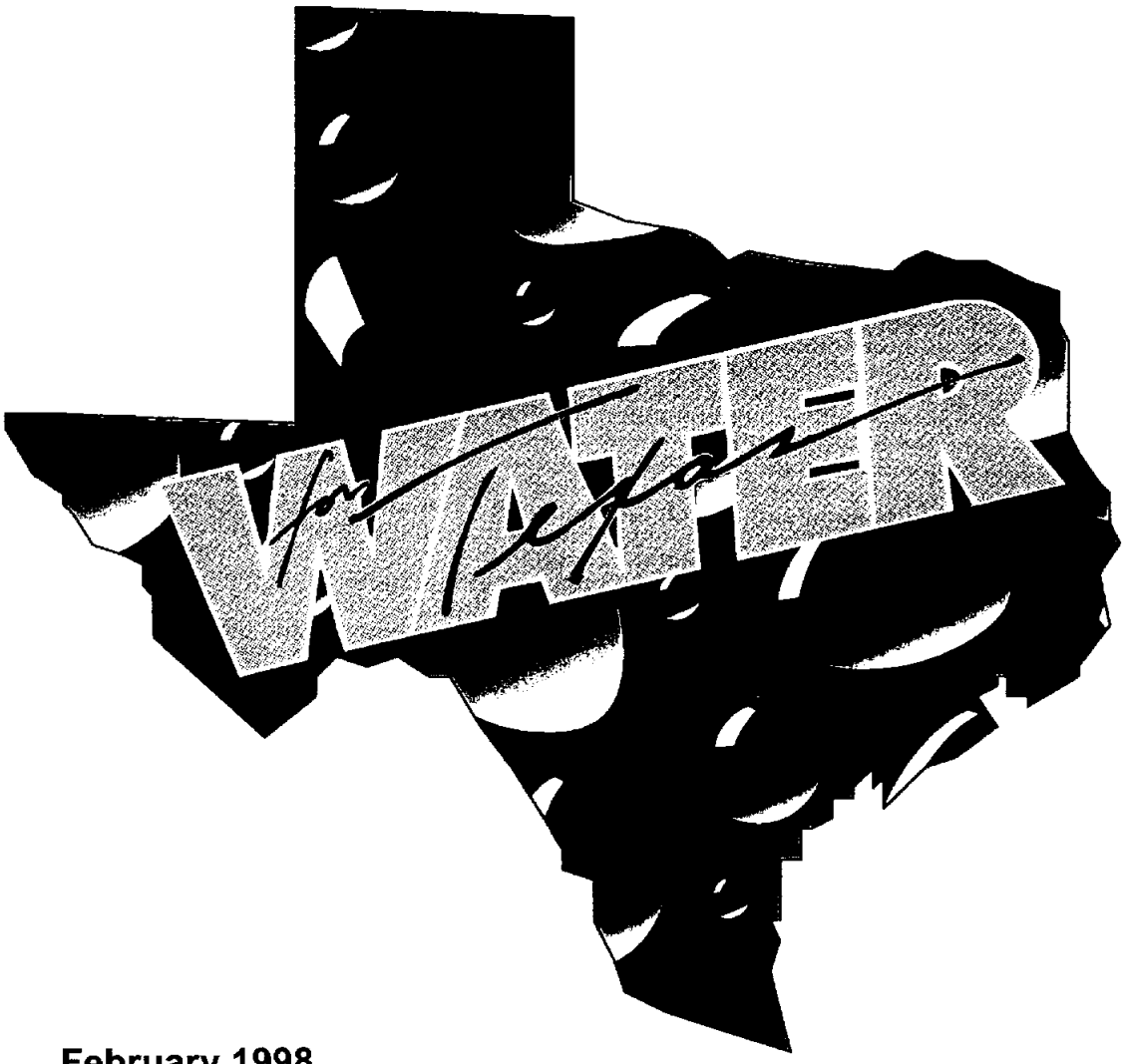
TRANS-TEXAS WATER PROGRAM

North Central Study Area Phase II Report

Volume 1

Integrated Water Supply Plans



February 1998

HDR

HDR Engineering, Inc.

in association with
Paul Price Associates, Inc.

Brazos River Authority

City of Austin

City of Cedar Park

City of Georgetown

City of Hutto

City of Leander

City of Pflugerville

City of Round Rock

Jonah Special Utility District

Manville Water Supply Corporation

Brushy Creek Municipal Utility District

Williamson County

Lower Colorado River Authority

Texas Water Development Board

Texas Natural Resource Conservation Commission

Texas Parks and Wildlife Department

TRANS-TEXAS WATER PROGRAM
NORTH CENTRAL STUDY AREA
PHASE II REPORT

VOLUME 1

INTEGRATED WATER SUPPLY PLANS

Prepared for

City of Austin
City of Cedar Park
City of Georgetown
City of Hutto
City of Leander
City of Pflugerville
City of Round Rock
Jonah Special Utility District
Manville Water Supply Corporation
Brushy Creek Municipal Utility District
Williamson County
Lower Colorado River Authority
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By

HDR Engineering Inc.
in association with
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February 1998

HDR Engineering, Inc.

TRANS-TEXAS WATER PROGRAM
NORTH CENTRAL STUDY AREA
PHASE II REPORT

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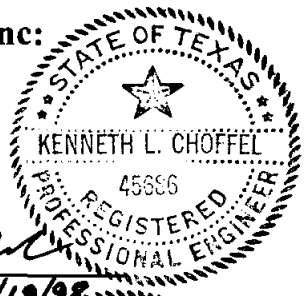

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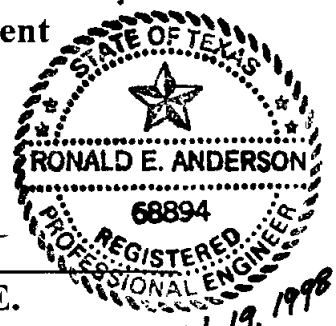

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TRANS-TEXAS WATER PROGRAM
NORTH CENTRAL STUDY AREA
PHASE II STUDY

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ACKNOWLEDGMENTS

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TRANS-TEXAS WATER PROGRAM
NORTH CENTRAL STUDY AREA
PHASE II REPORT

EXECUTIVE SUMMARY

Rapid growth in Travis and Williamson counties is straining water supply facilities and, in some localities, the source of supply. Projections clearly show that prudent water management and additional sources of supply are needed, as current water supplies are not sufficient to meet the expected long-term needs of the area.

In 1990, the two-county area had a population of 729,763 and water use of 166,447 acft (one acft is 325,851 gallons or enough water to meet the needs of about 4.5 people for one year). The area is projected to more than triple to a population of 2.57 million in year 2050, and have a water demand of 566,000 acft. Present surface water supply sources include the Highland Lakes of the Colorado River Basin, and Lake Georgetown and Lake Granger in the Brazos River Basin. Groundwater sources include the Barton Springs portion of the Edwards Aquifer, the Edwards Aquifer in Williamson County, and the Trinity Aquifer, occurring in both counties. Current water supply available to the area for municipal purposes is estimated to be 410,000 acft, resulting in a potential shortage of 156,000 acft by year 2050.

A comparison of estimated future water demands and supplies, currently available or under contract, is presented below for selected entities.

City of Austin

Austin's presently available firm supply of 250,000 acft/yr can meet projected demands through about the year 2018. By 2030, demand will exceed current supply by about 45,600 acft/yr, and in 2050 it is estimated that demand will exceed current supply by about 92,700 acft/yr.

City of Round Rock

Round Rock's existing supply from Lake Georgetown and groundwater totals 11,760 acft/yr. This supply is adequate through about 2001. Once the waterline is constructed from Lake Stillhouse Hollow to Lake Georgetown, an additional 18,134 acft/yr will be available to Round Rock and will meet needs through about 2010. By 2030, demand will exceed supplies by an estimated 11,500 acft/yr, and in 2050 demand will exceed current supplies by about 19,800 acft/yr.

City of Cedar Park

Cedar Park's current supply of 7,000 acft from the Highland Lakes is adequate through about the year 2004. By 2030, demand will exceed current supply by an estimated 8,800 acft/yr, and in 2050 demand will exceed current supply by about 11,300 acft/yr.

City of Georgetown

Georgetown's present supply from Lake Georgetown and groundwater is about 10,080 acft/yr. This supply is adequate through about the year 2007. Once the waterline is constructed from Lake Stillhouse Hollow to Lake Georgetown, an additional 15,448 acft/yr will be available to Georgetown and will meet needs through about 2040. In 2050, demand is expected to exceed current supply by about 8,100 acft/yr.

City of Pflugerville

Pflugerville's groundwater supply of 1,700 acft and contract with the City of Austin for 5,600 acft is adequate through about the year 2009. By 2030, demand will exceed current supply by an estimated 6,800 acft/yr, and in 2050 demand will exceed current supply by about 8,900 acft/yr.

City of Leander

Leander is currently negotiating the purchase of 6,400 acft/yr from LCRA for Lake Travis water and also holds a contract with BRA for 2,700 acft/yr for water from Lake Stillhouse Hollow. Considering only the Lake Travis contract, the 6,400 acft/yr is adequate through about the year 2041, and in 2050 it is estimated that demand will exceed supply by about 1,500 acft/yr.

City of Hutto

Hutto has a groundwater supply of 131 acft/yr and has recently negotiated a contract with Manville WSC for 336 acft/yr. These supplies are estimated to be adequate through 2036, and in 2050 demand will exceed current supply by about 250 acft/yr.

Jonah Special Utility District

Jonah's supply from groundwater is 2,688 acft/yr. If current groundwater supplies are maintained, this supply is adequate through about 2037. Once the waterline is constructed from Lake Stillhouse Hollow to Lake Georgetown, an additional 2,439 acft/yr will be available and should meet needs beyond 2050.

Manville Water Supply Corporation

Manville's groundwater supply of 1,800 acft is barely adequate to meet current needs through a protracted drought. By 2030, it is estimated that demand will exceed current supply by 1,100 acft/yr, and in 2050 demand is estimated to exceed current supply by about 1,800 acft/yr.

Brushy Creek Municipal Utility District

Brushy Creek MUD's groundwater supply of 1,792 acft/yr and contract with the City of Round Rock for 3,360 acft is adequate through about 2005 (Round Rock contract expires in 2006). Once the waterline is constructed from Lake Stillhouse Hollow to Lake Georgetown, an additional 4,000 acft/yr will be available and should meet needs beyond 2050.

Objectives

As indicated above, most entities in the two-county region are facing additional water supply needs within the 50-year planning period, and several are challenged with immediate water needs. The objectives of this study are to provide regional water supply solutions to local government and water supply agencies in the North Central Trans-Texas study area to meet potential water supply shortfalls resulting from projected growth. Coordinated planning information, including projected water demands, current dependable water supply, water supply alternatives, and regional integrated water supply plans have been developed to meet needs through the year 2050.

Water Supply Alternatives

A wide array of supply-side and demand-side alternatives was included in the scope as potential building blocks of the plans to meet the water needs of the study area. Eighteen primary water management and supply alternatives with 38 variations were evaluated with respect to: water supply potential, environmental effects, water quality, cost, and implementation issues.

The management and supply alternatives are summarized in Section S-5 of this volume and evaluations of individual alternatives are contained in Section 3.0 of Volume 2.

Integrated Water Supply Plans

Integrated water supply plans have been developed that meet these key goals:

- Consideration of a wide array of supply-side and demand-side alternatives.
- Public participation.
- Provide a clear guide for future actions.
- Are flexible and relevant.
- Provide near-term and long-term actions.
- Identify uncertainties and implementation issues.

- Minimize environmental impact
- Promote regional solutions.

Regional Planning

Three sub-region planning areas within the two-county study area were identified in the study process: (1) Austin Service Area/Travis County subregion; (2) US 183 Corridor/Western Williamson County subregion; and, (3) I-35 Corridor/Eastern Williamson County subregion.

These planning subregions represent likely groupings of general growth and development patterns, ETJ boundaries and service areas, current or potential supply sources common to the area, and proximity to others.

These subregions do not imply that a development or area near the boundary is destined to be served only from that area's water supply source. In fact, interconnections of water supply among these subregions are a recommended action for the future.

Integrated Regional and Local Plans

Given the projected shortages, timing of need for additional water supply, delineation of subregions, and the ranking of supply alternatives, integrated regional and local plans were developed for each of the subregions and participating entities within those areas. For all entities and sub-regions in the study area, sufficient water supply alternatives exist to meet the projected long-term needs. However, for most entities, investments in infrastructure must be made to develop new water supplies to ensure a reliable water supply.

There are significant opportunities for regionalization of water supply and treatment facilities. Key to the success of such ventures is demonstrable cost savings, inter-local cooperation, a regional sponsor, and in some cases, interim sharing or leasing of surplus water supplies among participants to facilitate coordinated timing of new supply development.

The integrated supply plans are contained in Section 6.5 of this volume and are marked with a tabbed divider for each subregion and entity. Each of these plans meets the 50-year needs of the area at reasonable cost, promotes regional cooperation, and is responsive to environmental and implementation issues.

Water management and supply elements that are common to most, if not all, of the individual plans are:

- Accelerated and Additional Water Conservation (where opportunities exist for significant demand reductions)
- Reclaimed Water Reuse (again, where opportunities exist)
- Increased Use or Sharing of Existing Sources
- Long-term options include augmentation of the Colorado River system; development of the Carrizo-Wilcox Aquifer; and, diversions from Brushy Creek or Little River system.

Transition to SB 1 Planning

Coupled with these integrated plans is the impending change in the institutional aspects of regional planning. The closure of this Trans-Texas planning effort is being built upon and, to some degree, supplanted by the new regional planning requirements specified under Senate Bill 1 (75^{th} Texas Legislature). What is now the Trans-Texas North Central Study Area will be separated into two new planning regions of different geographic size and participant composition and the regional plan(s) may be developed and adopted under somewhat different process procedures.

For all of the above reasons, it seems prudent to end the planning efforts of the North Central Trans-Texas study area (and begin the SB 1 efforts) with a recommendation that supports near-term actions and a limited number of longer-term optional plans for water supply that generally span the range of future possibilities and uncertainties. This will allow the SB 1 efforts to: (1) focus on specific near-term treatment and transmission facility needs, (2) resolve remaining uncertainties towards definite courses of longer-term action, and (3) build greater "buy-in" and commitment by the SB 1 participants towards cooperative regional solutions.

Report Organization

Volume 1 (this volume) contains the following:

- **Summary of population and water demand projections.**
- **Comparisons of water supply to projected demands.**
- **Summary of water supply alternatives available to the study area.**
- **Integrated Water Supply Plans for subregions within the study area as well as for each of the study participants.**
- **An environmental issues matrix for the water supply alternatives.**

Volume 2 contains the following:

- **Population and water demand projections for water supply entities in the two-county study area.**
- **Comparison of water supply to projected demands for entities in the study area.**
- **Environmental overview.**
- **Analyses of water supply alternatives, including available supply, environmental effects, cost, and implementation issues.**
- **Appendices: hydrology calculations; comment letters.**

Introduction

TRANS-TEXAS WATER PROGRAM
NORTH CENTRAL STUDY AREA
PHASE II REPORT

SUMMARY OF WATER SUPPLIES, PROJECTED DEMANDS, AND SUPPLY ALTERNATIVES

S-1 INTRODUCTION

In 1992, the Texas Water Development Board (TWDB), in cooperation with local area water agencies, organized the Trans-Texas Water Program to address the water supply needs of South East, South Central, and West Central Texas. In 1995, the North Central area of Travis, Williamson, and Northern Hays Counties was added in response to very rapid population and economic growth, and recognition by local officials of the need to assess the water demand and supply conditions of the area and to develop plans to meet the water supply needs of the area.

The Trans-Texas Water Program has multiple phases, beginning with Phase I planning studies to determine projected water demands and supplies for the period 1990 through 2050, and to identify potential water supply alternatives to meet future needs. Phase I planning studies for the City of Austin Water Service area were completed in August of 1994 as an adjunct to the South Central Phase I Trans-Texas studies. Upon review of the City of Austin Phase I report, the TWDB, City of Austin, Lower Colorado River Authority (LCRA), Williamson County Officials, and the Brazos River Authority (BRA) concluded that the Travis, Williamson, and Northern Hays County areas were experiencing very similar rapid growth and facing quite similar water demand and supply problems. Thus, the North Central Trans-Texas study area was delineated and this Phase II study was organized.

In 1990, the North Central Trans-Texas study area had a population of 729,763 and water use for municipal, industrial, and other purposes of 166,447 acre-feet per year (1 acre-foot is 325,851 gallons). The study area's population growth rate during the 1990 to 1996 period has been approximately 3.5 percent per year, and is projected to be between 2.5 percent and 3.0 percent per year for the next 20 years. At these growth rates, the area's population is projected to increase to 2.57 million by 2050 (a 60-year increase of 252 percent), with a 2050 water demand of 566,457 acft/yr (a 60-year increase of 240 percent). The present sources of supply include the Highland Lakes of the Colorado River Basin, the Barton Springs Edwards Aquifer, Lake

Georgetown on the North San Gabriel River and Lake Granger on the San Gabriel River in Williamson County, the Edwards Aquifer north of the Colorado River, and the Trinity Group of aquifers in Hays, Travis, and Williamson Counties. At the present time, rapid growth is straining both the water supply facilities and the sources of supply of the area. Projected future demands clearly show that additional facilities and sources of supply will be needed in the immediate and long-term future.

S-1.1 Study Area

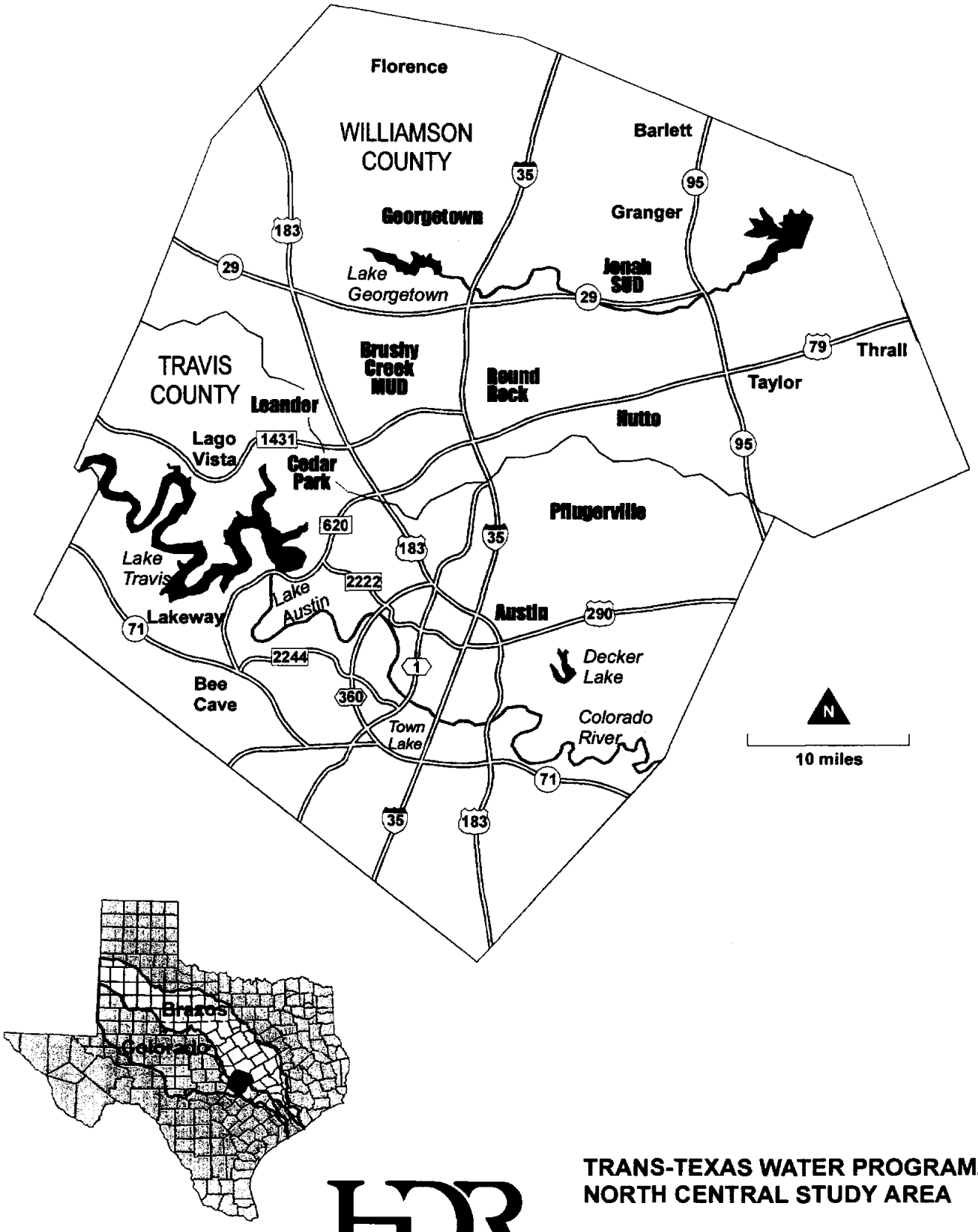
The North Central Trans-Texas study area (NCTT) includes all of Travis and Williamson Counties, and a small part of northern Hays County. The individual participants include: (1) City of Austin; (2) City of Cedar Park; (3) City of Round Rock; (4) City of Georgetown; (5) City of Hutto; (6) City of Leander; (7) City of Pflugerville; (8) Jonah Special Utility District; (9) Manville Water Supply Corporation; (10) Brushy Creek Municipal Utility District; (11) areas of Williamson County east of Interstate 35, and areas of Williamson County west of Interstate 35 (Figure S-1).

S.1.2 Objectives

The objectives of the North Central Trans-Texas study area are to:

1. Present projections of population and water demands and present water supplies for individual study area participants' service areas, and for each of Travis, Williamson, and northeastern Hays Counties;
2. Identify and describe potential water supply options to meet the needs of the study participants (18 primary water supply options were considered);
3. Provide an assessment of the water supply potentials, costs, and environmental advantages and disadvantages of each water supply option; and,
4. Provide integrated water supply plans for the study area based upon information from objectives 1, 2, and 3 above.

Water supply options studied include local area water conservation potentials, water reuse, present surface water and groundwater resources, and potential surface water and groundwater sources of the Colorado and Brazos River Basins within and near the study area counties.



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TRANS-TEXAS WATER PROGRAM/ NORTH CENTRAL STUDY AREA

TRAVIS AND WILIAMSON COUNTIES

FIGURE S-1

S-2 POPULATION AND WATER DEMAND PROJECTIONS

Population projections for the study area of Travis, Williamson, and Northern Hays Counties are summarized below. In 1990, the population of Travis County was 576,047 and is projected to increase to 807,027 in 2000, to 1.25 million in 2020, and to 1.72 million in 2050 (Table S-1 and Figure S-2). Within Travis County, approximately 90 percent of the population is projected to be supplied water through the City of Austin Water Utility during the planning period from year 1990 through 2050.

