize sustainable growth and put all the Central Texas area river basins at risk of being unsustainable if you can't properly manage this basin to be sustainable. Aqua and LCRA seem to be willing to take water anywhere as demonstrated by this very plan. San Antonio has overgrown its ability to sustain its growth. Why should we help them consume our water too?

I suggest that a moratorium be placed on this project until all the unfinished instream studies are completed and I suggest that the work be done by a non-involved third party like the National Academy of Sciences not subject to political pressure. And that is being kind about it. Actually, I am opposed to any out of basin transfers or river diversions of any kind. I just think it raises too many environmental questions that can not be answered.

I also will attach two exhibits from the *Springs of Texas* book where Gunnar Brune has surveyed both Matagorda and Wharton Counties in the 1970s and found that most groundwater tables have dropped from agricultural and industrial use, and oil and gas production to the point where salt water has invaded portions of the Gulf Coast Aquifer and area springs have historically declined. I am not sure, therefore, that area rice farmers can depend on 62,000 acre feet of groundwater a year during a drought as the joint region plans call for.

Since I am submitting this letter by email, I will drop off the attachments next week at your office. Finally, legally, I an not sure that the LCRA can transfer water outside of its basin under its current 1930-1940s federal construction mandate. Could you also respond with notification that you have received this e-mail?

Respectfully submitted for the sustainable health of the Colorado River Basin

Don Trepagnier
riosverdes@ev1.net
Bastrop County, TX

1/4/2006

Austin Water Utility, P.O. Box 1088, Austin, Texas 78767

November 6, 2005

Mr. John E. Burke
Chairman
Lower Colorado Regional Water Planning Group
C/O Aqua Water Supply Corporation
P.O. Drawer P
Bastrop, Texas 78602

Re: 2006 Region K Initially Prepared Lower Colorado Regional Water Planning Group (LCRWPG) Water Plan Comments

Dear Chairman Burke:

We appreciate the opportunity to provide additional comments on the Region K Initially Prepared Plan (IPP). The attached comments for the LCRWPG's consideration are primarily from the City of Austin, Watershed Protection and Development Review Department (WPDRD), plan review.

Should you have questions about these comments please contact me at 972-0179 or Tom Ennis at 974-2217. Additional City of Austin representatives can plan to attend an upcoming Region K meeting to answer questions or discuss these comments, if needed. As always, Austin appreciates the opportunity to participate in the ongoing regional water planning process.

Sincerely,

(Signed original has been sent via FAX/mail)

Teresa L. Lutes, P.E.
Austin Water Utility

Attachment

xc: Chris Lippe, P.E., Austin Water Utility Director
Thomas E. Ennis, P.E., City of Austin, Watershed Protection and Development Review Department
William Conrad, Manager, Wildland Conservation Division, Austin Water Utility

Comments on 2006 Region K Initially Prepared Lower Colorado Regional Water Planning Group Water Plan Primarily from City of Austin's Watershed Protection and Development Review Department's Review

General Comments:

- The plan references preservation of 90% historical minimum leakage from aquifers. However, a Barton Springs flow of 1 cfs is mentioned in the plan as the minimum flow (10%). In our opinion, this is not an acceptable level for endangered species protection. If actually 90%, this minimum flow would be 9 cfs which is closer to the historical flow during the drought of record.

- We suggest that additional entities in the basin consider open space maintenance and land acquisition as a strategy for water quality and quantity protection. The City of Austin is investing a considerable amount of funds consistent with this strategy, through its Water Quality Protection Lands and Balcones Canyonland Preserve programs. Further expansion of such a region-wide strategy could help forge a link between both water quantity and quality management proposed in this plan.

  Furthermore, linked with this land protection strategy should be management in a manner which protects or enhances proper function and condition of floodplains and riparian areas. By managing and enhancing these important riverine processes, aquifer recharge and resulting spring flows could be enhanced by increasing recharge opportunities. This can be specifically accomplished by maintaining storm flows and base flows for longer durations over important recharge features, in a manner that would not put these features at risk of damage from deposition of stream bed load as a result of impoundment.

- Upon review of the Barton Springs/Edwards Aquifer Conservation District's sustainable yield model, in support of their management plan component, it appeared that the district could not permit any additional users and stay above the flow necessary to support the Barton Springs Salamander. This conclusion is based on a regression of dissolved oxygen and spring flows and an estimate of the dissolved oxygen requirements for salamander survival. (A report to that effect is available and can be provided, if needed.) The Region K plan includes steadily increasing usage from Edwards Barton Springs Zone wells. We are concerned that increased pumpage will jeopardize the maintenance of sufficient flow at Barton Springs, particularly during drought periods.

- The Barton Springs/Edwards Aquifer Conservation District is preparing a Habitat Conservation Plan that may set additional conservation measures and drought contingency trigger policy. We recommend that the resulting information be incorporated into Region K planning, as appropriate. This study will also evaluate salamander dissolved oxygen requirements, which are potentially critical under drought conditions.

- The City of Austin should be involved as a stakeholder in planning and studies related to recharge enhancement or similar type projects potentially impacting particular City of Austin land. A number of concerns associated with various proposed projects of this type have been raised including potential land impacts, hydrological impacts, and others. Austin is interested in continuing to be involved to help ensure that stakeholders in the region benefit from such projects.

The proposed Onion Creek recharge dams/structures in the Region K IPP, Section 4.8.4 starting on Page 4-84, including the Rutherford Recharge Dam, may impact Austin's Water Quality Protection Lands. Austin has a number of concerns relating to this project included a concern that this project may actually serve to work against maintaining or improving spring flows. A key concern is that impounding Onion Creek over significant recharge features on this property, due to decreased stream velocity, would likely result in deposition of the stream's bed load into and over these features. This deposition would likely then obstruct and clog these recharge features potentially at a much greater severity and frequency than observed during normal stream flow.

An additional long-term strategy that should be considered is a program to support improved flood plain and riparian area management. Financial and technical assistance could be offered, for these programs, to landowners who own land with these ecological sites along Onion Creek.

- We are interested in getting additional information on the ecologically unique stream segments determination process and potentially making additional suggestions for candidates.

- Austin is interested in potentially assisting in the group's possible future efforts in linking groundwater/surface water models. Austin is interested in the possibility of a project related to the Barton Springs Zone in support of the Barton Springs Zone Regional Water Quality Plan.

Specific comments are as follows:

1) Section ES.9.4, on groundwater sustainability, should mention importance of environmental aspects of groundwater, including endangered species protection.
2) Chapter 1 contains water quality concerns and impairment information from the 2002 303(d) list. A subsequent 2004 draft has been prepared, so it may be beneficial to update some tables in this chapter, now or in the future.
3) In Chapter 1, the Jollyville Plateau salamander is listed on tables entitled: "Table A-12: Threatened or Endangered Species of Travis County" and "Table A-14: Threatened or Endangered Species of Williamson County" (on Page 1A-23 and 1A-28, respectively). A petition is currently being considered by U.S. Fish and Wildlife Service, but this species is not currently listed as endangered or threatened.
4) It is unclear which Barton Springs/Edwards Aquifer groundwater availability model (GAM) was used and referenced in this plan. There is an original Barton Springs/Edwards Aquifer Conservation District (BS/EACD) model created by the Bureau of Economic Geology. However, there is also a GAM version with recent improvements made by BS/EACD staff, and there may be others. The GAM source reference information should be added, as well as any other pertinent water availability estimate source reference information.

5) Section 4.7.1.2, the last sentence in the first paragraph references "available water" from Edwards Balcones Fault Zone. It is unclear if this is the same as the sustainable yield. (As discussed above, the BS/EACD is already beyond its sustainable yield for permitted and exempt wells.)
6) On page 4-63, and elsewhere in the chapter, the estimated cost for land acquisition for wells is $2,000/ac. This figure may be low, for at least some locals within Region K. Suggest using a figure of $5,000/acre, or more, depending on location.
7) On page 4-68, the Onion Creek Recharge Enhancement Project references enhanced recharge at 5,043 ac-ft/yr (6.97 cfs), whereas, the Executive Summary of the BS/EACD sustainable yield report indicates recharge at 3,515 ac-ft/yr (4.86 cfs). Does this difference represent the expected yield increase with the recharge enhancement project? Please clarify.
8) Page 4-85, the site acquisition costs in Table 4.80 appear low given current market conditions, see Specific Comment 6, above.
9) Suggest that aquifer storage and recovery potentially be explored in future as a supply management or enhancement strategy.
10) Section 7.1.2, on Page 7-2, the last sentence 5th paragraph is too simplified and should be deleted unless significant detail can be added to describe the environmental conditions, particularly in the vicinity of the proposed recharge structures.
11) Discussion of endangered salamander flow needs should be included in the drought contingency plans, in Chapter 6, which this is not currently addressed.
12) Page 7-4, Section 7.3.1, states: "environmental impacts as a result of water management strategies discussed in Chapter 4 are expected to be minimal....potential impacts to threatened or endangered species are expected to be limited." There is no discussion of the potentially catastrophic impact on the Barton Springs Salamander at a Barton Springs flow of 1 cfs in Chapter 4 or elsewhere in the plan. Again, we are concerned about the potential impacts.
13) An engineered approach to in-stream recharge enhancement in Onion Creek would require tremendous financial investments for both initial construction, and operation and maintenance. Both an off-stream impoundment and a riparian area enhancement program benefiting the entire Onion Creek segment within the recharge and contributing zones of the aquifer, could be accomplished at a lower cost than the in-stream engineered solution.

Should you have questions about these comments please contact Tom Ennis, City of Austin's Watershed Protection and Development Review Department, at 974-2217. William Conrad, 263-6430 is an additional information source contact, particularly for issues related to Austin Water Utility's Wildland Conservation and Water Quality Protection Lands management programs.

LCRA Comments for the IPP:

1. The IPP currently does not provide an idea about how much water (from LCRA specifically, but others too if applicable) is already going to other Regions, like Region G, from the Highland Lakes' firm source. New strategy adds more to Region G from Highland Lakes. Regarding the transfer to Region L, there seems to be adequate discussion to cover the topic of water transfer to Region L.

   To address this, add under Section 4.6, Wholesale Water Provider Management Strategy, a new subsection of water transfer to Region G, existing and proposed (Lometa, Cedar Park, Leander, Liberty Hills, Round Rock, etc.)? A footnote could also be added to Table 3.26 indicating that there are existing contracts with entities within Region G.

2. Table 4.22 shows the shortages for LCRA as a Wholesale Water Provider based on the modeling of 'No Call' assumption of Chapter 3. Table 4.29 and partial information from Table 4.26 address how the shortages will be addressed. It may clarify to combine the above information in one Table, like Table 4.32 for City of Austin, to show LCRA's proposed strategies for meeting all the M&I needs.

3. Table 4.89, p. 4-99 (and Table ES.12, p. ES-15):

   There was an error in developing the supply available to irrigation after taking out the portions needed for in-basin M&I needs and LSWP needs. Attached please find the revised Table with the corrected numbers.

   Table 4.89, revised, follows after the comments.

4. Table 4.89, p. 4-99 (and Table ES.12, p. ES-15):

   To estimate the supply available with the strategies, groundwater to be developed as a part of LSWP was shown in Table 4.89 as annual maximum value of 95,000 acre-feet, with footnote 3 explaining the limitations. The amount of 95,000 was used in the table so that it would balance in 2060 when LSWP is shown to start have water transfer since the surface water supply are used as annual minimum, although the modeling was done with the appropriate groundwater criteria (limits of 36,000 acre-feet per year as long-term average, 62,000 acre-feet per year as 10-year rolling average, and 95,000 acre-feet per year as the annual maximum). Along with the use of 95,000 of groundwater in the Table, the full 118,000 acre-feet of conservation also was used starting in 2020. The result is that for the decades of 2020-2040, there seems to be some surplus in irrigation strategy. And some members suggested to clarify that there really is not a surplus as it can be interpreted from the Table combined with the needs in Table 4.87 (and Table 4.23).

   To address that, we are proposing to use the 62,000 acre-feet per year as 10-year rolling average in the table instead of 95,000 acre-feet as annual maximum. The correction as addressed in Comment #2 above along with all the strategies identified in Table 4.89, the use of 62,000 does not result in any shortage in 2060.

Also, suggest changing the footnote #3 to clarify the limits of groundwater use in LSWP, and how the ongoing modeling would define what the limits might be.

5. Chapter 4: The reference to the CH2MHill preliminary groundwater availability needs to be deleted or qualified with language added to indicate that the groundwater availability is still being evaluated under LSWP with participation by the TWDB and the GCDs. Reference to the Region K resolution should also be made.

6. Chapter 4: Region K's IPP shows LSWP water transfer to Region L in 2060, whereas Region L IPP shows in 2050. Suggest adding the water transfer estimates from 2060 to 2050 to be consistent with Region L. However, if this timing gets changed for the Final Plan from what is in Region L's IPP, we may need to change to that timing.

7. Chapter 4: Suggest adding footnotes, or text, clarifying that limited modeling was conducted to show the implementation of the strategies for only the 2000 and 2060 conditions and estimates/interpolation were used for the rest of the decades.

8. Section 4.6.1.9, p. 4-34, ¶2. The total estimated cost for the LSWP should be changed from $1,704,473 to $1,704,473,000.

9. Chapter 4: The description of the environmental impacts from HB 1437 implementation in Chapter 4 and throughout the rest of the IPP needs to be consistent with that in the Executive Summary.

10. Table 4.107, p. 4-116: The amounts shown here as LCRA contract water to meet City of Austin's steam electric needs for Decker appear to be different from those of Table 3.27, p. 3-65.

11. Table 4.86, HB 1437 Strategy, p. 4-97: The total for the decades shown in the table seem to be in error.

12. Table 3.2a, p. 3-23. The minor reservoir subtotal is incorrect for all decades. It appears that the yield for the City of Goldthwaite was added in twice. The subtotal and total should both be corrected.

13. Other minor comments:

    - Table 2.20, p. 2-36. For clarity, the county headings for Williamson and Wharton Counties should be bolded.

    - Table 4.22, p. 4-17. In the note below the table, the word "Counties" should be deleted from the list in parentheses, "(Leander, Cedar Park, and Lometa Counties)".

Table 4.89 Rice Irrigation Water Management Strategies

Rice Irrigation Strategies	2000	2010	2020	2030	2040	2050	2060
Continued Use of Austin Return Flows	14,603	17,163	19,723	22,283	24,842	27,402	29,962
Continued Use of Downstream Return Flows [1]	0	0	0	150	600	1,125	1,500
Water Management Plan-Interruptible Water Supply	241,607	238,156	162,892	123,534	84,176	44,819	5,461
On-Farm Conservation [2]			36,480	36,480	36,480	36,480	36,480
Irrigation District Conveyance Improvements [2]			46,220	46,220	46,220	46,220	46,220
Conjunctive Use of Groundwater [3]			62,000	62,000	62,000	62,000	62,000
Development of New Rice Varieties [2]			35,300	35,300	35,300	35,300	35,300
LSWP Subtotal			*180,000*	*180,000*	*180,000*	*180,000*	*180,000*
Firm up ROR With Off-Channel Reservoir							47,000
HB 1437	0	4,000	4,000	4,000	4,000	14,700	25,000
Supply Reduction due to LSWP							71,381
Transfer ROR Supply to Municipal and Industrial	(24,000)	(38,769)	(42,769)	(50,769)	(58,769)	(68,769)	90,487
TOTAL	**232,210**	**220,550**	**356,846**	**312,198**	**267,849**	**232,277**	**126,863**

Please change the TOTAL to reflect the revisions.

e downstream return flows are from Pflugerville and Aqua WSC.
mand reductions through advanced conservation made available under LSWP were distributed to county-basin ation WUGs based on the location of shortages. These estimates continue to be refined as a part of the ongoing P studies and it is anticipated that these needs will be addressed by managing all of the components as a LCRA m.
[3] Groundwater supplies made available under LSWP as shown here are estimated to be annual maximums, and were distributed to county-basin irrigation WUGs based on the location of shortages. The model study for strategy of LSWP was conducted with the limits of long-term average as 36,000 acre-feet per year, 62,000 acre-feet per year as the 10-year rolling average (for a repeat of the drought of record) and 95,000 as the annual maximum limit. These estimates continue to be refined as a part of the ongoing LSWP studies with the development of a site-specific GAM. It is anticipated that these needs will be addressed by managing all of the components as a LCRA system.

Regional K Draft 2002 Plan Comments – LCRA
10/28/05

31TAC Chapter 357 Regional Water Planning Guidelines include specific information in regards to water conservation and drought contingency planning as shown below:

357.5 Guidelines for Development of Regional Water Plans
(e) Plan development. In developing regional water plans, regional planning groups shall:
(5) incorporate water conservation planning and drought contingency planning;

Chapter 6 of the draft plan includes the TCEQ 288 rules for conservation and drought contingency planning and also some model templates for plan development. However, Chapter 6 should also recognize that the two major water rights holders in the lower Colorado River basin – the LCRA and the City of Austin – have approved TCEQ water conservation and drought contingency plans. At a minimum, these plans should be summarized. I have included at the end of these comments a summary of the LCRA Water Conservation Plan. A summary of the drought contingency component of the LCRA Water Management Plan should also be included along with City of Austin plans. There are also dozens of other utilities in the basin with conservation plans that could be reviewed.

LCRA is also required to be the repository of drought contingency plans for public water suppliers in the lower Colorado River basin. We now have two full notebooks of plans from non-LCRA customers as well as plans from LCRA customers. These could be reviewed and summarized for such items as: trigger levels, drought response measures (such as watering schedules – are they consistent throughout the basin), enforcement and variances.

Major water rights holders and public water suppliers in Texas were first required to develop plans in 1999 and 2000. The timeline required to meet the 2002 deadline for the first set of regional plans could not include a summary of these conservation and drought contingency plans (WC & DC). However, because the plans have been in place for at least five years, information about regional WC& DC plans should be included in this round of regional plans.

LCRA Water Conservation Programs

LCRA's municipal water conservation programs are predicated on the fact that the implementation of conservation measures must occur largely at the local level. Wholesale water use accounts for more than 90 percent of all LCRA potable water supply use. It is a mandatory requirement for LCRA, as the wholesale water rights holder, to require customers with new and amended plans to develop a water conservation plan. LCRA Water Conservation Rules for Water Sale Contracts, developed in 1991, are used to implement this requirement. LCRA also provides technical assistance with the development and review of wholesale customer water conservation plans and programs. LCRA assists with the development of rules and regulations that encourage water conservation, such as adding water conservation components into landscape ordinances.

LCRA provides public outreach activities in the area of conservation landscaping. LCRA programs that focus in this area adoption of Hill Country Landscapes in new developments and with new homeowners, landscape irrigation audits for existing retail homeowners, and distribution of Grow Green landscaping materials to nurseries around the Highland Lakes. The Major Rivers 4th grade curriculum teacher workshops and materials are also provided through the LCRA Natural Science Centers.

LCRA's efforts in agricultural water conservation are focused on promoting water conservation at its irrigation districts: Lakeside, Gulf Coast and Garwood. Proposed conservation efforts in the next five- to 10-year period include laser land leveling on individual farms, adding automatic check valves and a control system for the Garwood Irrigation District, and replacement of lock control structures in the Lane City Pumping Plant canal system.

Each of LCRA's three power plants has industrial water conservation plans, which address water usage and return flow for the facilities. Opportunities to conserve water in the once-through cooling water process and boiler water treatment are not readily available because of efficiencies in existing processes. However, the plants' specific five- and 10-year goals focus on reducing losses, reducing use and reusing water.

Lien, Rebeka

From: Mark Jordan [Mark.Jordan@lcra.org]
Sent: Wednesday, November 16, 2005 8:35 AM
To: Barbara Johnson; Joe McCarley; Julia Marsden; Mayor Jones; P.E. Steve Coonan; Cynthia Braendle; John E. Burke; Ronald G. Fieseler; Roy Varley; Bill Miller; Dan Strub; Teresa Lutes; Harold Streicher; Jennifer Walker; ronaldg@elc.net; Terry Bray; Robena Jackson; Chris King; Paul Tybor; Bill Neve; James Sultemeier; Haskell Simon; Teri Waters; Del Waters; Rick Gangluff; Lowry, Mark; Lien, Rebeka; David Bradsby; Jim Barho; David Meesey; W.R. Bob Pickens
Cc: Lyn Dean; Nadira Kabir; Ron Anderson
Subject: Re: FW: Comments

As a followup to the first item - the additional 26,200 AF/yr is a strategy Region G has proposed for obtaining additional water from LCRA. It doesn't currently exist under contract and would require an amendment to existing contracts and permit authorizations. According to the Region G IPP, the 26,200 AF/yr would include an additional 25,000 AF/yr for Cedar Park and 1,200 for Liberty Hill. Existing LCRA contracts for Williamson County include: Cedar Park (18,000 AF/yr), Leander (6,400 AF/yr), and BRA/HB 1437 (25,000/yr). Let me know if you have any questions. Thanks!

>>> "Cynthia Braendle" <CBraendle@aquawsc.com> 11/14/2005 8:27:51 AM >>>

-----Original Message-----
From: Mark Jordan [mailto:Mark.Jordan@lcra.org]

****
****
Sent: Friday, November 11, 2005 5:02 PM
****
****

To: Barbara Johnson; Joe McCarley; Julia Marsden; Mayor Jones; P.E. Steve Coonan; Cynthia Braendle; John Burke; Ronald G. Fieseler; Roy Varley; Bill Miller; Dan Strub; Teresa Lutes; Harold Streicher; Jennifer Walker; ronaldg@elc.net; Terry Bray; Robena Jackson; Chris King; Paul Tybor; Bill Neve; James Sultemeier; Haskell Simon; Teri Waters; Del Waters; Rick Gangluff; Mark Lowry; Rebeka Lien; David Bradsby; Jim Barho; David Meesey; W.R. Bob Pickens
Cc: Kris Martinez; Leah Manning; Lyn Dean; Nadira Kabir; Ron Anderson
Subject: Re: Comments

Attached are LCRA's comments on the draft IPP. Thanks!

Lien, Rebeka

From: Ron Anderson [Ron.Anderson@lcra.org]

Sent: Monday, November 21, 2005 1:17 PM

To: Mark Jordan

Cc: Nadira Kabir

Subject: Water Rate confusion

It appears that the LCRA exact rate is $114.48/acft. We have been using $115 per acft for long range planning purposes. Region G used $115, Region L used $115.50, Region K used $115/af (but the old number of $105/af appears in places).

>>> Anissa Menefee 11/21/05 1:12:02 PM >>>
It comes to $0.35/1000 gallons, multiply that by 325,851 and you get $114.48. We had just rounded up I guess to $115. So not sure why they are using $115.50.

>>> Ron Anderson 11/21/2005 1:05:33 PM >>>
some of the regional plans are using $115.50/acft any idea why?

Ron Anderson, P.E., MBA phone (512) 473-3572
Project Manager/River Services fax (512) 473-3551

Lower Colorado River Authority
P.O. Box 220; Mail Stop H300
Austin, Texas 78767-0220

>>> Anissa Menefee 11/21/05 12:58:46 PM >>>
Oh yes, was $4/AF now it is $5/AF. Anissa

>>> Ron Anderson 11/21/2005 12:54:16 PM >>>
How about the interuptible water price?

>>> Anissa Menefee 11/21/05 12:53:00 PM >>>
Actually our firm raw water rate increased to $115/AF effective 1-1-05. In addition our reservation fee went from $52.50/AF to $57.50/AF and the inverted block fee went from $200/Af to $219/AF.

Let me know if you need any additional information or have any questions. Thanks, Anissa

>>> Ron Anderson 11/21/2005 12:51:16 PM >>>
is our current raw water ate $105/acft?

November 5, 2005

RECEIVED
NOV 14 2005
Aqua Water Supply Corp.

Mr. John Burke, Chairman
Lower Colorado Regional Water Planning Group
c/o Aqua Water
P.O. Drawer P
Bastrop, Texas 78602

Dear Mr. Burke and the Lower Colorado Regional Water Planning Group,

I would like to provide my comments and observations concerning the Region K 2005 Initially Prepared Water Plan given that it will have long-lasting impacts on our economy, our rich wildlife and landscape heritage, and the health of our environment.

I believe as a State and a Region we can provide water for people and keep our environment healthy, but to do so, Texas must plan carefully.

Some Shortfalls of the Region K Water Plan:

No Quantitative Assessment of Impacts to Environmental Flows:
Ensuring the Colorado River maintains adequate in-stream flows, and that Matagorda Bay receives adequate freshwater inflows from the Colorado, is critical to the health of the fish and wildlife of the region. Without careful consideration of how water supply projects will impact environmental flows, both fish and wildlife and the tourism and fishing industries they support along the coast are at risk. The Region K plan does not include an adequate quantitative assessment of how environmental flows would be affected by the proposed water projects in the plan.

No Consideration of Limits to Non-Essential Water Use During Drought:
Drought management measures aimed at reducing water demands during periods of unusually dry conditions are important components of good water management. From both an economic and ecological standpoint, it only makes sense to take steps to reduce non-essential uses of water (fountain filling, car washing, and lawn watering, for example) during times of serious shortage instead of spending vast sums of money to develop new supply sources that would be used to meet those non-essential water demands only during serious droughts. Senate Bill 2 and Texas Water Development Board rules mandate consideration and inclusion in regional plans of reasonable levels of drought management as water management strategies. However, the Region K plan does not even consider, much less include, drought management as a water supply strategy.

Unsustainable Groundwater Use in LCRA-SAWS Project:
The Regional Water Planning Group endorsed a sustainable approach to groundwater use. However, the plan also recommends the LCRA-SAWS Water Development Project which includes a level of groundwater pumping from the Gulf Coast Aquifer that, based on the Group's definition, is not sustainable.

Thank you for your time and consideration. Please keep me informed as to future planning meetings and public comment opportunities. Sincerely,

Bill Stout
5616 Arroyo Rd.
Austin, TX. 78734-1504

Lien, Rebeka

From: Gangluff, Richard [ragangluff@STPEGS.COM]
Sent: Wednesday, November 16, 2005 4:48 PM
To: Mark Jordan; Barbara Johnson; Joe McCarley; Julia Marsden; Mayor Jones; P.E. Steve Coonan; Cynthia Braendle; John E. Burke; Ronald G. Fieseler; Roy Varley; Bill Miller; Dan Strub; Teresa Lutes; Harold Streicher; Jennifer Walker; ronaldg@elc.net; Terry Bray; Robena Jackson; Chris King; Paul Tybor; Bill Neve; James Sultemeier; Haskell Simon; Teri Waters; Del Waters; Lowry, Mark; Lien, Rebeka; David Bradsby; Jim Barho; David Meesey; W.R. Bob Pickens
Cc: Dannhardt, Sandra
Subject: Water Conservation Plan Input from STP

STPWaterConservationLCRWPlan11...

Attached is the STP conservation plan information that should also be included in this section.

Thanks,
Rick

-----Original Message-----
From: Mark Jordan [mailto:Mark.Jordan@lcra.org]
Sent: Tuesday, November 15, 2005 4:38 PM
To: Barbara Johnson; Joe McCarley; Julia Marsden; Mayor Jones; P.E. Steve Coonan; Cynthia Braendle; John E. Burke; Ronald G. Fieseler; Roy Varley; Bill Miller; Dan Strub; Teresa Lutes; Harold Streicher; Jennifer Walker; ronaldg@elc.net; Terry Bray; Robena Jackson; Chris King; Paul Tybor; Bill Neve; James Sultemeier; Haskell Simon; Teri Waters; Del Waters; Gangluff, Richard; Mark Lowry; Rebeka Lien; David Bradsby; Jim Barho; David Meesey; W.R. Bob Pickens
Cc: Nora Mullarkey; Ron Anderson
Subject: Re: FW: Comments

Please find attached additional comments from LCRA specifically regarding the water conservation provisions. Thanks!

>>> "Cynthia Braendle" <CBraendle@aquawsc.com> 11/14/2005 8:27:51 AM >>>

-----Original Message-----
From: Mark Jordan [mailto:Mark.Jordan@lcra.org]

****
****
Sent: Friday, November 11, 2005 5:02 PM
****
****

To: Barbara Johnson; Joe McCarley; Julia Marsden; Mayor Jones; P.E. Steve Coonan; Cynthia Braendle; John Burke; Ronald G. Fieseler; Roy Varley; Bill Miller; Dan Strub; Teresa Lutes; Harold Streicher; Jennifer Walker; ronaldg@elc.net; Terry Bray; Robena Jackson; Chris King; Paul Tybor; Bill Neve; James Sultemeier; Haskell Simon; Teri Waters; Del Waters; Rick Gangluff; Mark Lowry; Rebeka Lien; David Bradsby; Jim Barho; David Meesey; W.R. Bob Pickens
Cc: Kris Martinez; Leah Manning; Lyn Dean; Nadira Kabir; Ron Anderson
Subject: Re: Comments

Attached are LCRA's comments on the draft IPP. Thanks!

11/16/05

STP Nuclear Operating Company Water Conservation Plan

STP Nuclear Operating Company has developed an industrial Water Conservation Plan for the South Texas Electric Generating Station. Water is an essential component of electricity production. The South Texas Project uses both groundwater and surface water for station purposes. Most of the water used by the South Texas Project is needed to condense steam and provide cooling for plant generating system. The main consumptive use of water is forced and natural evaporation from the Main Cooling Reservoir and Essential Cooling Pond.

Numerous water conservation measures have been put in place at the generating station. These include maintaining water quality in the Main Cooling Reservoir by selective diversion from the Colorado River during excess flow conditions, conjunctive use of groundwater for maintaining quality and level in the Essential Cooling Pond, and reuse of treated wastewater, HVAC condensate, and storm water. The water right for the South Texas Project includes a special provision to limit diversion from the Colorado River to 55% of the flow over 300 cubic feet per second, to protect environmental flows during low river flow conditions. In addition, a guideline has been developed for water management during drought conditions, where reservoir water quality is sacrificed to maintain reservoir level during drought conditions. A reduction goal for stored water of 5% has also been established consistent with LCRA's Drought Contingency Plan, based on the combined storage of lakes Travis and Buchanan on January 1 of each year.

STP Nuclear Operating Company is committed to operating the South Texas Project in a safe, reliable, economical, and environmentally sound manner. Water conservation is a part of that commitment. In reviewing water conservation measures, the ability to conserve water is most often a function of the design of the installed equipment and therefore there is limited potential to conserve additional water after a system is installed. Including water conservation, and its associated economic benefit, as one of the considerations used when comparing new project alternatives may ultimately have the greatest impact on water use at the generating station in the future.

Lien, Rebeka

From: Teresa.Lutes@ci.austin.tx.us

Sent: Thursday, November 17, 2005 8:26 AM

To: jburke@aquawsc.com

Cc: CBraendle@aquawsc.com; ragangluff@STPEGS.COM; Mark.Jordan@lcra.org; Lien, Rebeka; bjohnson@aaroregion.com; joe.mccarley@agr.state.tx.us; jmars80278@aol.com; scoonan@apaienv.com; CBraendle@aquawsc.com; manager@blancocountygroundwater.org; rlvvarl@centex.net; gene@centuryranchlodging.com; Dan.Strub@ci.austin.tx.us; fcatty@cmaaccess.com; jennifermwalker@earthlink.net; ronaldg@elc.net; tbray@gdhm.com; rj@groupsolutionsrjw.com; d.chris@intertex.net; ptybor@ktc.com; bccpct1@moment.net; blcomm2@moment.net; aquainfo@sbcglobal.net; goosewaters@sbcglobal.net; del@skidock.com; Lowry, Mark; david.bradsby@tpwd.state.tx.us; jimbarho@tstar.net; david.meesey@twdb.state.tx.us; gravel@wcnet.net; Sharon.Smith@ci.austin.tx.us; Ross.Crow@ci.austin.tx.us; Tony.Gregg@ci.austin.tx.us; Chris.Lippe@ci.austin.tx.us; David.Juarez@ci.austin.tx.us

Subject: Additional City of Austin Municipal Water Conservation Program information

John and All,

Here is some additional information on the City of Austin Municipal Water Conservation Program also for addition to the Region K water plan section on water conservation.

Please let me know if you have any questions, etc.

Thank you,
-Teresa

Teresa Lutes
Division Manager
Systems Planning Division
Water Resources Management Program
Austin Water Utility
512/972-0179
512/972-0168 FAX

Currently, the City of Austin has an aggressive water conservation program, one of the most active in the state, and it currently meets 20 of the 22 municipal best management practices recommended by the Water Conservation Implementation Task Force Report of the 79^{th} Texas Legislature. The Water Conservation Program offers its customers a wide variety of initiatives for all customer classes designed to develop awareness of the need for water conservation. These initiatives include incentives to conserve water, services to reduce demand, educational programs, and regulatory measures.

Programs designed to reduce residential indoor water use include free water efficient toilets and toilet rebates, free water-efficient showerheads and sink aerators, high efficiency clothes washer rebates, and free leak detection kits. Programs designed to reduce residential outdoor water use include free irrigation system audits performed by licensed irrigators, WaterWise landscape rebates, rebates for water saving repairs or upgrades of irrigation systems, reduced price rainbarrels and rainbarrel rebates, and rainwater harvesting system rebates.

The Conservation Program also offers a number of free services and incentives for industrial, commercial and institutional (ICI) customers. Programs designed to reduce indoor consumption by ICI customers include helping them modify special equipment and processes to reduce water use or reuse water internally, as well as free water-efficient toilets and toilet rebates, free water-efficient showerheads and aerators, high efficiency clothes washer rebates, medical dry vacuum pump rebates, and free pre-rinse spray valves for food service establishments. Programs designed to reduce outdoor water consumption by ICI customers include free irrigation system audits, free whole system water audits, rebates for water saving repairs or upgrades of irrigation systems, and rebates of up to $40,000 for large water saving projects. The City also offers awards and recognition to ICI customers for achievements in water conservation.

The Conservation Program also administers several water conservation education programs. There are two programs designed to educate school children about water conservation: the Dowser Dan Assembly Program for kindergarten through 4^{th} grades; and the 5^{th} and 6^{th} grade Water in Our World programs administered in partnership with the Austin Independent School District. Other educational efforts include conservation brochures, booklets, videos, radio, television and newspaper ads, an electronic newsletter, and the water conservation web page. In addition, the Program organizes rainwater harvesting and WaterWise landscape tours, produces an ICI water conservation newsletter, and offers a WaterWise training course for professional irrigators and ICI workshops. During the summer months, a substantial effort is made each year to educate customers about efficient water use in the landscape.

Regulatory measures include the water waste ordinance, which prohibits water waste year round and has several watering stages for the summer under which water use is further restricted, and building codes that require separate metering of duplexes, triplexes and fourplexes, as well as the installation of plumbing that would accommodate the installation of submeters on larger multifamily properties.

City of Austin
Austin Water Utility
12/4/2005

Draft Chapter 9: Water Infrastructure Financing Recommendations
Comments/Questions

1) Page 9-2: Suggest adding the following footnote #4, for the COA Reuse line item on Table 9.1:

"Footnote #4: Note that the City of Austin continually updates its Capital Improvements Program spending plan through its budgeting and approval process, therefore, the anticipated capital expenditures related to City of Austin water management strategies is subject to change. In addition, the City of Austin is currently conducting a comprehensive water resources planning study, the results of which may affect expected expenditures and quantities associated with reuse."

2) Page 9-2: To the Table 9.1 Footnote 1, suggest adding:

", which could result in expenditures being spread out over the entire planning period."

3) Page 9-2: Table 9.1 includes a Recharge Edwards BFZ w/ Onion Creek line item. The City of Austin has previously expressed concerns related to this water management strategy in its Initially Prepared Plan Comments submitted November 6, 2005. To help ensure that stakeholders in the region benefit from such projects, the City of Austin continues to be interested in being involved as a stakeholder in planning and studies related to recharge enhancement or similar type projects. This is especially the case for projects which could potentially impact City of Austin lands (for example, Austin's Water Quality Protection Lands).

4) Page 9-2: What type of information is needed for the grey box entitled "City of Austin Service Expansion" in Table 9.1? Local infrastructure plans to meet projected needs do represent major infrastructure costs and funding requirements, however, this table relates to "Recommended Strategies", requiring capital expenditures in the plan, and City of Austin service plans and associated infrastructure costs and funding requirements for the entire planning period have not been explicitly addressed elsewhere in the Region K plan.

5) Note that the dollar amount in Austin's Infrastructure Financing Survey is lower than the amount in Table 9.1, on Page 9-2. However, the amount in Table 9.1 is consistent with the cost estimate included in Chapter 4. Regardless, Austin's survey responses would not change, since they are percentage-based and are indicative of financing options. No change to the text or report should be necessary.

6) Page 9-3: Figure 9.1, Add footnote on figure indicating:

"Note that in some cases actual expenditures will likely be spread out over the entire planning period".

7) Page 9-3: Figure 9.1, Suggest inserting "Starting" before the word "Decade" in title. Therefore, the figure title will be: "Costs by Starting Decade and Category"

8) Page 9-4: Suggest updating the first sentence on the top of page to reflect additional surveys received since first draft was prepared:

> "Of these, 14 (?) responses were received, two of which were from the City of Austin and LCRA, which are both characterized as Wholesale Water Providers (WWPs)."

9) Page 9-4: In first full paragraph on page, suggest replacing: "No useful data was collected from these responses." with: "Consequently, no funding data was collected from these responses."

10) Page 9-4: In second full paragraph on page, suggest rewording: "This is typical, as developers typically form utility districts tasked with providing water and wastewater service within these new communities." with: "This is typical, in cases where developers form utility districts tasked with providing water and wastewater service within a specified area."

11) Page 9-4: In second full paragraph on page, suggest rewording: "It appears that future districts will absorb most of the project population growth in these areas." with: "Other entities or future districts will likely absorb most of the projected population growth in these areas."

12) Page 9-4: In the second to last sentence in the second full paragraph on page, suggest changing the ending in the following sentence: "It should be noted that formation of new districts, rather than expansion of existing districts, reduces the potential for state loan requests." to: "...districts, may reduce the number of state loan requests."

13) Page 9-4: In last sentence in second full paragraph on page, suggest deleting the word "These" and starting the sentence with "New".

14) Page 9-5: Bottom of page Section 9.3.3 Wholesale Water Providers, under <u>City of Austin</u> heading: Suggest inserting the following:

> "Austin Water Utility (AWU) updates its ten-year Capital Improvements Program (CIP) plan annually. The update process includes reviewing all existing CIP projects, identifying new projects, and evaluating financing options. AWU generally finances its capital improvement projects through a combination of cash or current revenues, bonds, and grant funding, to the extent available. The percent share of each funding source is typically 20% for cash or current revenues, 65% for bonds, and up to 15% for Federal Government Grant Programs (through the Bureau of Reclamation's Grant Program, for example). To the extent that grant programs do not supplement the funding needs, the remainder would be funded by cash and bonds."

15) Page 9-8: Figure 9.2, What are the correct units for the y-axis on this graph? Is it in millions of dollars?

16) Page 9-9: Is there somewhere in the report where there is a specific quantification of the magnitude of the "Unmet Needs", which were used to determine the impacts as described in Sections 9.4. and 9.5 and in report in Appendix 9C?

17) Appendices: Austin's survey (Appendix 9B) and survey results (in Appendix 9A) should be added.

State and Federal Comments

November 7, 2005

Mr. John Burke, Chairman
Lower Colorado Regional Water Planning Group
P.O. Drawer P
Bastrop, Texas 78602

Re: Review of Lower Colorado Region Initially Prepared Regional Water Plan

Dear Mr. Burke:

Thank you for the opportunity to review and comment on the 2005 Initially Prepared Regional Water Plan (IPP) for the Lower Colorado Region (Region K). The Texas Parks and Wildlife Department (TPWD) 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 were faced with a new requirement under 31 T.A.C. §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. TPWD recognizes that each region's unique natural resources, water management strategies and funding limitations dictated the level of quantitative analysis for each regional plan. Nonetheless, TPWD feels strongly that quantification of environmental impacts is a critical step in planning for our state's future water needs while also protecting environmental resources.

TPWD staff has reviewed the IPP to determine if the following questions were addressed:

- Does the plan include a quantitative reporting of environmental factors including the effects of proposed strategies 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 and reuse as water management strategies?

- Does the plan recommend that any stream segments be nominated as ecologically unique?

- If the plan includes strategies identified in the 2000 regional water plan, does it address concerns raised by TPWD at that time?

In general the Lower Colorado Region IPP does not include a detailed quantitative reporting of environmental factors as required by 31 T.A.C. §357.7(a)(8)(A). The plan includes a brief description of natural resources in the Lower Colorado Region including vegetational areas, lists of species of special concern, and limited information on environmental flows for the lower Colorado River as identified in the LCRA's Water Management Plan (WMP). However, there is little information in the IPP on characteristic fish and wildlife species, spring systems, and groundwater/surface water interactions in the region. Such information would be useful in evaluating the impacts of selected water supply strategies on fish and wildlife species, water quality, and water-based recreation in the region. In general, the IPP environmental assessments are narrative and based on conjecture rather than being quantitative and derived from data. Future plans should include a thorough quantitative environmental analysis of all identified water supply strategies, including the LSWP.

In addition, the use of the modified water availability model (WAM) that included subordination assumptions was done without a review of potential environmental implications. The IPP correctly states that impact results from the "No Call" model should be considered unreliable. Thus, the quantitative analyses that are dependent upon the modified WAM are suspect. It might have been more appropriate to identify subordination as a water supply strategy, which would have required a quantitative environmental assessment. A priority for the next planning cycle should be early evaluation and validation of the WAM that is used to develop the next regional plan.

TPW notes that municipal water conservation and reuse are identified as water management strategies. In general, these strategies are preferred alternatives to large-scale water development projects. Municipal and agricultural conservation are important elements of the plan and should be utilized as much as practicable for meeting future water needs. The use of drought contingency plans should also be addressed as a potential supply strategy in conjunction with conservation. The IPP identifies reuse, especially by the City of Austin, as a water supply strategy. However, potential environmental impacts should be fully evaluated before adopting increased reuse as a strategy. TPWD encourages the Region's consideration of brush control/management as an additional means of conserving water. If done properly, brush management can also benefit wildlife habitat.

Although the IPP does not recommend nomination of any stream segments as ecologically unique, it does state that further study may be warranted in future Lower Colorado Regional Water Plans. If the Region decides to pursue designation of a stream segment as ecologically unique, TPWD would be willing to assist with the preparation of a recommendation packet as identified in T.A.C. §357.8.

TPWD agrees with many of the policy recommendations included in the IPP. The recommendations consistently recognize the importance of instream flows and freshwater inflows in planning for the management of water resources in Texas. The policies are not only explicitly related to environmental flows, but also to groundwater/surface water interaction and modeling, groundwater and conjunctive use, interbasin transfers, reuse, and education. It is important that fish and wildlife resources and the environment are acknowledged as users of water and are not relegated to the category of afterthought.

Thank you for your consideration of these comments. Please be assured that TPWD will continue to explore all possibilities to meet future water supply needs and ensure the ecological health of the region's aquatic resources.

Sincerely,

Larry D. McKinney, Ph.D.
Director of Coastal Fisheries

LDM:DB:dh

November 21, 2005

John Burke, Chairman
Lower Colorado Water Planning Group
Aqua Water Supply Corporation
P.O. Drawer P
Bastrop, Texas 78602

Mark Jordan
Lower Colorado River Authority
P.O. Box 220
Austin, Texas 78767-0220

Re: Texas Water Development Board Comments for the Lower Colorado Water Planning Group (Region K) Initially Prepared Plan, Contract No. 2002-483-462

Dear Chairman Burke and Mr. Jordan:

Texas Water Development Board (TWDB) staff completed a review of the Initially Prepared Plan (IPP) submitted August 1, 2005 on behalf of the Lower Colorado Planning Group. The attached comments addressing the IPP follow a format similar to those used in developing the prior regional plans, including:

- Level 1: Comments and questions 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.

In addition, the TWDB reserves the right to submit additional Level 1 comments as missing or incomplete materials become available. Comments will be provided after review of the online database (DB07) is complete. Also, the TWDB's statutory requirement for review of potential interregional conflict will not be completed until all applicable data and information has been provided by any potentially affected planning group. TWDB's streamflow assessment, based on full implementation of the region's IPP, will be provided under separate cover.

Title 31, Texas Administrative Code §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.

If you have questions, please do not hesitate to contact David Meesey at (512) 936-0852.

Sincerely,

William F. Mullican III
Deputy Executive Administrator
Office of Planning

Attachment

c w/att.: Mr. Mark Lowry, TC&B Engineering, Inc.

Attachment

Lower Colorado Regional Water Plan – Region K

LEVEL 1. Comments and questions *must be satisfactorily addressed* in order to meet statutory, agency rule, and/or contract requirements.

Chapter 1: Description of Region

1. The plan must include a description of the effect of the regional water plan on navigation *[Title 31, Texas Administrative Code (TAC) §357.5(e)(8)].*

Chapter 2: Projected Population and Water Demands for the Region

2. Please ensure that the water demand projections for mining in Bastrop County (Table 2.13, p. 2-17) for the years 2010, 2020 and 2030 are apportioned between river basins, and are equal to the TWDB approved projections, as shown in the table below. The water demand category totals have projections that are inconsistent with the TWDB approved totals. Some of the differences appear to be due to a shift of demand amounts between river basins. While this shifting of demand amounts between basins but within a single county can be done within the current TWDB approval, TWDB staff should be notified of the region's desire to shift use/demand so that changes can be made in the DB07 online database. Please coordinate with TWDB staff and provide relevant data in a tabular, electronic format to ensure that the plan is consistent with the online database. *[Title 31, TAC §357.5(d)(1)&(2), §357.7(a)(1)(B)].*

County	Basin	Source	2010	2020	2030	2040	2050	2060
BASTROP	BRAZOS	TWDB	**1,439**	**1,438**	**1,439**	11	11	11
BASTROP	BRAZOS	IPP	10	9	10	11	11	11
BASTROP	COLORADO	TWDB	**2,516**	**2,518**	**2,518**	18	19	20
BASTROP	COLORADO	IPP	5,016	5,018	5,018	18	19	20
BASTROP	GUADALUPE	TWDB	**1,078**	**1,079**	**1,079**	8	8	8
BASTROP	GUADALUPE	IPP	7	8	8	8	8	8
	total TWDB		5,033	5,035	5,036	37	38	39
	total IPP		5,033	5,035	5,036	37	38	39

Chapter 3: Evaluation of Current Water Supplies in the Region

3. The plan must report water supplies and availability for each wholesale water provider by category of water use (municipal, manufacturing, irrigation, steam electric power

generation, mining, and livestock) for each county or portion of a county in the regional water planning area. If a county or portion of a county is in more than one river basin, data shall be reported for each river basin. The wholesale water provider's current contractual obligations to supply water must be reported in addition to any demands projected for the wholesale water provider *[Title 31, TAC §357.7(a)(3)(B)].*

4. Please verify if water supply availability numbers for the Gulf Coast, Carrizo-Wilcox, and Edwards-Trinity (Plateau) aquifers are based on TWDB groundwater availability models (GAM). If the availability estimates were not derived from GAM, please provide further justification for the estimates selected *[Contract Exhibit B, Section 3.2.2].*

<u>Chapter 4: Identification, Evaluation, and Selection of Water Management Strategies Based on Needs</u>

5. In Chapter 4, Pages 47-71, the plan must address potential impacts to the environment from any of the recommended water management strategies involving groundwater wells and pipelines *[Title 31, (TAC) §357.7(a)(8)(A)(ii) and 357.7(a)(8)(C)].*

6. Please verify that all existing water rights, contracts and option agreements were protected in developing the regional water plan *[Title 31 TAC §357.5(e)(3)].*

7. Ensure that the plan shows costs associated with irrigation conservation water management strategies, including pages 4,8,9,16, & 17 and Appendix 4B *[Title 31, TAC, §357.7(a)(7)(A)].*

8. Please ensure that water management strategy evaluations contain quantitative reporting on impacts to agricultural resources *[Title 31, TAC §357.7(a)(8)(A)(iii)].*

9. Please provide the analysis required in the three "supplemental funding" contract tasks ("buy-out of rice farmers' second crop to eliminate the need for developing groundwater"; "policy development based on sustainable uses of natural resources"; and "advanced water conservation strategies to meet regional water needs" to TWDB for review, and include them in the final report *[TWDB contract #2002-483-462, Tasks 4(h)(i)(j), Exhibit A, p.9].*

LEVEL 2—Comments and suggestions that might be considered to clarify or help enhance the plan.