The population of Williamson County was 139,551 in 1990, and is projected to increase to 226,842 in year 2000, to 520,307 in 2020 and to 805,868 in 2050 (Table S-1). Within Williamson County, the Round Rock service area had 24 percent of the population in 1990, and is projected to increase to 27 percent of the county total in 2020 (Table S-1) and be 24 percent in 2050. In 1990, Cedar Park had 8 percent of the Williamson County population, and is projected to have 11 to 12 percent of the county's population for the period 2000 through 2050 (Table S-1). In 1990, Georgetown's water service area included 13 percent of the Williamson County population, and is projected to increase to 15 percent of the county total in 2020, and to 20 percent in 2050 (Table S-1).

The portion of Hays County that is included in the North Central Trans-Texas study area had a population of 13,805 in 1990, and is projected to increase to 17,742 in 2000, to 25,326 in 2020 and to 42,263 in 2050 (Table S-1).

The study area total population in 1990 was 729,763 and is projected to be 1.05 million in 2000, 1.79 million in 2020, and 2.57 million in 2050 (Table S-1). In 1990, 79 percent of the population of the area was in Travis County, 19 percent was in Williamson County, and 2 percent was in Hays County. In 2050, it is projected that 66 percent of the study area population will reside in Travis County, 31 percent is projected to reside in Williamson County, and 2 percent will be located in northern Hays County (Table S-1).

Table S-1
Population Projections
North Central Study Area
Trans-Texas Water Program

Area	1990	Population Projections 1995	2000	2005	2010	2015	2020	2030	2040	2050
Travis County Areas										
City of Austin Service Area	520,589	597,487	729,692	812,199	895,904	998,918	1,105,543	1,287,428	1,406,443	1,533,934
Manor Service Area	1,041	1,201	1,424	1,643	1,862	2,035	2,208	2,523	2,728	2,950
Pflugerville Service Area	4,444	8,888	17,776	31,108	46,662	58,327	69,992	80,471	88,540	92,967
Manville WSC/Travis County	6,416	7,400	8,212	9,112	10,012	10,960	11,908	13,819	15,647	17,284
Manville WSC/Total	9,165	10,571	11,732	13,017	14,302	15,657	17,011	19,742	22,353	24,692
Remainder/Travis County	43,917	49,826	49,923	51,008	53,660	55,006	56,352	59,127	64,998	71,383
Travis County Total[3]	576,407	664,802	807,027	905,070	1,008,100	1,125,246	1,246,003	1,443,368	1,578,356	1,718,518
Williamson County Areas										
Round Rock Service Area	33,971	44,848	58,742	74,353	92,430	115,430	140,605	165,487	189,521	197,313
Austin Service Area	2,444	3,227	7,458	9,440	13,292	16,600	21,555	28,036	32,106	36,767
Cedar Park Service Area	11,534	20,547	27,249	36,556	48,404	55,173	61,941	76,306	83,458	87,542
Leander Service Area	5,617	7,802	9,381	12,787	15,557	18,928	20,214	26,478	32,333	39,195
Brushy Creek	5,630	8,538	12,589	18,498	20,648	21,723	22,798	23,800	23,800	23,800
Liberty Hill	970	1,281	1,435	1,816	2,125	2,654	3,145	4,436	5,962	7,632
Georgetown Service Area	18,690	24,674	33,357	42,222	54,419	67,960	77,409	100,432	128,994	163,777
Taylor	11,472	15,145	16,025	20,284	22,028	27,509	30,886	35,597	41,021	48,996
Jonah SUD	5,113	6,750	7,212	9,129	9,931	12,402	13,346	17,505	22,408	27,992
Hutto	703	928	1,065	1,348	1,578	1,971	2,280	3,216	4,322	5,532
Other Water Utilities/East/I-35[1]	6,517	7,631	7,941	9,321	10,361	14,384	19,191	22,755	24,625	25,910
Other Water Utilities/West/I-35[2]	16,806	19,680	20,480	24,039	26,722	37,097	49,493	57,890	59,805	63,220
Remainder of County/East/I-35	12,050	14,111	14,685	17,236	19,161	26,599	35,487	42,258	44,934	47,211
Remainder of County/West/I-35	8,033	9,073	9,223	10,096	10,754	14,928	21,957	26,872	29,430	30,982
Williamson County Total	139,551	184,234	226,842	287,126	347,410	433,358	520,307	631,068	722,719	805,868

Table S-1 continued

Area	1990	Population Projections								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
Northeastern Hays County Areas										
Barton Springs EACD/Hays Co.	13,805	15,698	17,742	19,493	21,254	23,246	25,326	30,039	35,625	42,263
Barton Springs EACD/Travis Co[3]	8,660	9,381	10,272	11,245	12,311	13,386	14,553	16,613	18,419	20,438
Barton Springs EACD/Total.	22,465	25,079	28,014	30,738	33,565	36,632	39,879	46,652	54,044	62,701
North Central Area Total[4]	729,763	864,734	1,051,612	1,211,689	1,376,763	1,581,850	1,791,637	2,104,475	2,336,700	2,566,649

Source: Texas Water Development Board, 1996 Consensus Water Plan Projections, Most Likely Case; as modified.

[1] Bartlett, Granger, Jarrell/Schwertner, Noack, Thrall, Walburg WSC, and Weir.

[2] Andice, Blockhouse MUD, Chisolm Trail WSC, Durham Park, Fern Bluff, Florence, South San Gabriel River Ranches, Berry Creek,and Tal/Tex.

[3] Included in Travis County totals.

[4] Area total includes only entities of Travis, Williamson, and Barton Springs EACD/Hays Counties.

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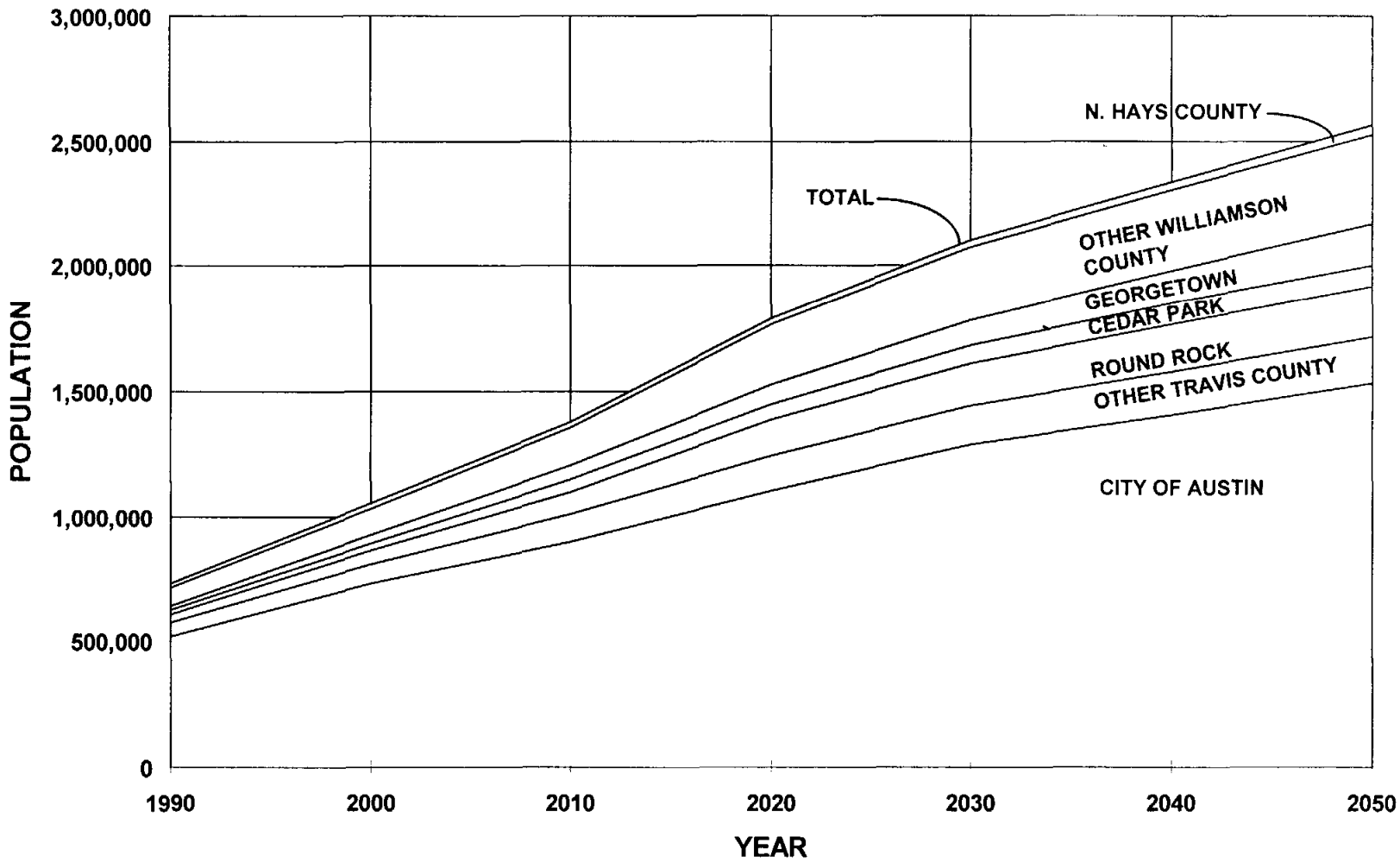

TRANS TEXAS WATER PROGRAM / NORTH CENTRAL STUDY AREA

POPULATION PROJECTIONS

Source: Texas Water Development Board, 1996 Consensus Water Plan Projections, Most Likely Case, as modified.

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FIGURE S-2

S-2.2 Water Demand Projections

In 1990, total water use[1] in the study area of Travis, Williamson, and northern Hays Counties was 166,447 acft/yr (Table S-2 and Figure S-3). Projected water demand for the study area in year 2000 is 281,733 acft/yr, in 2020 is 419,006 acft/yr, and in 2050 is 566,457 acft/yr (Table S-2 and Figure S-3). For the Travis County area, water use in 1990 was 136,544 acft/yr and is projected to increase to 307,226 acft/yr in 2020, and to 398,496 acft/yr in 2050 (Table S-2 and Figure S-3). In 1990, municipal use in Travis County was 108,872 acft/yr (80 percent of the Travis County total), and is projected to grow to 346,284 acft/yr (87 percent of the total) in 2050 (Table S-2 and Figure S-3).

In 1990 in Travis County, industrial water use was 14,003 acft/yr, or 10 percent of total water use in Travis County (Table S-2). Projected industrial water use in Travis County in 2050 is 30,226 acft/yr, which is 7.5 percent of projected total water demand for the county in 2050 (Table S-2).

Total water use in Williamson County in 1990 was 28,189 acft/yr, of which 87 percent was for municipal purposes. Projected total water demand for Williamson County in year 2000 is 49,533 acft/yr, in 2020 is 107,372 acft/yr, and in 2050 is 160,756 acft/yr (Table S-2 and Figure S-3). Projected Williamson County municipal water demand is 43,521 acft/yr in 2000, 88,848 acft/yr in 2020, and 133,526 acft/yr in 2050 (Table S-2). The projected municipal water demands for each of the 10 municipal service areas (Round Rock, Austin, Cedar Park, Leander, Brushy Creek MUD, Liberty Hill, Georgetown, Taylor, Jonah SUD, and Hutto) and the four rural areas of Williamson County are shown in Table S-2.

The recent location of industry in Williamson County has resulted in the projection of industrial water demand to increase from 326 acft/yr in 1990 to 2,653 acft/yr in 2000, and to 23,688 acft/yr in 2050 (Table S-2). Projected growth of the Williamson County mining sector, which is primarily quarrying, indicates a projected growth in water demand from 1,713 acft/yr in 1990 to 1,885 acft/yr in 2000, and to 2,068 acft/yr in 2050 (Table S-2). However, livestock and

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[1] Water use and demand projections are presented in units of acre-feet per year (acft/yr). One acre-foot is 325,851 gallons, which would supply about 4.5 people for one year.

Table S-2
Water Demand Projections
North Central Study Area
Trans-Texas Water Program

Area	1990	Water Demand Projections (acft/yr) 1995	2000	2005	2010	2015	2020	2030	2040	2050
Travis County Areas										
Municipal Demand										
City of Austin Service Area	99,129	103,064	166,735	181,949	195,683	213,708	232,804	266,779	289,866	312,705
Manor Service Area[1]	180	202	233	259	284	301	317	356	379	406
Pflugerville Service Area[1]	777	1,792	3,385	5,714	8,258	10,257	12,230	14,061	15,471	16,245
Manville WSC/Travis County[2]	769	1,293	1,343	1,408	1,469	1,608	1,747	2,028	2,296	2,536
Manville WSC/Total	1,098	1,847	1,919	2,012	2,099	2,297	2,496	2,897	3,280	3,623
Remainder/Travis County	8,018	9,097	11,911	11,827	12,081	12,322	12,498	12,252	13,250	14,392
Travis County Subtotal	108,872	115,448	183,606	201,158	217,775	238,196	259,596	295,476	321,262	346,284
Industrial[3]	14,003	14,152	25,832	26,283	26,730	27,050	27,369	27,875	29,011	30,226
Steam-Electric[4]	9,639	12,698	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500
Irrigation	800	765	731	699	667	638	609	557	508	464
Mining	2,288	3,584	4,880	4,813	4,746	4,996	5,246	5,791	6,407	7,116
Livestock	942	906	906	906	906	906	906	906	906	906
Travis County Total	136,544	147,553	229,455	247,359	264,324	285,286	307,226	344,105	371,594	398,496
Williamson County Areas										
Municipal										
Round Rock Service Area	6,652	8,782	13,087	16,565	18,165	22,685	25,636	28,727	32,881	34,987
Austin Service Area	494	652	1,378	1,745	2,352	2,938	3,791	4,899	5,394	6,054
Cedar Park Service Area	2,024	3,590	5,494	7,166	9,271	10,382	11,448	13,932	14,864	15,493
Leander Service Area	871	1,380	1,891	2,506	2,979	3,625	3,736	4,832	5,759	6,934
Brushy Creek	984	1,500	2,538	3,626	3,955	4,112	4,214	4,345	4,239	4,212
Liberty Hill	136	180	201	254	298	372	440	621	834	1,068
Georgetown Service Area	4,250	5,611	7,052	8,513	10,444	12,560	13,826	17,416	21,962	27,800

Table S-2 continued

Area	1990	Water Demand Projections (acft/yr) 1995	2000	2005	2010	2015	2020	2030	2040	2050
Taylor	2,038	2,691	3,016	3,818	3,874	4,838	5,155	5,861	6,663	7,958
Jonah SUD	660	871	930	1,177	1,281	1,600	1,722	2,258	2,891	3,611
Hutto	72	95	131	166	194	242	281	396	532	681
Other Water Utilities/East/I-35[5]	1,191	1,239	1,228	1,379	1,533	2,128	2,839	3,367	3,643	3,834
Other Water Utilities/West/I-35[6]	3,165	3,262	3,166	3,557	3,625	5,305	7,167	8,264	8,749	9,254
Remainder of County/East/I-35	1,167	1,541	1,961	2,352	2,835	3,936	5,251	6,252	6,648	6,985
Remainder of County/West/I-35	778	1,027	1,448	1,700	1,890	2,440	3,343	4,239	4,394	4,655
Williamson County Subtotal	24,482	32,420	43,521	54,523	62,696	77,163	88,848	105,409	119,453	133,526
Industrial[7]	326	347	2,653	8,435	13,057	14,596	15,154	17,579	19,919	23,688
Steam-Electric	0	0	0	0	0	0	0	0	0	0
Irrigation	160	160	160	160	160	160	160	160	160	160
Mining	1,713	1,799	1,885	1,865	1,845	1,870	1,896	1,949	2,007	2,068
Livestock	1,508	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Williamson County Total	28,189	36,040	49,533	66,297	79,072	95,103	107,372	126,411	142,853	160,756
Northeastern Hays County Areas										
Barton Springs EACD/Hays Co.	1,714	2,055	2,744	3,433	3,730	4,060	4,408	5,190	6,113	7,205
Barton Springs EACD/Travis Co[8]	1,112	1,405	1,624	1,842	2,006	2,171	2,365	2,693	2,980	3,300
Barton Springs EACD/Total.	2,826	3,460	4,368	5,275	5,736	6,231	6,773	7,883	9,093	10,505
North Central Area Total[9]	166,447	185,648	281,733	317,089	347,126	384,450	419,006	475,706	520,560	566,457

Source: Texas Water Development Board, 1996 Consensus Water Plan Projections, Most Likely Case; as modified.

Water use and demand projections are presented in units of acre-feet per year (acft/yr). One acre-foot is 325,851 gallons, which would supply about 4.5 people for one year.

[1] This area may ultimately be served by the Austin water utility as described in the Austin Water Utility Long Range Planning Guide, 1994.

[2] Only Travis County part is included in Travis County totals.

[3] TWDB projection was adjusted upward to include a new industry that was announced in early 1996.

[4] Includes 6,500 acft/yr of make-up water for natural evaporation at Lake Long.

Table S-2 continued

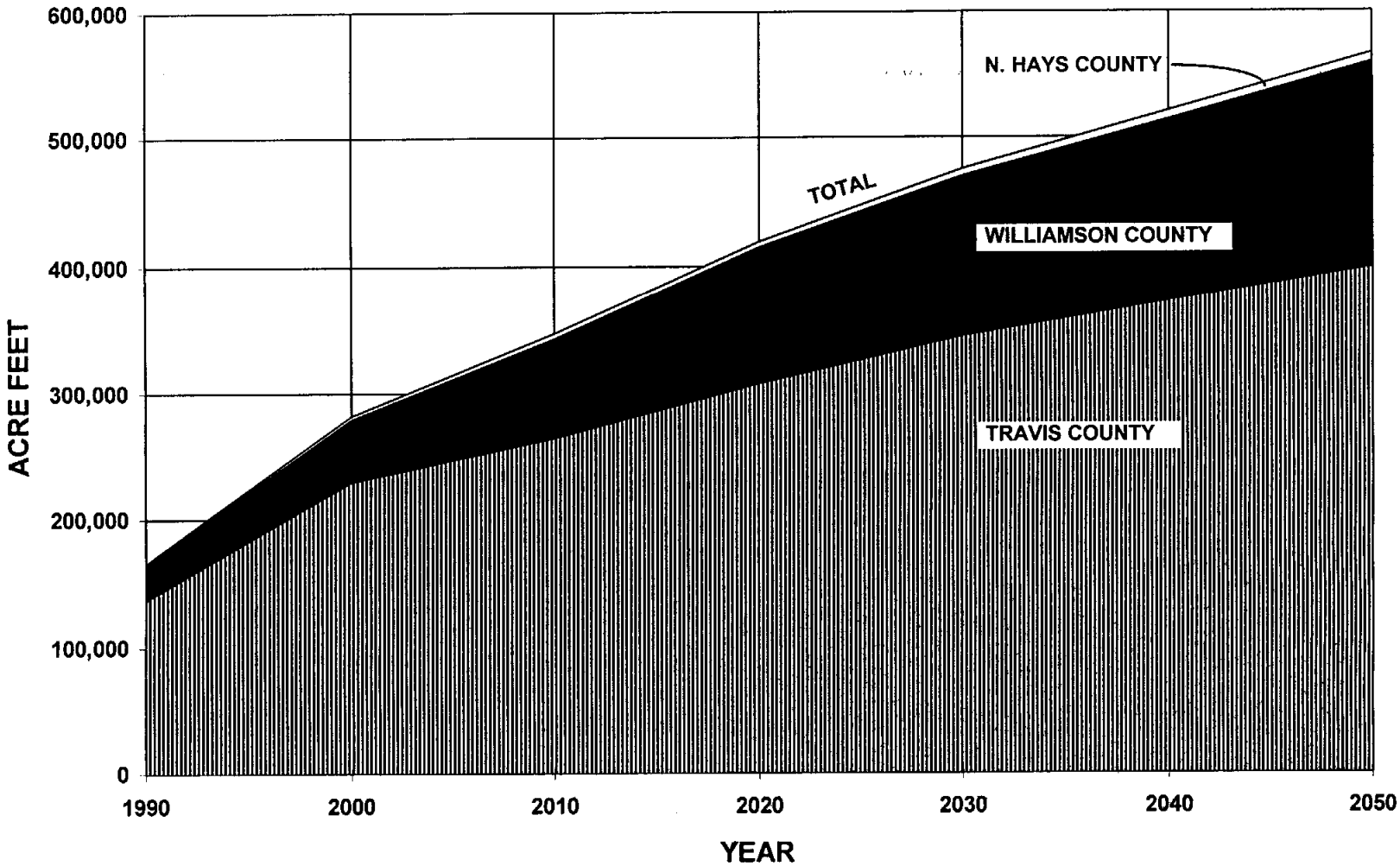
[5] Bartlett, Granger, Jarrell/Schwertner, Noack, Thrall, Walburg WSC, and Weir.

[6] Andice, Blockhouse MUD, Chisolm Trail WSC, Durham Park, Fern Bluff, Florence, South San Gabriel River Ranches, Berry Creek,and Tal/Tex.

[7] TWDB projections adjusted to include requirements for new industry announced in early 1996.

[8] Included in Travis County totals.

[9] Area total includes projections for entities of Travis, Williamson, and Barton Springs EACD/Hays Counties.



TRANS TEXAS WATER PROGRAM /
NORTH CENTRAL STUDY AREA

WATER DEMAND PROJECTIONS

Source: Texas Water Development Board, 1996 Consensus Water Plan Projections, Most Likely Case, as modified.

Projections include municipal, industrial, steam-electric, irrigation, mining, and livestock uses.

HDR Engineering, Inc.

FIGURE S-3

irrigation water demands are projected to remain constant at 1,314 and 160 acft/yr, respectively, for the 1995 through 2050 planning period (Table S-2).

The northern Hays County part of the North Central Trans-Texas study area is projected to remain residential in nature with a projected municipal water demand in year 2000 of 2,744 acft/yr, a year 2020 municipal water demand of 4,408 acft/yr and a 2050 municipal water demand of 7,205 acft/yr (Table S-2).

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S-3 CURRENT WATER SUPPLIES

The water supplies currently available to each of the individual participants of the study area include water use permits issued by the Texas Natural Resource Conservation Commission (TNRCC) to individual entities, contracts and agreements with the Lower Colorado River Authority (LCRA), contracts and agreements with the Brazos River Authority (BRA), and estimates of quantities of groundwater available to those study participants that rely upon the study area's aquifers for their respective water supplies. A summary of sources currently available to each project participant is shown in Table S-3

A brief description of the water supplies currently available to study participants of Travis and Williamson Counties is presented below.

S-3.1 Travis County Participants

S-3.1.1 City of Austin

The City of Austin holds permits to divert up to 292,703 acft/yr from the Colorado River for municipal and industrial use. Austin and the Lower Colorado River Authority (LCRA) have an agreement in which the City's rights are backed up by storage in LCRA's reservoirs, resulting in a firm municipal water supply of 250,000 acft/yr, and run-of-river rights to the remaining 42,703 acft/yr.[2] The run-of-river rights are not available at full amount each and every year. In addition, Austin has 40,156 acft/yr of consumptive water rights for steam-electric power generation which are backed up by storage in LCRA's reservoirs. Under the steam-electric power rights, the City may divert any quantity available for pass-through cooling, however, no more than 40,156 acft/yr may be consumed through evaporation.

S-3.1.2 City of Manor

The City of Manor, through a joint effort with Travis County Municipal Utility District No. 2 obtains its water supply from a well field located in the Colorado River Alluvium Aquifer

[2]The municipal supply includes 1,000 acft/yr which has been changed to irrigation uses through December 31, 2011.

Table S-3

Summary of Current Water Supplies
North Central Study Area Participants
Trans-Texas Water Program

Participant	Source of Supply	Purpose of Use	Quantity acft/yr
Travis County			
City of Austin[1]	➢ Colorado River/Highland Lakes[2]	Municipal & Industrial	250,000
	➢ Colorado River/Run-of-River Rights	Municipal & Industrial	42,703
	➢ Colorado River/ Highland Lakes[2]	Electric Power Generation	40,156
	➢ Colorado River/Run-of-River Rights	Irrigation	1,150
City of Manor	➢ Groundwater — Colorado River, Alluvium	Municipal	2,900
City of Pflugerville	➢ Groundwater — Edwards Aquifer	Municipal	1,700
	➢ Contract with Austin[3]	Municipal	5,600
Manville WSC	➢ Groundwater — Carrizo & Edwards	Municipal	1,800
Remainder of Travis County			
Southern Areas	➢ Groundwater — Edwards Aquifer	Municipal	8,000
Western Areas	➢ Groundwater — Trinity Aquifer	Municipal	855
Western Areas	➢ Colorado River/Lake Travis (Est)[4]	Municipal	6,300
Industries	➢ Colorado River/Run-of-River Rights	Industrial	5,576
Travis County Total[5]			361,140
Williamson County			
City of Round Rock	➢ Groundwater — Edwards Aquifer	Municipal & Industrial	5,040
	➢ Lake Georgetown	Municipal & Industrial	6,720
	➢ Stillhouse Hollow Lake	Municipal & Industrial	18,134
	➢ Contract with Austin through yr 2000	Municipal & Industrial	5,376
City of Austin[6]	➢ Colorado River/Highland Lakes	Municipal	3,000
City of Cedar Park[7]	➢ Colorado River/Lake Travis	Municipal & Industrial	7,000
City of Leander	➢ Colorado River/Lake Travis through Cedar Park through yr 2000	Municipal	2,400
	➢ Groundwater until yr 2000	Municipal	392
	➢ Contract with Chisholm Trail SUD, which phases to zero in yr 2015	Municipal	784
	➢ Stillhouse Hollow Lake	Municipal	2,700

Table S-3

Summary of Current Water Supplies
North Central Study Area Participants
Trans-Texas Water Program (Continued)

Participant	Source of Supply	Purpose of Use	Quantity acft/yr
Brushy Creek MUD	➢ Contract with Round Rock until yr 2006	Municipal	3,360
	➢ Stillhouse Hollow Lake	Municipal	4,000
	➢ Groundwater — Edwards Aquifer	Municipal	1,792
Liberty Hill	➢ Contract with Chisholm Trail SUD	Municipal	200
City of Georgetown	➢ Lake Georgetown	Municipal & Industrial	6,720
	➢ Stillhouse Hollow Lake	Municipal & Industrial	15,448
	➢ Groundwater — Edwards Aquifer	Municipal & Industrial	3,360
City of Taylor	➢ Granger Lake	Municipal & Industrial	6,721
Jonah Special Utility District	➢ Stillhouse Hollow Lake	Municipal	2,439
	➢ Groundwater — Edwards Aquifer	Municipal	2,688
City of Hutto	➢ Groundwater — Edwards Aquifer	Municipal	131
	➢ Contract Manville WSC	Municipal	336
Other Water Utilities East of IH-35			
City of Bartlett	➢ Groundwater	Municipal	230
City of Granger	➢ Groundwater	Municipal	348
Jarrell/Schwertner WSC	➢ Groundwater	Municipal	530
Noack WSC	➢ Groundwater	Municipal	100
City of Thrall	➢ Groundwater	Municipal	70
Walburg WSC	➢ Groundwater	Municipal	10
City of Weir	➢ Groundwater	Municipal	12
Other Water Utilities West of IH-35			
City of Andice	➢ Groundwater	Municipal	18
Blockhouse MUD	➢ Groundwater	Municipal	1,028
Chisholm Trail Special Utility District	➢ Stillhouse Hollow Lake	Municipal	1,110
Durham Park WSC	➢ Groundwater	Municipal	76

Table S-3

Summary of Current Water Supplies
North Central Study Area Participants
Trans-Texas Water Program (Continued)

Participant	Source of Supply	Purpose of Use	Quantity acft/yr
Fern Bluff MUD	➢ Groundwater	Municipal	311
City of Florence	➢ Groundwater	Municipal	434
High Gabriel WSC	➢ Groundwater	Municipal	170
South San Gabriel River Ranches	➢ Groundwater	Municipal	113
San Gabriel River Ranches	➢ Groundwater	Municipal	113
Berry Creek MUD	➢ Groundwater	Municipal	590
Tal/Tex (Tonkawa & Springs)	➢ Groundwater	Municipal	489
Remainder of Williamson County East of IH-35	➢ Groundwater (Individual Wells)	Municipal	1,541
Remainder of Williamson County West of IH-35	➢ Groundwater (Individual Wells)	Municipal	1,027
Williamson County Total			104,932

[1]Austin service area includes customer cities of Rollingwood and West Lake Hills, and water supply districts of western Travis County that are not listed here.

[2]Backed up by storage in the Lower Colorado River Authority's Highland Lakes per Austin/LCRA Settlement Agreement

[3]Included in City of Austin totals.

[4]Contracts with Lower Colorado River Authority and own supplies.

[5]Includes 277,131 acft M&I water supply plus 42,703 acft R-O-R rights (which are not 100% dependable at all times), 40,156 acft steam electric water supply and 1,150 acft irrigation water supply.

[6]That part of Austin located in Williamson County and is included in Austin's demands, as listed in Travis County.

[7]Contract with Lower Colorado River Authority.

approximately 4 miles south of the city. It is estimated that the aquifer has a long-term yield of approximately 2.6 mgd or 2,900 acft/yr.

S-3.1.3 City of Pflugerville

The City of Pflugerville has wells in the Edwards Aquifer north of the Colorado River which are estimated to have a yield at the present time of approximately 1,700 acft/yr. Since this section of the Edwards Aquifer appears to be at or near full development, Pflugerville has a contract with the City of Austin to provide a peak day supply of 10 mgd, with an estimated annual limit of 5 mgd or 5,600 acft.

S-3.1.4 Manville Water Supply Corporation

The Manville Water Supply Corporation (WSC) obtains its water from wells in the Carrizo-Wilcox, Edwards, and Colorado River alluvium aquifers. Present capacity of the Manville WSC wells is approximately 1,800 acft/yr, and is the quantity of supply used in this study for the Manville WSC.

S-3.1.5 Remainder of Travis County

Areas in southern Travis County are supplied from the underlying Barton Springs Edwards Aquifer and areas in western Travis County are supplied from the underlying Trinity Group Aquifer and Lake Travis through contracts with LCRA. The estimated total dependable supply from the aquifers is approximately 8,855 acft/yr, while the contracts with LCRA are approximately 41,286 acft/yr. In addition, individual industries and farmers and ranchers hold permits to use 5,576 acft/yr of surface water from streams of Travis County, including the Colorado River, and are the quantities used in this study.

S-3.1.6 Travis County Water Supply Summary

Estimated total water supply available to the Travis County study area from all sources—local groundwater and surface water from existing reservoirs and water rights permits is approximately 361,140 acft/yr. Of this amount, 312,117 acft/yr is a dependable supply firmed up with Highland Lakes stored water, or from groundwater sources.

S-3.2 Williamson County Participants

S-3.2.1 City of Round Rock

Round Rock has an estimated groundwater supply from its Williamson County Edwards Aquifer wells of 5,040 acft/yr, a contract with the Brazos River Authority for 6,720 acft/yr of water from Lake Georgetown, a contract with the Brazos River Authority for 18,134 acft/yr of Stillhouse Hollow Lake water, and a contract with the City of Austin for 5,376 acft/yr through year 2000. Total supplies available to Round Rock from ground and surface sources is estimated at 29,894 acft/yr for the 2000 to 2050 period.

S-3.2.2 City of Austin in Williamson County

The City of Austin serves a small area of south central Williamson County. Austin's water supplies are described above and the description will not be repeated here. It is anticipated that supplies available to Austin will be used to meet the projected needs of the City of Austin Service Area, including those parts located in Williamson County. It is estimated that Austin's supply available for the Austin service area, including Williamson County, would be adequate through about 2016 and that the supply for this area from Austin's present supplies would reach an upper limit of about 3,000 acft/yr beginning in 2014.

S-3.2.3 City of Cedar Park

The City of Cedar Park water supply is obtained from Lake Travis through two contracts with the LCRA. The first contract, which terminates on June 1, 2014, but is renewable on an annual basis if both parties agree to a renewal, provides for a maximum diversion of 7,000 acft/yr. A second contract for 2,400 acft/yr was obtained in 1996 and provides this water to Cedar Park, which in turn provides 2,400 acft/yr of water to neighboring Leander through year 2000, at which time the 2,400 acft/yr reverts to LCRA. Thus, Cedar Park's present water supply is 7,000 acft/yr.

S-3.2.4 City of Leander

Leander obtains its water through a wholesale services contract with Chisholm Trail Special Utility District, from wells, and through a contract with Cedar Park. The Trinity Group

Aquifer in which Leander's wells are completed is inadequate to continue to meet the City's needs (i.e., well yields are predicted to decline from the 871 acft supplied in 1990 to 392 acft/yr in 2000, and to zero in 2005. Chisholm Trail Special District (SUD) provides a supply of water which is projected to decline from 0.7 mgd (784 acft/yr) in 1995, to 0.36 mgd (403 acft/yr) in 2000, to 0.28 mgd (313 acft/yr) in 2005, to 0.20 mgd (224 acft/yr) in 2010, to 0.10 mgd (112 acft/yr) in 2015.

The contract between Leander and Cedar Park provides Leander with up to 2,400 acft/yr of treated water through year 2000. The Cedar Park/Leander agreement is based upon the condition that LCRA agrees to provide Cedar Park an additional 2,400 acft/yr of water to meet part of Leander's water needs. In 1996, Leander arranged to contract with the Brazos River Authority (BRA) to obtain 2,700 acft/yr of water from Stillhouse Hollow Lake. Thus until 2001, Leander has a supply of 5,895 acft/yr and thereafter has 2,700 acft/yr.

S-3.2.5 Brushy Creek Municipal Utility District

Brushy Creek Municipal Utility District's (MUD) Edwards Aquifer wells have an estimated yield of 1,792 acft/yr. The District has a contract with Round Rock, which expires in 2006, for 3,360 acft/yr of surface water and has obtained 4,000 acft/yr of Stillhouse Hollow Lake water from BRA. Thus, the Brushy Creek MUD water supply is 9,152 acft/yr through 2006, and 5,792 acft/yr thereafter.

S-3.2.6 City of Liberty Hill

Liberty Hill has a water supply contract with Chisholm Trail Water Supply Corporation (WSC) for 200 acft/yr.

S-3.2.7 City of Georgetown

Through contracts with the BRA, Georgetown has 6,720 acft/yr of water from Lake Georgetown, and 15,448 acft/yr of water from Stillhouse Hollow Lake. In addition, Georgetown's Edwards Aquifer wells have an estimated dependable yield of 3,360 acft/yr, bringing Georgetown's water supply to a total of 25,528 acft/yr.

S-3.2.8 City of Taylor

Taylor has a water supply contract with the BRA for 6,721 acft/yr of water from Granger Lake.

S-3.2.9 Jonah Specialty Utility District

Through a contract with the Brazos River Authority, the Jonah Specialty Utility District (SUD) has a water supply of 2,439 acft/yr from Stillhouse Hollow Lake. In addition, Jonah SUD has an estimated groundwater supply of 2,688 acft/yr from the Edwards Aquifer, bringing its total supply to 5,127 acft/yr.

S-3.2.10 City of Hutto

Hutto has an estimated groundwater supply of 131 acft/yr from the Edwards Aquifer and a contract for 336 acft/yr from Manville WSC.

S-3.2.11 Other Water Utilities/East of IH-35

In the Williamson County areas east of IH-35, there are sever (7) water utilities (Bartlett, Granger, Jarrell/Schwertner, Noack WSC, Thrall, Walburg WSC, and Weir) in addition to the participates of this study. These utilities presently depend upon groundwater obtained from the Edwards and Trinity Aquifers. The estimated supply available to these seven (7) utilities is listed in Table S-3 with the total of all seven (7) of approximately 1,300 acft/yr.

S-3.2.12 Other Water Utilities/West of IH-35

In the Williamson County areas west of IH-35, there are eleven (11) water utilities (Andice, Blockhouse MUD, Chisholm Trail SUD, Durham Park, Fern Bluff, Florence, High Gabriel, South San Gabriel River Ranches, San Gabriel River Ranches, Berry Creek, and Tal/Tex) in addition to the participants of this study. These utilities depend upon groundwater from the Edwards and Trinity Aquifers with one entity obtaining surface water through a contract with the Brazos River Authority for 1,110 acft/yr water from Stillhouse Hollow Lake. The estimated total supply available to the 11 utilities is 4,452 acft/yr of which 1,110 acft/yr is surface water and 3,342 acft/yr is groundwater (see Table S-3 for estimates for individual utilities).

S-3.2.13 Remainder of County/East of IH-35

Approximately 14,111 people lived in Williamson County areas east of IH-35 in 1995 that did not have water service from public water utilities. The population of these areas is projected to increase to 19,161 in 2010 and to 47,211 in 2050. At the present time, water is obtained for individual homes and businesses from wells developed in local aquifers. The quantity available is estimated at about 1,541 acft/yr.

S-3.2.14 Remainder of County/West of IH-35

The population of those areas of Williamson County west of IH-35 that do not have water service from public water utilities was estimated at 9,073 in 1995, and is projected to grow to about 30,982 in 2050. Water supplies are obtained through wells completed in local aquifers and are estimated at about 1,027 acft/yr.

S-3.2.15 Williamson County Water Supply Summary

Estimated total water supplies available to the Williamson County study area from all sources—local groundwater, existing reservoirs, and contracts with LCRA and BRA for water from Lakes Travis and Stillhouse Hollow Lake located outside the County is approximately 105,000 acft/yr at the present time.

In Section S-4, which follows, a comparison is made of each participant's projected water demands (Section S-2) with the respective supplies available (Section S-3). This comparison predicts the time at which each participant will need to obtain additional water supplies and the quantities that will be needed to meet projected water demands through 2050.

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Travis County
Demand and Supply

S-4 WATER DEMAND AND SUPPLY COMPARISONS

S-4.1 Travis County Entities

S-4.1.1 City of Austin

A comparison of projected water demands for municipal and industrial purposes for the City of Austin service area shows that the City's presently available firm annual supply of 250,000 acft/yr of surface water from the Colorado River and the Highland Lakes can meet projected demands through the year 2017 (Table S-4 and Figure S-4). By 2020, demands exceed supplies by 11,402 acft/yr, and in 2050 demands exceed supplies by 92,731 acft/yr (Table S-4 and Figure S-4).

S-4.1.2 Manor

Manor's projected water supply of 2,900 acft/yr from the Colorado River alluvium appears to be adequate to meet projected water demands which increase from 233 acft/yr in 2000 to 406 acft/yr in 2050 (Table S-4).

S-4.1.3 Pflugerville

Pflugerville's projected municipal water supply of 1,700 acft/yr of groundwater and contract with City of Austin for 5,600 acft/yr of surface water appear to be adequate to meet projected demands to approximately year 2008 (Table S-4 and Figure S-5).[3] In year 2010, Pflugerville's projected shortage is 958 acft/yr and in 2050 is 8,945 acft/yr, with a projected total 2050 demand of 16,245 acft/yr (Table S-4).

S-4.1.4 Manville Water Supply Corporation

Manville Water Supply Corporation's present supply of approximately 1,800 acft/yr from the Edwards and Trinity aquifers is barely adequate to meet present demands. Projected demands show that Manville WSC needs an additional supply of 119 acft/yr in 2000, 212 acft/yr in 2005, 696 acft/yr in 2020, and 1,823 acft/yr in 2050 (Table S-4 and Figure S-6).

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[3] Note that Pflugerville's contract is included as a part of the projected City of Austin demands.

Table S-4
Water Demand and Supply Projections and Comparisons
Travis County Areas
Trans-Texas Water Program

Area	Use in 1990	Projections (acft/yr)								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
City of Austin										
Municipal Demand (M)	99,129	103,064	166,735	181,949	195,683	213,708	232,804	266,779	289,866	312,705
Industrial Demand (I)	13,816	13,923	22,231	22,454	22,678	22,838	22,998	23,251	23,819	24,426
Total M&I Demand	112,945	116,987	188,966	204,403	218,361	236,546	255,802	290,030	313,685	337,131
Round Rock Contract[1]	0	5,376	5,376	0	0	0	0	0	0	0
Pflugerville Contract[2]	0	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600
Total Demand	112,945	127,963	199,942	210,003	223,961	242,146	261,402	295,630	319,285	342,731
Water Supply (Surface)[3]	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Supply minus Demand[4]	137,055	122,037	50,058	39,997	26,039	7,854	(11,402)	(45,630)	(69,285)	(92,731)
Manor Service Area										
Municipal Demand	180	202	233	259	284	301	317	356	379	406
Water Supply (Ground)	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900
Supply minus Demand[4]	2,720	2,698	2,667	2,642	2,616	2,600	2,583	2,544	2,521	2,494
Pflugerville Service Area										
Municipal Demand	777	1,792	3,385	5,714	8,258	10,257	12,230	14,061	15,471	16,245
Water Supply										
Austin Contract[5]	0	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600
Ground	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Total Supply	1,700	7,300	7,300	7,300	7,300	7,300	7,300	7,300	7,300	7,300
Supply minus Demand[4]	923	5,508	3,915	1,586	(958)	(2,957)	(4,930)	(6,761)	(8,171)	(8,945)

Table S-4 continued

Area	Use in 1990	Projections (acft/yr)								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
Manville WSC Service Area										
Municipal Demand										
Travis County (70.38%/1995	769	1,293	1,343	1,408	1,469	1,608	1,747	2,028	2,296	2,536
Williamson Co (23.04%/1995)	253	425	441	463	483	528	574	666	754	833
Bastrop Co (5.95%/1995)	66	111	115	121	126	138	150	174	197	217
Lee County (0.63%/1995)	11	18	19	20	21	23	25	29	33	36
Subtotal	1,098	1,847	1,919	2,012	2,099	2,297	2,496	2,897	3,280	3,623
Water Supply(Ground)	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
Supply minus Demand[4]	702	(47)	(119)	(212)	(299)	(497)	(696)	(1,097)	(1,480)	(1,823)
Remainder of Travis County										
Municipal Demand	8,018	9,097	11,911	11,827	12,081	12,322	12,498	12,252	13,250	14,392
Industrial Demand	187	229	3,601	3,829	4,052	4,212	4,371	4,624	5,192	5,800
Irrigation Demand	800	765	731	699	667	638	609	557	508	464
Mining Demand	2,288	3,584	4,880	4,813	4,746	4,996	5,246	5,791	6,407	7,116
Livestock Demand	942	906	906	906	906	906	906	906	906	906
Total Demand	12,235	14,581	22,029	22,074	22,452	23,074	23,630	24,130	26,263	28,678
Water Supply										
Surface[5]	5,576	5,576	5,576	5,576	5,576	5,576	5,576	5,576	5,576	5,576
Surface Contracts/Lake Travis[6]	6,300	41,286	41,286	41,286	41,286	41,286	41,286	41,286	41,286	41,286
Ground(Edwards and Trinity)	8,855	8,855	8,855	8,855	8,855	8,855	8,855	8,855	8,855	8,855
Total Supply	20,731	55,717	55,717	55,717	55,717	55,717	55,717	55,717	55,717	55,717
Supply minus Demand[4]	8,496	41,136	33,688	33,643	33,265	32,643	32,087	31,587	29,454	27,039
Travis County Summary										
Total M&I Demand	122,876	129,600	209,438	227,440	244,505	265,246	286,965	323,351	350,273	376,510
Total M&I Supply	277,131	312,117	312,117	312,117	312,117	312,117	312,117	312,117	312,117	312,117
Supply minus Demand	154,255	182,517	102,679	84,677	67,612	46,871	25,152	(11,234)	(38,156)	(64,393)

Table S-4 continued

Area	Use in 1990	Projections (acft/yr)								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
City of Austin - Steam Electric										
Steam-Electric Demand										
Forced Evaporation	3,139	6,198	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Natural Evap (Lake Long only	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500
Total Demand	9,639	12,698	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500
Steam-Electric Supply (Surface)	40,156	40,156	40,156	40,156	40,156	40,156	40,156	40,156	40,156	40,156
Supply minus Demand[4]	30,517	27,458	26,656	26,656	26,656	26,656	26,656	26,656	26,656	26,656

* Demand projections are fron Table 2.1-2. Water supply information is from records of The Texas Natural Resource Conservation Commission and The Texas Water Development Board. Austin Industrial Demand includes requirements for a new industry announced in early 1996.

[1]Contract through year 2000.

[2]Total contract amount of 10 mgd peak day delivery with estimated annual use of 5,600 acft/yr.

[3]Firm yield of Austin's permits, as backed up with storage in the Lower Colorado River Authority's lakes.

[4] Positive values mean projected surpluses, while ( ) values mean projected shortages.

[5] Run-of-River rights to Colorado River flows, therefore, entire quantity may not be available every year.

[6] Estimated quantities of contracts with Lower Colorado River Authority for water from Lake Travis.