<u>Executive Summary:</u>

1. Consider presenting a full summary of the key findings, recommendations, and costs of the entire plan in the Executive Summary.

2. Consider adding the units (acre-feet) to the return flows in Table ES.3 (p. ES-9).

Chapter 4: Identification, Evaluation, and Selection of Water Management Strategies Based on Needs

3. Consider including information on current per-capita water usage (gallons per-capita per-day) for the region and for individual water user groups within the region.

LCRWPG Responses to Comments

Comments Received at 8/23/05 Region K Public Meeting:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
1	Donald Braden	Owner of Cardon Villa Mobile Home Parks on the Colorado River	1500 Braden Lane Columbus, TX 78934	979-732-3252			gumpo@sbcglobal.net
	Comment: Don't think one little voice would matter. **Response:** *Public input is an important part of the regional water plan development.*						
2	Herman W. Brune	Self	1079 FM 1890 Columbus, TX 78934	979-732-5241			lostrider@wcnet.net
	Comment: (made a statement) Most questions answered at meeting (refer to transcript). Is San Antonio's municipal needs reflected in Plans numbers, strategy, etc.? What would be the impact without the SAWS? What happens when freshwater inflows needs are determined? **Response:** *The tables of population and water demand for Region K do not include Region L populations or water demands, since those numbers are generated in Region L. Once the water demands in Region K are compared with the water supplies, there is a shortage in irrigation supplies for the lower three counties in Region K. The LCRA-SAWS Water Project (LSWP) is a management strategy that develops approximately 180,000 ac-ft of conservation and supply to meet the irrigation shortages in Region K. This strategy also develops 150,000 ac-ft of municipal supply for SAWS. Without the LSWP the rice farmers would have a difficult time coming up with the necessary capital to develop projects to meet their future water demands. The LSWP will be paid for by SAWS.* *The LSWP is currently in the development stage and a number of studies are underway to determine the impacts of LSWP on the environment. The legislation that allows the LCRA to participate in the LSWP imposes a number of requirements concerning necessary environmental protection of the Colorado River and Matagorda Bay. Specifically, the project cannot go forward unless it protects and benefits the lower Colorado River watershed and the authority's water service area, including municipal, industrial, agricultural, recreational, and environmental interests; ensures that the beneficial inflows remaining after any water diversions will be adequate to maintain the ecological health and productivity of the Matagorda Bay system; and provides for instream flows no less protective than those included in the authority's Water Management Plan for the Lower Colorado River Basin, as approved by the commission.*						

Comments Received at 8/23/05 Region K Public Meeting:

<table>
<tr><td rowspan="2">3</td><td>Mark Gwin</td><td>Smithville Times</td><td>267 Winfield Thicket
Smithville, TX 78602</td><td>512-237-
4655</td><td></td><td></td><td>mgwin@smithvilletimes.com</td></tr>
<tr><td colspan="7">Comment: (made a statement) Questions answered at meeting (refer to transcript).
Will the region need the extra water generated by the SAWS-LCRA Diversion project? Is that need just generated by rice farmers? So they already have those water rights, or are we granting them down the line?
Response:
Without the LCRA-SAWS Water Project (LSWP) the rice farmers would have a difficult time coming up with the necessary capital to develop projects to meet their future water demands. The LSWP will be paid for by SAWS.

The irrigation water rights are owned by LCRA, but in the future as municipal needs grow these rights will be utilized for municipal and industrial needs and new water sources for irrigation in the lower counties (rice) will have to be found. Conservation is an option but due to the prohibitive costs most farmers can not afford to do these measures without help. The LSWP will not only provide some municipal water for San Antonio through the construction of off-channel reservoirs it will also provide money to implement agricultural conservation measures and the conjunctive use of groundwater for the irrigators. The off-channel reservoirs constructed as part of the LSWP have not been permitted yet and will undergo extensive studies to determine the viability and effects (environmental, etc.). Long-term, these off-channel reservoirs are expected to provide additional firm water supply to users within the Colorado River basin beyond the term of the SAWS contract.</td></tr>
<tr><td rowspan="2">4</td><td>Clarence R. Matula</td><td>Fayette County Farmer, FMHA Supervisor, USDA, Fayette Water Supply Corp., Lee County WSC & Bastrop Aqua</td><td>P.O. Box 533
La Grange, TX
78945</td><td>979-968-
2881</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Comment:
Please do not allow anyone to sell water in Fayette County. I am the father of Fayette Water Supply Corp. I feel that each presently pumping well for a Water Supply Corp. in a rural area should be allowed to pump only for its rural customers. Help keep the water sellers and buyers away from Fayette County, which has a growing Rural Water Supply Corp. Help keep existing water well grandfathered.
Response:
Fayette County has future water needs and several of the recommended strategies involve expanding current groundwater supplies (new wells or additional capacity) or developing new groundwater supplies (drilling wells for water users that are currently using surface water or that have wells in other aquifers). This water is not leaving Fayette County, but is being used to meet the Fayette County water needs. The Fayette County Groundwater Conservation District water availability numbers were utilized to determine how much groundwater was available in Fayette County.</td></tr>
</table>

Comments Received at 8/23/05 Region K Public Meeting:

Response to Oral Statements/Comments:

2. Herman Brune
Most of his questions were responded to at the meeting (refer to transcript).

Comment: How are we going to keep 90 percent of our springs flowing and still get freshwater to the Gulf?
Response:
Groundwater availability values were determined for each county or portion of a county located in Region K for each of the GAMs (Groundwater Availability Models). The general approach to determine groundwater availability values from the GAM runs were to maintain 90 percent of the stream flow contribution from the aquifer compared to a no pumpage run during the worst drought of record year. This approach was approved by the Region K Water Modeling Committee to minimize adverse effect on stream flow during drought of record condition. Specific criteria were needed to determine availability for some of the GAMs due to the unique nature of each model. The portions of the LCRWPA where no GAM is available or did not have an availability value adopted by a GCD in a Groundwater Management Plan, utilized the values previously adopted by Lower Colorado Regional Water Planning Group (LCRWPG) in 2000 Region K Water Supply Plan.

Surface water in addition to spring flow also contributes to freshwater inflows. The 1999 LCRA Water Management Plan states: "Total commitments of the Combined Firm Yield from the Highland Lakes for instream flow maintenance will be an average of 12,860 acre-feet per year, with a maximum of 36,720 acre-feet in any one year; 58,700 acre-feet in any two consecutive years; 76,800 acre-feet in any three or four consecutive years; 106,100 acre-feet in any five consecutive years and 128,600 acre-feet in any six to ten consecutive years."

3. Mark Gwin
Response:
His questions were responded to at the meeting (refer to transcript).

Comments Received at 8/30/05 Region K Public Meeting:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
1	Carroll A. Asbill	Burnet	824 Cottonwood Burnet, TX 78611	512-756-4937		Worked in formation	
	Comment:						
2	Carter Barcus		2838 C.R. 334 Burnet, TX 78611	512-355-3195			carterbarcus@yahoo.com
	Comment: (made a statement) What is Burnet County's role in the "big scheme of things"? Who will be on Burnet County's control commission? How, appointed or elected? What are qualifications? Are they paid? If so, how much? Do they tax us? How is my well to be affected?						
	Response: *The consultant team members and Regional Water Planning Group members spoke to Mr. Barcus after the meeting and determined that Mr. Barcus questions and comments were directed to the newly created groundwater conservation district for Burnet County and not the regional planning efforts.*						
3	James Bluhm	Concerned citizen	1303 Lakeshore Dr. Marble Falls, TX 78654	830-798-8855			jhbluhm@tstar.net
	Comment:						
4	Tyson Broad	Self	107 E Luce Llano, TX 78643	325-247-2301			
	Comment: (made a statement)						
5	Brian Carey	LBJ National Historical Park	P.O. Box 329 Johnson City, TX 78636	830-869-7128 x 232	830-868-0810		Brian_carey@nps.gov
	Comment: Will file later.						
6	Jim Carlile	Self	827 Cottonwood Dr. Burnet, TX 78611	512-756-0387			jcarlile@nctv.com
	Comment:						

Comments Received at 8/30/05 Region K Public Meeting:

<table>
<tr><th></th><th>Name</th><th>Representing</th><th>Address</th><th>Phone Number</th><th>Fax Number</th><th>Elected Official</th><th>Email</th></tr>
<tr><td rowspan="2">7</td><td>M. Anne Carlile</td><td></td><td>827 Cottonwood Dr.
Burnet, TX 78611</td><td>512-756-0387</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">**Comment:**
Arrived at 6:30, therefore I missed a very informative part of the meeting. Thank you for your efforts.</td></tr>
<tr><td rowspan="2">8</td><td>Bonilee K. Garrett</td><td>Burnet County-landowner – rancher</td><td>P.O. Box
Lampasas, TX 76550</td><td>512-556-8245</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">**Comment:**
Need better explanation of: Where do new groundwater supplies come from? How do you expand groundwater supplies? What does STP stand for? What kind of contracts does HB 1437 provide for? What kind of legislative changes can protect instream flows? Which 10 segments listed as deserving further study for ecological designation? What does “no call” mean?
Response:
The strategies titled “Development of New Groundwater Supplies” refers to communities tapping into aquifers in their area that they have not historically used, therefore this will be a new supply for the community.

Groundwater supplies are taken from major and minor aquifers as well as alluvial aquifers. An expansion of groundwater supplies means that the water user currently has a well, but the supply is not enough to meet future need. Either they need additional capacity or they need more wells in order to pump more supply. The expansion of existing groundwater supplies appears in the plan only if the aquifer has the capacity to supply that additional demand based on the criteria set up by the planning group on sustainability and spring flows.

STP refers to the South Texas Project. STP is a two-unit nuclear power plant in Matagorda County.

The House Bill 1437 legislation allows the LCRA to meet municipal demands in Williamson County that are actually in the Brazos River Basin, primarily because the customers are much closer to water from the Colorado River than they are to water from the Brazos. This bill also requires that the cost savings from using the closer water be applied to develop additional water supplies in the Colorado basin to replace all of the water that is being used out of basin.

There are several ways in which legislation could be written to protect streamflows. The legislature could pass a law that requires TCEQ to meet certain minimum instream flow requirements by purchasing unused rights, by contracting for water, by accepting donations of water from various parties, and by requiring that environmental flows be assured in totally allocated and over allocated basins by providing for a pro rata reduction of all rights until the necessary instream flows are met. It is not being suggested here that any of the above are under current consideration by the Legislature, just that these are some of the ways in which legislation could be</td></tr>
</table>

Comments Received at 8/30/05 Region K Public Meeting:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email

used to assure instream flows.

The 10 stream segments listed as deserving further study are (refer to Chapter 8 for more details):

Stream Segment	Location
Barton Springs segment of the Edwards Aquifer	Recharge stretches of Barton, Bear, Little Bear, Onion, Slaughter, and Williamson Creeks in Travis and Hays Counties
Bull Creek	From the confluence with Lake Austin upstream to its headwaters in Travis County
Colorado River	Within TCEQ classified Segments 1409 and 1410 including Gorman Creek in Burnet, Lampasas, and Mills Counties
Colorado River	TCEQ classified Segments 1428 and 1434 in Travis, Bastrop, and Fayette Counties
Colorado River	TCEQ classified Segment 1402 including Shaws Bend in Fayette, Colorado, Wharton, and Matagorda Counties
Cummins Creek	From the confluence with the Colorado River upstream to FM 159 in Fayette County
Llano River	TCEQ classified Segment 1415 from the confluence with Johnson Creek to CR 2768 near Castell in Llano County
Pedernales River	TCEQ classified Segment 1414 in Kimball, Gillespie, Blanco, and Travis Counties
Rocky Creek	From the confluence with the Lampasas River upstream to the union of North Rocky Creek and South Rocky Creek in Burnet County.
Hamilton Creek	From the outflow of Hamilton Springs to the confluence with the Colorado River.

"No Call" refers to the modified Water Availability Modeling scenario that generally assumes that, during the 50-year planning period, certain large downstream senior water rights holders would not call for water they were legally entitled to by virtue of their priority and would instead allow that water to be impounded in upstream Region F reservoirs.

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
9	David Garrett		P.O. Box 885 76550	512-556-3057	512-556-3649		dave@ltex.net
	Comment:						
10	Kim Garrett	Landowner	402 S Ridge Lampasas, TX 76550 or Burnet Co.	512-556-6713			kimgtoto@yahoo.com
	Comment:						

Comments Received at 8/30/05 Region K Public Meeting:

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<tr><th></th><th>Name</th><th>Representing</th><th>Address</th><th>Phone Number</th><th>Fax Number</th><th>Elected Official</th><th>Email</th></tr>
<tr><td></td><td colspan="7"></td></tr>
<tr><td rowspan="2">11</td><td>John Graham</td><td></td><td>386 Lake Loop
Tow, TX 78672</td><td>325-379-1219</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Comment: (made a statement)
I thought we went through this 3-5 years ago.
Response:
The Regional Water Plans and State Water Plan are expected to be updated every five years.</td></tr>
<tr><td rowspan="2">12</td><td>C. T. Head</td><td>Mills County State Bank</td><td>P.O. Box 309
Goldthwaite, TX 76844</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Comment:</td></tr>
<tr><td rowspan="2">13</td><td>J. Heinrichs</td><td>Self (property owners)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Comment:</td></tr>
<tr><td rowspan="2">14</td><td>Misty Huggins</td><td>Citizens</td><td>P.O. Box 112
Round Mtn, TX</td><td>830-825-3518</td><td></td><td></td><td>misty@tstar.net</td></tr>
<tr><td colspan="7">Comment:
How clean is our reuse water? Why don't we have certain days we are allowed to wash cars, water lawns, etc.? I see often water wasting from sprinkler systems on city property & private properties wasting running down the road.
Well, maybe we should save our run off channel rain water into reservoirs our self. Maybe we need to have a limit of children per family like China. What about all the people who drain water from lakes for their own lawns.
Response:
Reuse water that is used in Texas must meet the water quality standards set forth in Texas Commission on Environmental Quality (TCEQ) rules, which are codified in Section 210 of those rules. Standards are established for both Type II effluent, which can only be applied to areas where access is controlled and people are not allowed in the irrigation area while irrigation is occurring, and Type I, which is suitable for application to public access areas. Standard include limits for biochemical or chemical oxygen demand, suspended solids, and indicators of harmful bacteria.

There are a number of conservation measures that can be implemented to conserve water and those water user groups with needs and with per capita consumption above 140 gallons per capita day (gpcd) all have conservation as one of their strategies. The individual conservation measures that are implemented are the choice of the local cities and water districts and they can include programs to</td></tr>
</table>

Comments Received at 8/30/05 Region K Public Meeting:

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<tr><th></th><th>Name</th><th>Representing</th><th>Address</th><th>Phone Number</th><th>Fax Number</th><th>Elected Official</th><th>Email</th></tr>
<tr><td></td><td colspan="7">monitor sprinkler systems and reduce overspray. Allowing the washing of cars and watering of lawns only on alternate days has not been shown to be a reliable method of reducing demands during peak conditions, but it can be evaluated for use by each locality if they so desire.

Use of reservoirs to catch rain water is subject to the permitting procedures of the TCEQ. The reason that the plan contains few new reservoirs is because of the difficulty in permitting such facilities. For individuals who want to capture rainwater for use on their own property, they are allowed to do so. This process is known as rainwater harvesting.

Population control is not a viable option at this time since the laws are not in place, but if in the future the State of Texas or the US passed laws that would outline how a measure like this would be implemented then this option could be considered at that time.

As noted in the question above about capturing rain water, at least some of those individuals who live along rivers and lakes are allowed to use surface water for irrigation purposes for their residences. The older residences operate under grandfathered conditions. Newer residences seldom have this right.</td></tr>
<tr><td rowspan="2">15</td><td>Bob Lanfear</td><td>Burnet- citizen – advisor board</td><td>1518 CR 133
Burnet, TX 78611</td><td>512-756-6814</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Comment: (made a statement)</td></tr>
<tr><td rowspan="2">16</td><td>David Leonard</td><td>Pecan Tex LLC</td><td>Mills & San Saba County</td><td>817-335-4261</td><td>817-335-4801</td><td>Advisor Board LCRA</td><td>david@leioffice.com</td></tr>
<tr><td colspan="7">Comment:
What about the irrigation systems for Mills and San Saba County for the Pecan growers? What is the planning process for these counties? What about upper flow from the Upper Colorado? This means Lake Avery, Spence.
Response:
Both Mills and San Saba Counties show a demand for agricultural irrigation. This is the total demand for all crops and it would include pecans if the usage has been reported to the TWDB in the past. The information also shows this demand is met by local surface water supplies.

The planning process for Mills County and San Saba County is the same as for all of the other counties in Region K. Population and water demand projections were determined and refined, water supply amounts were analyzed. The water demand was compared to the water supply to determine where shortages are expected. Water management strategies were developed to meet these shortages. In the case of irrigation usage, if the water usage in these systems is reported to the TWDB in their water use survey, then the demands of</td></tr>
</table>

Comments Received at 8/30/05 Region K Public Meeting:

<table>
<tr><th></th><th>Name</th><th>Representing</th><th>Address</th><th>Phone Number</th><th>Fax Number</th><th>Elected Official</th><th>Email</th></tr>
<tr><td></td><td colspan="7">these growers are included in the plan. Even if they were not inventoried in the water use database, their demands may have been picked up in the water demand review public meetings over the draft demands.

The upper Colorado basin flows, including Lake Avery and Spence are located in Region F, which is upstream of Region K. The Water Availability Model, or WAM, used to determine the availability of Colorado River water and availability from the reservoirs on the Colorado included all reservoirs and water rights on the Colorado River, therefore the upper basin flows and Avery and Spence were included in the analysis, but were not specifically studied in Region K since they are located in Region F. For detailed availability and supply information for these reservoirs please refer to the Region F Water Plan.</td></tr>
<tr><td rowspan="2">17</td><td>Frank Ligon</td><td>Self</td><td>P.O. Box 2451
Granite Shoals, TX 78654</td><td>830-596-0582</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Comment:
Have you considered silt fill up of Highland Lakes, thus decreasing the amount of lake water?
Response:
Sedimentation was taken into consideration for the Highland Lakes. The Highland Lakes total system yield decreases over time due to sedimentation of the reservoirs.</td></tr>
<tr><td rowspan="2">18</td><td>Robert Lindsey</td><td>Mills County</td><td>P.O. Box 483
Goldthwaite, TX 76844</td><td>325-648-2222</td><td></td><td>County Judge</td><td>mcojudge@centex.net</td></tr>
<tr><td colspan="7">Comment:
The 50 year demand forecast is not representative of actual demand growth. Demand for water is growing in Mills County. We have a large and growing number of recreational/part-time landowners/users who have demand for water. Limited access to groundwater in the western part of the county is generating demand for other water sources. Bottom line – demand for water is increasing and will continue to do so for the next 50 years.
Response:
The demand projections for Mills County are 4,826 ac-ft in 2010 reducing some to 4,501 by 2060. There were opportunities to comment and request changes to the Region K population projections in October of 2002 and to the water demands projections in February of 2003. During the next planning cycle the Mills County population and demand projections can be further analyzed to determine if they are realistic.</td></tr>
<tr><td rowspan="2">19</td><td>Marcia Neuhaus</td><td>myself</td><td>P.O. Box 93
Tow, TX 78672</td><td>325-379-7842</td><td></td><td></td><td>mneuhaus@hotmail.com</td></tr>
<tr><td colspan="7">Comment:</td></tr>
</table>

Comments Received at 8/30/05 Region K Public Meeting:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
20	Macy L. Ormand	Four Oaks Ranch	745 CR 108 Burnet, TX 78611	512-756-4178	512-756-1948		fouroaksranchmko@burnetpc.net
	Comment:						
21	Nancy P Payne	Self	3805	512-345-2010 325-379-1213	512-345-2010		nancyppayne@earthlink.net
	Comment:						
22	Billy C. Pederson	Burnet Co.	5900 FM 2657 Briggs, TX 78608	512-734-0633 512-489-2558 (h)			N/A
	Comment: (made a statement) Mail information or call (no email).						
23	John Simmons		6244 County Rd 340 Burnet, TX 78611	512-756-9840	512-756-0779		john@simmonsranch.com
	Comment:						
24	Clayton Simpkins	Self	1014 CR 130 Burnet, TX 78611	512-715-0134	325-388-8344		cd005765@ktc.com
	Comment: What is the status of the planned H20 Pipeline on the east side of lake Buchanan? **Response:** *That question is being referred to LCRA for their response.*						
25	Spencer Tanksley		1007 Co Rd 321 Burnet, TX 78605	512-355-3507			l.tanksley@281.com
	Comment:						
26	Tom Weirich	Self	P.O. Box 813	512-793-			N/A

Comments Received at 8/30/05 Region K Public Meeting:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
			Buchanan Dam, TX 78609	2408			

Comment: (made a statement)
Please mail info – don't have e-mail. What is the origin of the GAMS model? What is the plan on compensating owners of water rights/private owner of water? Have any of the data been based on monitoring well data? Are there plans to put in monitoring wells?

Response:
The GAMs (Groundwater Availability Models) were developed for the Texas Water Development Board (TWDB). Some were developed by consultants employed by the Board and some were developed by Board staff.

The system of water rights currently covers only surface water. Any transfer of water rights from one owner to another is through a willing buyer and willing seller arrangement. No rights are being taken from one owner and given to another entity in this plan. In many cases, owners of rights sell water under those rights but do not sell the rights themselves. Groundwater is regulated by the Rule of Capture except where modified by rules of Groundwater Conservation Districts. Under the Rule of Capture, private entities own water only after they have captured it, or brought it to the surface for use.

The GAMs make extensive use of monitor well data to calibrate the results of the GAMS. The GAM is a computer model that simulates resulting water levels in wells in the aquifer as a result of pumpage. The results of the model are compared to measured water levels in wells throughout the area and the model is adjusted until the results from the model reproduce the water levels observed in the monitor wells. The TWDB maintains monitor wells throughout the various aquifers in Texas.

Response to Oral Statements/Comments:

22. Bill Pederson

Response:
The LCRA-SAWS Water Project (LSWP) project involves off-channel reservoirs (in the lower portion of the river basin), agricultural conservation measures, and conjunctive use of groundwater (Gulf Coast Aquifer). The LSWP takes some of San Antonio's municipal needs into account (150,000 ac-ft). The water supply for San Antonio will be provided from the off-channel reservoirs which will store flood flows that are normally passed to the gulf since there are no downstream reservoirs to capture these flows. Without the LSWP the rice farmers in Region K would have a difficult time coming up with the necessary capital to develop projects to meet their future water demands. The LSWP will be paid for by SAWS. There are studies being done to determine the viability and effects of the LSWP, and the project will not be implemented if the studies determine that the project is not viable or that the impacts are too large.

Comments Received at 8/30/05 Region K Public Meeting:

15. Bob Lanfear

Response:

The strategies titled "Development of New Groundwater Supplies" refers to communities tapping into aquifers in their area that they have not historically used, therefore this will be a new supply for the community.

11. John Graham

Response:

Jim Barho responded at meeting (refer to meeting transcript)

4. Tyson Broad

Response:

The projected Llano County Population is 17,360 for 2010- 2050 in the Region K plan. The 2000 Census value was 17,044, which is exactly what the Region K Plan has as the year 2000 Llano County Population. The 2004 Population Estimate from the Census is 18,143 however this information was not available during the population and demand portion of the planning process for Region K. There were opportunities to comment and request changes to the Region K population projections in October of 2002 and to the water demands projections in February of 2003. During the next planning cycle the Llano County population projections can be further analyzed to determine if they are realistic.