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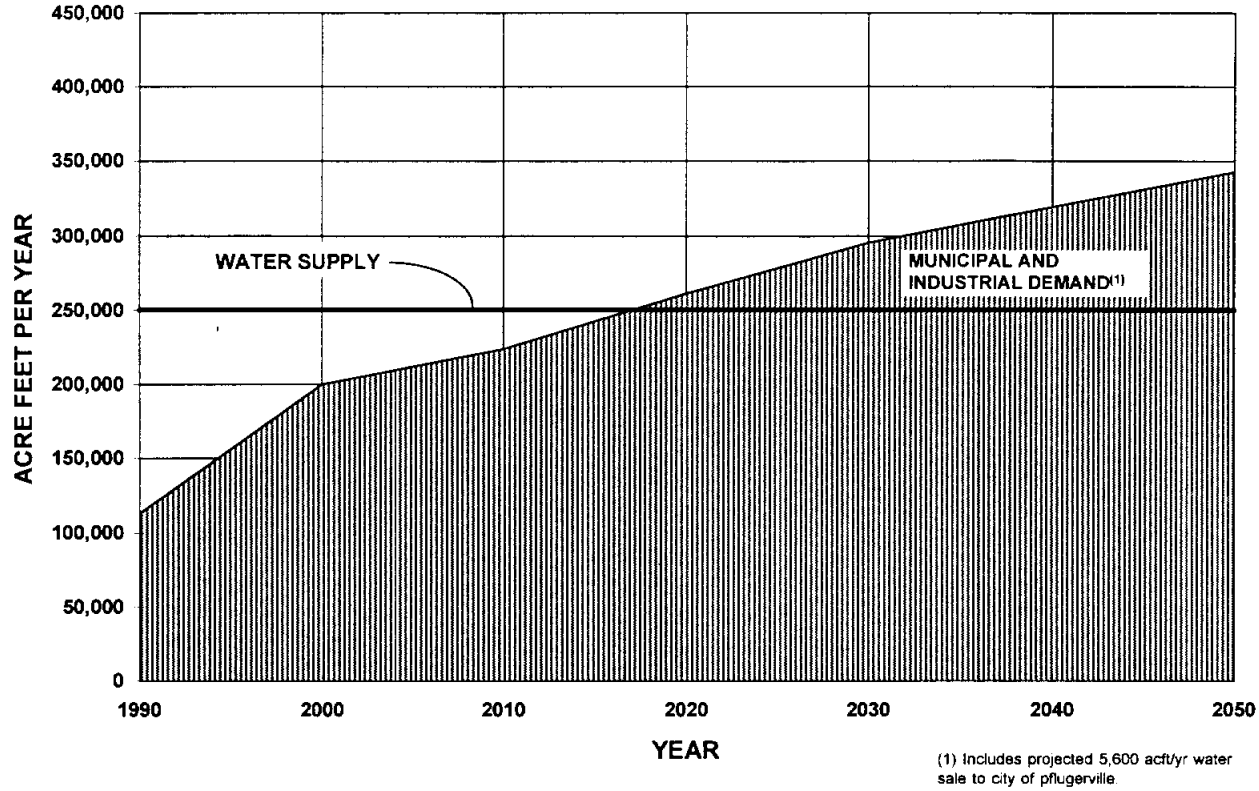


City of Austin Water Supply:

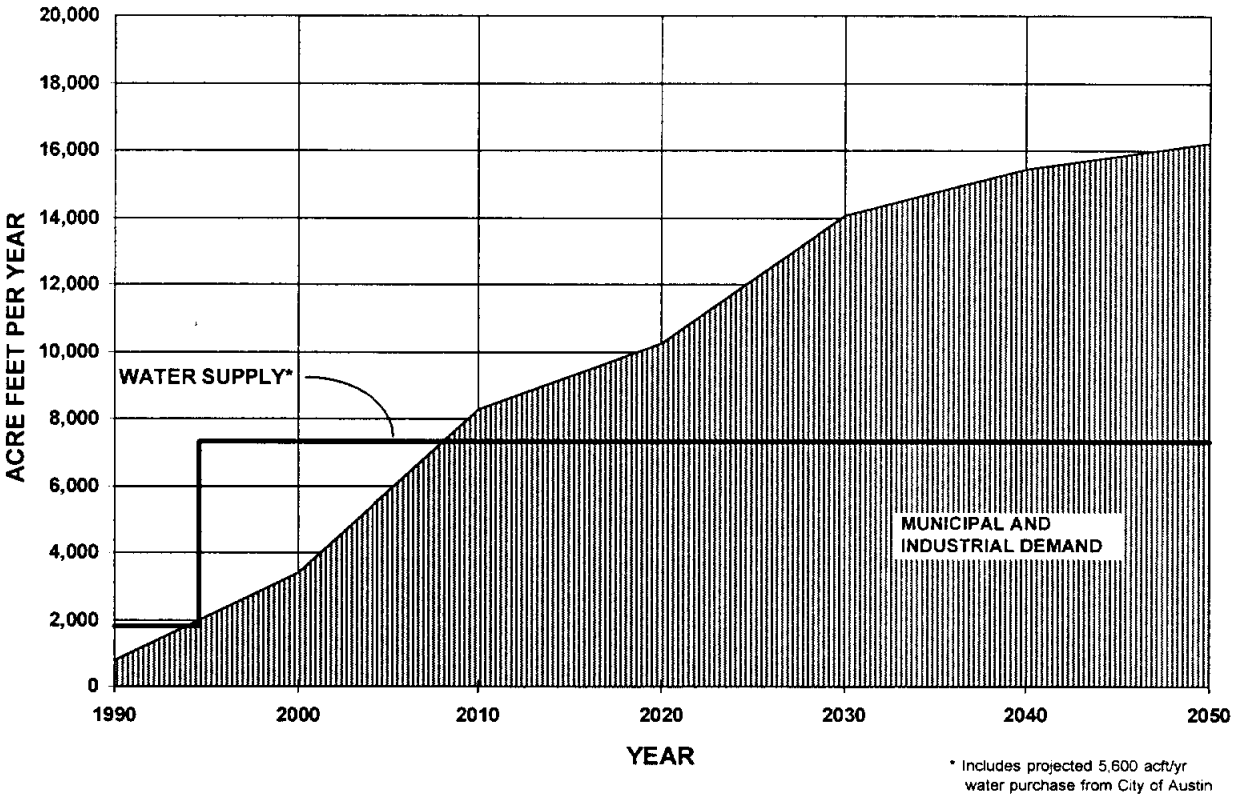
The City of Austin has run-of-river rights to 292,703 acft/yr of municipal water from the Colorado River. Austin and the Lower Colorado River Authority (LCRA) have an agreement in which the City's rights are backed up by storage in LCRA's reservoirs, resulting in a firm municipal water supply of 250,000 acft/yr, and run-of-river rights to the remaining 42,703 acft/yr.(1) In addition, Austin has 40,156 acft/yr of consumptive water rights for steam-electric power generation. Under the steam-electric power rights, the City may divert any quantity available for pass-through cooling, however, no more than 40,156 acft/yr may be consumed through evaporation.

TRANS TEXAS WATER PROGRAM / NORTH CENTRAL STUDY AREA

WATER DEMAND AND SUPPLY COMPARISON AUSTIN SERVICE AREA

HDR Engineering, Inc.

FIGURE S-4



City of Pflugerville Water Supply:

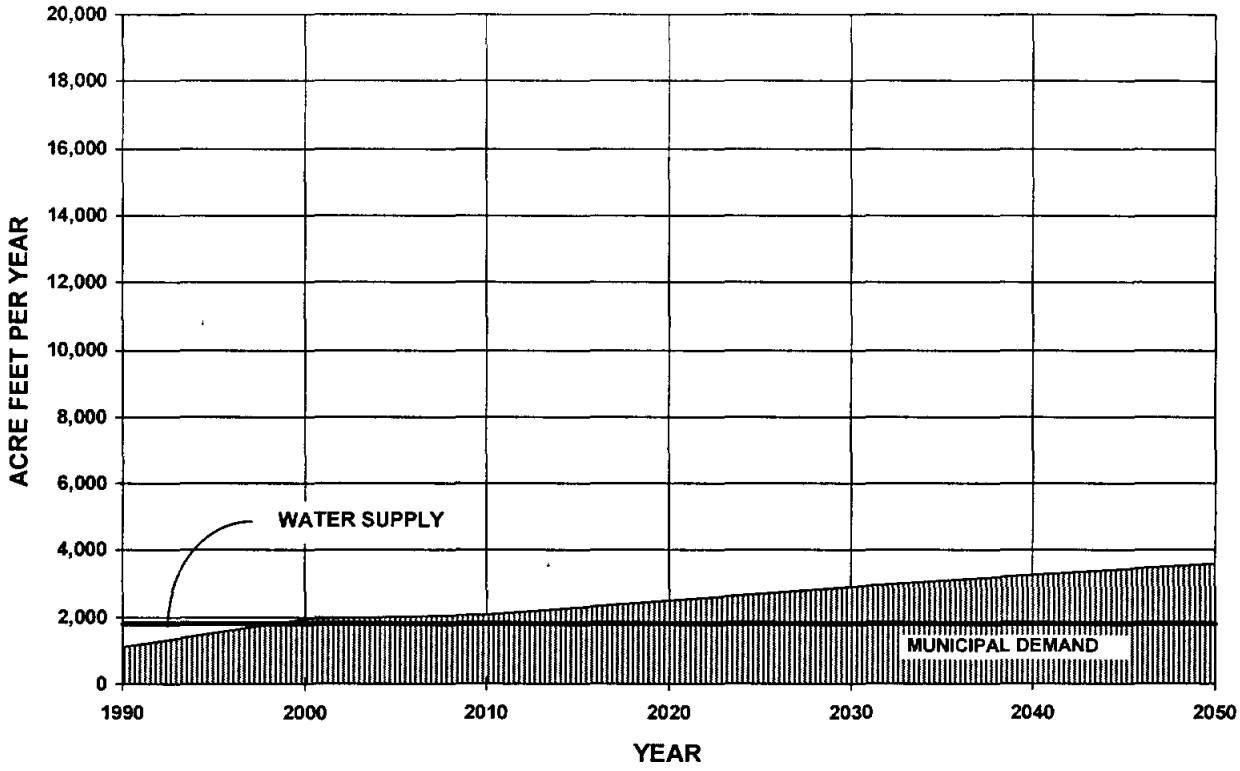
The City of Pflugerville has wells in the Edwards Aquifer north of the Colorado River which have a yield at the present time of approximately 1,700 acft/yr. Since this section of the Edwards Aquifer appears to be at or near full development, Pflugerville has a contract with the City of Austin to provide a peak day supply of 10 mgd, with an estimated annual limit of 5 mgd or 5,600 acft.

TRANS TEXAS WATER PROGRAM /
NORTH CENTRAL STUDY AREA

WATER DEMAND AND SUPPLY COMPARISON CITY OF PFLUGERVILLE

HDR Engineering, Inc.

FIGURE S-5



Manville Water Supply Corporation Water Supply:

The Manville Water Supply Corporation (WSC) obtains its water from wells in the Carrizo-Wilcox, Edwards, and Colorado River alluvium aquifers. Present capacity of the Manville WSC wells is approximately 1,800 acft/yr, and is the quantity of supply used in this study for the Manville WSC.

TRANS TEXAS WATER PROGRAM / NORTH CENTRAL STUDY AREA

WATER DEMAND AND SUPPLY COMPARISON MANVILLE WSC

HDR Engineering, Inc.

FIGURE S-6

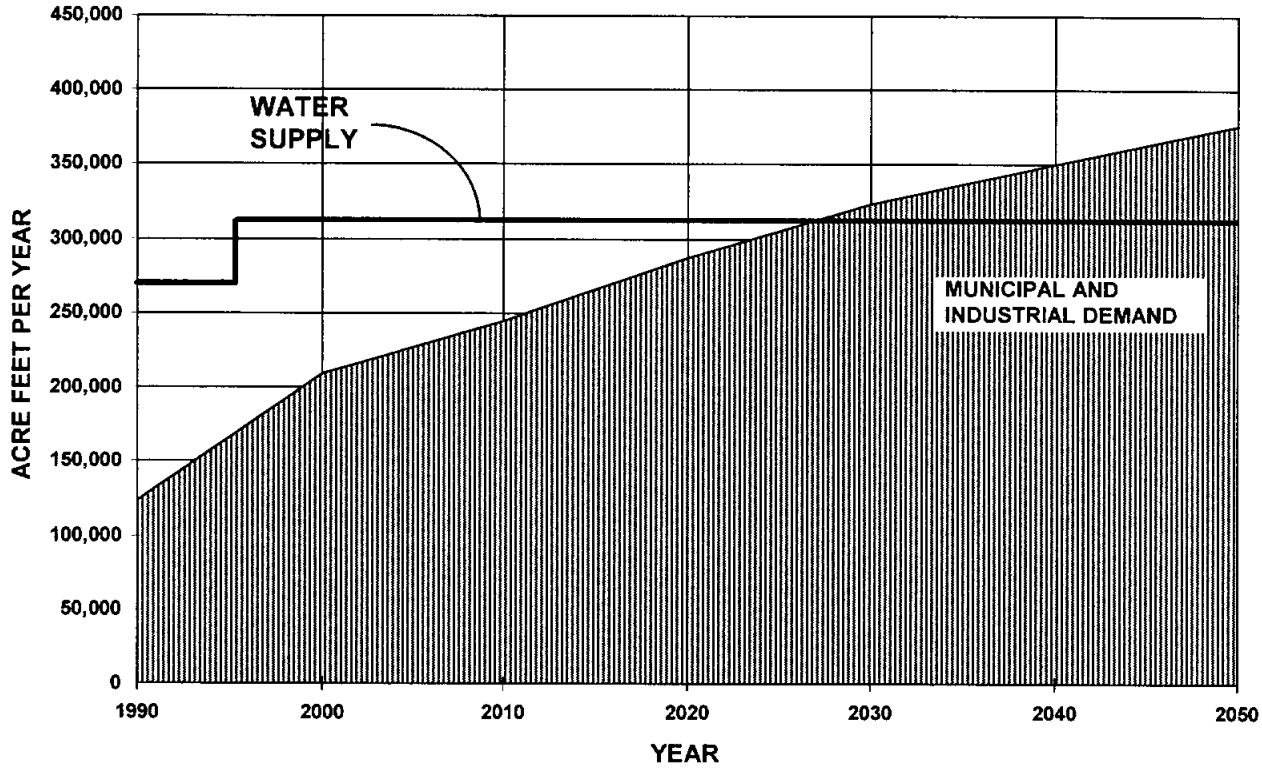
S-4.1.5 Remainder of Travis County

Projected municipal water demands in housing subdivisions and for individual dwellings of unincorporated areas of Travis County increase from 8,018 acft/yr in 1990 to 11,911 acft/yr in 2000 and to 14,392 acft/yr in 2050 (Table S-4). At the present time, much of these needs are met from the Trinity and Barton Springs Edwards aquifers, which have an estimated yield in Travis County of approximately 8,855 acft/yr, and from surface water contracts with the Lower Colorado River Authority for approximately 6,300 acft/yr of water from Lake Travis (Table S-4 and Figure S-7).

The total projected demands for municipal, industrial, irrigation, mining, and livestock that are not included in the service area demands of Austin, Manor, Pflugerville, and the Manville WSC increase from 12,235 acft/yr in 1990 to 22,029 acft/yr in 2000, and to 28,678 acft/yr in 2050 (Table S-4). Surface water use permits presently held by individual mining and industrial establishments, and irrigators of Travis County are 5,576 acft/yr, which together with the 8,855 acft/yr of groundwater and 6,300 acft/yr of surface water mentioned above, brings the potential supply available to meet the water needs of the remainder of Travis County to approximately 20,731 acft/yr (Table S-4). However, present needs are being met in some areas by overdrafting the Trinity and Barton Springs Edwards Aquifers. The projected shortage in year 2000 is 1,298 acft/yr and in 2050 is 7,947 acft/yr (Table S-4 and Figure S-7).

S-4.1.6 Travis County Municipal and Industrial Water Demand and Supply Summary

In 1990, municipal and industrial water use in Travis County was 122,876 acft/yr, and under dry weather conditions, with conservation, is projected to increase to 209,438 acft/yr in 2000 and to 376,510 acft/yr in 2050 (Table S-4). Supply available within Travis County from existing sources for municipal and industrial use is approximately 312,117 acft/yr (Table S-4). In about the year 2027, demand is projected to equal the available supply, resulting in projected shortages in following years. In 2030, projected shortages in the County are 11,234 acft/yr, and in 2050 projected shortages are 64,393 acft/yr (Table S-4 and Figure S-7).



Travis County Water Supply:

Travis County Water Supply Summary: Estimated firm water supply for municipal and industrial use available to the Travis County study area from local groundwater and surface water is approximately 312,117 acft/yr.

TRANS TEXAS WATER PROGRAM / NORTH CENTRAL STUDY AREA

WATER DEMAND AND SUPPLY COMPARISON TRAVIS COUNTY

HDR Engineering, Inc.

FIGURE S-7

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Williamson County
Demand and Supply

S-4.2 Williamson County Entities

S-4.2.1 Round Rock

For the Round Rock service area, projected water demands are estimated to exceed projected water supplies in about 2010 (Table S-5 and Figure S-8). Projected surpluses in 2010 are only 131 acft/yr, with projected shortages in 2015 of 4,394 acft/yr, in 2020 of 7,751 acft/yr, and in 2050 of 19,774 acft/yr (Table S-5 and Figure S-8).

S-4.2.2 Austin

Water demands in the Austin service area located within Williamson County are projected to increase from 652 acft/yr in 1995 to 2,352 acft/yr in 2010, and to 6,054 acft/yr in 2050. Projected demands upon the City of Austin service area increase to equal presently available supplies in about the year 2016 (Table S-4), which when applied uniformly to the service area customers shows a shortage for this part of the system of 791 acft/yr in 2020, 1,899 acft/yr in 2030, and 3,054 acft/yr in 2050 (Table S-5).

S-4.2.3 Cedar Park

Cedar Park's surface water supplies of 7,000 acft/yr from Lake Travis via contracts with LCRA, assuming present contracts are renewed on or before expiration, are projected to meet projected demands of the Cedar Park service area until about 2003. Projected shortages in 2010 are 3,069 acft/yr, and by 2050 are 11,349 acft/yr (Table S-5 and Figure S-9).

S-4.2.4 Leander

Leander's present groundwater supplies from the Trinity Aquifer are temporary in nature (i.e., well yields and water quality are declining such that no usable groundwater supply is expected to be available after the year 2004). Surface water supplies of 2,803 acft/yr from Lake Travis are through short-term contracts with neighboring Cedar Park and the Chisholm Trail SUD, with 2,700 acft/yr through long-term contracts for Stillhouse Hollow Lake with BRA. Thus, Leander has projected supplies adequate to meet projected demands through about 2005. Projected shortages occur after 2005, and are 180 acft/yr in 2010, 1,286 acft/yr in 2020, and 5,234 acft/yr in 2050 (Table S-5 and Figure S-10).

Table S-5
Water Demand and Supply Projections and Comparisons
Williamson County Areas
Trans-Texas Water Program

Area	Use in 1990	Projections (acft/yr)							
		1995	2000	2005	2010	2015	2020	2030	2040	2050
Round Rock Service Area										
Municipal Demand (M)	6,652	8,782	13,087	16,565	18,165	22,685	25,636	28,727	32,881	34,987
Industrial Demand (I)	163	174	2,608	7,103	11,598	11,603	12,009	12,625	13,643	14,681
Brushy Creek MUD Contract[1]		3,360	3,360	3,360						
Total M&I Demand	6,815	12,316	19,055	27,028	29,763	34,288	37,645	41,352	46,524	49,668
Water Supply										
Surface/Lake Georgetown	6,720	6,720	6,720	6,720	6,720	6,720	6,720	6,720	6,720	6,720
Surface/Stillhouse HollowLake		8,134	18,134	18,134	18,134	18,134	18,134	18,134	18,134	18,134
Surface/Contract with Austin[2]		5,376								
Surface/Total	6,720	20,230	24,854	24,854	24,854	24,854	24,854	24,854	24,854	24,854
Ground(Edwards Aquifer)	5,040	5,040	5,040	5,040	5,040	5,040	5,040	5,040	5,040	5,040
Total Supply	11,760	25,270	29,894	29,894	29,894	29,894	29,894	29,894	29,894	29,894
Supply minus Demand[3]	4,945	12,954	10,839	2,866	131	(4,394)	(7,751)	(11,458)	(16,630)	(19,774)
Austin Service Area										
Municipal Demand (M)[4]	494	652	1,378	1,745	2,352	2,938	3,791	4,899	5,394	6,054
Water Supply (Surface)[5]	494	652	1,378	1,745	2,352	2,938	3,000	3,000	3,000	3,000
Supply minus Demand[3]	0	0	0	0	0	0	(791)	(1,899)	(2,394)	(3,054)

Table S-5 continued

Area	Use in 1990	Projections (acft/yr)								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
Cedar Park Service Area										
Municipal Demand (M)	2,024	3,590	5,494	7,166	9,271	10,382	11,448	13,932	14,864	15,493
Industrial Demand (I)	0	180	288	405	798	1,069	1,294	1,883	2,355	2,856
Contract with Leander[6]			2,400							
Total M&I Demand	2,024	3,770	5,782	7,571	10,069	11,451	12,742	15,815	17,219	18,349
Water Supply (Surface)[7]	7,000	7,000	9,400	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Supply minus Demand[3]	4,976	3,230	3,618	(571)	(3,069)	(4,451)	(5,742)	(8,815)	(10,219)	(11,349)
Leander Service Area										
Municipal Demand (M)	871	1,380	1,891	2,506	2,979	3,625	3,736	4,832	5,759	6,934
Industrial Demand (I)	0	0	40	80	125	180	250	350	500	1,000
Total M&I Demand	871	1,380	1,931	2,586	3,104	3,805	3,986	5,182	6,259	7,934
Water Supply										
Contract with Cedar Park/LCRA[6]			2,400							
Contract/Stillhouse Hollow Lake			2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700
Contract/Chisolm Trail SUD[8]		784	403	313	224	112				
Ground(Trinity Aquifer)	871	596	392	0	0	0	0	0	0	0
Total Supply	871	1,380	5,895	3,013	2,924	2,812	2,700	2,700	2,700	2,700
Supply minus Demand[3]	0	0	3,964	427	(180)	(993)	(1,286)	(2,482)	(3,559)	(5,234)
Brushy Creek Municipal Utility District										
Municipal Demand (M)	984	1,500	2,538	3,626	3,955	4,112	4,214	4,345	4,239	4,212
Water Supply										
Contract with Round Rock[9]	3,360	3,360	3,360	3,360						
Contract/Stillhouse Hollow Lake			4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Ground (Edwards Aquifer)	112	112	1,792	1,792	1,792	1,792	1,792	1,792	1,792	1,792
Total Supply	3,472	3,472	9,152	9,152	5,792	5,792	5,792	5,792	5,792	5,792
Supply minus Demand[3]	2,488	1,972	6,614	5,526	1,837	1,680	1,578	1,447	1,553	1,580

Table S-5 continued

Area	Use in 1990	Projections (acft/yr)								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
Liberty Hill										
Municipal Demand (M)	136	180	201	254	298	372	440	621	834	1,068
Water Supply (Ground) [10]	200	200	200	200	200	200	200	200	200	200
Supply minus Demand[3]	64	20	(1)	(54)	(98)	(172)	(240)	(421)	(634)	(868)
Georgetown Service Area										
Municipal Demand (M)	4,250	5,611	7,052	8,513	10,444	12,560	13,826	17,416	21,962	27,800
Industrial Demand (I)	130	130	398	809	1,425	1,950	2,443	3,481	4,600	5,800
Total M&I Demand	4,380	5,741	7,450	9,322	11,869	14,510	16,269	20,897	26,562	33,600
Water Supply										
Contract/Lake Georgetown	6,720	6,720	6,720	6,720	6,720	6,720	6,720	6,720	6,720	6,720
Contract/Stillhouse Hollow Lake		5,448	15,448	15,448	15,448	15,448	15,448	15,448	15,448	15,448
Ground (Edwards Aquifer)	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360
Total Supply	10,080	15,528	25,528	25,528	25,528	25,528	25,528	25,528	25,528	25,528
Supply minus Demand[3]	5,700	9,787	18,078	16,206	13,659	11,018	9,259	4,631	(1,034)	(8,072)
Taylor										
Municipal Demand (M)	2,038	2,691	3,016	3,818	3,874	4,838	5,155	5,861	6,663	7,958
Industrial Demand (I)	33	35	90	150	200	250	300	400	500	600
Total M&I Demand	2,071	2,726	3,106	3,968	4,074	5,088	5,455	6,261	7,163	8,558
Water Supply										
Contract/Granger Lake	6,721	6,721	6,721	6,721	6,721	6,721	6,721	6,721	6,721	6,721
Ground	0	0	0	0	0	0	0	0	0	0
Total Supply	6,721	6,721	6,721	6,721	6,721	6,721	6,721	6,721	6,721	6,721
Supply minus Demand[3]	4,650	3,995	3,615	2,753	2,647	1,633	1,266	460	(442)	(1,837)

Table S-5 continued

Area	Use in 1990	Projections (acft/yr)								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
Jonah SUD										
Municipal Demand (M)	660	871	930	1,177	1,281	1,600	1,722	2,258	2,891	3,611
Water Supply										
Contract/Stillhouse Hollow Lake	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439	2,439
Ground (Edwards Aquifer)	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688
Total Supply	5,127	5,127	5,127	5,127	5,127	5,127	5,127	5,127	5,127	5,127
Supply minus Demand[3]	4,467	4,256	4,197	3,950	3,846	3,527	3,405	2,869	2,236	1,516
Hutto										
Municipal Demand (M)	72	95	131	166	194	242	281	396	532	681
Contract with Manville	336	336	336	336	336	336	336	336	336	336
Water Supply (Edwards Aquifer	131	131	131	131	131	131	131	131	131	131
Total Supply	467	467	467	467	467	467	467	467	467	467
Supply minus Demand[3]	395	372	336	301	273	225	186	71	(65)	(214)
Other Water Utilities/East of I35										
Municipal Demand (M)	1,191	1,239	1,228	1,379	1,533	2,128	2,839	3,367	3,643	3,834
Water Supply (Ground)	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Supply minus Demand[3]	109	61	72	(79)	(233)	(828)	(1,539)	(2,067)	(2,343)	(2,534)
Other Water Utilities/West of I35										
Municipal Demand (M)	3,165	3,262	3,166	3,557	3,625	5,305	7,167	8,264	8,749	9,254
Water Supply										
Contract/Stillhouse Hollow Lake	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110
Ground	3,342	3,342	3,342	3,342	3,342	3,342	3,342	3,342	3,342	3,342
Total Supply	4,452	4,452	4,452	4,452	4,452	4,452	4,452	4,452	4,452	4,452
Supply minus Demand[3]	1,287	1,190	1,286	895	827	(853)	(2,715)	(3,812)	(4,297)	(4,802)

Table S-5 continued

Area	Use in 1990	Projections (acft/yr)								
		1995	2000	2005	2010	2015	2020	2030	2040	2050
Remainder of County/East of I35										
Municipal Demand (M)	1,167	1,541	1,961	2,352	2,835	3,936	5,251	6,252	6,648	6,985
Water Supply (Ground)	1,541	1,541	1,541	1,541	1,541	1,541	1,541	1,541	1,541	1,541
Supply minus Demand[3]	374	0	(420)	(811)	(1,294)	(2,395)	(3,710)	(4,711)	(5,107)	(5,444)
Remainder of County/West of I35										
Municipal Demand (M)	778	1,027	1,448	1,700	1,890	2,440	3,343	4,239	4,394	4,655
Water Supply (Ground)	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027
Supply minus Demand[3]	249	0	(421)	(673)	(863)	(1,413)	(2,316)	(3,212)	(3,367)	(3,628)
Total Municipal Demand	24,482	32,420	43,521	54,523	62,696	77,163	88,849	105,409	119,453	133,526
Other Water Demands										
Industrial	326	347	2,653	8,435	13,057	14,596	15,154	17,579	19,919	23,688
Steam-Electric	0	0	0	0	0	0	0	0	0	0
Irrigation	160	160	160	160	160	160	160	160	160	160
Mining	1,713	1,799	1,885	1,865	1,845	1,870	1,896	1,949	2,007	2,068
Livestock	1,508	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Total Other Demands	3,707	3,620	6,012	11,774	16,376	17,940	18,524	21,002	23,400	27,230
Other Water Supply										
Ground	3,620	3,620	3,620	3,620	3,620	3,620	3,620	3,620	3,620	3,620
Williamson County Summary										
Total M&I Demand	24,808	32,767	46,174	62,958	75,753	91,759	104,003	122,988	139,372	157,214
Total M&I Supply[6]	58,132	77,757	105,702	100,787	97,945	98,419	98,369	98,369	98,369	98,369
Supply minus Demand[3]	33,324	44,990	59,528	37,829	22,192	6,660	(5,634)	(24,619)	(41,003)	(58,845)

Footnotes are on next page.

Table S-5 continued

Source: Water Demand Projections are from Texas Water Development Board, 1996 Concensus Water Plan Projections, Most Likely Case: Dry Weather/Average Water Conservation. Water Supply information is from TWDB ground and surface water studies, individual Water Suppliers', information, and HDR computations for this study.

[1]Contract terminates in year 2006.

[2]Contract terminates in year 2000.

[2]Contract terminates in year 2000.

[3] Positive values mean projected surpluses, while ( ) values mean projected shortages.

[4] Included in City of Austin Northwest A pressure Zone demands listed in Table S-4.

[5]Included in City of Austin supplies listed in Table S-4.

[6]Contract with Cedar Park and the Lower Colorado River Authority, which terminates in year 2000.

[7] Assuming that contracts with the Lower Colorado River Authority are renewed to continue beyond present 2014 expiration date.

[8]Present contract is projected to decline from 784 acft/yr in 1995 to 112 acft/yr in 2015 , and to zero thereafter.

[9] Contract with Round Rock, which expires in 2006.

[10] Liberty Hill is supplied by Chisolm Trail WSC.

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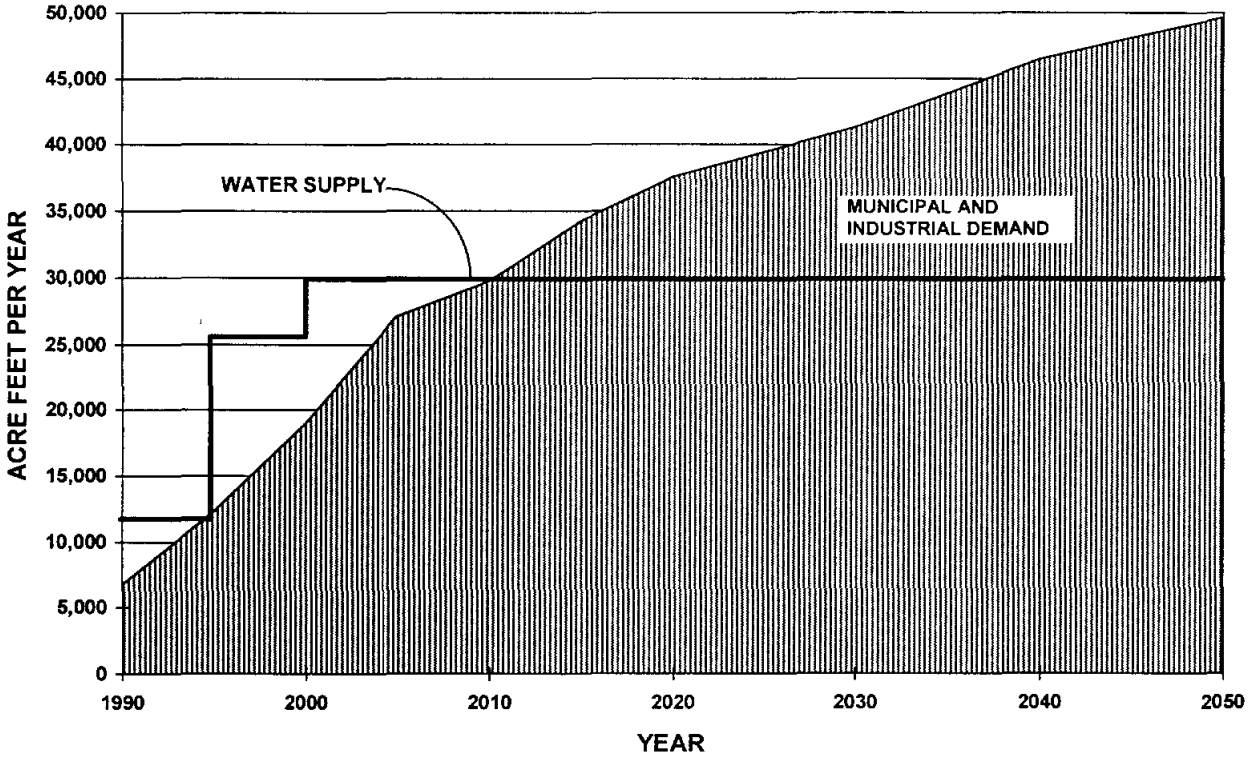

City of Round Rock Water Supply:

Round Rock has a groundwater supply from its Williamson County Edwards Aquifer wells of 5,040 acft/yr, a contract with the Brazos River Authority for 6,720 acft/yr of water from Lake Georgetown, a contract with the Brazos River Authority for 18,134 acft/yr of Stillhouse Hollow Lake water, and a contract with the City of Austin for 5,376 acft/yr through year 2000. Total supplies available to Round Rock from ground and surface sources is estimated at 29,894 acft/yr for the period 2000 through 2050

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NORTH CENTRAL STUDY AREA

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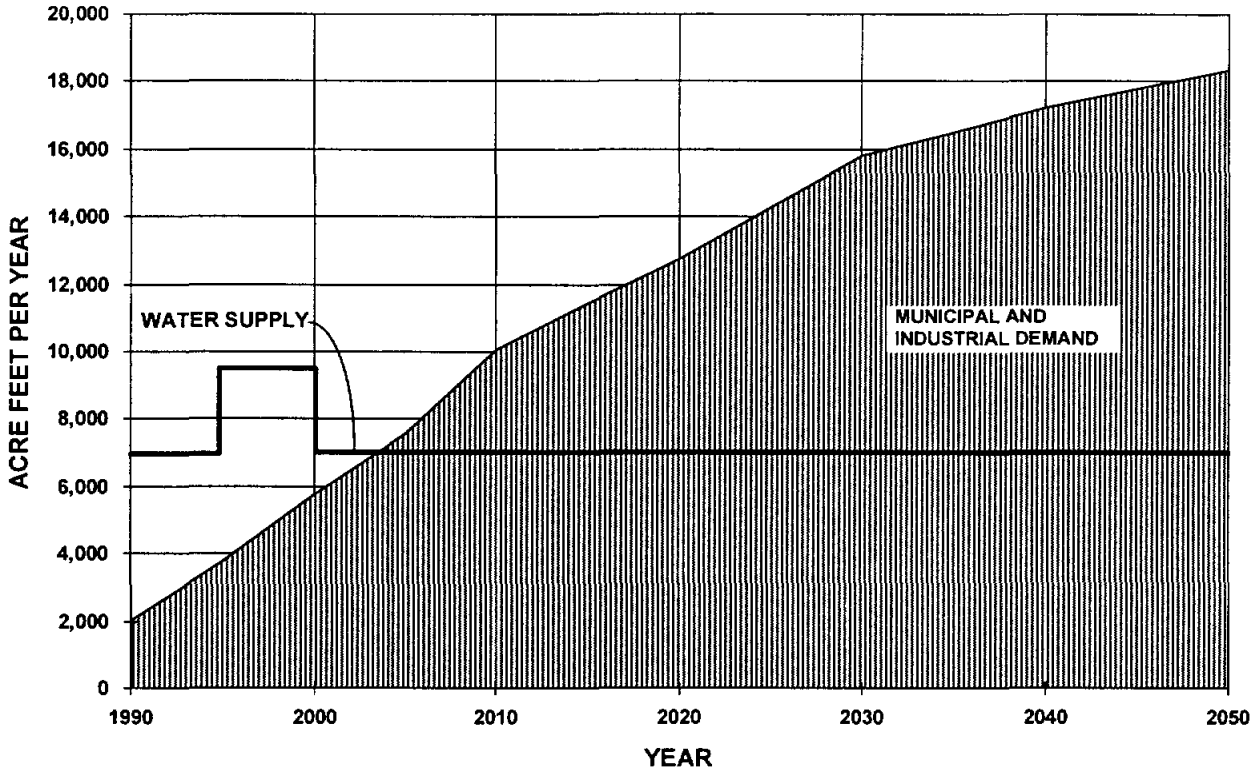
WATER DEMAND AND SUPPLY COMPARISON CITY OF ROUND ROCK

FIGURE S-8



City of Cedar Park Water Supply:

The City of Cedar Park water supply is obtained from Lake Travis through two contracts with the LCRA. The first contract, which terminates on June 1, 2014, but is renewable on an annual basis if both parties agree to a renewal, provides for a maximum diversion of 7,000 acft/yr. A second contract for 2,400 acft/yr was obtained in 1996 and provides this water to Cedar Park, which in turn provides 2,400 acft/yr of water to neighboring Leander through year 2000, at which time the 2,400 acft/yr reverts to LCRA. Thus, Cedar Park's present water supply is 7,000 acft/yr.

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NORTH CENTRAL STUDY AREA

WATER DEMAND AND SUPPLY COMPARISON CITY OF CEDAR PARK

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FIGURE S-9

S-4.2.5 Brushy Creek MUD

The Brushy Creek MUD water supply contract with Round Rock for 3,360 acft/yr expires in 2006. In 1996, Brushy Creek MUD arranged to obtain 4,000 acft/yr of Stillhouse Hollow lake water from BRA. In addition, Brushy Creek MUD's Edwards Aquifer wells are estimated to produce 1,792 acft/yr. Thus, with the Lake Stillhouse Hollow water, the Brushy Creek MUD projected demands can be met through 2050 (Table S-5 and Figure S-11).

S-4.2.6 Liberty Hill

Liberty Hill's projected water demands increase to 201 acft/yr in 2000, which almost exactly equals the present 200 acft/yr of supply available via contract with the Chisholm Trail SUD. Assuming the present contract is continued, Liberty Hill would have a shortage of 54 acft/yr in 2005, 98 acft/yr in 2010, 240 acft/yr in 2020, and 868 acft/yr in 2050 (Table S-5).

S-4.2.7 Georgetown

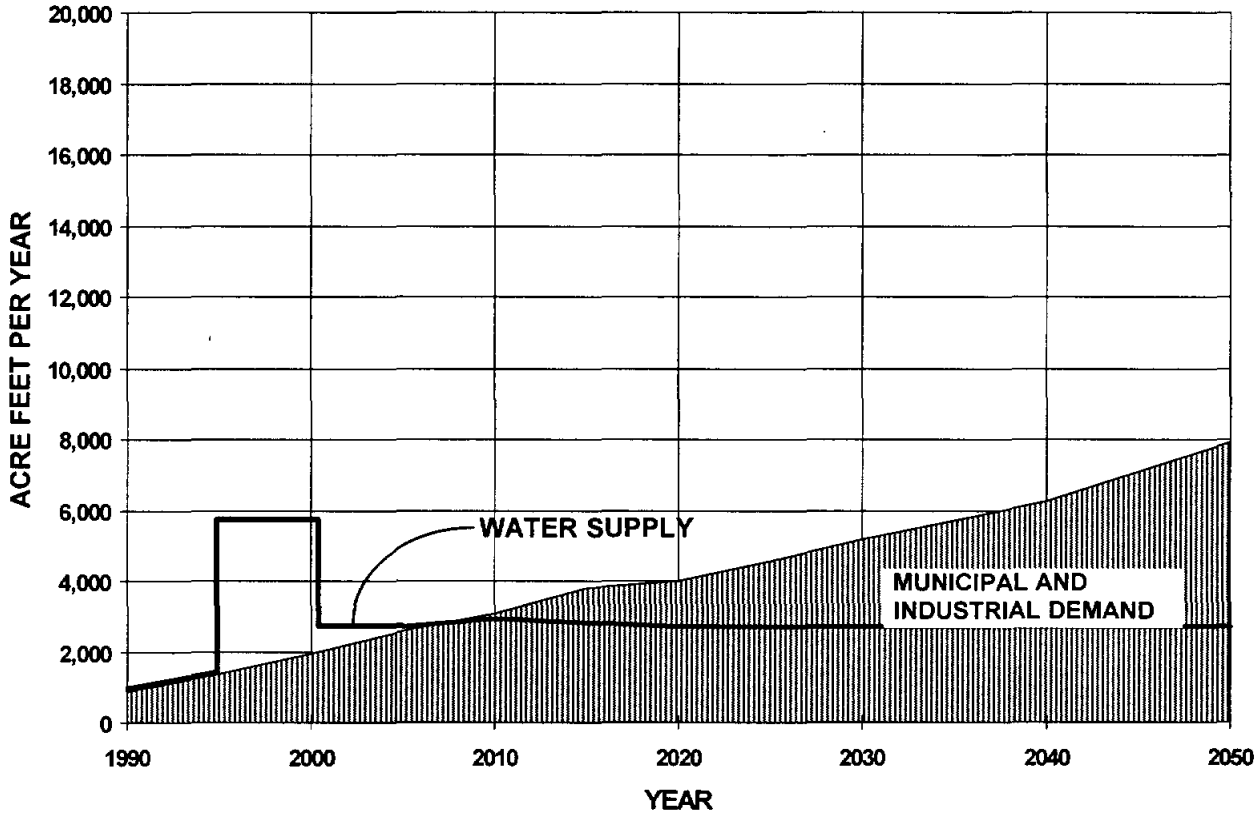
Georgetown's projected water supplies of 25,528 acft/yr (22,168 acft/yr of surface water from Lake Georgetown and Stillhouse Hollow Lake and 3,360 acft/yr of groundwater from the Edwards Aquifer) are adequate to meet projected demands to about the year 2038. Projected shortages in 2040 are 1,034 acft/yr, and in 2050 are 8,072 acft/yr (Table S-5 and Figure S-12).

S-4.2.8 Taylor

Taylor's water supply of 6,721 acft/yr from Granger Lake is projected to be adequate to meet projected demands to approximately 2035. In 2040, projected shortages are 442 acft/yr, and in 2050 are 1,837 acft/yr (Table S-5).

S-4.2.9 Jonah Special Utility District

Jonah SUD's surface water supply of 2,439 acft/yr from Stillhouse Hollow Lake and groundwater supply of 2,688 acft/yr from the Edwards Aquifer (total of 5,127 acft/yr) is greater than projected demands through 2050 (Table S-5 and Figure S-13). Based upon these projections, Jonah SUD has a surplus of 4,197 acft/yr in 2000, 3,405 acft/yr in 2020, and 1,516 acft/yr in 2050 (Table S-5 and Figure S-13).



City of Leander Water Supply:

Leander obtains its water through a wholesale services contract with Chisholm Trail Special Utility District, from wells, and through a contract with Cedar Park. The Trinity Group Aquifer in which Leander's wells are completed is inadequate to continue to meet the City's needs (i.e., well yields are predicted to decline from the 871 acft supplied in 1990 to 392 acft/yr in 2000, and to zero in 2005. Chisholm Trail Special District (SUD) provides a supply of water which is projected to decline.

The Contract between Leander and Cedar Park provides Leander with up to 2,400 acft/yr of treated water through year 2000. The Cedar Park/Leander agreement is based upon the condition that LCRA agrees to provide Cedar Park an additional 2,400 acft/yr of water to meet part of Leander's water needs. In 1996, Leander arranged to contract with the Brazos River Authority (BRA) to obtain 2,700 acft/yr of water from Stillhouse Hollow Lake. Thus until 2001, Leander has a supply of 5,895 acft/yr and thereafter has 2,700 acft/yr.

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WATER DEMAND AND SUPPLY COMPARISON CITY OF LEANDER

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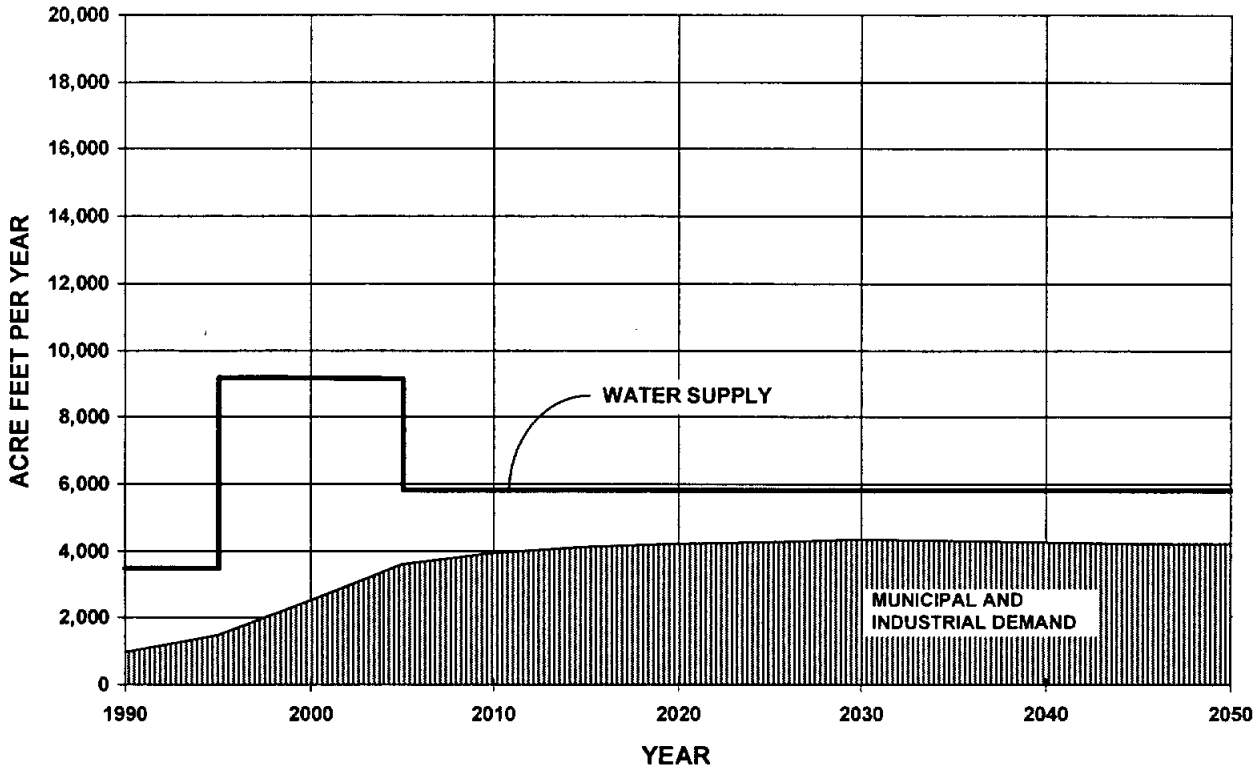
FIGURE S-10



Brushy Creek Municipal Utility District Water Supply:

Brushy Creek Municipal Utility District's (MUD) Edwards Aquifer wells have an estimated yield of 1,792 acft/yr. The District has a contract with Round Rock, which expires in 2006, for 3,360 acft/yr of surface water and has obtained 4,000 acft/yr of Stillhouse Hollow Lake water from BRA. Thus, the Brushy Creek MUD water supply is 9,152 acft/yr through 2006, and 5,792 acft/yr thereafter.