The current plan includes water supplies from the drought of record conditions analysis and water demands for below normal rainfall periods. The Planning Group, as mandated by the Texas Water Development Board (TWDB), included conservation as the first management strategy for any water user group (WUG) with a need and a per capita usage of greater than 140 gallons per capita day (gpcd). This long term conservation provides reduction of the overall water needs. The Group considered Drought Contingency measures as a management strategy, but did not include such measures for the following reasons:

1. *The Region K Planning Group adopted the firm yield of the Highland Lakes and other surface water resources as the amount of available supply that would be used. Many other regions used a safe yield which is a more conservative assumption and requires the search for greater volumes of additional supply. However, the firm yield assumption means that at the end of the drought of record, the reservoirs are empty. Most if not all of the municipal supplies that have intakes in the lake take water well above the actual bottom of the lake. As a result, there would be significant difficulty in reaching water if the lake were really empty. The Drought Contingency Plan for the LCRA uses drought contingency measures to extend the supply in the lake anywhere from one to three years to account for the intakes as well as to anticipate a potential future drought that would be longer than the drought of record.*
2. *Implementation of drought contingency measures is generally a short term measure that causes considerable discomfort to the residents but they are willing to put up with it for a short period of time. Measures such as dipping bathwater out of the bathtub and flushing toilets with it are ways to greatly reduce demand. However it would be difficult to sustain local enthusiasm among young families in keeping up with these types of measures for the 10 years of a drought.*

Comments Received at 8/30/05 Region K Public Meeting:

3. *Many smaller cities that have apparently high per capita usage may actually be regional commerce centers that have department stores and other facilities that bring people in from surrounding areas to shop. By the nature of the TWDB statistics, the water used by such facilities is considered municipal water and is included in the per capita usage of the area. The smaller the town that such conditions apply to the larger the per capita usage is. That means that it would not be easy to make large reductions in the per capita usage without cutting off the businesses that are using the water.*
4. *Drought contingency plans are often used to reduce the peak demands to make up for lack of adequate facilities to handle those infrequent peaks. However, in the long term, they may not reduce the total usage over a year period of time. For this reason, the RWPG believes that conservation is a better means of implementing long term savings.*

26. Tom Weirich

Response:

The GAMs make extensive use of monitor well data to calibrate the results of the GAMS. The GAM is a computer model that simulates resulting water levels in wells in the aquifer as a result of pumpage. The results of the model are compared to measured water levels in wells throughout the area and the model is adjusted until the results from the model reproduce the water levels observed in the monitor wells. The TWDB maintains monitor wells throughout the various aquifers in Texas.

2. Carter Barcus

Response:

The consultant team members and Regional Water Planning Group members spoke to Mr. Barcus after the meeting and determined that Mr. Barcus questions and comments were directed to the newly created groundwater conservation district for Burnet County and not the regional planning efforts.

11. John Graham

Response:

No, LCRA has not started construction of the off-channel reservoirs for the LCRA-SAWS Water Project (LSWP). There are on-going studies to determine the viability and effects of the LSWP, and the project will not be implemented unless the studies determine that the project is viable and that the effects are acceptable.

Comments Received at 9/7/05 Region K Public Hearing:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
1	Randell G. Brown, P.E.	City of Pflugerville	102 S. 3rd St Pflugerville, TX 78691	512-251-2243	512-251-2874		randyb@cityofpflugerville.com
	Comment: My thanks for this meeting!						
2	Margot Clarke	Public	5106 Evergreen Ct Austin, TX 78731	512-451-0908			
	Comment: (made a statement)						
3	Joe Day	Hays Trinity Groundwater Conservation Dist.	5300 Mt. Sharp Rd Wimberley, TX 78676	512-217-5206		HTGCD Board	joecday@msn.com
	Comment: Flow regime associated w/ LCRA/SAWS project, coordination of GAMS w/ WAMS for spring flow & baseflows, mandatory drought mgnt. plans for all user groups. **Response:** *The LCRA/SAWS Project will involve a combination of taking some high flows and diverting them into the off channel reservoirs, as well as using existing water rights and diverting them into the reservoirs. The LCRA management plan will be used to send interruptible supplies from existing rights to the proposed reservoirs.* *The Planning Group concurs with your comment on the need for coordination of the WAMs and GAMs. A policy statement is made to that effect in Chapter 8 of the Initially Prepared Plan, page 8-5, in 8.2.1.2.2.* *Chapter 288 of the Water Code requires the development of drought contingency plans for all retail public water supplies, all public water wholesalers, and all irrigation districts. This set of rules is administered by the TCEQ.*						
4	Julia Heinrichs	Self (private property owner involved in agriculture)	1827 La Sombra San Antonio, TX 78209	210-828-3604			Jgh1827@aol.com
	Comment: (1) I am especially concerned about treatment of water rights of property owners, especially those involved in agriculture. (Will I lose the right to use groundwater, because a "plan" decides I'm letting livestock drink too much?) (2) I am concerned about preventing inter-basin transfers.						

Comments Received at 9/7/05 Region K Public Hearing:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email

(3) Who will own and maintain the proposed catchment reservoirs after San Antonio's lease expires?

(4) When the presenter says the cart of the bottom of p.7 is skewed for emphasis, I am concerned that other information is misrepresented, and that public representatives would resort to this!

(5) Re: "Considered Impacts on" (p.15), where did you spend the monies?

Response:

(1) No one will lose their rights to use groundwater, and no one will lose their surface water rights because of the Region K Plan. The purpose of the plan is to help identify future water shortages and determine ways to meet those shortages.

(2) There is a nine point policy on inter-basin transfers included in Chapter 8 of the report:

> *The LCRWPG has adopted a resolution (Appendix 8A) supporting the following nine-point policy that identifies the conceptual elements and guidelines for transporting water outside of the Lower Colorado River Basin:*
>
> *1. A cooperative regional water solution shall benefit each region.*
>
> *2. Lower Colorado Regional Planning Area's (LCRPA) water shortages shall be substantially reduced if there is an exchange for an equitable contribution from LCRPA to meet the municipal water shortages in the South Central Texas Region (or similar transfers to other regions of the State).*
>
> *3. Proposed actions for inter-regional water transfers shall have minimal detrimental water quality, environmental, social, economic, and cultural impacts.*
>
> *4. Regional water plans with exports of significant water resources shall provide for the improvement of lake recreation and tourism in the Colorado River Basin over what would occur without water exports.*
>
> *5. Each region shall determine its own water management strategies to meet internal water shortages when those strategies involve internal water supplies and/or water demand management.*
>
> *6. Cooperative regional solutions shall include consideration of alternatives to resolve conflicts over groundwater availability.*
>
> *7. Any water export from the Colorado River would not be guaranteed on a permanent basis.*
>
> *8. Any water export from the Colorado River shall make maximum use of flood or excess inflows below Austin, but only after in-basin demands are met in the lower basin. Provisions and supporting technical reviews included in a draft permit to support this principle shall be reviewed by the Regional Water Planning Group to assure consistency with the planning process.*
>
> *9. Any water exported from the Colorado River shall comply with the LCRA's inter-basin water transfer policy.*

(3) The LCRA will own and operate the proposed off channel reservoirs throughout the term of the agreement with SAWS to supply water at up to 150,000 acre-feet per year. The proposed agreement will have a 50 year base term and a 30 year extension. After the expiration of the base term and the extension, the LCRA will continue to own and operate the reservoirs.

(4) The purpose of the Comparison of Available Water Supplies with 2001 Plan chart is to show the difference between the 2001 Plan values and the current Plan values. The scale starts at 1,245,000 ac-ft/yr instead of zero so that the individual looking at the chart can actually see the difference. If the scale started at zero then the difference would be very hard to see and the purpose of the chart would

Comments Received at 9/7/05 Region K Public Hearing:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
	be lost. The numbers are accurate and to make the chart's purpose more clear an adjusted scale was used, which is labeled on the chart. *(5) All monies expended for the regional plan development were administered by the LCRA under a grant with the Texas Water Development Board. The contract includes specific tasks and specific deliverables that are to be provided for each task. There are a number of tasks that developed information that led into the assessment of impacts on each of the areas listed here. Some of those tasks included the exercise and use of the GAMs (Groundwater Availability Models) to determine the impacts on water levels and spring flows from increased pumping, and the exercise of the WAM (Water Availability Model) to determine the impacts of the management strategies. A complete listing of the scope of services that was performed is included on the TWDB website, at www.twdb.state.tx.us under the Planning heading and then under Region K.*						
5	Donna Hoffman	Lone Star Sierra Club	1202 San Antonio St. Austin, TX 78702	512-477-1729			Donna.hoffman@sierraclub.org
	Comment: (made a statement) Will submit.						
6	Dick Kallerman	SOS Alliance	2510 Cedarview Austin, TX 78704	512-444-1326			cedartex@aol.com
	Comment: (made a statement)						
7	Daniel L Lanes	River Bluff Neigh. Ass., member PODER Austin	4907 Red Bluff Rd Austin, TX 78702	389-1512			dllanesrb@earthlink.net
	Comment: (made a statement)						
8	Jamie Mitchell	Surfrider Foundation, Central TX Chapter	P.O. Box 8262 Austin, TX 78713	512-694-1073			jamie@collectivestrength.com
	Comment: (made a statement)						
9	Cathy Porter	The Nature Conservancy	P.O. Box 163 Collefeport, TX 77428	361-972-2559	361-972-6426		cporter@tnc.org
	Comment: Do you anticipate changes to plan due to instream & bay/estuary flows analysis? Where would that occur?						

Comments Received at 9/7/05 Region K Public Hearing:

	Name	Representing	Address	Phone Number	Fax Number	Elected Official	Email
	Response: *The Freshwater Inflow Needs Study is currently underway for the Matagorda Bay system. As revisions are made to the quantities needed to maintain bay and instream flow needs, LCRA has amended their management plan to accommodate those needs. This is a long term plan, and the amounts shown in the plan are sufficient to meet needs 50 years into the future. If more water is needed and allocated to environmental flow needs in the next few years, there is still adequate water to shift from unused supplies and to amend the plan in future planning cycles to find new water to replace that dedicated to environmental needs.*						
10	Craig Smith	Barton Springs Edwards Aquifer Conservation District	1908 Barton Parkway Austin, TX 78704	512-442-3414	512-472-3059		
	Comment: (made a statement)						
11	Terry Tull	Self/Regional Water Quality Planning Project for Barton Springs Zone	16712 Rivendell Lane Austin, TX 78737	512-663-2093			totalltull@aol.com
	Comment: (made a statement) See Executive Summary of Regional Water Quality Plan and outline of my remarks						
12	Ben Vaughan	Coastal Conservation Association	P.O. Box 98 Austin, TX 78767	480-5617			bvaughan@gdhm.com
	Comment: (made a statement)						

Response to Oral Statements/Comments:

7. Daniel L. Lanes
Comments:
The first commenter was Daniel L. Lanes. Mr. Lanes provided two primary comments on the draft plan. His first comment was that needs of the environment should be considered in the planning process. His second comment was that conservation savings should be targeted to the urban areas. He also recommended pervious cover parking areas to reduce stormwater runoff and ponds or cisterns to capture stormwater.

Comments Received at 9/7/05 Region K Public Hearing:

Response to Comment 1 concerning the needs of the environment:
The Region K Regional Planning Group concurs with the need to make water available to meet environmental needs throughout the planning period. State practice in permitting water to be used from rivers, lakes and streams has only recently begun to require that yields of new permits be reduced by an amount of water that is dedicated to environmental uses. All new permits and all projects such as the LCRA-SAWS water sharing plan (LSWP) have a significant requirement for determining the impacts of the plan on environmental flows, and environmental flows will be considered in any permitting procedures for such plans. In addition, the LCRA is currently proceeding with an update of the environmental flow needs in the Lower Colorado River and Matagorda Bay to better establish the needs under times with plentiful water as well as times of drought conditions. These types of studies are generally longer in term and conducted to a much greater level of detail than the reconnaissance level studies in the regional water planning arena. In fact, the RWPG is required to use existing data to the greatest extent feasible, and the results of existing studies have been used in the development of the plan.

There are two primary areas where environmental flow needs are considered in the current plan. The first is in the determination of the available water from the firm yield of the Lower Colorado River. LCRA has developed a management plan for its basin that includes a minimum amount of flow that is dedicated to instream flow and environmental needs. The plan requires that flows in the River not go below these predetermined levels to ensure that minimum streamflow needs are met. Discussions continue about the adequacy of these flows during the drought of record, but they are included in the management plan specifically for environmental needs.

The second area where the environment is considered is with regard to the use of groundwater. Groundwater Availability Models have been developed for most of the aquifers that are being used in the Region K area. The consensus of the RWPG was that groundwater should be used in such a fashion that water would be replaced on an annual basis wherever possible, and that springflows should be maintained at 90 percent of average flows during a drought or record condition. Flow of water from springs is often the base flow in small rivers and streams during times of drought, and maintaining these spring outflows at 90 percent of the pre drought levels provides water from environmental needs in the areas of those springs. The pumpage from the aquifers for municipal and manufacturing uses was limited in order to maintain those target springflows.

In summary, the RWPG believes that water has been set aside specifically for environmental flow needs as Mr. Lanes has requested. The RWPG further recognizes that debate will continue on the adequacy of these amounts and has also recommended that the State Legislature deal with this issue in Policy Recommendation 8.2.2, found on pages 8-6 and 8-7 of Volume 2 of the Initially Prepared Plan. This policy recommends that new permits in critical environmental areas be issued only with thorough mitigation plans that would assure the maintenance of appropriate environmental flows. In addition, the state should encourage the conversion of existing water rights to environmental uses through programs such as the voluntary sale or lease of under utilized water rights back to the state as a means of regaining adequate flow conditions.

***Action Taken**: Inasmuch as the above information documents that amounts have been set aside for environmental flow needs, and that further efforts by the state to provide additional water for environmental needs is encouraged in the plan, no further changes to the plan in response to this comment are contemplated by the RWPG.*

Response:
The second comment concerning imposition of water conservation on the municipalities is similarly addressed in the plan. The City of Austin has committed to significant savings from its highly recognized Water Conservation Programs, and it and all municipal users with a need for additional water and a per capita use above 140 gallons per capita per day during the 50 year planning horizon are required to use conservation as a management strategy. Conservation amounts and impacts on the per capita use are recommended in accordance with the findings of the Water Conservation Task Force and their final report. The RWPG concurs that pervious cover is a good tool for the management of surface water runoff and provides some additional recharge to groundwater aquifers in the area. In addition, the RWPG is supportive of rainwater harvesting to conserve surface water supplies. The amounts of conservation indicated in the plan for the users with needs is assumed to come from a suite of potential conservation measures of which Rainwater Harvesting could be one.

***Action Taken**: The above information again indicates that the items commented on are addressed in the plan and no changes to the draft are contemplated.*

2. Margot Clarke
Comments:
The next commenter was Margo Clarke. She made several comments, the first of which was that she did not understand why the agricultural savings were tied to the LCRA-SAWS project. The second comment was that maintaining environmental flows is critical. She encouraged the planning group to do strong environmental assessments of projects such as the LCRA-SAWS project and to place a stronger emphasis on conservation in all areas and not tied to a particular project.

Response:
The response to the first comment or question is that the agricultural users are not able to afford the cost of the conservation improvements on their own. Although many individual farmers have partnered with the Natural Resource Conservation Service to implement precision leveling and multiple inlets and other water saving devices, these farmers are primarily landowners. There is a significant segment of the rice industry which consists of tenant farmers farming land owned by someone else. The landowner is often not interested in improving the land and the tenant cannot economically do so. As a result, the linkage to the LCRA-SAWS project is to provide the necessary funds to accomplish the conservation of water in the rice industry on a much broader scale. If the multi-year multi-million dollar studies of the LCRA-SAWS project show that it is feasible, then SAWS will pay the full cost of developing 330,000 acre feet of additional water supply in the Lower Colorado basin, and will receive 150,000 acre feet of that supply. The remaining 180,000 acre feet will be used to provide for needs within the Region K planning area. Therefore, the linkage of conservation with the LCRA-SAWS project is to provide an economic driver for the process that is not currently available.

***Action Taken**: The above has responded to the question asked, and no changes to the plan are contemplated by the RWPG.*

Response:
The second comment was the encouragement to the RWPG to do strong environmental assessments of large projects such as LCRA-SAWS. The RWPG notes that the funds provided by the TWDB are not sufficient to perform large independent studies of such projects. However, the studies noted above that are being undertaken by LCRA and SAWS include a significant amount of funds for determination of the environmental impacts and any necessary mitigation that would be needed. As noted in response to previous comments, the LCRA-SAWS project is the subject of legislation which requires that the environmental impacts be determined and either mitigation provided or the project will not be allowed to go forward.

Action Taken*: The above has responded to the issue of environmental studies for large water supply projects. No changes to the plan are contemplated by the RWPG.*

5. Donna Hoffman
Comments:
The next commenter was Donna Hoffman. Ms. Hoffman commended the planning group for including environmental water demands in the plan, for recommending conservation for users with needs, and for the policy of sustainable groundwater pumping and working cooperatively with the groundwater districts. She also offered concerns about the lack of drought management strategies which she alleges lead to an artificial demand for water and recommended incorporating drought management as a water management strategy. She also stated that she felt the plan did not fully assess how environmental flows are affected by current and proposed water supply projects. She further expressed concern about the level of groundwater pumping proposed to the lower counties and the possible harm to the Colorado River and Matagorda Bay and its estuary from a lack of freshwater inflows, and urged the planning group to closely monitor the studies underway and to not accept this project if it is determined that it will mine the Gulf Coast Aquifer or harm the Colorado River or Matagorda Bay.

Response:
The consultant team considered Drought Management and presented information to the Planning group. The response to the first comment is somewhat involved, but the basic principal involved is that the consultant team recommended that the RWPG distinguish between conservation, which reduces the per capita consumption over the long term, and drought management plans, which reduce peak consumption for a period of time, but do not necessarily have a significant impact on the overall average annual water usage. The RWPG has consistently used the drought of record conditions for determining the amount of firm yield available from the LCRA system. However, the impact of that decision is that when the drought of record occurs, the drought will last for the ten years that the previous drought of record occurred, and at the end of that ten year period, the reservoirs will be empty. This is undesirable for several reasons, not the least of which is that if the new drought is more severe or longer than the 10-year drought of record that is modeled, water supplies may be depleted at a faster rate than predicted. In addition, few if any of the surface water users in the basin have surface water intakes in the very bottom of the reservoir. Most will be out of the pool long before the reservoir is empty and will have to implement restrictions to reduce usage. LCRA's drought contingency plan is designed to encourage customers to reduce usage before a drought worse than the drought of record is

experienced so that the reservoir supply life can be extended for an additional two years, to account for the possibility of a drought worse than the drought of record without total interruption of the supply.

Another more conventional application of drought management measures is to reduce the peak day demands of a particular system in order to reduce the amount of infrastructure that is dedicated solely to meeting peak demands. Utilities that experience declining well capacities often implement drought management strategies to reduce the peak day demand and can then exist on lower capacity wells for peak summer demand conditions. The criteria from the Texas Commission on Environmental Quality is that a peak day to average day factor of 2.4 is used in the absence of data from individual systems. The RWPG's consultant team used a factor of 2.0 in scaling up from the average annual shortage to determine the required delivery capacity in wells or transmission lines. This lower factor takes advantage of any surplus currently available but may also involve the use of drought management measures to lower the peak daily demands and allow the use of less capacity in the system. Some systems will choose to install additional capacity and some will choose to use lower capacity and ask for drought management measures to make the smaller capacities work. In any event the plan costs were based on the lower peaking factor assumption.

A third concern of the RWPG is the past history of success of drought management measures. While people are cooperative for a period of time, the success of drought management measures that must be implemented is more difficult to accomplish if the measures have to be applied over a number of years. Again, the measures are typically more successful in lowering peak conditions than in reducing the average consumption over a year's time.

For all of the reasons noted above, the consultant team reported to the RWPG that it considered drought management measures as a water management strategy, but did not include them in the current plan.

Action Taken: *Text will be added to the plan to document the issues noted above.*

Response:
The second item from Ms. Hoffman's statement concerned the manner in which management strategy impacts to environmental flows were quantified. Ms. Hoffman noted that TWDB rules require the planning group to perform a quantitative analysis of impacts to the environment, and that her view and that of the Sierra Club is that analysis should include a comparison of current environmental conditions to future environmental conditions. The RWPG members have been unanimous in their concern about the condition of the model that was used to determine the availability of supplies as well as the impacts on the environment from the implementation of the various management strategies. The following details are provided to give an account of why the modeling that was done needs further refinement.

The RWPG and its consultant team were reviewing the results of the modeling conducted using the November WAM Run 3 issued by TCEQ. This was the second model that was reviewed by the consultant team because of the revision to the model being approved after the initial investigations had already been done with the July WAM Run 3. LCRA had also noted that there is an issue with their management plan in using full utilization of rights, since LCRA uses the unused portion of those rights as a part of their interruptible supplies. However, this *discussion was cut off by the advent of a request from Region F to consider changes to the November WAM Run 3. The November WAM Run 3 showed that numerous small systems in Region F that rely on small reservoirs were showing no yield under drought of record conditions and that water generated in that area would be used to supply needs downstream based strictly on prior appropriations. Region F representatives requested a modification to the model that would allow the storage of a portion of the water in their area to remain there to supply their needs. A modified model, know as the "No Call" model was prepared and tested. Although extensively reviewed and modified through a number or iterations, the "No Call" model has several anomalies remaining that cause doubt about the accuracy. This information is discussed in detail in Chapter 4. One outcome of this process is that there is no corresponding model, similar to a WAM Run 8 or current conditions model available for use. TCEQ's WAM Run 8 for the Colorado River does not have the adjustments to the agreements that allow the water to remain in the upstream reservoirs, and introducing a new model at this point provides further confusion to the results. The RWPG recommended that further research be done into the model at the earliest opportunity, but was forced to move ahead with the model as it is because of scheduling issues. The delivery date for the final plans is mandated in legislation and TWDB was not able to entertain any changes to that date. The analyses mandated by TWDB to determine the quantitative impacts to the environment from the management strategies were performed using the "No Call" WAM Run 3 version. The RWPG concurs that additional analysis is needed and so states in Chapter 4.*

***Action Taken**: No changes were made to the text of the report.*

Response:
The final item from Ms. Hoffman was a request that "We urge the planning group to closely follow the studies that are currently underway as part of the project and to not accept this project if it is determined that it will mine the Gulf Coast Aquifer or harm the Colorado River or Matagorda Bay." The RWPG concurs with this request completely and will continue to monitor the ongoing studies related to the LCRA-SAWS project in that light.

***Action Taken:** Will add text to the report to clarify this position*

11. Terry Tull
Comment:
The next commenter was Terry Tull. Mr. Tull's comments were that in his opinion, the plan needs to give more focus to the implications of water quality in terms of availability of adequate amounts of water for the needs of the area. He then recommended that the RWPG consider a tool that has been developed by a consortium of 13 different agencies in and around the Austin Metropolitan area.

Response:
The RWPG concurs that water quality is important and that further attention needs to be paid to quality issues as the population of the area continues to grow. However, the impact of the study that was done for this regional plan is again, a reconnaissance level at best. The results of the study that Mr. Tull was referring to were not available at the time of the completion of the analysis on water quality impacts. In addition, rules concerning development are similarly changing over time as stormwater issues and permits become more stringent. The

Comments Received at 9/7/05 Region K Public Hearing:

RWPG looks forward to reviewing the full report and incorporating further information from it into the next round of planning, but does not feel it can be incorporated into this round of planning.

Action Taken: *The LCRWPG acknowledges the issues related to water quality in urban areas. Text will be added in the next planning cycle.*

12. Ben Vaughan
Comments:
The next commenter was Ben Vaughan. Mr. Vaughn made the following comments:

1. Studies have shown the Region L can handle their water problems and Region K should not sacrifice its bays and estuaries in the interest of assisting Region L.
2. The studies for maintaining bay health are ongoing. Take advantage of them, including studies for the LCRA-SAWS project by the University of Texas Marine Science Institute.
3. Any inter-basin transfers should be limited to the consumed amounts, and not the stated paper amounts of the permits
4. Demand may be reduced as the cost of water increases.
5. Include bays and estuaries as a water user group

Response:
The RWPG agrees that the health of the bays and estuaries should not be sacrificed as part of the LSWP. As noted in previous comments, there is an extensive program of investigations to determine the impacts of the LCRA-SAWS project on the environment, and mitigation must be both possible and provided or the project will not be allowed to continue.