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NORTH CENTRAL STUDY AREA

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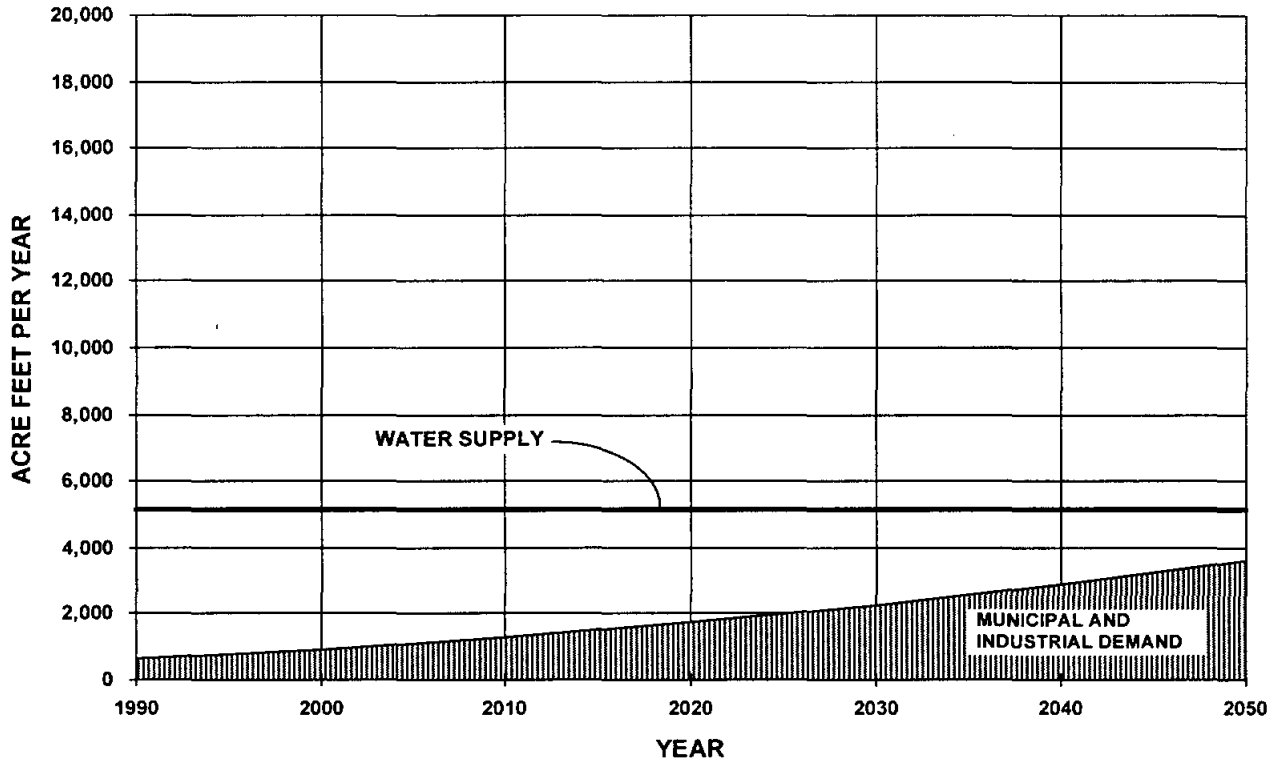
WATER DEMAND AND SUPPLY COMPARISON BRUSHY CREEK MUD

FIGURE S-11



Jonah Special Utility District Water Supply:

Through a contract with the Brazos River Authority, the Jonah Special Utility District (SUD) has a water supply of 2,439 acft/yr from Stillhouse Hollow Lake. In addition, Jonah SUD as a groundwater supply of 2,688 acft/yr, bringing its total supply to 5,127 acft/yr.

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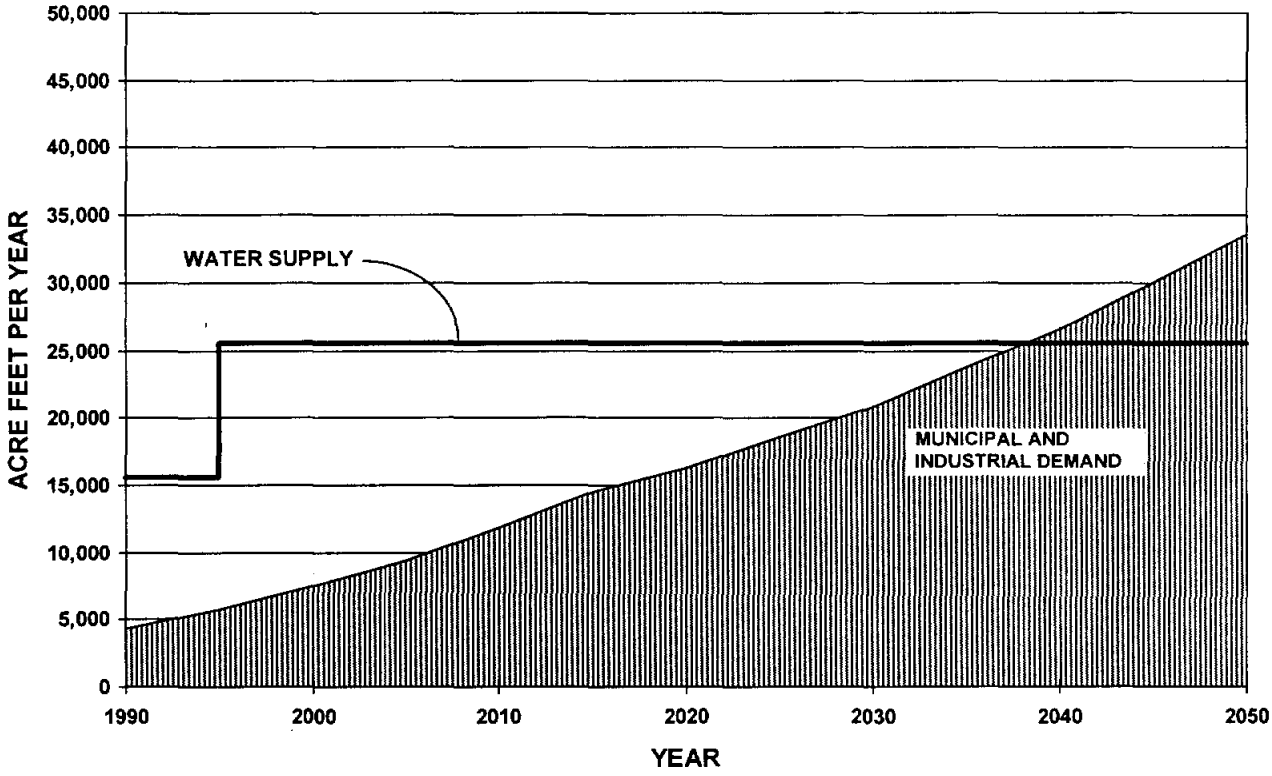
WATER DEMAND AND SUPPLY COMPARISON JONAH SUD

HDR Engineering, Inc.

FIGURE S-13



City of Georgetown Water Supply:

Through contracts with the BRA, Georgetown has 6,720 acft/yr of water from Lake Georgetown, and 15,448 acft/yr of water from Stillhouse Hollow Lake. In addition, Georgetown's Edwards Aquifer wells have an estimated dependable yield of 3,360 acft/yr, bringing Georgetown's water supply to a total of 25,528 acft/yr.

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NORTH CENTRAL STUDY AREA

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WATER DEMAND AND SUPPLY COMPARISON CITY OF GEORGETOWN

FIGURE S-12

S-4.2.10 Hutto

Hutto's present supply of 467 acft/yr from the Edwards Aquifer is projected to meet demands through year 2000. A recently concluded contract to purchase 336 acft/yr from Manville WSC for 336 acft/yr will support demands until about 2040. (Table S-5 and Figure S-14).

S-4.2.11 Other Water Utilities/East of IH-35

Estimated water supplies of the seven water utilities east of IH-35, that are not study participants, of 1,300 acft/yr are projected to meet demands to about 2003. Projected shortages in year 2005 are 79 acft/yr, in 2020 are 1,539 acft/yr, and in 2050 are 2,534 acft/yr (Table S-5).

S-4.2.12 Other Water Utilities/West of IH-35

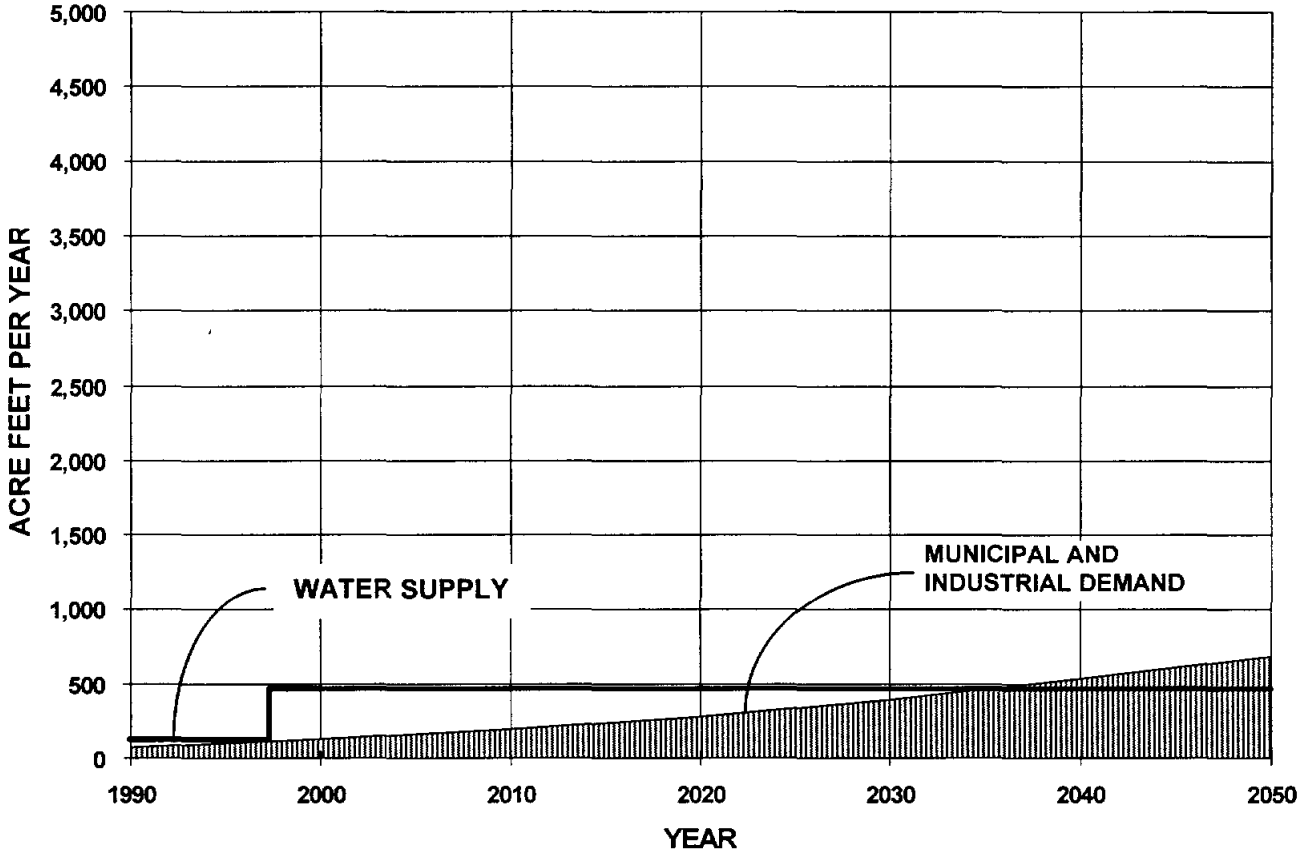
Estimated water supplies of the eleven (11) water utilities west of IH-35, that are not study participants, of 4,452 acft/yr are projected to meet demands to about the year 2012. Projected shortages in these areas in 2015 are 853 acft/yr, in 2020 are 2,715 acft/yr, and in 2050 are 4,802 acft/yr (Table S-5).

S-4.2.13 Remainder of Williamson County/East of IH-35

For that part of Williamson County east of IH-35 that depends upon individual household and business wells completed in local aquifers, the estimated present supplies of 1,541 acft/yr are about equal to present demands. Projected shortages in 2000 are 420 acft/yr, in 2020 are 3,710 acft/yr, and in 2050 are 5,444 acft/yr (Table S-5).

S-4.2.14 Remainder of Williamson County/West of IH-35

For that part of Williamson County west of IH-35 that depends upon individual household and business wells completed in local aquifers, the estimated present supplies of 1,027 acft/yr are about equal to present demands. However, unless these supplies can be increased, projected shortages of 421 acft/yr occur in year 2000, and increase to 2,316 acft/yr in 2020, and to 3,628 acft/yr in 2050 (Table S-5).



City of Hutto:

Hutto has an estimated groundwater supply of 131 acft/yr and a contract with Manville WSC for 336 acft/yr.

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NORTH CENTRAL STUDY AREA

WATER DEMAND AND SUPPLY COMPARISON CITY OF HUTTO

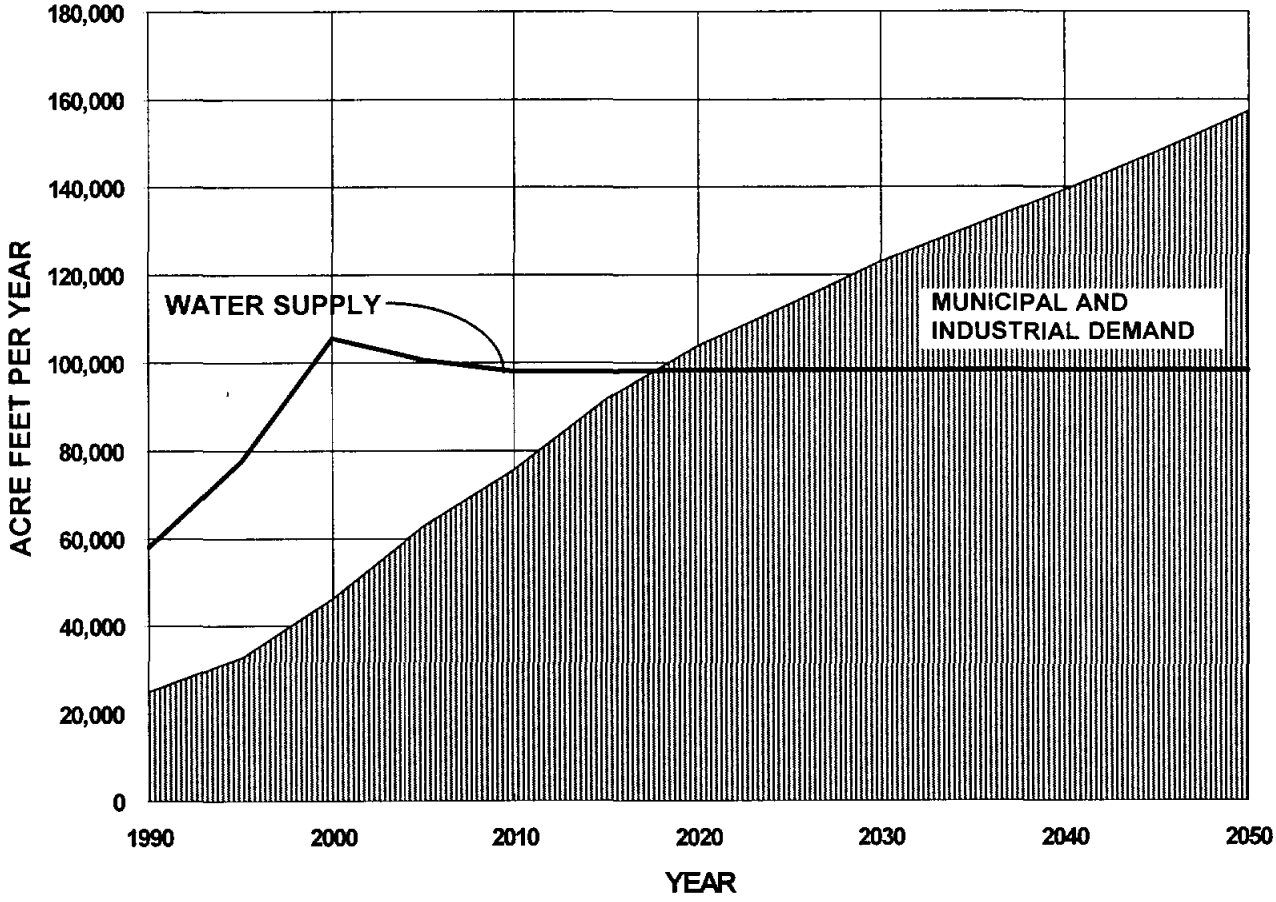
HDR Engineering, Inc.

FIGURE S-14

S-4.2.15 Williamson County Summary of Municipal and Industrial Water Demands

In 1990, total municipal and industrial (M&I) water use in Williamson County was 24,808 acft/yr. Projected M&I water demand in year 2000 is 46,174 acft/yr, in 2020 is 104,003 acft/yr and in 2050 is 157,214 acft/yr. Supplies available within the county from local groundwater, existing surface water reservoirs (Lake Georgetown and Granger Lake), and through contracts with LCRA and BRA for water from Lakes Travis and Stillhouse Hollow Lake, respectively, are large enough to meet projected total M&I demands within the county through about the year 2018 (Table S-5 and Figure S-15). Williamson County M&I water shortages in 2030 are projected at 24,619 acft/yr, and in 2050 are 58,845 acft/yr (Table S-5 and Figure S-15).

These comparisons are county totals. In some cases, available water supplies are distant from the demand centers and delivery facilities must be constructed to utilize available water supplies.



Williamson County Water Supply:

Estimated total water supply available to the Williamson County study area from all sources—local groundwater, existing reservoirs, and contracts with LCRA and BRA for water from Lakes Travis and Stillhouse Hollow Lake located outside the County is approximately 105,000 acft/yr at the present time.

TRANS TEXAS WATER PROGRAM / NORTH CENTRAL STUDY AREA

WATER DEMAND AND SUPPLY COMPARISON WILLIAMSON COUNTY

HDR Engineering, Inc.

FIGURE S-15

S-5 SUMMARY OF POTENTIAL WATER SUPPLY ALTERNATIVES

A total of 18 primary water supply alternatives have been evaluated in this Phase II study. Each of these alternatives was evaluated for water supply potential, environmental effects, and cost. Detailed descriptions and technical evaluations performed for each of these alternatives are included in Volume 2 of this study. Alternatives have been grouped into three general categories as follows:

- Conservation and Reuse
- Brazos River Basin Sources
- Colorado River Basin Sources.

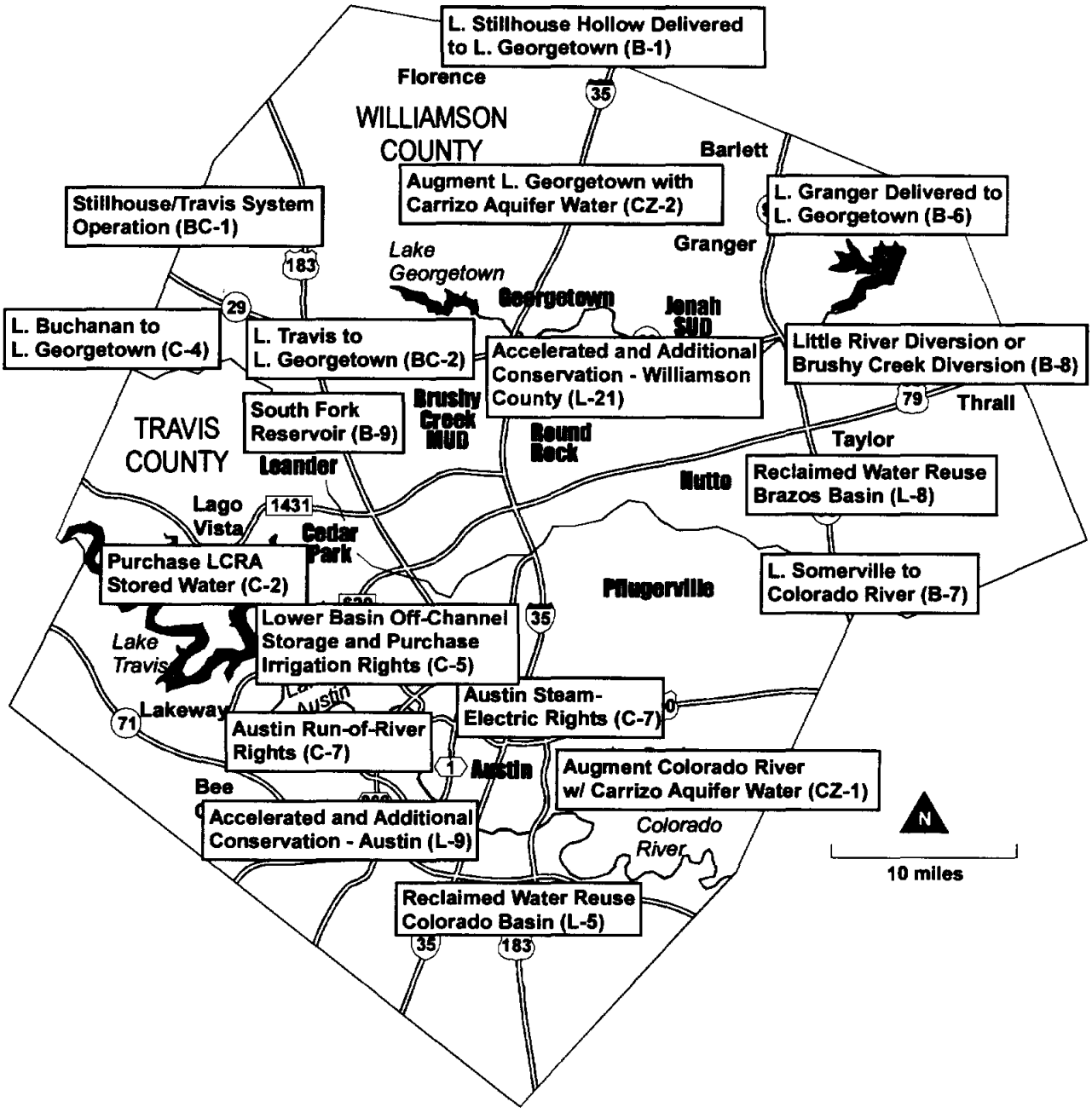
The alternatives are listed in Table S-6 and the locations of the water supply sources for each alternative are shown on Figure S-16.