The RWPG is following the studies on environmental issues closely and will continue to do so as the studies proceed. These studies are multi year studies with significant budgets for determining the impacts and any mitigation possible. The RWPG is required by the TWDB to use the results of existing studies, and is committed to doing so.

The issues of what water will be transferred and in what amounts will be handled in the permitting process with the TCEQ. The purpose of this study is to determine the availability of the water and cost at a planning level. Again, the amounts to be transferred will be a part of a much longer term study being funded by SAWS.

The current demand factors for per capita use include some reductions built in as a result of savings from water saving plumbing fixtures. In addition, the San Antonio area has a significant program of water conservation that includes savings from conservation pricing as well as other conservation programs.

The RWPG has included water for environmental flow needs as noted in previous comments. However, designation of the bays and estuaries as a water user group is not within the ability of the RWPG. The TWDB designates the water user groups that will be included in *the plan. As also noted previously, the RWPG has made policy recommendations to the TWDB and the legislature concerning reserving water for environmental flow needs.*

Action Taken: *No changes to the report are recommended as the comments have been addressed in the report.*

6. Dick Kallerman
Comments:
Dick Kallerman spoke next and noted his concern and the concern of his organization, the Save Our Springs Alliance, that groundwater in the Barton Springs/Edwards Aquifer be protected. He further noted that the groundwater supplies in 2060 will be tapped at a level of approximately 10 times current usage.

Response:
The RWPG and its consultant team has used all of the models that were available at the time the work was performed to determine the impacts on the aquifers. The criteria that were used were to cap usage at a level equal to the amount that is replaced annually, and where that determination was difficult to make, then the next criteria was to make sure that any springs associated with that aquifer were protected by only using those supplies of groundwater that would not cause the springflow to go below 90 percent of the normal value. It is the opinion of the RWPG that this protection provides the protection to the groundwater that Mr. Kallerman suggested. The Barton Springs Edwards Aquifer Conservation District (BSEACD) numbers were used instead of the procedure outlined above for their portion of the Edwards Aquifer.

Action Taken: *No changes to the report were recommended as the issues Mr. Kallerman suggested were addressed in the report.*

8. Jamie Mitchell
Comment:
Jamie Mitchell of the Surfrider Foundation spoke next. He made two comments, one that the level of 140 gpcd was not low enough and he thought conservation could reduce that number further, and that more conservation could potentially reduce the need for the LCRA-SAWS project, which captures flood flows and thereby reduces nourishment to the beaches along the coast.

Response:
The RWPG notes that it has followed the Water Conservation Task Force recommendations as required by the TWDB. As a part of the investigation into water conservation practices, the Task Force determined that even large cities with extensive water conservation programs have ended with per capita usages in that range or higher. That is why the recommendations of the Task Force were set at the 140 gpcd number. In addition, the LCRA-SAWS project is not solely dependent on flood flows but also uses water from other sources as well. Modeling for the project indicates that scalping of flood flows accounts for approximately 7% of the total water generated in the project over the period of record.

Comments Received at 9/7/05 Region K Public Hearing:

The RWPG recognizes that beach renourishment is a concern to the beach front areas of the state. As has been noted previously, there are extensive environmental studies taking place concerning the LSWP and its numerous environmental impacts. These studies will include looking at the impacts on sediment carriage in the river which will help determine the extent to which solids will be transported for beach renourishment.

Action Taken: *No changes to the report were recommended.*

10. Craig Smith
Comment:
Craig Smith spoke next about the Barton Springs Edwards Aquifer. Mr. Smith noted that they had gone through a significant process to determine the sustainable amount of water that the aquifer would produce and that they have arrived at a number of approximately 10 cubic feet per second. He further noted that their current permits are in excess of that amount of water so that in a drought of record condition, they will have to limit pumping further. He noted that they are making all new permits conditional upon actual conditions.

Response:
The RWPG's consultant team used the availability studies from groundwater conservation districts and from their management plans where possible. In the case of the Barton Springs/Edwards Aquifer District, the number that was used for the sustainable yield was obtained from the District.

Action Taken: *No changes to the plan were recommended.*

Additional Region K Public Comments

Michael Booth (9/14/05)
Response:
The conservation Scenarios 1 and 2 discussed in your comments were not recommended as strategies at this time. One of the Region K tasks involved looking at advanced municipal conservation as a strategy; therefore, several conservation scenarios were analyzed as potential strategies. The only conservation strategy recommended in the Plan was a 1 percent reduction in per capita use annually for all municipal water user groups with shortages and per capita usage above 140 gallons per capita day (gpcd).

Jennifer Walker Response:
The Lower Colorado Region has a wetter climate than El Paso and we should be able to decrease water usage below levels that El Paso is able to achieve. Currently, El Paso is at 137 gpcd. The areas of the region that are experiencing growth, but have no conservation plans currently in place are prime for instituting the latest in conservation programs, especially in new construction.

One factor that will come into effect over time that will help people achieve reductions is energy efficient clothes washers. These washers should save 5.6 gpcd in household where they are used.

In areas where there is a high number of commercial or retail water users that drive up the gpcd numbers, reduction are still possible. There are many ways for these entities to save large amounts of water through efficient ice machines, spray washer nozzles, cooling water recirculation and other measures.

Sharon Killough (9/13/05)
Response:
1. A quantitative assessment of the impact on environmental flows was performed for the management strategies using the "No Call" WAM model developed for this plan update. However, the advent of the "No Call" model late in the planning process and the lengthy period of review and application and fixing of issues with the model left no time or budget for more extensive study after the model was available. However, the TWDB is also performing a quantitative assessment of the impact on environmental flows. Further development of the model and the "No Call" concept, if it is to be continued, is needed in the next plan update.

2. The consultant team for Region K recommended that The LCRWPG distinguished between conservation, which reduces the per capita consumption over the long term, and drought management plans, which reduce peak consumption for a period of time, but not necessarily having a significant impact on the overall average annual water usage. The LCRWPG has consistently used the drought of record conditions for determining the amount of firm yield available from the LCRA system. However, the impact of that decision is that when the drought of record occurs, the drought will last for the ten years that the previous drought of record occurred, and at the end of that ten year period, the reservoirs will be empty. This is undesirable for several reasons, not the least of which is that if the new drought is more severe or longer than the 10-year drought of record that is modeled, water supplies may be depleted at a faster rate than predicted. In addition, few if any of the surface water users in the basin have surface water intakes in the very bottom of the reservoir. Most will be out of the pool long before the reservoir is empty and will have to implement restrictions to reduce usage. LCRA's drought contingency plan is designed to encourage customers to reduce usage before a drought worse than the drought of record is experienced so that the reservoir supply life can be extended for an additional two years, to account for the possibility of a drought worse than the drought of record without total interruption of the supply.

Another more conventional application of drought management measures is to reduce the peak day demands of a particular system in order to reduce the amount of infrastructure that is dedicated solely to meeting peak demands. Utilities that experience declining well capacities often implement drought management strategies to reduce the peak day demand and can then exist on lower capacity wells for peak summer demand conditions. The criteria from the Texas Commission on Environmental Quality is that a peak day to average day factor of 2.4 is used in the absence of data from individual systems. The LCRWPG's consultant team used a factor of 2.0 in scaling up from the average annual shortage to determine the required delivery capacity in wells or transmission lines. This lower factor takes advantage of any surplus currently available but may also involve the use of drought management measures to lower the peak daily demands and allow the use of less capacity in the system. Some systems will choose to install additional capacity and some will choose to use lower capacity and ask for drought management measures to make the smaller capacities work. In any event the plan costs were based on the lower peaking factor assumption.

A third concern of the LCRWPG is the past history of success of drought management measures. While people are cooperative for a period of time, the success of drought management measures that must be implemented is more difficult to accomplish if the measures have to be applied over a number of years. Again, the measures are typically more successful in lowering peak conditions than in reducing the average consumption over a year's time.

3. The LSWP proposes to pump groundwater for irrigation purposes during those periods of time when surface water is not available when surface water rights are more fully utilized. The LSWP Project Viability Assessment contains data which states that the levels proposed will have some additional drawdown over what is currently being experienced. However, the purpose of the project viability assessment is to determine those impacts to a greater degree of certainty and determine whether or not they are acceptable from a social, economic, and environmental standpoint. The LSWP is tasked with constructing a more localized model to better determine the overall long term impacts to the aquifer from the additional pumpage proposed. That work is just beginning and results are not currently available. The LCRWPG concurs that this is a primary concern of the group and that study results from the LSWP will be followed carefully and scrutinized closely. As a part of this oversight, the TWDB has been asked to provide quality reviews of the information developed in this aquifer modeling effort.

Neal Cook (9/10/05)
Response:
1. The Texas Water Development Board (TWDB) determined which categories of water use would be analyzed in the regional water plans (municipal, manufacturing, mining, steam electric power, livestock, and irrigation). It is up to the TWDB to determine these categories and the base information behind them (preliminary water demand estimates).

2. The LCRA Water Management Plan takes recreation into consideration. The LCRA Water Management Plan has specific amounts of water allocated to environmental flow needs. This water provides minimum levels of streamflows which can provide water for recreational uses as well. LCRA continues to develop and refine the Management Plan to meet the needs of the multiple users of the water resources in the Lower Colorado Basin.

3. The control of pollution from strip mines is an issue that should be raised with the Texas Commission on Environmental Quality (TCEQ). The TCEQ is the state agency responsible for pollution control.

4. Groundwater availability values were determined for each county or portion of a county located in Region K for each of the GAMs (Groundwater Availability Models). The general approach to determine groundwater availability values from the GAM runs were to maintain 90 percent of the stream flow contribution from the aquifer compared to a no pumpage run during the worst drought of record year. This approach was approved by the Region K Water Modeling Committee to minimize adverse effect on stream flow during drought of record condition. Specific criteria were needed to determine availability for some of the GAMs due to the unique nature of each model. The portions of the LCRWPA where no

GAM is available or did not have an availability value adopted by a GCD in a Groundwater Management Plan, utilized the values previously adopted by Lower Colorado Regional Water Planning Group (LCRWPG) in 2000 Region K Water Supply Plan.

David Todd (8/31/05)
Response:
The LCRA-SAWS Water Project (LSWP) is a management strategy that develops approximately 180,000 ac-ft of supply to meet the irrigation shortages in Region K. This strategy also develops 150,000 ac-ft of municipal supply for SAWS. Without the LSWP the rice farmers would have a difficult time coming up with the necessary capital to develop projects to meet their future water demands.

The LSWP project involves off-channel reservoirs (in the lower portion of the river basin), agricultural conservation measures, and conjunctive use of groundwater (Gulf Coast Aquifer). The water supply for San Antonio will be provided from the off-channel reservoirs which will store flood flows that are normally passed to the gulf since there are no downstream reservoirs to capture these flows. Without the LSWP the rice farmers in Region K would have a difficult time coming up with the necessary capital to develop projects to meet their future water demands. The LSWP will be paid for by SAWS. The LSWP is currently in the development stage and a number of studies are underway to determine the impacts of LSWP on the environment. Once these studies are complete, the impacts will be reviewed and if adverse impacts can be mitigated, the project may go forward, depending upon the revised cost and yield. If adverse impacts cannot be mitigated, the LSWP will not continue.

Gene Hall Miller (8/20/05)
Response:
The Plan will be dedicated to the deceased members. Since the voting members are listed in the plan to allow the public to see who represents their interests and how to contact them we felt only the current voting members and their contact information should be listed.

Mark Jordan (8/16/05)
Response:
Chapter 7 language not consistent with Executive Summary and Chapter 4; Changes will be made to the text to make this consistent.

Bobby Rountree (8/11/05)
Response:
The sentence in Chapter 4 regarding the completions of the Additional Goldthwaite off-channel reservoir will be revised to:
The reservoir construction was completed in July 2005,

Richard Burns (9/14/05)
Response:
Requested changes to Alcoa Three Oaks Mine demands in Bastrop and Lee Counties:
The water demands were determined in a public process and taken through a public meeting to receive comments and revise as needed. Changes requested at that time were made and were used to form the basis of the needs assessment which led to the identification of shortages. The management strategies were then developed to meet those shortages. Since the plan is substantially complete it is not possible to change those demands at this time. However, your comment will be included in the plan and this issue will be addressed with the next plan update.

Joe Cooper (9/26/05)
Response:
There are no references to the discontinued SAWS/Alcoa project in the Region K Plan.

Kirby Brown (9/21/05)
Response:
The LCRWPG has received the information provided on Land Stewardship and concurs that the quality and quantity of runoff and percolation water is impacted by the condition of the land on which it falls. The report and comment will be included in the comments section of this plan and will be reviewed during the next plan update for potential incorporation as a strategy.

Hal Strickland (10/2/05)
Response:
The LCRWPG has reviewed the article on graywater reuse provided and noted that it in not necessarily a new concept. Encouraging such consumptive use of municipal water supplies would not necessarily lead to conservation as it could encourage homeowners to grow more water consumptive ornamental vegetation and irrigate more or in some other way further consumptively use graywater than what they may have otherwise done, thereby leading to less conservation rather than more. In addition, the article fails to discuss the issue of phosphates and other dissolved solids that could eventually present a problem when used extensively for irrigation or waterscapes, particularly when used in every house in new development conditions. This could be a particular concern over the Edwards Aquifer Recharge Zone and other environmentally sensitive areas. Furthermore, the author assumes that water returning to a wastewater treatment facility is "wasted" water. On the contrary, such "wastewater", "grey' or "black" in many cases is a positive contribution to environmental flows and downstream irrigation.

Carrie F. Knox (10/19/05)
Response:
1. The LCRWPG notes that it has followed the Water Conservation Task Force recommendations as required by the TWDB. As a part of the investigation into water conservation practices, the Task Force determined that even large cities with extensive water conservation programs have ended with per capita usages in that range or higher. That is why the recommendations of the Task Force were set at the 140 gpcd number.

2. The current plan includes water supplies from the drought of record conditions analysis and water demands for below normal rainfall periods. The Planning Group, as mandated by the Texas Water Development Board (TWDB), included conservation as the first management strategy for any water user group (WUG) with a need and a per capita usage of greater than 140 gallons per capita day (gpcd). This long term conservation provides reduction of the overall water needs. The Group considered Drought Contingency measures as a management strategy, but did not include such measures for the following reasons:

- The Region K Planning Group adopted the firm yield of the Highland Lakes and other surface water resources as the amount of available supply that would be used. Many other regions used a safe yield which is a more conservative assumption and requires the search for greater volumes of additional supply. However, the firm yield assumption means that at the end of the drought of record, the reservoirs are empty. Most if not all of the municipal supplies that have intakes in the lake take water well above the actual bottom of the lake. As a result, there would be significant difficulty in reaching water if the lake were really empty. The Drought Contingency Plan for the LCRA uses drought contingency measures to extend the supply in the lake anywhere from one to three years to account for the intakes as well as to anticipate a potential future drought that would be longer than the drought of record.

- Implementation of drought contingency measures is generally a short term measure that causes considerable discomfort to the residents but they are willing to put up with it for a short period of time. Measures such as dipping bathwater out of the bathtub and flushing toilets with it are ways to greatly reduce demand. However it would be difficult to sustain local enthusiasm among young families in keeping up with these types of measures for the 10 years of a drought.
- Many smaller cities that have apparently high per capita usage may actually be regional commerce centers that have department stores and other facilities that bring people in from surrounding areas to shop. By the nature of the TWDB statistics, the water used by such facilities is considered municipal water and is included in the per capita usage of the area. The smaller the town that such conditions apply to the larger the per capita usage is. That means that it would not be easy to make large reductions in the per capita usage without cutting off the businesses that are using the water.
- Drought contingency plans are often used to reduce the peak demands to make up for lack of adequate facilities to handle those infrequent peaks. However, in the long term, they may not reduce the total usage over a year period of time. For this reason, the LCRWPG believes that conservation is a better means of implementing long term savings.

3. Audits of irrigation practices and ordinances for control of the timing and application of irrigation water through sprinkler systems, for residential, commercial, and public systems is one of the water conservation measures that can be adopted by cities, water districts, and other water users to curtail waste and improve efficiencies. The LCRWPG approved conservation as the first management strategy for all users with needs and with per capita use above 140 gpcd. An average per acre foot cost for conservation programs using common conservation measures was used, and the individual measures were left up to the specific entity that will implement them. In that fashion, those entities can apply their measures to the areas with the largest potential savings.

4. The LSWP proposes to pump groundwater for irrigation purposes during those periods of time when surface water is not available when surface water rights are more fully utilized. The LSWP Project Viability Assessment contains data which states that the levels proposed will have some additional drawdown over what is currently being experienced. However, the purpose of the project viability assessment is to determine those impacts to a greater degree of certainty and determine whether or not they are acceptable from a social, economic, and environmental standpoint. The LSWP is tasked with constructing a more localized model to better determine the overall long term impacts to the aquifer from the additional pumpage proposed. That work is just beginning and results are not currently available. The LCRWPG concurs that this is a primary concern of the group and that study results from the LSWP will be followed carefully and scrutinized closely. As a part of this oversight, the TWDB has been asked to provide quality reviews of the information developed in this aquifer modeling effort.

5. An assessment of the impact on environmental flows was performed for the management strategies using the "No Call" WAM model developed for this plan update. However, the advent of the "No Call" model late in the planning process and the lengthy period of review and application and fixing of issues with the model left no time or budget for more extensive study after the model was available. However, the TWDB is also performing a quantitative assessment of the impact on environmental flows, and that information will be included as an appendix to the report. Further development of the model is needed in the next plan update.

6. The consultants for the LCRWPG reviewed information from the Texas Parks and Wildlife Department, as well as the book called "Springs of Texas" Volume I by Gunnar Brune (1981) in order to determine whether or not there are current springs in the lower three counties. As far as these publications indicate, there are no currently active springs and there have been no active springs for some time. Water does flow into and out of the Colorado River from alluvial aquifers and from perched water

that rides on top of clay layers close to the surface, but to the best of our knowledge, there is no interchange of water from the Gulf Coast Aquifer in the lower three counties to the Colorado River.

Groundwater availability values were determined for each county or portion of a county located in Region K using the available GAMs (Groundwater Availability Models). The general approach to determine groundwater availability values from the GAM runs were to maintain 90 percent of the stream flow contribution from the aquifer compared to a no pumpage run during the worst drought of record year. This approach was approved by the Region K Water Modeling Committee to minimize adverse effect on stream flow during drought of record condition. Specific criteria were needed to determine availability for some of the GAMs due to the unique nature of each model. The portions of the LCRWPA where no GAM is available or did not have an availability value adopted by a GCD in a Groundwater Management Plan, utilized the values previously adopted by Lower Colorado Regional Water Planning Group (LCRWPG) in 2000 Region K Water Supply Plan.

John Fink (8/24/05)
Response:
The LCRA-SAWS Water Project (LSWP) was conceived to provide a funding vehicle to alleviate a water shortage in the basin. The current plan anticipates significant shortages in irrigation water for the Colorado, Matagorda, and Wharton County areas. The intent of the LSWP is for SAWS to pay for the development of up to 330,000 acre feet of water annually, but to receive up to 150,000 acre feet of the water developed. The LCRWPG recognizes that there are significant environmental issues that must be addressed. Inclusion in the plan does not signify that all of the necessary environmental tests have been successfully passed, but only that the project can be included in the water plan if the environmental issues can be satisfied. There has been and will continue to be consideration of the effects of the LSWP prior to implementation. A long term study is currently underway to provide the answers to the environmental impacts questions, and once that information is available, it will be considered by the LCRWPG in the next plan update.

Nancy L. Eskridge (10/20/05)
Response:
The Region K plan has used the best information available at the time to determine the impacts of management strategies, but concurs that further evaluation is necessary. LCRA-SAWS is currently undergoing a long term evaluation of the impacts of the project on the Colorado River, Matagorda Bay, and the Gulf Coast Aquifer. Inclusion of this strategy in the plan currently is subject to verification of the ability to provide mitigation to harmful environmental effects of the project. Subsequent plan updates will include the results of these additional investigations in deliberation on the suitability of the LSWP.

The Region K plan does include water conservation measures to the extent recommended by the Water Conservation Task Force in their recent report. The LCRWPG's consultant team has recommended that conservations measures be implemented to deal with long term reductions in demand. Drought contingency measures were recommended as a means of extending available supplies during droughts but not as a means of reducing overall average annual usage.

Ilse P. Munyon (11/2/05)
Response:
Thank you for your comments. We appreciate everyone's time and attendance at the public meetings and public hearing and will take the comments into account in this and the next round of planning.

Additional Region K Public Comments

Myron Hess, Mary Kelly, Jennifer Walker (11/4/05)
Response:

1. A Table of Contents for the entire plan will be added.

2. The second paragraph on page ES-5, starting with the third sentence will be modified as follows:
However, review of the model results demonstrated a shortage of firm yield water in reservoirs in Region F ~~and brought about a need for coordination between the Region F Planning Group and the LCRWPG.~~ ***Region F requested a meeting with Region K and presented the issue to the LCRWPG. The key issue is that downstream water rights holders with more senior rights have the ability to "call" on inflows from the upper reaches of the Colorado River watershed. This "call" would mean that flows from the watershed that come into the upper reservoirs would have to be passed through even if the upper reservoirs were nearly empty, in order to meet the priority calls from downstream rights holders. TWDB staff noted that the plans would be in conflict if Region F showed that water being impounded upstream and Region K included that amount in its supply determination. The two regions were requested to try to work out the potential conflict.*** *The result was* ***the development of*** *a WAM* ***that was*** *modified to include a planning assumption whereby* ***upstream water to meet downstream priority rights would not be released*** *~~downstream water rights holders would not call on~~ ~~inflows from Region F during the planning period~~* ***until some portion of the upstream needs were satisfied****. This "No Call" assumption does not have legal standing and does not impact the seniority of owner's rights, ~~but simply is a more accurate reflection of how water is managed in the basin.~~* ***This is a planning level assumption only that was agreed to by the LCRWPG solely to avoid a potential conflict with Region F. Region K supports efforts over the interim period before the next planning round to investigate the technical issues related to the WAM described in Sections 3.2.1.2.6 and 3.2.1.2.7. …***

3. The reference will be changed to "*WAM Run 3*".

4. Water demand values will be added to Figure ES.2.

5. The sentence will be modified as follows:
*The total amount of water supply for the water user groups (WUGs) in Region K is less than the total available water to the region presented in Table ES.2~~, since the~~***. This condition exists because WUGs generally balance current needs with cost of water and provide additional supplies as they are needed throughout the planning period. As an example, a WUG on groundwater with a current need of 1 MGD will not drill wells that will provide 10 MGD to meet its future needs. The water may still be available in the aquifer, but the WUG only has the capability to serve its current need plus some adequate factor of safety. In general,*** *water suppl***ies** *for the WUGs ~~is limited by~~* ***are responsive to*** *current needs, location relative to the source, and infrastructure limitations.*

6. The sentence will be modified as follows:
This identified shortage is based on availability estimates, which exclude water available from LCRA on an interruptible basis and water available as a result of ~~Austin's~~ return flows to the Colorado River.

A sentence will be added showing the reduction in shortages due to LCRA contract renewals.

7. The sentences will be modified.

8. A cross-reference to Table ES.10 will be added.

9. The information presented in Table ES-9 is for a temporary overdrafting of the aquifers that would occur only in the event that the drought of record conditions occurred with a corresponding maximum

utilization of water by the WUGs listed. In the case of Hays County Manufacturing, the current TWDB model includes only the Upper Trinity aquifer while there is physical evidence of water in the Lower Trinity that could meet this demand. Since the sources of water were established previously, the LCRWPG agreed to call this a temporary overdraft and to concur that it would be unlikely to cause any negative impacts on the aquifer. For Matagorda County, the amount of overdraft is small, and again it would only occur during the defined period of the drought of record. For that reason the temporary overdraft was approved by the LCRWPG instead of looking for more costly alternatives for this small amount.

10. The LCRWPG approved the levels of conservation recommended by the Water Conservation Task Force. In the discussion, it was noted that while conservation has been a priority for a number of WUGs with successful programs, the practical limit that many of them have achieved is in the 140 gpcd range. While the potential additional savings were presented to the LCRWPG, the decision was to include only the 1 percent reduction down to 140 gpcd.

11. This was not included in the plan per the discussion noted in 10 above.

12. The breakdown of rice irrigation shortages by county and by river basin does not lend itself well to an overall shortage table presentation. The purpose of this table is to present the overall management strategy. The tables in Appendix 4A present the individual WUGs with their individual shortages and the amount of that shortage that is covered by each portion of the overall irrigation strategy.

13. There is currently no legal requirement for the City of Austin, Aqua WSC, or the City of Pflugerville to discharge their effluent to downstream users. The City of Austin in particular has indicated its willingness to provide a portion of its return flows as a means of providing downstream water for other uses. However, the City has reserved the right to use that flow internally if conditions change between now and the time that strategy is implemented. Therefore, there is no firm yield to return flow supplies and it is applied as an interruptible flow for the purposes of this plan.

LCRA response:
This sentence and the rest of the response need to refer to the LCRA response to #47 regarding the return flows from City of Austin. Same issue with response to #74; should refer to the response to #47.

14. The LCRWPG concurs that additional analysis of the environmental impacts is needed. However within the current limits of funding, we have met the minimum TWDB requirements.

15. The LCRWPG notes that current instream flow requirements imposed on LCRA will continue to be met. Again, within the limits of available funding, the LCRWPG's position is that we have met the minimum requirements for the plan with the discussion included. The LCRWPG concurs that further definition is needed in future plan updates.

16. The purpose of referencing the LCRA Water Management Plan is to acknowledge that there is firm yield water committed in the management plan. The loss of any instream flow from the HB 1437 process will not impact that minimum flow. The LCRWPG concurs that interruptible water flows will likely see a decrease for at least a portion of the stream if HB 1437 diverts water upstream.

The sentence will be modified as follows:
However, LCRA will continue to meet ~~all~~ environmental flow requirements as provided ***for*** *by its Water Management Plan (WMP).*

17. The sentence will be modified as follows:
*For example, **the goals of the proposed LSWP project are:** the transfer is temporary; it benefits both regions by substantially reducing projected water shortages in Region K and meeting municipal shortages in Region L; the system operation necessary for the project maximizes use of inflows available below Austin; and the project ~~is~~ **will be** designed to have minimal detrimental environmental, social, economic and cultural impacts and provides benefits to lake recreation over what would occur without the project.*

18. The LCRWPG feels that the minimum requirements established by the TWDB have been met for this initially prepared plan. We concur that further consideration of this issue in future plans is warranted.

19. The LCRWPG agrees that further consideration of this issue is warranted in future planning efforts.

20. The LCRWPG disagrees with the suggestion to include all of the full versions of the policy statements in the ES. However, we do agree to the changes as proposed below.

21. The sentence will be changed as suggested.

22. The sentence will be changed as suggested.

23. The full version of this policy statement will be included.

24. The sentence will be changed as suggested.

25. Time did not permit the inclusion of this discussion. This discussion will be added during the next planning cycle.

26. Time did not permit the inclusion of this discussion. This discussion will be added during the next planning cycle.

27. Time did not permit the inclusion of this discussion. This discussion will be added during the next planning cycle.

28. A reference will be added to the almost completed Freshwater Inflow Needs Study.

29. Time did not permit the inclusion of additional explanation. Additional explanation will be added during the next planning cycle.

30. Time did not permit the inclusion of this discussion. This discussion will be added during the next planning cycle.

31. The sentence will be modified as follows:
*Increased groundwater pumping from the aquifer during drought conditions decreases all spring discharges, which can potentially impact the state and federally listed threatened and endangered species that depend on the springs for habitat, such as the Barton Springs salamander, **and can potentially affect water supply availability downstream.***

32. Time did not permit the inclusion of this discussion. This discussion will be added during the next planning cycle.

33. Time did not permit the updating of these tables. These tables will be updated during the next planning cycle.

34. Time did not permit the inclusion of this table. This table will be added during the next planning cycle.

35. A table showing the gpcd per WUG will be added as Appendix 2C. Time did not permit the inclusion of a plumbing code savings table; this table will be added in the next planning cycle.

36. The TWDB approach to population projections was used for the City of Austin. However, there were several utility districts who requested that their populations be capped because they had developed their entire service area and did not intend to annex any additional territory. The populations from these areas were transferred to the City of Austin in anticipation of continued annexations. For the per capita use calculations, the COA used an alternate year, 1998, due to mandatory conservation in 2000.

The following sentence will be added:
In this analysis, the City of Austin used year 1998 as their base year instead of year 2000, since the City had mandatory water conservation measures in place during year 2000.

37. The following sentences will be added:
The TWDB guidance allowed the use of a single year (1995-2000), a composite of all of the years, and either the largest acreage or the largest water demand based on their data for use in determining the irrigation demands. The largest year acreage planted was used for Colorado and Wharton Counties, and the largest water demand year was used for Matagorda County.

38. The correction will be made.

39. The sentence will be changed as suggested.

40. The paragraph will be modified as follows:
Recently, efforts were made to reopen Parker's Cut to accommodate recreational fishing ***by shortening the travel time to the fishing areas****.* ~~*It was also claimed that reopening the cut might be beneficial to fisheries production.*~~ *The resource agencies oppose the reopening* ~~*on similar grounds*~~ ***believing it would be detrimental to fisheries production****. Finally a compromise was reached that would open a channel into the Bay just North of the diversion dam. This would allow access to the Bay without going through the locks, but with minimal diversion of fresh water.*

41. The paragraph will be modified as follows:
In less than 75 years major alterations have been made that dramatically and dynamically changed the characteristics of the Bay. The river flow ***into Matagorda Bay*** *was reduced* ***significantly*** ~~*from 100 percent discharge into Matagorda Bay to practically zero discharge*~~*,* ***and*** *then* ~~*in only ten years*~~ *it was back to almost 100 percent discharge into West Matagorda Bay* ***by the early 1990s****. There are other sources that contribute to the freshwater inflows of Matagorda Bay in addition to the contributions by the Colorado River, but these flows have not been measured and are occasionally overlooked.*

42. A reference to the draft results of the revision to the freshwater inflow needs study for Matagorda Bay will be added on pages 2-28 and 2-30.

43. Theses paragraphs will be updated to reflect that the commission and committee have completed their work. The location of reports will be updated as needed.

44. The correction will be made.

45. The correction will be made.

46. The following sentence will be added to the end of the bullet:
In addition, a run-of-river right may not be able to divert even if there is water in the river or stream due to the constraints of the prior appropriation system or environmental flow limitations.

47. **LCRA response:**
This sentence has been misread by the commenter. The last sentence referenced actually acknowledges that the LCRA Water Management Plan *does* take return flows into consideration. The state-approved LCRA Water Management Plan considers return flows in two contexts: (1) for calculation of the combined firm yield of Lakes Buchanan and Travis, return flows expected as a result of full use of municipal water rights were assumed available to meet downstream senior water rights, and (2) for operational planning purposes, projected availability of return flows over the next ten-years are expressly included as part of the flows projected to actually be available for use to meet downstream water needs, including environmental needs. As recognized elsewhere in the IPP, the legal rights to return flows is the subject of ongoing litigation between the LCRA, the City of Austin and others.

48. The following sentences will be added to the end of the last paragraph on page 3-4:
The Colorado River surface water availability amounts developed through the No Call WAM are the amounts used in developing this plan. These availability numbers are presented starting on page 3-15.

49. The sentence will be changed as suggested.

50. The sentence will be modified as follows:
The firm yield of the Highland Lakes System ~~for this regional plan~~ was determined by using the Colorado River Basin WAM and adding up the various components of the ~~Buchanan/Travis~~ ***Highland Lakes*** *System.*

51. **LCRA response; Paragraph will be reworded as follows:**
In 1992, LCRA, working with the state natural resource agencies, completed an instream flow needs study. The study was later approved by the Texas Water Commission, predecessor agency to the TCEQ, as incorporated into LCRA's Water Management Plan. The results of that study included two sets of instream flow needs: Critical and Target instream flow needs. The quantity of water committed by the LCRA Highland Lakes System under the Water Management Plan to instream flows consists of (1) the passage of inflows to meet the Target and Critical instream flow criteria that might otherwise be available to store in the Highland lakes; and, (2) the release of stored water to help meet the Critical instream flow criteria. In order to determine the quantity of inflow the LCRA Highland Lakes System bypassed for instream flows in the WAM, the quantity of inflow available to the LCRA's Highland Lakes System before and after an environmental need is engaged is computed and the inflow reduction to the LCRA Highland Lakes System due to each environmental need is attributed as water bypassed for each environmental need. To determine the quantity of additional stored water released for critical instream flows, the exact quantity of water released from the LCRA Highland Lakes System Storage to help meet each environmental need is extracted from the WAM output and attributed as stored water released for each environmental need. Once all of these components have been extracted and tabulated, the total quantity of water dedicated to instream flows is determined.

52. Your objections to use of the No Call WAM are noted. With the benefit of hindsight, the LCRWPG concurs that the use of the No Call WAM is problematic. However, at this point, the point is moot. The

No Call WAM was used and the results were extensively qualified throughout the text. The next plan revision should include a more extensive modeling effort to develop a model which will represent the system adequately.

53. Your suggestion of analyzing the water availability impacts of the No Call modeling assumption as a water management strategy instead of a baseline water availability assumption is noted. The LCRWPG had considerable discussion on this issue during the planning process as to what would be the best approach.

54. Comment noted.

55. Comment noted.

56. Comment noted.

57. Comment noted.

58. Comment noted.

59. Comment noted.

60. Comment noted.

61. A reference to Appendix 3C page 14 of 23 will be added to the footnote.

62. **LCRA response:**
This quantity ("Highland Lakes Contracts") was reduced as a result of the model run using the "No-Call" assumption in WAM. The associated model shortage for these contractual obligations is addressed in Chapter 4 (LCRA Strategies 4.6.1).

63. **LCRA response:**
No water is lost. Table 3.1b documents the reduction in LCRA's Firm Annual Yield due to the "No-Call" assumption by comparing the yield of the LCRA System as calculated by the WAM (Table 3.1) with and without the "no call" assumption (Table 3.1a). In order to make such a comparison, the quantity of water committed to O.H Ivie Reservoir of 85,700 ac-ft/yr had to be removed from the total yield tabulation in the regular WAM run since the "No call" WAM run implicitly has taken care of the subordination concept. Tables referenced in the footnote need to be corrected, from 3,2 and 3.2a to 3.1 and 3.1a.

64. **LCRA response; Paragraph will be reworded as follows:**
The quantity of water committed by the LCRA Highland Lakes System to instream flows consists of (1) the passage of inflows that might otherwise be available to store in the Highland lakes, to meet the Target and Critical instream flow criteria; and, (2) the release of stored water to help meet the Critical instream flow criteria. In order to determine the quantity of inflow the LCRA Highland Lakes System bypassed for instream flows in the WAM, the quantity of inflow available to the LCRA's Highland Lakes System before and after an environmental need is engaged is computed and the inflow reduction to the LCRA Highland Lakes System due to each environmental need is attributed as water bypassed for each environmental need. To determine the quantity of additional stored water released for critical instream flows, the exact quantity of water released from the LCRA Highland Lakes System Storage to help meet each environmental need is extracted from the WAM output and attributed as stored water

released for each environmental need. Once all of these components have been extracted and tabulated, the total quantity of water dedicated to instream flows is determined.

65. This reference was included because the WAM attempts to approximate the instream flow requirements exactly as they are written.

66. Comment noted.

67. Comment noted.

68. The LCRWPG concurs that additional analysis is needed to establish the impacts of low stream flow with regard to long-term protection of natural resources.

The following sentence will be added:
This level may not provide adequate flows for protection of endangered species. Further studies are required to establish minimum required flows.

69. The footnotes refer to previous tables that contain references to the No Call model.

70. The sentence will be modified as follows:
The amount of total water supply available to the WUGs in Region K is less than the total available water to the region presented in Table 3.24, since the water supply for the WUGs is limited by current ~~needs~~ ***supplies owned or controlled by each WUG****, location relative to the source, and infrastructure limitations.*

71. Comment noted.

72. Comment noted. The LCRWPG believes that it has met the minimum requirements established by the TWDB based on the available time and budget for this investigation. We concur that additional investigation would be beneficial, but limited budgets are available for this work.

73. Comment noted. The LCRWPG believes that it has met the minimum requirements established by the TWDB based on the available time and budget for this investigation. We concur that additional investigation would be beneficial, but limited budgets are available for this work.

74. Municipal return flows are deemed interruptible since there is no firm legal requirement that they be discharged, if the producer of the flow can beneficially reuse the effluent produced. The City of Austin is the largest producer of return flows, and they have indicated amount of return flows expected, but reserved the right to reduce those quantities if changes to the rate of growth precipitate a need to reuse more effluent at an earlier date.

LCRA Response:
The response suggested by consultant is: “The municipal return flows are deemed interruptible since there is no firm legal requirement that they be discharged………” This sentence and the rest of the response need to refer to the LCRA response #47 regarding the return flows from City of Austin. Same issue with response to #13.

The contract expiration shortages are discussed on the next page.

75. The last sentence of the paragraph will be modified as follows:
This includes not only the amendment of its water rights to meet changing and future water needs, but also an aggressive water conservation program and the development of alternative water supplies and conjunctive water management strategies~~, funded by leveraging the sale outside of the region of any surplus water made available through these measures. LCRA believes that this funding mechanism will also provide a significant cost savings to the water customers of LCRA in the LCRWPA~~.

LCRA response:
The phrase "predicated on" should precede "LCRA's ability." (fourth sentence)

76. The comment is noted and consideration will be made for including this in the next round of planning.

77. Comment noted.

78. Comment noted.

79. Comment noted.

80. Comment noted.

81. The sentence will be amended to read "*additional strategies*" instead of "*additional water.*"

82. The LCRWPG concurs that the statement needs to be reworded to indicate that LCRA provides a minimum level of flow, and not flow sufficient to meet all opinions of what the environmental need is. It is noted that the water set aside for minimum environmental flow needs is include in the LCRA management plan, and it is therefore not shown as supply for any WUG. Under current rules, TWDB does not allow the planning groups to allocate water for other than the WUGs that TWDB establishes.

The sentence will be modified as follows:
*Finally, LCRA provides water to meet **requirements for** environmental needs of the river and bay **according to the LCRA WMP.***

83. Each of the major strategies has ongoing studies which are continuing to provide additional information on the impacts to the environment of the proposed projects. There are numerous statements throughout the plan that reference these studies and indicate that acceptance of the strategies is based on confirmation through studies of the potential impacts and whether or not they are acceptable. The LCRWPG concurs that this is an area where continued vigilance is needed as well as further analysis.

84. **LCRA response:**
Return flow assumptions are tabulated in Table 4.35 (and in Table 4.26) and discussed in Section 4.6.2.2 on Reclaimed Water Initiative. The reference to Table 4.35 could be added after the first sentence of last paragraph to clarify that these return flows were used after the Region F's simulation of "No call" with return flows.

85. **LCRA response:**
The WAM treats return flows like any other intervening inflow. First priority is to the most senior water rights, subject to any environmental flow restrictions which may apply, including both instream flow and bay and estuary freshwater inflows. In the case of the WAM, environmental flow restrictions contained in the LCRA Water Management Plan, including caps on these restrictions, are given a priority date one day senior to the Highland Lakes, making these environmental flows junior only to rights with priority dates senior to March 1926. However, the

analysis conducted by Region F's consultant for "No call" with return flows may have had different orders for the priority of environmental flows.

86. The amounts shown in the table are the firm yield increases for all rights.

87. The inclusion of the return flows is an increase to the potential freshwater inflows to Matagorda Bay over the use of the TWDB mandated model with full utilization of rights and no return flows.

88. **LCRA response:**
The reference to an "overall management plan" is not meant to refer to the current LCRA Water Management Plan, which is applicable only to the Highland Lakes. Rather, it is meant to refer to the overall management of all of LCRA's water rights to help meet existing and future water supply needs. To avoid this confusion, the sentence will be reworded as follows:
The ~~overall management plan~~ system operations approach that LCRA plans to continue to employ, involves the use of a number of specific strategies tied to major projects such as the LCRA-SAWS Water Project and HB 1437 conservation savings, which are…

89. **LCRA response:**
The term 'interruptible' in the third paragraph is an error; it should say 'firm', as correctly characterized in the second paragraph.

90. Comment noted.

91. **LCRA response:**
A full discussion of the environmental flow amounts accounted for under the LCRA Water Management Plan is found in Section 3.2.1.1.1. The reference to "system operations model" in this paragraph should be revised to reference the "LCRA Water Management Plan." The first part of the last sentence should be revised to read:
LCRA's ability to continue to provide interruptible surface water supplies to the lower counties for rice production does provide benefit to instream flows as these interruptible flows make their way through the river system…..

This sentence recognizes that, without this management strategy, surface water supplies available for irrigation and flowing in the river would be significantly reduced, and there would be reduced releases of return flows from the fields.

92. **LCRA response:**
This table reflects the projected interruptible supplies to be available for irrigation needs, as Section 4.6.1.2.2 applies to Irrigation. While these supplies would contribute to meeting instream flow needs as they flow down the river to meet irrigation needs, this strategy presently assumes the same approach employed in the current LCRA Water Management Plan. Under the current WMP, except to the extent that interruptible supplies that are provided to meet irrigation needs also count towards meeting instream flow needs, the interruptible supplies are only available to meet additional environmental needs after irrigation demands are satisfied. Note, however, that the WMP also continues to provide firm supplies to meet critical environmental flow needs even after irrigation supplies are curtailed.

A footnote should be added to clarify that limited simulations were conducted for only 2000 and 2060 conditions due to time and budget constraints; information for other decades were interpolated from the results of 2000 and 2060.

93. **LCRA response:**
Additional evaluation and quantification of environmental impacts is needed and is being done as part of the LSWP studies. For clarification, the sentence on groundwater will be deleted since it does not directly relate to this section of the study. The WMP clearly states now that with continued increase in the use of firm water from the Highland Lakes' in the future, the availability of interruptible supply will continue to diminish in the future. This is characterized by the 2nd paragraph on page 4-25.

94. This strategy is shown in table 4.30 for Steam Electric in Llano County.

95. **LCRA response:**
The figures are not directly comparable. Table 3.24 shows water availability without any water management strategies. The second full sentence referring to the use of about 150,000 to 200,000 acre-feet of water from the Lakeside, Gulf Coast, and Pierce Ranch refer to the "authorized" amounts. Utilization of Return Flows and LCRA's management strategies were incorporated in to the planning runs described in the subject paragraph. These management strategies increase the water availability under the senior run-of-river rights to meet these irrigation district demands.

96. The sentence will be modified as follows:
Portions of these ROR irrigation water rights that are no longer needed for irrigation because of conservation and other factors resulting in reduced irrigation demands are proposed for use as part of a system operation employing off-channel storage, potential new water rights associated with LCRA's ~~"flood flow"~~ permit application ***for the remaining unappropriated water in the Lower Colorado River Basin****, and backup from the Highland Lakes to develop water supplies that would help meet in-basin future needs as well as needs in the San Antonio region and Williamson County.*

97. The LCRWPG disagrees with this comment for a number of reasons. One is that the change in diversion point of the permitted flows will impact the amount that can be diverted upstream. Flows which are accumulated from the watershed downstream of the point of diversion are excluded from the diverted amount and those flows will remain in the river. If irrigation flows are supplied by another source, then there would be no net annual flow difference. The LCRWPG does concur that under some months, the flow may be less because the irrigation flows are only needed during the irrigation season. In addition, the use of groundwater will not require flow in the river from interruptible rights to meet the demands and some reductions could occur then as well. A statement to that effect will be added to this text.

98. Comment noted.

99. Comment noted.

100. The title will be changed as suggested to "*Application for Unappropriated Flows and Off-Channel Storage*"

Refer to the Region L Plan for the unit cost and the amount of water available for this strategy. As noted previously, the discussion of the Water Management Plan with regard to target instream and target freshwater flows is contained in Chapter 3. The LCRA did accommodate the pending changes in the management plan in the numbers contained there, but did not incorporate the results of the freshwater inflow needs study as it was not completed in time to be included. The analysis of the environmental impacts of the off-channel reservoir construction and the costs for all of the LSWP facilities are contained in the Region L Plan because all of the costs will be borne by Region L. If the costs were included in the

Region K plan that would be a misrepresentation of the cost. The monetary cost to entities in Region K is $0.

101. The sentence will be changed as suggested.

102. The missing zeros will be added. The unit cost can be found in the Region L Plan.

103. The TWDB approach to population projections was used for the City of Austin. However, there were several utility districts who requested that their populations be capped because they had developed their entire service area and did not intend to annex any additional territory. The populations from these areas were transferred to the City of Austin in anticipation of continued annexations. For the per capita use calculations, the COA used an alternate year, 1998, due to mandatory conservation in 2000.

The paragraphs will be modified as follows:
The COA began an aggressive water conservation campaign in the mid 1980s in response to rapid growth and a series of particularly dry years. The City has achieved significant reductions in both per capita consumption and peak day to average day demand ratio. ~~*The base year for the water demands for the COA is year 2000 data, which captures the effects of the COA's conservation program's current level of effort, but not the impacts of any additional initiatives.*~~ ***For the per capita use calculations, the City of Austin used year 1998 as their base year instead of year 2000, since the City had mandatory water conservation measures in place during year 2000.***

~~*The COA water demand projections were initially based on recorded usage during the year 2000, which was approximately 160,000 ac-ft/yr, but this amount was increased to reflect actual contracted amounts.*~~ …

104. The LCRWPG has received your comment and will review the levels of conservation for the City of Austin in the next planning cycle.

105. The LCRWPG acknowledges that there will always be differences of opinion concerning the amount to which conservation should be applied. It should be noted, however, that the conservation program in the San Antonio area has a significant driver in that San Antonio became short of water as a result of a court decision, and discovered that new sources of water are expensive and take some time to develop. This knowledge among the general citizenry has led to greater acceptance of conservation than is the case in other areas. The City of Austin has had a progressive program in effect for some time, a program that was placed in effect and funded by the City when the City had adequate water supplies to meet its needs for the foreseeable future. It is further noted that Austin has met the identified needs it faced solely through conservation and reuse, and not through the development of any new sources. The LCRWPG agrees to revisit this issue in the next plan, but does not plan to change this number in this planning cycle.

106. The systems to which conservation programs must be applied vary widely in the amount of single family residential, multi family residential, commercial, and other categories of use. A system with largely single family homes on large lots built after 1992 with extensive landscaping will need to focus its efforts on control of outdoor irrigation. One with multi-family homes and largely commercial will need to have a different focus. For this reason, the concept of an average cost does not have any relevance. The range of costs is presented so systems can determine how the cost of the measure that is most likely to give them the greatest reduction in use compares to the other strategies that will be required in addition to conservation.

107. The following sentence will be added to the end to the paragraph:
In addition, water conservation generally does not result in adverse impacts to environmental flows or other environmental considerations.

108. The term "*water factories*" will be changed to "*reclaimed water facilities*".

109. The City of Austin has a consistent share of the power produced from this project, and the amount of effluent represents the amount of cooling water required for that share. This strategy only replaces firm yield water from another source with effluent. All of the costs of diverting and pumping from the river remain the same. No additional infrastructure is required.

110. The LCRWPG feels that the minimum requirements of the plan have been met. As noted earlier, the Group concurs that additional refinement of the models is needed.

111. The overall management of the river for the target inflows is the responsibility of the LCRA. As such, LCRA has looked at the overall models for the river with current flows and anticipated flows and determined the contribution from each of the various strategies. With the limitation on the capability of the model available, it was not possible to make a realistic determination of how much adjustment should be made for environmental flows from each component of the system.