S-5.1 Water Delivery Locations

Many of the water supply alternatives could provide increased water supply to the entire study area, while other alternatives can realistically only provide service to one or several entities. To allow direct comparison of costs between alternatives, five key locations for delivery of treated water were chosen for development of cost estimates. The five delivery locations used for cost comparison of alternatives include:

- **City of Austin Service Area.** For water supply alternatives that could be diverted at Lake Travis, costs were estimated for construction of WTP 4 on Lake Travis and included necessary distribution facilities to convey new water supplies into Austin's distribution system and to supply wholesale customers on the periphery of the Austin system.
- **Cedar Park WTP.** For supply alternatives that could be diverted at Lake Travis through Cedar Park's facilities, costs were estimated for expansion of the treatment and pumping facilities at the Cedar Park plant. In some cases, costs of treated water conveyance facilities from the Cedar Park plant to other entities were also estimated as part of the stand-alone project analysis.
- **City of Round Rock WTP and City of Georgetown WTP.** Round Rock and Georgetown each own and operate separate intake and treatment facilities at Lake Georgetown and expansion of either of these facilities could benefit others. For alternatives which include additional water supply in Lake Georgetown, costs were estimated for expansion of each of these existing facilities.

Table S-6 Water Supply Alternatives — North Central Study Area	
Conservation/Local Alternatives	
Alt No.	**Description**
L-9	Accelerated and Additional Municipal Water Conservation for the Austin Service Area
L-21	Accelerated and Additional Municipal Water Conservation for Williamson County Area
L-5	Reclaimed Water Reuse —Areas in the Colorado River Basin
L-8	Reclaimed Water Reuse — Areas in the Brazos River Basin
Brazos River Basin Sources	
Alt No.	**Description**
B-1	Purchase of Water from Brazos River Authority at Lake Stillhouse Hollow Delivered to Lake Georgetown
B-6	Purchase of Water from Brazos River Authority at Lake Granger Delivered to Lake Georgetown
B-8	Water Availability from Little River or Brushy Creek
B-9	South Fork Reservoir
CZ-2	Use of Carrizo-Wilcox Aquifer to Augment Lake Georgetown Yield
Colorado River Basin Sources	
Alt No.	**Description**
C-7	Water Available from Austin's Existing Rights
B-7	Purchase and Transfer of Yield from Lake Somerville in the Brazos River Basin to the Colorado River
C-2	Purchase of Uncommitted Stored Water from LCRA for Diversion at Lake Travis
C-4	Purchase of Water from LCRA Near Lake Buchanan Delivered to Lake Georgetown
C-5	Purchase of Irrigation Rights in the Lower Colorado River Basin with Off-Channel Storage Near Columbus in Exchange for Additional Water from Lake Travis
C-6	Potential Use of Austin Steam-Electric Generation Water Rights for Municipal use
CZ-1	Use of Carrizo-Wilcox Aquifer to Augment Colorado River Flows
BC-1	System Operation of Lake Stillhouse Hollow and Lake Travis
BC-2	Purchase of Uncommitted Water Stored in Lake Travis to Augment Lake Georgetown



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TRANS-TEXAS WATER PROGRAM/ NORTH CENTRAL STUDY AREA

WATER SUPPLY ALTERNATIVES

FIGURE S-16

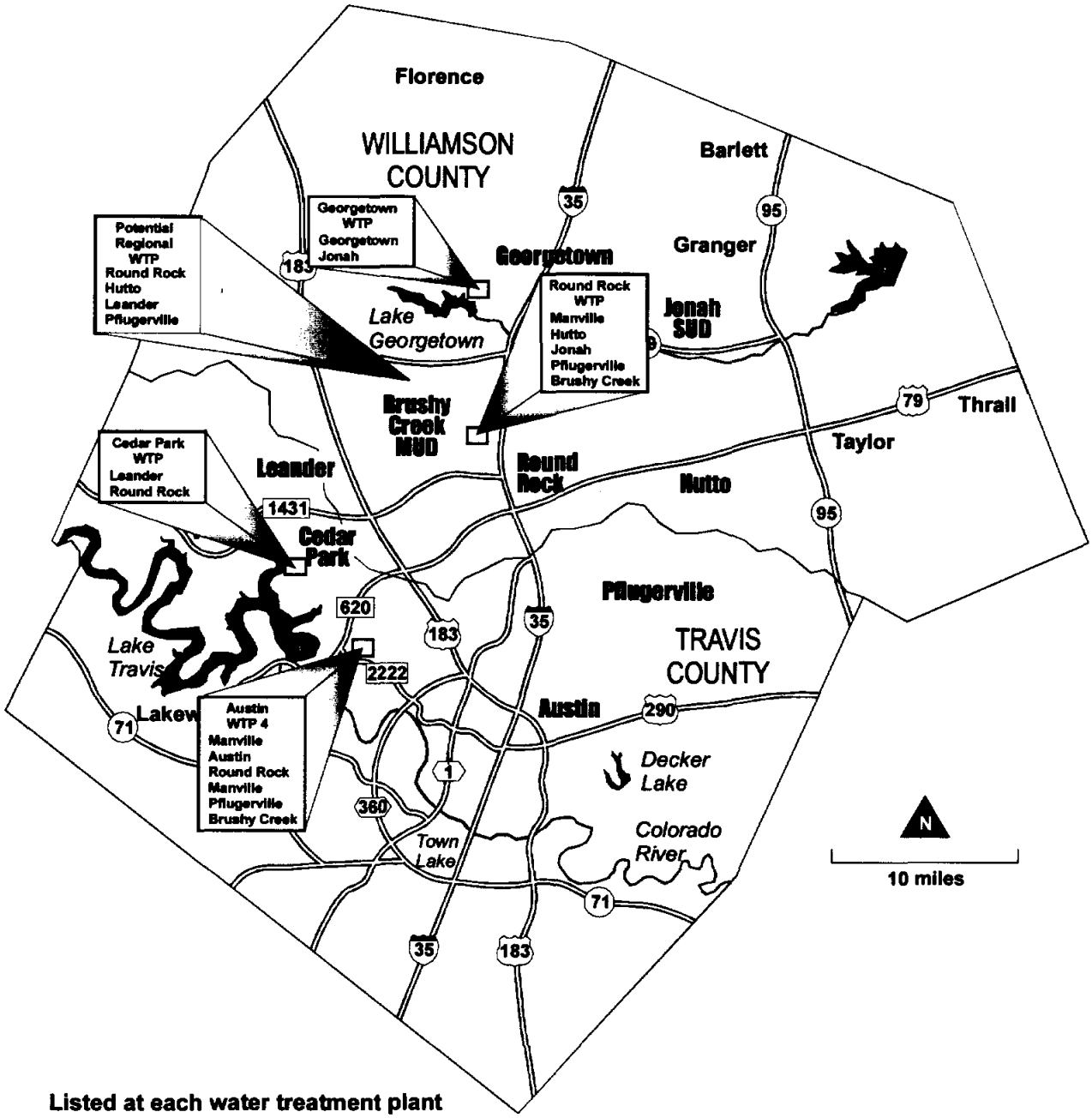
- **Williamson County Regional WTP.** This would be a potential new water treatment plant to be located at or near Round Rock's existing water treatment plant and could possibly provide service to one or more of these entities: southern Georgetown, Round Rock, Cedar Park, Leander, Brushy Creek MUD, Pflugerville, Hutto, and possibly others.

Each of these five delivery locations are shown in Figure S-17 along with a list of potential users of the water from these treatment plants.

Table S-7 is a summary table for all of the alternatives compared on a standalone basis indicating the costs to provide treated water at each of the five key delivery locations. Table S-7 lists the potential available water supply, a summary of potential environmental issues and special concerns, and the estimated unit cost in 1996 dollars (including capital, operation and maintenance, and water purchase costs) of the water supply alternatives. Unit costs for treated water to entities other than the five WTP delivery locations are provided in the integrated plan phase. During development of the integrated water supply plans, conceptual delivery systems and cost estimates were developed for all projects even though some participants will not directly receive water from the delivery locations listed above.

Costs for treated water at Cedar Park, Round Rock, Georgetown, and a possible Williamson County regional WTP are inclusive of all components at the treatment plant and raw water purchase costs. Distribution, elevated storage, and retail delivery costs are not included.

Costs for treated water through the City of Austin WTP 4 are inclusive of all treatment plant components and also include major transmission pipelines, pump stations, and large storage reservoirs. Purchase of raw water is also included.



Listed at each water treatment plant location are the entities that could potentially receive water in the integrated supply plan.

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TRANS-TEXAS WATER PROGRAM/ NORTH CENTRAL STUDY AREA

WATER DELIVERY LOCATIONS AND POSSIBLE USERS

FIGURE S-17

Table S-7
Summary of Potential Water Supply Alternatives for the Trans-Texas Water Program — North Central Study Area

Alternative	Supply Available or Project Capacity (acft/yr)	Unit Cost of Additional Water Supply[1] ($ per acft/yr) (1996 Dollars)					Environmental Issues/ Special Concerns
		Austin Service Area[2]	Cedar Park	Round Rock	Georgetown	Williamson Co. Regional WTP[3]	
Conservation and Reuse							
L-9 Accelerated and Additional Conservation — Austin Service Area	11,000	$203					Reduced return flows to Colorado River.
L-21 Accelerated and Additional Conservation — Williamson County	13,000		$413	$413	$413		Reduced return flows to Brazos River.
L-5 Reuse — Austin Service Area							For options using Decker Lake and Lake Austin, increased nutrient levels will occur. Public acceptance issues. Slight reductions in return flows to Colorado River.
A. Central Reuse Project	2,590	$363					
Central Reuse Project w/ use of L. Austin	14,900	$394					
B. South Reuse System	1,938	$807					
C. Northwest Water Reclamation Plan	1,000	$3,105					
D. Reuse at Decker Lake	4,505	$109					
E. Reuse at Semiconductor Plant	375	($341)[a]					[a]Avoided water purchase and wastewater treatment costs create a net cost benefit.
L-8 Reuse — Williamson County							Firm water supply is for nonpotable
A. Landscape Irrigation, Restricted Access	2,600		$263	$263	$263		irrigation use. Replaces use of municipal raw water supply, thereby increasing overall supply. Public acceptance issues.
B. Industrial Process or Public Access Irrigation	2,600		$543	$543	$543		Slight reduction in return flows.

[1] Costs are for treated water at the treatment plant locations listed. Costs include purchase of raw water (when applicable).
[2] Costs include treatment and major transmission, pumping, and storage facilities where applicable.
[3] Potential water treatment plant to be located near Williamson County demand centers.

Table S-7
Summary of Potential Water Supply Alternatives for the Trans-Texas Water Program — North Central Study Area (Continued)

Alternative	Supply Available or Project Capacity (acft/yr)	Unit Cost of Additional Water Supply[1] ($ per acft/yr) (1996 Dollars)					Environmental Issues/ Special Concerns
		Austin Service Area[2]	Cedar Park	Round Rock	Georgetown	Williamson Co. Regional WTP[3]	
Brazos River Basin Alternatives							
B-1 Lake Stillhouse Hollow Water to Lake Georgetown	42,721			$513	$459	$463	Potential effects on endangered and important species can be mitigated w/ pipeline alignment. Potential minor water quality changes in Lake Georgetown.
B-6 Lake Granger to Lake Georgetown	4,060			$980	$854	$980	Water quality effects at Lake Georgetown; potential terrestrial impacts near Lake Georgetown to be mitigated with pipeline alignment.
B-8 Little River or Brushy Creek Diversion to Augment Lake Georgetown	19,160			$637	$576	$637	Potential increased nutrient loading in Lake Granger and Lake Georgetown. Instream flow changes in Brushy Creek
B-9 South Fork Reservoir	5,950					$1,830	Inundates 980 acres; terrestrial habitat impact.
CZ-2 Carrizo-Wilcox Aquifer to Lake Georgetown							Lowering of the water table in the outcrop. Potential effects on
A,C Uniform Delivery *(Conventional WTP)*	25,000			$777	$718	$777	endangered and important terrestrial species.
B,D Summer Peak Delivery *(Specialized WTP for Carrizo Water)*	25,000			$573	$614	$573	Potential effects on water quality of Lake Georgetown. Increased flows in Brazos River Basin

[1] Costs are for treated water at the treatment plant locations listed. Costs include purchase of raw water (when applicable).
[2] Costs include treatment and major transmission, pumping, and storage facilities where applicable.
[3] Potential water treatment plant to be located near Williamson Co. demand centers.

Table S-7
Summary of Potential Water Supply Alternatives for the Trans-Texas Water Program — North Central Study Area (Continued)

Alternative	Supply Available or Project Capacity (acft/yr)	Unit Cost of Additional Water Supply[1] ($ per acft/yr) (1996 Dollars)					Environmental Issues/ Special Concerns
		Austin Service Area[2]	Cedar Park	Round Rock	Georgetown	Williamson Co. Regional WTP[3]	
Colorado River Basin Alternatives							
C-6 Austin Steam-Electric Water Rights	23,960	$275					LCRA settlement agreement firms 40,156 for steam-electric use only; implementation for municipal use would require amended agreement; change in Austin's generation plans could reduce availability.
C-7 Austin's Existing Water Rights	Up to limits of existing rights and terms of LCRA-Austin Agreement	$275					Cost shown is for a 30,000 acft/yr expansion (about 60 mgd) of current treatment plants for a total annual capacity of about 160,000 acft. See Alt. C-2 for costs of WTP4 to treat additional water supplies.
B-7 Lake Somerville to Colorado River to Increase Water Availability at Lake Travis through Water Trades	29,100[a]	$719[b]	$532[b]	$561[b]			Lake Somerville is in the Brazos River Basin; interbasin transfer permit required; reduced flow in Brazos River Basin; increased flow in Cummins Creek, Colorado River, and Lavaca—Matagorda Bay and estuary. (a) Water supply shown is the net benefit to Lake Travis, Austin run-of-river rights and other senior rights. (b) Combined cost of the Lake Somerville project and diversion, transmission, and treatment at WTP location shown.

[1] Costs are for treated water at the treatment plant locations listed. Costs include purchase of raw water (when applicable).
[2] Costs include treatment and major transmission, pumping, and storage facilities where applicable.
[3] Potential water treatment plant to be located near Williamson Co. demand centers.

Table S-7
Summary of Potential Water Supply Alternatives for the Trans-Texas Water Program — North Central Study Area (Continued)

Alternative	Supply Available or Project Capacity (acft/yr)	Unit Cost of Additional Water Supply[1] ($ per acft/yr) (1996 Dollars)					Environmental Issues/ Special Concerns
		Austin Service Area[2]	Cedar Park	Round Rock	Georgetown	Williamson Co. Regional WTP[3]	
Colorado River Basin Alternatives (Continued)							
C-2 Purchase Water from LCRA at Lake Travis	104,967[a] (uncommitted firm yield)						(a) About 200,000 acft/yr is available at Lake Travis to WTP4; 104,967 acft/yr from uncommitted firm yield; 95,000 acft/yr out of the 250,000 acft Austin - LCRA agreement. Diversion in excess of 200,000 acft/yr requires augmentation of Lake Travis. See Alt. B-7, C-5, and CZ-1. Interbasin transfers needed for use in Williamson County.
1. Treatment at WTP4 (Austin Service Area Only) (207 mgd)	139,614[a]	$624					
2. Treatment at WTP4 (Austin, Round Rock, Pflugerville) (222 mgd)	156,190[a]	$611		$611			
3. Treatment at WTP4 (Austin, Round Rock, Pflugerville, BCMUD) (291 mgd)	186,764[a]	$628		$684			
4. Treatment at WTP4 (Austin, Round Rock, Pflugerville, BCMUD, Cedar Park, Leander) (324 mgd)	205,134[a]	$629	$675	$685			

[1] Costs are for treated water at the treatment plant locations listed. Costs include purchase of raw water (when applicable).
[2] Costs include treatment and major transmission, pumping, and storage facilities where applicable.
[3] Potential water treatment plant to be located near Williamson Co. demand centers.

Table S-7
Summary of Potential Water Supply Alternatives for the Trans-Texas Water Program — North Central Study Area (Continued)

Alternative	Supply Available or Project Capacity (acft/yr)	Unit Cost of Additional Water Supply[1] ($ per acft/yr) (1996 Dollars)					Environmental Issues/ Special Concerns
		Austin Service Area[2]	Cedar Park	Round Rock	Georgetown	Williamson Co. Regional WTP[3]	
Colorado River Basin Alternatives (Continued)							
C-2 Purchase Water from LCRA at Lake Travis (Continued)							
5. Treatment at WTP4 (Austin, Round Rock, Pflugerville, BCMUD, Cedar Park, Leander, Georgetown) (356 mgd)	223,206[a]	$685	$728	$736	$755		(b) Capacity to meet proposed year 2030 shortages of 8,816 acft to Cedar Park 5,182 acft to Leander
6. Treatment at CP WTP (Cedar Park, Leander)	13,998[b]		$506				(c) 8,816 acft to Cedar Park, 5,182 acft to Leander, 11,458 acft to Round Rock
							(d) Includes Round Rock and surrounding area shortages.
7. Treatment at CP WTP (Cedar Park, Leander, Round Rock)	25,456[c]		$467	$632			Potential effects on protected and important species can be mitigated with pipeline alignment.
8. Treatment at Will Co Regional (for Round Rock and Surrounding Area (34 mgd)	19,000[d]			$631		$631	
C-4 Purchase Water from LCRA at Lake Buchanan and Deliver to Lake Georgetown							Slight decreases in Colorado River flows; slight increases in Brazos River Basin flows; effects on aquatic and terrestrial species from flow increases in Russell Creek and San Gabriel River; interbasin transfer permit required
A. Treatment at Round Rock or Georgetown WTP	19,000			$649	$596	$649	

[1] Costs are for treated water at the treatment plant locations listed. Costs include purchase of raw water (when applicable).
[2] Costs include treatment and major transmission, pumping, and storage facilities where applicable.
[3] Potential water treatment plant to be located near Williamson Co. demand centers.

Table S-7
Summary of Potential Water Supply Alternatives for the Trans-Texas Water Program — North Central Study Area (Continued))

Alternative	Supply Available or Project Capacity (acft/yr)	Unit Cost of Additional Water Supply[1] ($ per acft/yr) (1996 Dollars)					Environmental Issues/ Special Concerns
		Austin Service Area[2]	Cedar Park	Round Rock	Georgetown	Williamson Co. Regional WTP[3]	
Colorado River Basin Alternatives (Continued)							
C-4 Purchase Water from LCRA at Lake Buchanan and Deliver to Lake Georgetown (Continued)							
B. Treatment at Will Co Regional WTP	42,000					$546	
C-5 Off-Channel Storage in Lower Colorado River Basin to Increase Availability at Lake Travis through Water Trades							Potential environmental effects include effects of terrestrial and aquatic species in Cummins Creek; inundation of terrestrial habitat at reservoir site (6,600 ac)
A. Off-Channel Reservoir Only	36,600[a]	$869[b]	$682[b]	$711[b]			(a) Water supply shown is the net benefit to Lake Travis firm yield, Austin run-of-river rights, and other senior water rights with mitigation for reduced B&E inflows.
B. Off-Channel Reservoir and River Diversion	67,300[a]	$808[b]	$621[b]	$650[b]			
C. Off-Channel Reservoir and Purchase Irrigation Rights	67,400[a]	$739[b]	$552[b]	$581[b]			
D. Off-Channel Reservoir, River Diversion, and Purchase Irrigation Rights	105,200[a]	$724[b]	$537[b]	$566[b]			(b) Combined cost of the lower river basin project and diversion, transmission, and treatment at WTP location shown.

[1] Costs are for treated water at the treatment plant locations listed. Costs include purchase of raw water (when applicable).
[2] Costs include treatment and major transmission, pumping, and storage facilities where applicable.
[3] Potential water treatment plant to be located near Williamson Co. demand centers.

Table S-7
Summary of Potential Water Supply Alternatives for the Trans-Texas Water Program — North Central Study Area (Concluded))

Alternative	Supply Available or Project Capacity (acft/yr)	Unit Cost of Additional Water Supply[1] ($ per acft/yr) (1996 Dollars)					Environmental Issues/ Special Concerns
		Austin Service Area[2]	Cedar Park	Round Rock	Georgetown	Williamson Co. Regional WTP[3]	
Colorado River Basin Alternatives (Concluded)							
CZ-1 Carrizo-Wilcox Aquifer to Augment Colorado River							Environmental effects include potential effects on endangered and important terrestrial and aquatic species due to lowering of the water table in the outcrop; flow changes in sections of the Colorado River; potential effects on terrestrial and aquatic species in Cummins Creek; potential inundation of terrestrial habitat at reservoir site. (a) Water supply shown is the net benefit to Lake Travis from yield, Austin run-of-river rights, and other senior water rights with mitigation for reduced B&E inflows. (b) Combined cost of the Carrizo augmentation project and diversion, transmission, and treatment at WTP location shown.
A. Pump Directly to River	69,100[a]	$644[b]	$457[b]	$486[b]			
B. Pump to Off-Channel Reservoir	90,400[a]	$750[b]	$563[b]	$592[b]			
BC-1 System Operation of Lake Stillhouse Hollow and Lake Travis	800	*	*	*	*	*	*No reasonably cost-effective system operation alternatives were found
BC-2 Purchase Water from LCRA to Augment Lake Georgetown	42,721			$496		$496	Interbasin transfer permit required; flow changes in Brazos and Colorado river basins.

[1] Costs are for treated water at the treatment plant locations listed. Costs include purchase of raw water (when applicable).
[2] Costs include treatment and major transmission, pumping, and storage facilities where applicable.
[3] Potential water treatment plant to be located near Williamson Co. demand centers.

Integrated Water
Supply Plans

S-6 INTEGRATED WATER MANAGEMENT PLANS

This chapter contains the culmination of the North Central Trans Texas study efforts with the presentation of integrated water management plans for the region, identified sub-regions, and various localities. Important background information and planning principles that guided the evaluation is first summarized to briefly provide the context for how the study was performed and how the integrated plan recommendations were identified.

S-6.1 Planning Perspectives and "Envisioning" the Future

S-6.1.1 Planning Methods

The Texas Water Development Board (TWDB) and its regional and local participants in the Trans Texas Study Program adopted, at the start of the planning process, the framework of what has been termed "Integrated Resources Planning" or IRP. The IRP methods evolved from earlier methods of selecting supply projects based primarily on least cost and later evaluations in the electric utility industry that also addressed demand-side measures.