112. The LCRWPG concurs that final implementation of a strategy can only come after significant environmental analysis and study. This occurs in the permitting process and elsewhere. For the purposes of this analysis the group is trying to identify fatal flaws, as well as to try to determine the costs of environmental mitigation that might make one project stand out over another. It has been mentioned several times in this report that ongoing studies will be used in future plan revisions to make adjustments to the selection of strategies.

113. The following text will be added:
Environmental Impacts

The environmental impacts of expanded use of the Edward-BFZ Aquifer are in question at the time of this report completion. Water availability for this aquifer was based on modeling performed by the Barton Springs Edwards Aquifer Conservation District, and documented in a report released late in the planning cycle. The final modeling performed indicates that spring flows may be temporarily reduced to approximately 1 cfs during the worst period of a repeat of the drought of record if all of the permits that have been issued by the District are fully utilized. The 1 cfs spring flow may not be sufficient to support endangered species in the areas downstream of Barton Springs and potential negative environmental impacts could be high. This issue was raised by several individuals during the public comment process. As a result of this finding the District is considering making all future permits conditional, so no additional firm yield would be available from the aquifer. While there was not time to provide an alternative strategy in this planning cycle, this will be a high priority in the next planning cycle. In addition to the potential stream impacts, the installation of pipelines and wells can have an impact on the environment, but it should be limited to the construction period and have little or no impact thereafter if adequate precautions are taken.

114. The last sentence will be modified and text will be added to the end of the fifth paragraph on Page 4-73 as follows:
*As a result, surface water will be used whenever it is available, **significant amounts of** groundwater will be used only when surface water is not available, and the aquifer will recover. **There is currently some question as to whether the aquifer levels will recover fully in terms of drawdown. The LSWP has a significant portion of its study dedicated to the development of a groundwater availability model that***

builds upon the current version to make it more site specific in the lower counties of Region K. This study will provide more definitive data on the long term impacts to the aquifer and will be incorporated into any deliberations or revisions to the plan.

115. Comment noted.

116. The savings reported in Table 4.76 were presented to the group as potential savings from advanced conservation. The LCRWPG did not include these savings in the base plan as you have noted.

117. The LCRWPG will review the amounts of water conservation for each WUG in the next planning cycle.

118. A reference to the TWDB Report 362- *Water Conservation Best Management Practices Guide* will be added.

119. Comment noted.

120. This recommendation will be considered in the next planning round.

121. The following sentence will be added after the first sentence of Section 4.8.4:
This strategy would provide water to Hays County-Other to meet projected water shortages for that WUG.

This strategy is a carryover from the previous planning cycle. The consultant team looked at the yields reported at that time and also reviewed the results of the dye tracing study. It is uncertain at this point whether or not the results of the dye tracing study would be the same under low drought conditions. For that reason, the yield of the two recharge dams proposed for implementation was reduced to approximately 50 percent of the previous total to account somewhat for the uncertainty of the project.

122. As noted above, the yield was significantly reduced from the previous plan as a result of the dye study results. Further study will be directed to this alternative in the next planning round.

123. The sentence will be modified as follows:
Water provided by the COA would be specifically designated for the Spillar Ranch and Pfluger Ranch developments ***(located in Hays County-Other)****.*

The paragraph on page 4-87 under Figure 4.8 contains the amount of water provided by the strategy (approximately 1,100 ac-ft/yr).

124. This version of the plan is based on best available data. The LCRWPG concurs that more specific information is needed on this project to more fully address the impacts.

125. The sentence will be modified as follows:
However, LCRA will continue to meet ~~all~~ ***the*** *environmental flow requirements as ~~provided by~~* ***specified in*** *its WMP.*

126. **LCRA response:**
Section 4.6.1.3, Amendment to RoR Rights (page 4-27), discusses the strategy "Firm up ROR with Off-Channel Reservoir as part of the LSWP." The strategy of "Firm up ROR with Off-Channel Reservoir" contemplates the use of off-channel reservoir storage in the vicinity of the actual irrigation water rights to enable the LCRA's run-of-river water rights to realize a more reliable

water supply by storing run-of-river flows when they are plentiful and utilizing these stored irrigation waters when river flows are not available. This concept is being analyzed along with the LSWP to properly refine the reliability and water needs of LCRA's Irrigation water rights in the future. As stated earlier, for the draft plan, limited analyses were conducted for assessing the proposed strategies due to various constraints noted in the IPP, and the draft plan refers to the ongoing studies being conducted and the future studies to be conducted for the LSWP to refine these further details regarding the LSWP to (see Response #128).

127. **LCRA response:**
Section 4.6.1.3, Amendment to RoR Rights (page 4-27), discusses the strategy of using portions of the existing LCRA ROR rights for the LSWP. Since "supply available" for these RoRs were based on the full authorized amounts, an adjustment to the supply available was made by reducing the current estimated amount that will be used for LSWP. Again, for the draft plan, limited analyses were conducted for assessing the proposed strategies due to various constraints noted in the IPP, and the draft plan refers to the ongoing studies being conducted and the future studies to be conducted for the LSWP to refine these further details regarding the LSWP to (see Response #128).

128. SAWS and LCRA are spending 7 years for detailed studies to determine environmental impacts of this project. The LCRWPG and its consultant team had limited budget to develop this information. The LCRWPG concurs that much more definition is needed prior to implementation but recognizes that the ongoing studies are designed to provide that information. Results of most of those studies will be known during the next planning cycle and be incorporated into the updated plan.

129. Refer to Comment 128

130. Refer to Comment 128

131. The use of laser leveling and multiple inlets provides greater control of the water flow into and through a rice field. As a result of the greater precision of the structures, there is less concern that rainfall may wash out the levees and cause a discharge of water from the fields soon after application of fertilizer or herbicides. However, the discharge of the reduced amount of return flow water is already accomplished in a manner to minimize the carryover of any fertilizer or herbicides by not applying those materials for some time before the fields are drained. We proposed to eliminate that sentence altogether.

132. The LCRWPG believes that LCRA will continue to provide the environmental flows called for in their management plan. The tools to perform the analysis of impacts of strategies versus current uses were not reliable for this planning round. Additional attention will be paid to this in the next planning round.

133. As noted previously, the tools to perform the analyses being requested are being developed by the LSWP. The current Gulf Coast WAM does not have the capability of predicting the areal extent of drawdown conditions because it is intended for much more regional types of analyses. The consultant team has looked at the issue of potential impacts to local wells, and more specifically to wells not in known aquifers used for livestock watering. In summary, many of the livestock watering wells are using perched water which may not be reliable under drought of record conditions. If there is a drought, however, the amount of pasture available will be similarly reduced and animal population will be reduced because of the lack of feed rather than a lack of water. The increased drawdown of wells in the Gulf Coast Aquifer is unlikely to contribute to the reduction in local source groundwater in any event.

134. As noted previously, the improvements to the Gulf Coast Aquifer model and the environmental impact studies commissioned under LSWP will be looking at this issue.

135. **LCRA response:**
The reference to the prior LSWP Project Viability Assessment (PVA) is now out-of-date and will be omitted. The table represents the latest information from the latest PVA based on 100 percent adoption.

136. The LCRWPG concurs and will do this in the next planning round.

137. Section 4.9 contains the Irrigation Water Management Strategies; therefore the only portion of HB 1437 discussed or analyzed here is the portion affecting irrigation. The other portion of HB 1437 is discussed in Section 4.8.8 and in the Region G report.

138. The amount of on-farm conservation that is reasonably available is a function of the price for rice, the availability of funds for matching shares, and other factors. Assumptions were made in the Project Viability Assessment (PVA) and elsewhere about the amount of land that would be precision leveled and provided with multiple inlets, but those projections are not close to 100 percent of the land used for rice production. In this instance, both strategies will move forward with the improvements until they can no longer gain the savings through application of conservation measures. At that time, the HB 437 strategy will be required to provide their offset from other sources.

139. One of the difficulties of applying conservation as a strategy to manufacturing interests is that the LCRWPG does not even know what types of manufacturing make up the realm of manufacturing interests in the region. TWDB does not release statistical data on each manufacturer because that could be construed as releasing trade secrets. However, the increasingly stringent requirements for discharge of effluent has spurred a considerable interest in conserving and reusing because of the potential adverse effects from not meeting permit limits. In order to implement conservation strategies, the LCRWPG would have to blindly pick a number for a percent reduction and would have no way to determine a cost of achieving that reduction, or of knowing if that manufacturing interest was already operating under state of the art conservation. Further discussion with TWDB will be held in the next planning cycle.

140. The LCRWPG concurs and will give this increased attention in the next plan.

141. Comment noted. The LCRWPG concurs that is the case.

142. The following sentence will be added at the end of the last paragraph on page 4-120:
STPNOC requested that this strategy be recommended for implementation in 2010.

143. The LCRWPG concurs that these are important issues that should be addressed in further development of this strategy.

144. The LCRWPG concurs that further discussion of groundwater impacts is needed and should be addressed in further development of this strategy.

145. The LCRWPG concurs that location of the discharge from a desalination facility is a major concern and it should be addressed in further development of this strategy.

146. The LCRWPG included this at the request of STPNOC; however, there is no firm yield expected from this process and therefore no further discussion was warranted.

147. Comment noted.

148. Brush management is a common term in use.

149. The information presented is intended to be a general description of the potential problem parameters, and then to focus on quality issues that are present. The individual discussions do speak to nutrients, TDS, minerals, etc.

150. The last line on that page will be modified to read:
As rainfall conditions return to normal, this limited over-pumping of the aquifer is expected to decline, and water levels in the aquifer should return to ***near*** *normal levels without impacting water quality.*

151. This sentence will be added to the end of the fourth full paragraph on 5-5:
In any event, the quality of water produced by City of Austin wastewater facilities is such that no adverse impacts on water quality are anticipated.

152. This paragraph was written with knowledge of Austin's reuse plans. The amount of effluent produced by increasing population is such that there is a gradual increase in the amount of effluent released to the Colorado River over time and for most decades.

153. That statement is accurate in terms of the intent of the production of groundwater during dry years. The proposed wells will pump into the existing canal system to supplement available surface water supplies, when surface water supplies are insufficient by themselves.

154. The fourth sentence referenced will be amended by insertion of the word "*Environmental*" at the beginning of that sentence. It is the intent of the LCRWPG to state that the minimum flow requirements will be met, and that not all environmental flow requirements are met by the management plan.

155. It is not the understanding of the LCRWPG that impacts to rural and agricultural areas would include impacts to sport fishing and tourism. The LCRWPG concurs that impacts to migratory waterfowl that occur largely on rural property and generate income for rural landowners would be included in the impacts.

156. The losses being referred to are the losses to downstream users through the application of the No Call WAM.

To clarify, the following change will be made to the sentence containing the phrase "*off-set losses*":
Sufficient strategies are proposed within the Draft Plan to ~~offset losses that would be experienced from this general strategy for operation of the Lower Colorado River Basin.~~ ***meet identified agricultural needs even with the "No Call" WAM assumption.***

157. The word "*excellent*" will be removed, and the following text will be added to the second paragraph:
As has been noted previously in this document, the LSWP allows the needs of the various parties to the agreement to be met. However, there are significant studies underway to determine whether or not the needs of the environment will be met as well. The LSWP is required by statute to demonstrate that it can be implemented without significant detriment to the environment. The LCRWPG looks forward to receiving the results of the studies that are currently underway during future plan revision efforts.

158. Representative plans from the area are being added to this chapter.

159. Representative plans from the area are being added to this chapter.

160. This issue will be reviewed during the next plan revision.

161. The LCRWPG has and will continue to acknowledge the shortcomings of the No Call model approach. There is neither time nor funding for the major overhaul that would be required. However, within the limits of the available information, the LCRWPG believes that they have met the minimum requirements for this plan cycle.

162. One of the purposes for having the regional planning process on a regular repeat cycle is to be able to revise the plans when additional information is available. As stated previously, the level of detail in the regional planning process cannot be at the same level of detail required in a permitting process. For that reason, alternatives are ranked with the best available information and the ranking changes when new information is available.

163. Comment noted.

164. Comment noted.

165. Comment noted.

166. Comment noted.

Jack Fairchild (11/6/05)
Response:
The LCRWPG concurs that additional water could be saved through conservation efforts. One of the policy recommendations that was included in the plan concerns public education efforts to educate people about the need to conserve water. The LCRWPG feels that it is appropriate to include some amount of conservation in this plan and recommend further educational efforts to potentially try to increase the amount saved through conservation in future plans.

The LCRWPG concurs that drought contingency plans are necessary and appropriate, and are vital to every community. However, the LCRWPG consultant team recommended to the LCRWPG that drought contingency planning be used as a means of extending municipal supplies in critical drought periods rather than as a tool for reducing long term demand during an extended drought.

The Initially Prepared Plan has a significant amount of conservation in it, all of which is intended to be applied on a year round basis to increase the number of people that can be sustained by the same amount of resource. In this regard, it is also noted that we have coordinated with all of the groundwater conservation districts and have tried to achieve sustainable yields for all of our aquifers and surface water sources. The only exceptions include temporary overpumping during conjunctive use of ground and surface water with the intent that the overpumping will be mitigated by using less groundwater and more surface water when surface water is available. Further studies are underway to prove or refute this concept. These studies will be reviewed during the next planning cycle.

The LCRWPG concurs that all areas need to be represented fairly and we have tried to do that with using sustainability for groundwater resources and the firm yield for surface water. The Group shares your concerns about the need for environmental studies to determine the impacts of the LCRA-SAWS Water Project (LSWP). However, there are long term studies underway with much larger budgets than were available to this planning group to make those determinations. The determinations made in this plan are solely for initial comparison of alternatives and are based largely on existing data. As those long term studies are completed, the entire issue of the LSWP will be revisited and the results of the environmental studies incorporated into the deliberation process.

Legislation authorizing the LSWP prohibits pumping water directly from the Highland Lakes. The Region K plan contains no management strategy that pumps water directly from the Highland Lakes. Water that would go to San Antonio under the water sharing plan will be stored in off channel reservoirs.

The LCRWPG concurs that uncontrolled development does increase the speed or runoff, but that many areas have regulations that require permeable parking pavement, detention basins, and other means of regulating the speed of water runoff from developed properties. These procedures regulate the water flowing off site to predevelopment levels and thus mitigate the increase in impervious cover.

The Region K plan contains no reference to any “grid plan” for a network of pipelines covering the Hill Country. No such network is contemplated in any of the management strategies in the plan.

Dedication of groundwater resources by any development served by surface water is not within the purview of this plan. In fact, water underneath the land is not owned by the landowners until and unless they pump it to the surface. Restricting private wells in all subdivision development would accomplish the same purpose, but again, it is not within the purview of the group to accomplish that.

The LCRWPG concurs that return flows are an important part of the water resources of the State. The Texas Water Development Board rules required that the planning groups looked first at the availability of surface water without return flows. Return flows where added as a WMS. Amounts to be included as management strategies are clearly spelled out in the Initially Prepared Plan. TCEQ considers impacts on water quality when considering bed and banks permits.

Permit applications for water rights are handled by the Texas Commission on Environmental Quality and the development of Water Availability Models by that agency was recently completed. These models are being used to try to prevent any further over appropriation from occurring.

The LCRWPG concurs that environmental flow needs deserves to be included as a user group. This request has been made to the TWDB in the form of a policy request. However, the TWDB sets the user groups for which demands will be determined and until TWDB rules are changed, the planning group is unable to deviate from that position.

The LCRWPG concurs that it is imperative to get the word out concerning water management strategies and the decisions that have to be made. The Group has made extensive use of the internet and print media, published newsletters, and held meetings throughout the region to obtain input of the plan. Your input and appreciation of the need for this type of information is appreciated by the LCRWPG. Thank you for taking the time to comment.

Don Trepagnier (11/6/05)
Response:
The three points of discussion that you use to demonstrate your opposition to the LCRA-SAWS Water Project (LSWP), are currently being investigated in multi year studies. Results of these studies will be incorporated in the next round of planning. The purpose of the regional plans is to identify large scale projects far enough in advance to allow them to be proved up or discarded with time to implement other options for those that are not shown to be feasible. The regional plans rely heavily on these other studies as there is not sufficient budget in the regional planning process itself to perform these studies. Please be assured that they are underway and will be considered long before any permitting decisions are made for this project.

The LCRWPG does not necessarily concur that all development has reduced the amount of water that reaches the coast, or that the installation of dams has necessarily reduced the annual flow reaching the coast. The dams do regulate the flows to the extent that water is released during dry periods which might form the only flow in the river. If the dams did not exist, that water may not be flowing downstream to serve needs and contribute to instream flows along the way. In addition, the river receives return flow from groundwater supplies that are treated and released by communities along the way. A third area is the increased runoff that occurs from roadways and parking lots and buildings as a result of development.

The LCRWPG is not aware of any application by the City of Corpus Christi for any Colorado River water. The City of Corpus Christi has purchased a portion of the Garwood Water Company water rights and has access to that water at any time that they construct the facilities to deliver that water to Corpus Christi. However, the amount of water that they own is approximately 35,000 acre feet, and this purchase was finalized prior to the 2001 planning cycle.

The Initially Prepared Plan incorporates sufficient water and conservation to meet Austin's projected needs. Several upstream communities in Region F would have been without water without modifications to the Region K water availability through the No Call model.

The environmental studies that you are suggesting are currently underway and the results of those studies will be used in the next planning round as we noted earlier. In addition, studies of the Gulf Coast Aquifer are also underway with a new Groundwater Availability Model under development to provide answers to the sustainability issue for the groundwater in the lower three counties. It has been the intent of the LCRWPG to plan for the management of the area's water resources on a sustainable basis for both groundwater and surface water.

Thank you for taking the time to review the IPP and provide comments.

Teresa Lutes Austin Water Utility WPDRD (11/6/05)
Response:

1st bullet, page 1. The methodology outlined in the IPP is for those areas where the LCRWPG consultant team did the modeling. In the case of Barton Springs, the modeling was done by the Barton Springs Edwards Aquifer Conservation District (BS/EACD) and the results shown are what was provided to the LCRWPG. Text has been added to the plan to reflect the concerns about low spring flows and these numbers will be looked at again in the next planning round.

Bullet 2, page 1. The LCRWPG would be happy to entertain discussions concerning open space maintenance and land acquisition as a strategy for the next planning round. However, the LCRWPG has limited funds to develop strategies and generally must rely on existing data and reports. If reports have been developed on this as a strategy, the LCRWPG looks forward to receiving them and will consider them in the next planning round.

Bullet 3, page 1. As noted in 1 above, the sustainable yield of the aquifer was provided to the LCRWPG consultant team during the process of evaluating supplies and prior to the completion of the BS/EACD study. The completion of that study has developed the conclusions that there is not additional supply in the aquifer. The LCRWPG moved forward with the best data available at the time the IPP was developed. The LCRWPG concurs that this will be a priority area to be addressed in the next planning round.

Bullet 4, page 1. The LCRWPG is aware of the Habitat Conservation Plan under development by the BS/EACD and we look forward to incorporating conservation or drought contingency measures as appropriate in the next planning round.

Additional Region K Public Comments

Bullet 5, page 1. The LCRWPG concurs that the City of Austin should be a stakeholder in planning and studies related to recharge enhancement. However, the LCRWPG and its consultant team use primarily existing studies and information when assembling potential management strategies for the regional plan. The detailed studies that would lead to permitting decisions are well in the future, and those decisions will be made by the regulatory agencies. Your request to be included as a stakeholder should be made to those agencies directly. The City of Austin has been very ably represented by Teresa Lutes on the LCRWPG throughout the development of this IPP.

We do concur that there are unanswered questions relating to the proposed recharge dams that need much further study. Finally, the LCRWPG would be happy to discuss a strategy to support improved flood plain and riparian management along potential recharge locations, but some means of determining the potential yield of this strategy would be needed.

Bullet 1, page 2. The unique stream segment designation rests with the Texas Legislature. The LCRWPG can only recommend stream segments to the Legislature for designation if it chooses to do so. The listing of segments potentially deserving of designation was compiled for the LCRWPG by the Texas Parks and Wildlife Department. You may wish to contact them and discuss the criteria they use for compiling their listings. This issue will be revisited in the next round of planning.

Bullet 2, page 2. Any assistance that can be offered by Austin in future modeling efforts will be greatly appreciated.

Responses to specific comments.

1. Concur. A sentence concerning the importance of groundwater, and specifically spring flows in maintaining endangered species habitat will be added.
2. The LCRWPG concurs that this list should be updated in the next planning round.
3. Per conversation with David Bradsby, this species is not currently listed as Threatened or Endangered. The tables show the species as Rare, but with no regulatory listing status, so it will remain in the table as listed.
4. The model that was used to provide the aquifer yield is the current GAM version with improvements by BS/EACD staff.
5. For the purposes of this plan, the BS/EACD provided a number for the availability of water from the aquifer, based on their modeling efforts. That number was used for the IPP as the total water available. Refinements since that time have led to the conclusion that the aquifer is overtaxed, and this will be reviewed and alternative strategies proposed in the next planning round.
6. The LCRWPG concurs that this is probably low, particularly in developed urban areas. This will be addressed in the next planning round.
7. The reference to 5,043 acre-feet is correct. It reflects the reduction of the anticipated yield from the previous studies by approximately 50 percent as a result of the flow tracing studies that have been performed since the last planning cycle. The 3,515 af/yr number is incorrect for this planning round.
8. As noted in 6 above, this will be reviewed further in the next planning round.
9. The LCRWPG would be happy to receive any study results or other information that could be used to develop an ASR strategy for the City.
10. The last sentence of paragraph 5 in Section 7.1.2 will be deleted.
11. This issue will be reviewed in the next planning round and particularly if the BS/EACD adopts drought contingency plans for this need.

12. The impacts of expansion of groundwater in the BS/EACD area have been modified to include a discussion of these impacts in response to this and other comments. The text of the report will be modified in Chapter 4 and in Chapter 7.
13. If the City has data on such a project, the LCRWPG will be happy to entertain this as an alternative strategy for this area in the next round of planning.

Comments Received After 11/6/05:

LCRA (4 emails: 11/11/05, 11/15/05, 11/16/05, 11/21/05)
Response to LCRA comments from Nov. 11, 2005 email:

1. Concur with comment to add language showing the total amounts to Region G to the existing customers.
2. The time available did not permit the inclusion of this table in the plan. The information is contained in other places in the plan and we concur that this table would be an improvement. It will be included in the next planning round.
3. Revised table will be inserted.
4. Change will be made from 95,000 af/yr/decade to 62,000 af/yr/decade.
5. The reference to the CH2M HILL preliminary groundwater availability needs will be deleted.
6. The components of the Region K portion of the plan start being implemented earlier, and there is no competition for that water that would result in it being overallocated.
7. Concur. Additional text will be added to this effect.
8. That correction will be made.
9. Those areas will be made consistent.
10. The numbers will be corrected.
11. These totals will be corrected.
12. Concur. These totals will be corrected.
13. Response:
    a. Bullet 1: Concur. This will be done.
    b. Bullet 2: Concur. This will be done.

Response to LCRA Comments from November 15, 2005 email:
All materials provided by LCRA will be included in the conservation chapter. However, since the TWDB has not identified this chapter as a deficiency that must be remedied, there is neither time nor funds to read and summarize additional plans.

Response to LCRA email, November 16, 2005:
This issue has been included in a clarification requested by LCRA in a Nov. 11 email comment. A text comment will be added detailing the total amount of water to be provided to Region G.

Response to LCRA email, November 21, 2005:
The costs in the Plan will be checked.

Bill Stout (dated 11/5/05, received 11/14/05)
Response:

Response to concern regarding the quantification of environmental flow impacts:
The LCRWPG members have been unanimous in their concern about the condition of the model that was used to determine the availability of supplies as well as the impacts on the environment from the implementation of the various management strategies. The following details are provided to give an account of why the modeling that was done needs further refinement.

The LCRWPG and its consultant team were reviewing the results of the modeling conducted using the November WAM Run 3 issued by TCEQ. This was the second model that was reviewed by the consultant team because of the revision to the model being approved after the initial investigations had already been done with the July WAM Run 3. LCRA had also noted that there is an issue with their management plan in using full utilization of rights, since LCRA uses the unused portion of those rights as a part of their interruptible supplies. However, this discussion was cut off by the advent of a request from Region F to consider changes to the November WAM Run 3. Earlier versions of water availability models have shown that numerous small systems in Region F that rely on small reservoirs were showing no yield under drought of record conditions and that water generated in that area would be used to supply needs downstream based strictly on prior appropriations. Because this is the first planning cycle to use WAM Run 3, Region F representatives requested a temporary modification to the model, for planning purposes only, that would allow the storage of a portion of the water in their area to remain there to supply their needs. For additional information and a more complete discussion of this issue, please see Section 3.2.1.2 of Chapter 3 in the report. A copy of the report will be available electronically on the Texas Water Development Board's website at www.twdb.state.tx.us by the middle of January. A modified model, known as the "No Call" model was prepared and tested. Although extensively reviewed and modified through a number or iterations, the "No Call" model has several anomalies remaining that cause doubt about the accuracy. This information is discussed in detail in Chapter 4. One outcome of this process is that there is no corresponding model, similar to a WAM Run 8 or current conditions model available for use. TCEQ's WAM Run 8 for the Colorado River does not have the adjustments to the agreements that allow the water to remain in the upstream reservoirs, and introducing a new model at this point provides further confusion to the results. The LCRWPG recommended that further research be done into the model at the earliest opportunity, but was forced to move ahead with the model as it is because of scheduling issues. The delivery date for the final plans is mandated in legislation and TWDB was not able to entertain any changes to that date. The analyses mandated by TWDB to determine the quantitative impacts to the environment from the management strategies were performed using the "No Call" WAM Run 3 version. The LCRWPG concurs that additional analysis is needed and so states in Chapter 4.

Response to concern about lack of drought contingency measures as a management strategy:
The consultant team considered Drought Management and presented information to the Planning group. The response to the first comment is somewhat involved, but the basic principal involved is that the consultant team recommended that the LCRWPG distinguish between conservation, which reduces the per capita consumption over the long term, and drought management plans, which reduce peak consumption for a period of time, but do not necessarily have a significant impact on the overall average annual water usage. The LCRWPG has consistently used the drought of record conditions for determining the amount of firm yield available from the LCRA system. However, the impact of that decision is that when the drought of record occurs, the drought will last for the ten years that the previous drought of record occurred, and at the end of that ten year period, the reservoirs will be empty. This is undesirable for several reasons, not the least of which is that if the new drought is more severe or longer than the 10-year drought of record that is modeled, water supplies may be depleted at a faster rate than predicted. In addition, few if any of the surface water users in the basin have surface water intakes in the very bottom of the reservoir. Most will be out of the pool long before the reservoir is empty and will have to implement restrictions to reduce usage. LCRA's drought contingency plan is designed to encourage customers to reduce usage before a drought worse than the drought of record is experienced so that the reservoir supply life can be extended for an additional two years, to account for the possibility of a drought worse than the drought of record without total interruption of the supply.

Another more conventional application of drought management measures is to reduce the peak day demands of a particular system in order to reduce the amount of infrastructure that is dedicated solely to meeting peak demands. Utilities that experience declining well capacities often implement drought management strategies to reduce the peak day demand and can then exist on lower capacity wells for peak summer demand conditions. The criteria from the Texas Commission on Environmental Quality is that a peak day to average day factor of 2.4 is used in the absence of data from individual systems. The LCRWPG's consultant team used a factor of 2.0 in scaling up from the average annual shortage to determine the required delivery capacity in wells or transmission lines. This lower factor takes advantage of any surplus currently available but may also involve the use of drought management measures to lower the peak daily demands and allow the use of less capacity in the system. Some systems will choose to install additional capacity and some will choose to use lower capacity and ask for drought management measures to make the smaller capacities work. In any event the plan costs were based on the lower peaking factor assumption.

A third concern of the LCRWPG is the past history of success of drought management measures. While people are cooperative for a period of time, the success of drought management measures that must be implemented is more difficult to accomplish if the measures have to be applied over a number of years. Again, the measures are typically more successful in lowering peak conditions than in reducing the average consumption over a year's time.

For all of the reasons noted above, the consultant team reported to the LCRWPG that it considered drought management measures as a water management strategy, but did not include them in the current plan.

Response to comment on use of groundwater for LSWP:
The LSWP proposes to pump groundwater for irrigation purposes to be used in conjunction with surface water. The LSWP Project Viability Assessment contains data which states that the levels proposed will have some additional drawdown over what is currently being experienced. However, the purpose of the project viability assessment is to determine those impacts to a greater degree of certainty and determine whether or not they are acceptable from a social, economic, and environmental standpoint. The LSWP is tasked with constructing a more localized model to better determine the overall long term impacts to the aquifer from the additional pumpage proposed. That work is just beginning and results are not currently available. The LCRWPG concurs that this is a primary concern of the group and that study results from the LSWP will be followed carefully and scrutinized closely. As a part of this oversight, the TWDB has been asked to provide quality reviews of the information developed in this aquifer modeling effort.

STP (email: 11/16/05)
All materials provided by STP will be included in the conservation chapter.

COA (email: 11/17/05)
All materials provided by the City of Austin will be included in the conservation chapter.

COA (Chapter 9 Comments)
1) Page 9-2: Suggest adding the following footnote #4, for the COA Reuse line item on Table 9.1:

> "Footnote #4: Note that the City of Austin continually updates its Capital Improvements Program spending plan through its budgeting and approval process, therefore, the anticipated capital expenditures related to City of Austin water management strategies is subject to change. In addition, the City of Austin is currently conducting a comprehensive water resources planning study, the results of which may affect expected expenditures and quantities associated with reuse."
> *The consultant team concurs that this is appropriate and this language will be added to the text.*

2) Page 9-2: To the Table 9.1 Footnote 1, suggest adding:

", which could result in expenditures being spread out over the entire planning period."
Concur. This will be added.

3) Page 9-2: Table 9.1 includes a Recharge Edwards BFZ w/ Onion Creek line item. The City of Austin has previously expressed concerns related to this water management strategy in its Initially Prepared Plan Comments submitted November 6, 2005. To help ensure that stakeholders in the region benefit from such projects, the City of Austin continues to be interested in being involved as a stakeholder in planning and studies related to recharge enhancement or similar type projects. This is especially the case for projects which could potentially impact City of Austin lands (for example, Austin's Water Quality Protection Lands).
This comment is noted. There is no request for a change in the text of the report and none is recommended.

4) Page 9-2: What type of information is needed for the grey box entitled "City of Austin Service Expansion" in Table 9.1? Local infrastructure plans to meet projected needs do represent major infrastructure costs and funding requirements, however, this table relates to "Recommended Strategies", requiring capital expenditures in the plan, and City of Austin service plans and associated infrastructure costs and funding requirements for the entire planning period have not been explicitly addressed elsewhere in the Region K plan.
This request was an opportunity to include other expenses for transmission lines and pump stations that are related primarily to supply issues. It was not intended as a request to include costs for local service. The grey box will be deleted.

5) Note that the dollar amount in Austin's Infrastructure Financing Survey is lower than the amount in Table 9.1, on Page 9-2. However, the amount in Table 9.1 is consistent with the cost estimate included in Chapter 4. Regardless, Austin's survey responses would not change, since they are percentage-based and are indicative of financing options. No change to the text or report should be necessary.
Concur.

6) Page 9-3: Figure 9.1, Add footnote on figure indicating:
"Note that in some cases actual expenditures will likely be spread out over the entire planning period".
Concur. This footnote will be added.

7) Page 9-3: Figure 9.1, Suggest inserting "Starting" before the word "Decade" in title. Therefore, the figure title will be: "Costs by Starting Decade and Category"
Concur. This change will be made.

8) Page 9-4: Suggest updating the third sentence on the top of page to reflect additional surveys received since first draft was prepared:

"Of these, 14 (?) responses were received, two of which were from the City of Austin and LCRA, which are both characterized as Wholesale Water Providers (WWPs)."
Concur. This change will be included.

9) Page 9-4: In first full paragraph on page, suggest replacing: "No useful data was collected from these responses." with: "Consequently, no funding data was collected from these responses."
Concur. This wording will be changed.

10) Page 9-4: In second full paragraph on page, suggest rewording: "This is typical, as developers typically form utility districts tasked with providing water and wastewater service within these new communities." with: "This is typical, in cases where developers form utility districts tasked with providing water and wastewater service within a specified area."
Concur. This wording will be changed.

11) Page 9-4: In second full paragraph on page, suggest rewording: "It appears that future districts will absorb most of the project population growth in these areas." with: "Other entities or future districts will likely absorb most of the projected population growth in these areas."
Concur. Wording has been changed.

12) Page 9-4: In the second to last sentence in the second full paragraph on page, suggest changing the ending in the following sentence: "It should be noted that formation of new districts, rather than expansion of existing districts, reduces the potential for state loan requests." to: "…districts, may reduce the number of state loan requests."
Concur. This wording has been changed.

13) Page 9-4: In last sentence in second full paragraph on page, suggest deleting the word "These" and starting the sentence with "New".
Concur. Change has been made.

14) Page 9-5: Bottom of page Section 9.3.3 Wholesale Water Providers, under <u>City of Austin</u> heading: Suggest inserting the following:

> "Austin Water Utility (AWU) updates its ten-year Capital Improvements Program (CIP) plan annually. The update process includes reviewing all existing CIP projects, identifying new projects, and evaluating financing options. AWU generally finances its capital improvement projects through a combination of cash or current revenues, bonds, and grant funding, to the extent available. The percent share of each funding source is typically 20% for cash or current revenues, 65% for bonds, and up to 15% for Federal Government Grant Programs (through the Bureau of Reclamation's Grant Program, for example). To the extent that grant programs do not supplement the funding needs, the remainder would be funded by cash and bonds."
> *Concur. Wording inserted.*

15) Page 9-8: Figure 9.2, What are the correct units for the y-axis on this graph? Is it in millions of dollars?
As far as I am aware this is correct. It came directly from the TWDB.

16) Page 9-9: Is there somewhere in the report where there is a specific quantification of the magnitude of the "Unmet Needs", which were used to determine the impacts as described in Sections 9.4. and 9.5 and in report in Appendix 9C?
The unmet needs include the total needs identified in the plan, including those that could otherwise be resolved by contract extensions. The totals are shown on page 4-1 as 281,000 af/yr in 2030, and 557,000 af/yr in 2060. Individual county totals, river basin totals, and wholesale water provider totals are shown then in Chapter 4.

17) Appendices: Austin's survey (Appendix 9B) and survey results (in Appendix 9A) should be added.
Concur. This information will be added.

State and Federal Comments

State & Federal Region K Comments

Larry D. McKinney, TPWD (11/7/05)
Response:

Responses to Texas Parks and Wildlife

1st paragraph after last bullet on page 2. The LCRWPG concurs that while efforts were made in this plan to perform a quantitative impacts analysis of the proposed management strategies, there is certainly a need for improvement in this area. The LCRWPG agrees that this should be a top priority of the next planning round.

2nd paragraph after bulleted item on Page 2: The LCRWPG concurs that development of a usable WAM and agreement on the components of that WAM should be another top priority in the next planning round.

3rd paragraph after bulleted item on Page 2: The LCRWPG concurs that conservation for both municipal and agricultural users is important and is applied to the extent the LCRWPG decided was feasible. Upon the advice of the consultant team, the LCRWPG did not incorporate drought contingency planning as a strategy in this round of planning. The drought of record for this area is approximately 10 years in length, and the consultant team's recommendation was to focus on water conservation that could be sustained over the length of the drought of record and not to count on sustaining drought contingency measures over that time period. This issue will be revisited in the next planning round was well, as will brush control.

Last paragraph on Page two. The LCRWPG appreciates the assistance offered by TPWD in providing information on potential unique stream segments.

First paragraph on Page 3: The LCRWPG appreciates the TPWD concurrence in the policy recommendations.

William F. Mullican III, TWDB (dated 11/21/05)
Responses in bold:

Lower Colorado Regional Water Plan – Region K

LEVEL 1. Comments and questions *must be satisfactorily addressed* in order to meet statutory, agency rule, and/or contract requirements.

Chapter 1: Description of Region

1. The plan must include a description of the effect of the regional water plan on navigation *[Title 31, Texas Administrative Code (TAC) §357.5(e)(8)]*.

The following paragraph is suggested for the impact on navigation from the regional plan management strategies. This text will be included in the report on Page 4-35 as Section 4.6.1.10:

Description of the Impact of the Management Strategies on Navigation

As noted previously in the regional plan, there is a significant concern with the Water Availability Model that was used to determine the availability of surface water supply in the Colorado River in Region K. The issues and concerns with this model are documented in the report. That being established, the overall impact on navigation in Region K is negligible in the area of the Colorado River and Matagorda Bay that is tidally influenced. This is the area where the most shipping occurs and navigation will be least affected in this zone. Once beyond the tidally influenced areas, the overall impact of the management strategies will be to reduce the amount of currently available interruptible water supplies as the current WUGs increase in demand over time through growth in population. However, the current LCRA Water Management Plan calls for a minimum release of approximately 16,000 acre feet annually through 2010, and then increasing to approximately 33,000 acre feet annually after 2010. These release amounts are contained in Table 3.1a and in Section 3.2.1.2.3 on page 3-21. However, these amounts may change over the planning period as the results of the LSWP studies and mitigation strategies are better known. In addition, inflows originating downstream of the Highland Lakes would add to these release amounts. The 16,000 ac-ft/yr release translates to a rate of approximately 22 cubic feet per second. Navigation on the Colorado upstream of the tidally influenced areas is primarily for pleasure craft, and the impact of the mandated releases under the LCRA Management Plan plus other downstream flows may provide sufficient water for navigation purposes. Based in terms of a high, medium, or low impact, the estimated impact to navigation will be low.

Chapter 2: Projected Population and Water Demands for the Region

2. Please ensure that the water demand projections for mining in Bastrop County (Table 2.13, p. 2-17) for the years 2010, 2020 and 2030 are apportioned between river basins, and are equal to the TWDB approved projections, as shown in the table below. The water demand category totals have projections that are inconsistent with the TWDB approved totals. Some of the differences appear to be due to a shift of demand amounts between river basins. While this shifting of demand amounts between basins but within a single county can be done within the current TWDB approval, TWDB staff should be

notified of the region's desire to shift use/demand so that changes can be made in the DB07 online database. Please coordinate with TWDB staff and provide relevant data in a tabular, electronic format to ensure that the plan is consistent with the online database. *[Title 31, TAC §357.5(d)(1)&(2), §357.7(a)(1)(B)].*

County	Basin	Source	2010	2020	2030	2040	2050	2060
BASTROP	BRAZOS	TWDB	**1,439**	**1,438**	**1,439**	11	11	11
BASTROP	BRAZOS	IPP	10	9	10	11	11	11
BASTROP	COLORADO	TWDB	**2,516**	**2,518**	**2,518**	18	19	20
BASTROP	COLORADO	IPP	5,016	5,018	5,018	18	19	20
BASTROP	GUADALUPE	TWDB	**1,078**	**1,079**	**1,079**	8	8	8
BASTROP	GUADALUPE	IPP	7	8	8	8	8	8
	total TWDB		5,033	5,035	5,036	37	38	39
	total IPP		5,033	5,035	5,036	37	38	39

The consultant team will coordinate with the TWDB staff for the changes as noted. RWPG members had indicated that the mining activities were concentrated in the Colorado basin in Bastrop County and the supplies were shifted accordingly.

Chapter 3: Evaluation of Current Water Supplies in the Region

3. The plan must report water supplies and availability for each wholesale water provider by category of water use (municipal, manufacturing, irrigation, steam electric power generation, mining, and livestock) for each county or portion of a county in the regional water planning area. If a county or portion of a county is in more than one river basin, data shall be reported for each river basin. The wholesale water provider's current contractual obligations to supply water must be reported in addition to any demands projected for the wholesale water provider *[Title 31, TAC §357.7(a)(3)(B)].*

Table 3.26 on page 3-63, has been modified to include the basin splits for the LCRA contracts. Table 3.28 on page 3-66, has been modified to include the basin splits for the COA contracts.

4. Please verify if water supply availability numbers for the Gulf Coast, Carrizo-Wilcox, and Edwards-Trinity (Plateau) aquifers are based on TWDB groundwater availability models (GAM). If the availability estimates were not derived from GAM, please provide further justification for the estimates selected *[Contract Exhibit B, Section 3.2.2].*

Response to this comment is as follows: :

"Neither the Northern nor the Central Gulf Coast aquifer GAMs had been released for use by TWDB at the time the determination of the available water supplies had to be made in order to complete the project in time. The estimates of available water supply for the Gulf Coast aquifer are based on the management plans of the Coastal Bend (Wharton County) and Coastal Plains (Matagorda County) GCDs and the previous plan value for Colorado County. The RWPG feels that the numbers developed in this manner are representative of the aquifer conditions in this area and were sufficiently accurate to support the planning effort.

The calibration and potential predictive accuracy of either Gulf Coast aquifer GAM for application to the RWPG area is still subject to question. The RWPG looks forward to the results of the extensive effort underway through the LSWP to provide a more localized model. It is anticipated that this effort will be better able to determine local effects from groundwater pumpage planned for agricultural usage during times of surface water shortage. The results of this effort will be incorporated in the next round of planning.

The available water supply values for the Carrizo-Wilcox aquifer are based on the groundwater management plans of the Lost Pines GCD (Bastrop County) and the Fayette County GCD (Fayette County). The Lost Pines GCD value for Carrizo-Wilcox aquifer water supply availability is based on an application of the Central Carrizo-Wilcox aquifer GAM made by the District. The Carrizo-Wilcox aquifer has only a limited extent in Fayette County and the degree of development of this aquifer is also very limited. The Fayette County GCD requested that the RWPG use the current management plan value and the RWPG agreed the value is adequate to support the planning effort. The District is currently completing its own assessment of the Carrizo-Wilcox aquifer available water supplies.

Edwards-Trinity aquifer available water supply values are based on the groundwater management plans of the Blanco Pedernales GCD (Blanco County) and the Hill Country GCD (Gillespie County). The Edwards-Trinity aquifer has only a limited extent in both Counties and the degree of development of this aquifer is also very limited. Both Districts requested that the RWPG use the current management plan value and the RWPG agreed the values are adequate to support the planning effort."

<u>Chapter 4: Identification, Evaluation, and Selection of Water Management Strategies Based on Needs</u>

5. In Chapter 4, Pages 47-71, the plan must address potential impacts to the environment from any of the recommended water management strategies involving groundwater wells and pipelines *[Title 31, (TAC) §357.7(a)(8)(A)(ii) and 357.7(a)(8)(C)]*.

There is a section on page 4-47 entitled Environmental Impact which discusses the environmental impacts of expanded groundwater use which was intended to be applied to all expanded groundwater use strategies. It is as follows:

Environmental Impact
The environmental impacts of expanded groundwater use will vary depending upon site characteristics but are not expected to be significant. Some impacts may occur from the expansion of existing groundwater infrastructure, but well sites are generally small in areal

extent and the disturbance from pipeline construction is temporary. No groundwater use is expected to surpass the current, sustainable yield of the aquifers as determined in Chapter 3, except for limited specific instances of overdrafting during the drought of record conditions. As a result, no long term impacts upon groundwater resources are anticipated. Additionally, the treated return flows from WUGs supplied with groundwater may introduce additional return flows that contribute to in-stream habitat. Where aquifers were making direct contributions to stream flow through springs, the aquifers were modeled and the amount of water taken was limited to the amount that would cause a 10 percent reduction in spring flows or less. The returns of approximately 60 percent of the water diverted to the spring would mitigate this even further. However, the discharge of effluent will not always occur into the same stream segment that formerly received the springflow, so there may not be a direct influence. However, in other instances where the source of groundwater has a direct, hydrologic connection to the stream, the discharge of the same portion of this water to the stream will not have this impact. Also, this strategy does not require the diversion of additional surface water during drought conditions when stream levels are at their lowest.

However, the text above does not cover all of the groundwater strategies equally. As a result, text will be placed at the end of each individual aquifer covered under the groundwater expansion and development of new groundwater strategies sections, as well as after the transfer and allocate strategy and the temporary overdraft of aquifers strategy.

Expansion of Current Groundwater Supplies:
Carrizo-Wilcox Aquifer
Edwards Aquifer BFZ
Ellenburger-San Saba
Gulf Coast Aquifer
Hickory Aquifer
Marble Falls Aquifer
Queen City Aquifer
Sparta Aquifer
Trinity Aquifer
Other Aquifer

Development of New Groundwater Supplies:
Carrizo-Wilcox Aquifer
Ellenburger-San Saba
Trinity Aquifer
Other Aquifer

Transfer/Allocate Water From WUGs with Surplus

Temporary Overdraft of Aquifers

6. Please verify that all existing water rights, contracts and option agreements were protected in developing the regional water plan *[Title 31 TAC §357.5(e)(3)]*.

The following text will be added to Chapter 3:
Existing water rights, contracts, and option agreements that were existing at the time of the development of the regional plan were protected to the extent feasible. However, as documented in the plan in Section 3.2.1.2, Regions F and K used a "No Call" modeling

assumption in the surface water availability modeling effort for the Colorado River. No other adjustments to the model results were performed and individual entity amounts were determined through the modified model.

7. Ensure that the plan shows costs associated with irrigation conservation water management strategies, including pages 4,8,9,16, & 17 and Appendix 4B *[Title 31, TAC, §357.7(a)(7)(A)]*.

These costs were not included in the plan since they were being paid for by Region L and there was no cost to any entity in Region K for these improvements. Costs for conservation improvements on a per acre basis will be included as requested for reference purposes. A table will be provided showing the estimated costs for precision leveling, multiple inlets, and canal linings. This table is included on page 4-109 as Table 4.91.

8. Please ensure that water management strategy evaluations contain quantitative reporting on impacts to agricultural resources *[Title 31, TAC §357.7(a)(8)(A)(iii)]*.

The text will be amended for each strategy to provide an analysis of the impacts to agricultural resources based on a quantification of high, medium or low. For all of the strategies, the impact proposed is low impact from the fact that many of the strategies will propose improvements to the existing infrastructure at no cost to agriculture, and that alternative water supplies are provided through the plan that will take the place of water previously used.

9. Please provide the analysis required in the three "supplemental funding" contract tasks ("buy-out of rice farmers' second crop to eliminate the need for developing groundwater"; "policy development based on sustainable uses of natural resources"; and "advanced water conservation strategies to meet regional water needs" to TWDB for review, and include them in the final report *[TWDB contract #2002-483-462, Tasks 4(h)(i)(j), Exhibit A, p.9]*.

The task concerning the buyout of rice farmers second crop is now included as *Appendix 4D* at the end of Chapter 4.

A portion of the advanced water conservation strategies to meet regional needs was included in the Initially Prepared Plan. This analysis looked at the potential savings available if all WUGs without needs were also to conserve based on 1 percent per year for those at or above 140 gpcd and .25 percent per year for those below 140 but at or above 100 gpcd. This analysis is included started on page 4-134 of the text, as Section 4.15.1. The sustainability analysis included further discussion of advanced conservation and part of sustainability as proposed is imposition of advanced conservation measures including separation and reuse of graywater and minimal outdoor watering. This analysis is now included as *Appendix 4E* at the end of Chapter 4, entitled Sustainability and Advanced Water Conservation Analyses.

LEVEL 2—Comments and suggestions that might be considered to clarify or help enhance the plan.

Executive Summary:

1. Consider presenting a full summary of the key findings, recommendations, and costs of the entire plan in the Executive Summary.

The time available for completion did not allow any major revisions to the Executive Summary.

2. Consider adding the units (acre-feet) to the return flows in Table ES.3 (p. ES-9).

This has been done.

Chapter 4: Identification, Evaluation, and Selection of Water Management Strategies Based on Needs

3. Consider including information on current per-capita water usage (gallons per-capita per-day) for the region and for individual water user groups within the region.

This has been added as Appendix 2C as a response to an earlier comment.