The IRP methods used in this Trans-Texas planning effort incorporate consideration of:

- ✓ a wide array of alternatives that include both supply- and demand-side management of water resources,
- ✓ near- and longer-term needs in making appropriate near-term decisions,
- ✓ environmental and other indirect or third-party effects,
- ✓ selection of least cost alternatives, where overall "cost" includes estimated capital and operating expenses and perceived costs of environmental impacts, and
- ✓ broad public participation

In addition to these elements of Integrated Resources Planning, another primary principle of good long-range water supply planning is that the developed plan should serve as a reasonable guide to needed future actions, and as such, be relatively specific in identifying major needed activities, approximate supply quantities, costs, and timing.

Other key ingredients in good long-range planning are flexibility and relevancy. The potential uncertainties facing the development of new water resources can span many issues ranging from questions over the accuracy of future growth, water demand and supply forecasts to

legal, regulatory, and political uncertainties. Static, rigid plans can often become quickly out-of-date and irrelevant given changed conditions.

Especially important in the analyses was a vision of the longer-term future in defining courses of action. Over the past 10 to 20 years, Travis and Williamson counties have been among the fastest growing areas in the United States. The underlying factors that have spurred this growth (i.e., a good economy and jobs creation, quality of life and amenities, educated labor force, good climate, etc.) are not expected to significantly change in the foreseeable future, and as such, the populations of the two counties are expected to more than double in size. Given recent trends, it is not hard to envision significant portions of Travis and Williamson counties urbanized by the year 2050 and the region constituting one large metropolitan service area.

Given this likely future and other dependencies or mutual interests among the entities discussed in Section S-6.3, a priority planning goal became how to acknowledge the current municipal diversity of actions in the study area and guide and mold these near-term courses of action into developed regional and inter-connected system(s) which make the greatest sense for water service in the medium- and longer-term. Or stated differently, the planning question becomes,

> *"In the year 2050, can we look at the multi-county metropolitan area that has developed and say that we made the most appropriate choices for management, development, and conservation of the region's water resources over time?"*

S-6.1.2 Planning Certainties and Uncertainties

Some of the future issues facing the North Central Trans-Texas study area seem relatively clear, including the likelihood of continuing rapid growth and expansion of municipal service areas with current water supplies and development of contracted supplies. As stated above, it is also very likely that a substantial portion of the region will comprise one large metropolitan area by the year 2050. Another certainty is that several communities in eastern and western Williamson County are facing very near-term needs for additional water and that effective action to address these needs must occur as soon as possible.

However other issues facing the region, such as the feasibility and availability of water supplies from interbasin transfers, development of significant new groundwater resources, and the feasibility of water trades or sales, future regulatory requirements have higher degrees of

uncertainty and somewhat cloud the crystal ball picture of the future. These uncertainties become even more problematic in formulating a single long-range course of action when the straightforward measures that are mostly within a utility's direct control have already been exercised and only the more uncertain options remain.

S-6.1.3 Near- and Longer-term Planning Horizons

As mentioned above, the need for immediate action in some portions of the North Central regional study area implies very specific planning recommendations to help guide this near-term local decision-making and to help engender support at the State and/or Federal level for any permitting or financial assistance. Also, pending action by these few entities may also have consequences affecting the near- and longer-term options of other parties in the area, thus creating a need for planning, coordination and possible near-term actions by them as well.

Towards the other end of the timeline, the era of higher uncertainty for the North Central Trans-Texas study area arises in the years' 2025-2040 horizon. By this time, most supplies from existing and contracted supplies and near-term actions have been mostly utilized, water reuse and advanced conservation measures have already made their contribution to water needs, and most entities in the region are facing the development of significant new water resources. The remaining options available at this time could entail "go it alone" competition and conflict for limited water resources, higher degrees of regulatory uncertainties, and affordability issues, or alternatively through regional cooperation, more coordinated mutual or individual actions that could help minimize these hurdles and likely satisfy regional water needs at the lowest reasonable cost.

For these reasons and those mentioned below in the transition to SB1 planning, the integrated plan for each area and locality reflects particular courses of action in the near- and medium-term and a series of possible alternative actions for the longer-term.

S-6.1.4 Transition to SB1 Planning

Coupled with these other planning issues is the pending change in the institutional aspects of regional planning. The closure of this Trans-Texas planning effort is being built upon and, to some degree, supplanted by the new regional planning requirements specified under

Senate Bill 1 (75th Texas Legislature). What is now the North Central Trans-Texas study area will be separated into two new planning regions of different geographic size and participant composition and the regional plan(s) may be developed and adopted under somewhat different process procedures.

For all of the above reasons, it seems prudent to end the planning efforts of the North Central Trans-Texas study area (and begin the SB1 efforts) with a recommendation that supports near-term actions and a limited number of longer-term water optional plans for water supply that generally span the range of future possibilities and uncertainties. This will allow the SB1 efforts to: (1) focus on specific near-term treatment and transmission facility needs, (2) resolve remaining uncertainties towards definite courses of longer-term action, and (3) build greater "buy-in" and commitment by the SB1 participants towards cooperative regional solutions.

S-6.2 Timing of Additional Water Needs

In order to assess the timing and extent of needed future water management or supply actions and the desirability of regional or individual solutions to address these needs, three planning scenarios were defined for the major entities in the study area:

- No action future — where population, economic and water demand growth continues to occur, but no additional management steps are taken to address water supply needs.
- Current plans future — where population, economic and water demand growth continues to occur and local water supply entities pursue current actions-in-progress and develop the infrastructure necessary to access currently contracted water supplies.
- Local initiative and cooperation future — similar to the "current plans future" above, but also reflecting the implementation of local initiatives for wastewater reuse and advanced water conservation and the temporary sharing or trading of water among various entities.

The timing of need for new water supplies were assessed for each participating entity and rural area for each of the above scenarios and is summarized in Table S-8. As can be seen with the "no action" scenario, there is need for near-term action in various portions of Williamson County, while the City of Austin's demands are met from existing water supplies for some time.

Assuming "current plans" to develop infrastructure and access contracted supplies are pursued, some Williamson County entities gain some "breathing room" and others gain longer-term relief from water supply problems. However, this also results in some noticeable differences among the entities in the timing of need for the next water supplies. If Austin

chooses to exercise its agreement for water purchase from LCRA, it will defer its need for future supplies for many years.

Table S-8
Date Supplies Needed Under Differing Scenarios

Water Supply Entity	No Action	Current Plans[1]	Local Initiative & Cooperation
Austin	2018	2018	2019
Pflugerville	Note 2	2009	2009
Manville WSC	Note 2	1995	1995
Manor	2050	2050	2050
Cedar Park	2004	2004	2010
Leander	2001	2009	2009[3]
Liberty Hill	2000	2000	2013
W. Williamson Co.	Note 2	Soon	2002
Round Rock	2001	2011	2040
Georgetown	2007	2040	2040
BCMUD	2006	2050	2050
Jonah SUD	2037	2050	2050
Hutto	2036	2036	2050
Taylor	2036	2036	2044
E. Williamson Co.	2003	2003	2013

[1] Reflects acquisition of long-term water supply contract with LCRA or development of Stillhouse Hollow supplies.
[2] Current groundwater supply may be insufficient during next drought.
[3] Reflects acquisition of long-term contract with LCRA, or development of Stillhouse Hollow supplies.

If further "local initiatives and cooperation" are realized, (which could include wastewater reuse, advanced water conservation, and temporary sharing or trading of water) the more near- or medium-term needs of some parties can be delayed and roughly synchronized with the timing of additional action with their neighboring entities. In western Williamson County, this occurs about the 2010 time frame. In the middle portion of Williamson County, this occurs in the 2035-2040 time frame.

S-6.3 Definition of Planning Sub-Regions

In addition to identifying timing of individual entity need, other factors governing the feasibility of regional solutions were considered that led to the identification of logical planning sub-regions, including:

- current service areas,
- ETJ boundaries, areas of influence, and possible service to rural areas,
- current or potential supply sources common to the entities, and
- proximity to others.

Some portions of the two-county area are more proximate to certain supplies than others; some entities are very proximate to each other; the extension of utility service areas and ETJs also portend future service to an area. An assessment of these various factors led to definition of three planning sub-regions within the overall North Central Trans Texas study area as shown in Figure S-18. These include:

1. Austin Service Area/Travis County Sub-region.
2. U.S. 183 Corridor/Western Williamson County Sub-region, and
3. IH-35 Corridor/Eastern Williamson County Sub-region

The boundaries defined between these areas merely serves to illustrate likely groupings of general growth and development patterns. Ultimately in-filling will essentially result in one large metropolitan area over time. These sub-region boundaries do not imply that a development or area near the boundary is destined to be served only from that area's ultimate water supply system. In fact, inter-connections of water supply among these sub-regions are a recommended action for the future.

S-6.4 Screening of Alternatives

S-6.4.1 Factors Considered

Over 35 different water supply and management alternatives were identified and assessed during the course of this Trans-Texas study (see Volume 2). Many of these alternatives embodied different sources of supply, while others included alternative means of developing the same supply.

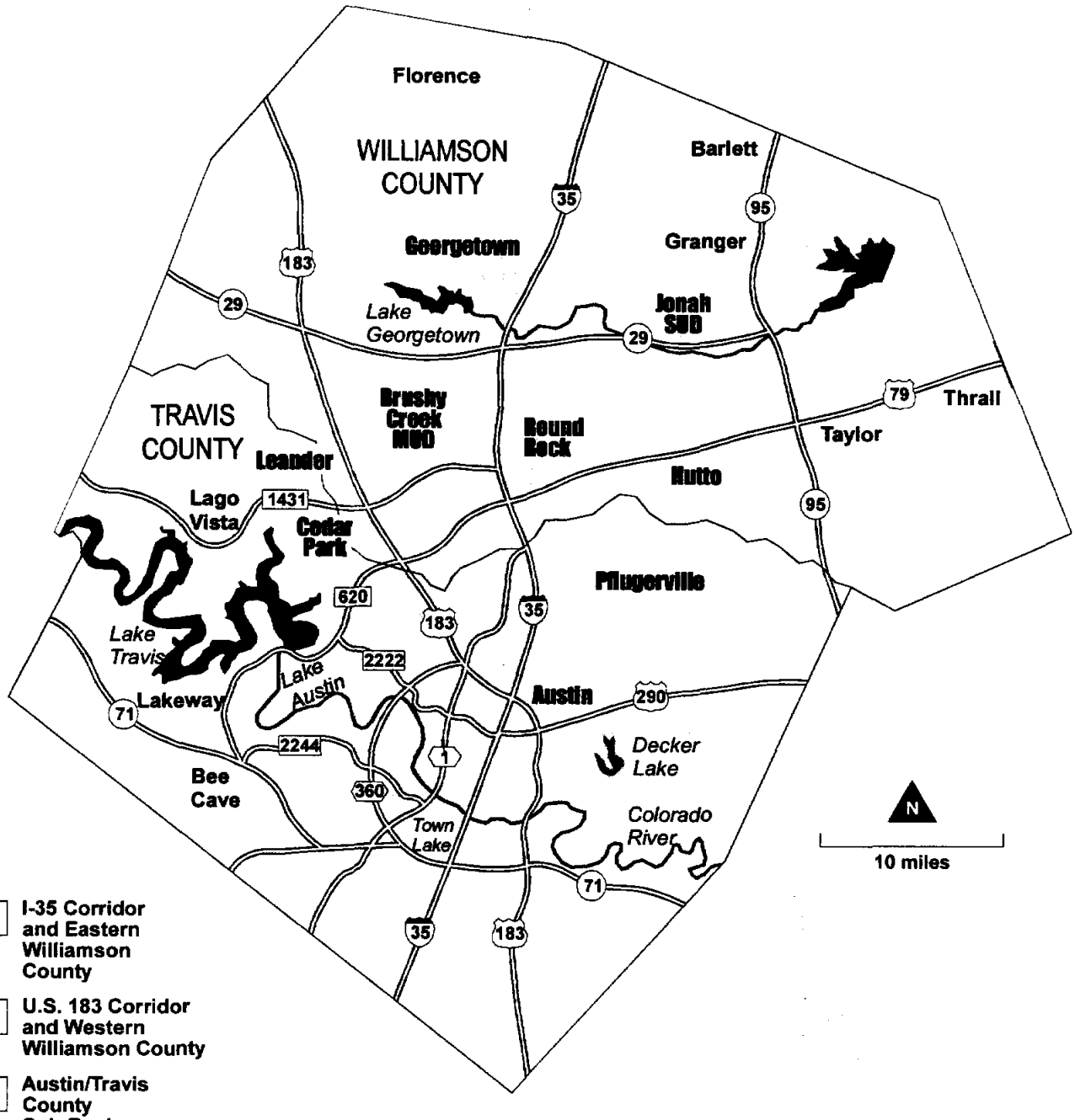
In general, four factors were considered in screening options for feasibility and desirability:

- Contribution to meeting future supply needs

  Does the alternative make a noticeable contribution to the water shortage, either in terms of the amount of supply or as a "bridge" to development of a next larger increment of supply?

- Cost and affordability

  Is the alternative economical when compared to the unit cost of other alternatives? Is the total cost or cost share of the alternative affordable to the local entity?



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INTEGRATED PLAN SUBREGIONS

FIGURE S-18

- Environmental impact

  What is the degree of direct and/or indirect environmental impact of the alternative, given current regulatory requirements and to what extent can impacts be mitigated?

- Implementation Issues

  What is the overall feasibility of implementing the alternative, considering engineering, economic, environmental, regulatory, and political issues?

S-6.4.2 Screening and Prioritization of Alternatives

Table S-9 below presents a summary matrix of the various demand and supply management alternatives considered for the North Central study area and the assignment of a level of effect or concern. This summary matrix draws on various cost, environmental impact, and other information presented earlier in this report and in other related volumes.

The regional perspective used to evaluate these above alternatives should be viewed cautiously. For instance, some alternatives may not be broadly available to all (e.g. Austin steam-electric rights). Similarly, small quantities of additional supply may be perfectly adequate for some entities or an interim solution for others. Additionally, implementing certain measures, such as conservation and reuse, may be a political or regulatory pre-requisite before undertaking a larger project.

From the information in Table S-9 a general ranking or prioritization of alternatives from more desirable to less desirable have been developed:

Group A: More efficient water use measures, including conservation and direct reuse for non-domestic purposes that are typically economic and have low environmental impact. The most noticeable concern over these measures is their acceptance by the public and the utility, and therefore, their implementability. This latter concern could be substantially overcome with a well-designed program and adequate public education.

Alternatives L-5, L-8, L-9, and L-21 are included among these low-cost, low-impact demand and supply management options.

Group B: Expanded use of existing surface water supplies, including accessing already developed surface water supplies, amending existing water rights, and water marketing or trades. These alternatives are moderate in cost, have less environmental impact than new development, have relatively high reliability, and reflect varying

degrees of implementability. Implementation issues would include, where relevant: concerns over interbasin transfers, competition among potential users, and "third-party" effects on local areas of removing water through water marketing or trades. Some of these implementation and environmental issues can be mitigated through contractual means or sensitive project design.

Alternatives B-1, B-6, B-7, B-8, C-2, C-4, C-6, C-7, BC-1, and BC-2 are included among these medium-cost, moderate-impact supply management options.

Table S-9
Evaluation and Screening of Water Demand and Supply Management Alternatives

Group	Alt. No.	Alternative	Supply Available[1]	Unit Cost[2]	Environmental Impact[3]	Implementation Issues[4]
Group A	**L-5**	**Reuse – Austin**	Limited	Low-Medium	Low	Medium
	L-8	**Reuse – Wm. Co.**	Limited	Low-Medium	Low	Medium
	L-9	**Accelerated and Additional Conservation – Austin**	Medium	Low	Low	Low-Medium
	L-21	**Accelerated and Additional Conservation – Wm. Co.**	Medium	Low	Low	Low-Medium
Group B	**B-1**	**Stillhouse to Lake Georgetown**	High	Medium	Low	Low
	B-6	**Granger to Lake Georgetown**	Low	High	Low	Low
	B-7	**Somerville to Colorado River/swap at Lake Travis**	High	Medium	Medium	Medium
	B-8	**Little River or Brushy Creek to Lake Georgetown**	Medium	Medium	Low	Medium
	BC-1	**Systems Ops of Lakes Stillhouse and Travis**	Low	High	n/a	Medium
	BC-2	**Purchase LCRA stored water to augment Lake Georgetown**	High	Medium	Medium	Medium
	C-6	**Austin Steam-electric water rights**	Medium	Low	Low	Low
	C-2	**Purchase LCRA stored water at Lake Travis**	High	Medium	Medium	Low-Medium
	C-4	**Purchase LCRA stored water at Buchanan to Lake Georgetown**	Medium	Medium	Medium	Medium
	C-7	**Austin existing water rights**	High	Low	Medium	Low
Group C	**CZ-1**	**Carrizo-Wilcox to augment Colorado River**	High	Medium	Medium	Medium
	CZ-2	**Carrizo-Wilcox Aquifer to Lake Georgetown**	High	Medium	n/a	Medium
Group D	**B-9**	**South Fork Reservoir**	Medium	High	High	High
	C-5	**Off-channel storage on Colorado/swap at Lake Travis**	High	Medium-High	High	Medium-High

[1] Low = 0 to 4,999 acft/yr; Medium = 5,000 to 19,999 acft/yr; High = over 20,000 acft/yr.
[2] Low = $0 to $399/acft; Medium = $400 to $799/acft; High = Over $800/acft.
[3] Low = 0 to 6; Medium = 6 to 12; High = over 12; reference scores on Table S-27
[4] Low = implementation issues can be solved.
Medium = moderate implementation issues, but no "fatal flaws."
High = difficult implementation issues, possible "fatal flaws."

Group C: Development of new groundwater supplies are moderate in capital cost, low in operational (treatment) cost, low to moderate in environmental impact, and reflect varying degrees of implementability. Environmental concerns might include potential impacts upon surface moisture or springflow due to aquifer drawdown. Supply reliability issues are relatively small with a properly designed system on the Carrizo-Wilcox Aquifer, and may offer some diversity and "insulation" of supply during periods of sustained drought. Implementation issues are somewhat uncertain if a groundwater management district were to form and oppose transfers of water from the area. However, any resulting well spacing or pumping regulations that address groundwater exports must be equitable and uniform for all users of the aquifer.

Alternatives CZ-1 and CZ-2 are included among these medium-cost, moderate-impact supply management options.

Group D: Development of new surface water supplies are higher in capital and operational cost than other alternatives, moderate to high in environmental impact, generally moderate to high in reliability, and reflect varying degrees of implementability. While potentially capable of producing large volumes of water, new surface water development is also one of the most costly and high impact options available, and because of these factors are often difficult to implement.

Alternatives B-9 and C-5 are included among these more high-cost, higher-impacting water supply options.

S-6.5 Integrated Water Supply Plans

Given the projected shortages, timing of need for additional water supply, the delineation of planning sub-regions, and the general ranking of priority alternatives discussed in the previous sections, integrated water supply plans were developed for each of the sub-regions and for participating entities within those areas. The plans indicate that there are significant opportunities for regionalization of water supply and treatment facilities. Key to the success of such ventures is demonstrable cost savings, inter-local cooperation, a "regional" sponsor, and in some cases, an interim sharing or leasing of surplus water among participating parties to facilitate coordinated timing of future water supply needs and project development.

Concerning the temporary sharing of surplus water supplies, this would most likely be affected through an interim lease agreement. Recently-enacted Senate Bill 1 greatly enhances the ability of an entity to sell water on an interim basis by requiring the receiving entity to develop replacement supplies, and ensuring that the providing entity will regain control of the water at the end of the contract term.

S-6.5.1 Austin/Travis County Sub-region

The Austin/Travis County Sub-region, comprised of Travis County and portions of southern Williamson and northern Hays counties, is graphically portrayed in Figure S-19. The plan for this sub-region is described in the following discussion on the Austin Service area and in the later discussion on the possibility of further extension of Austin service elsewhere in the county (see Section 6.5.1.4).

City of Austin Service Area — Integrated Water Supply Plan

The City of Austin (COA) is facing a future of continuing rapid growth with the population in its water service area expected to more than double from its anticipated level of 730,000 persons in the year 2000 to over 1.530 million people by the year 2050. There are, however, planning uncertainties concerning the geographic extent of the COA water service area in the future. Patterns of future annexations, desire to influence metropolitan growth patterns, degree of regional cooperation, aquifer/springflow protection and other environmental issues, water availability, cost, and other factors will all influence Austin's future decisions to extend potable water service either through expansion of city boundaries or out-of-city service contracts.

Water supply alternatives available to the City of Austin[4] are listed in Figure S-20 and range in cost from $109 per acft to $1,755 per acft. The upper portion of Figure S-20 lists the water supply alternatives available to the Austin Service Area, the water supply available from each, and their estimated unit cost. The supply alternatives in Figure S-20 are listed in order from lowest cost to highest cost. The two most economical supply alternatives are L-5D, Reclaimed Water Reuse at Decker Lake and L-9, Accelerated and Additional Conservation. The conservation alternative is potentially an integral part of the long term water supply plan. The Decker Lake option may have some long term benefit, but is of less value while available uncommitted stored water remains in the Highland Lakes. Among the available reuse projects, alternative L-5A, Reclaimed Water Reuse — Central would be the most favorable in the near to

[4] Austin currently uses about one-half of the 250,000 acft/yr firm water supply available under it's run-of-river water rights and the Settlement Agreement with LCRA. Further use of this current water supply will cost about $275 per acft for expansion of existing water treatment plants and $105 per acft payment to LCRA for water usage in excess of 150,000 acft/yr; therefore, for comparison to water supply alternatives, Austin's current supply at the treatment plant (i.e., no distribution and administrative costs included) is about $380 per acft.

S-6.5.1 Austin/Travis County Sub-region

The Austin/Travis County Sub-region, comprised of Travis County and portions of southern Williamson and northern Hays counties, is graphically portrayed in Figure S-19. The plan for this sub-region is described in the following discussion on the Austin Service area and in the later discussion on the possibility of further extension of Austin service elsewhere in the county (see Section 6.5.1.4).

City of Austin Service Area — Integrated Water Supply Plan

The City of Austin (COA) is facing a future of continuing rapid growth with the population in its water service area expected to more than double from its anticipated level of 730,000 persons in the year 2000 to over 1.530 million people by the year 2050. There are, however, planning uncertainties concerning the geographic extent of the COA water service area in the future. Patterns of future annexations, desire to influence metropolitan growth patterns, degree of regional cooperation, aquifer/springflow protection and other environmental issues, water availability, cost, and other factors will all influence Austin's future decisions to extend potable water service either through expansion of city boundaries or out-of-city service contracts.

Water supply alternatives available to the City of Austin[4] are listed in Figure S-20 and range in cost from $109 per acft to $1,755 per acft. The upper portion of Figure S-20 lists the water supply alternatives available to the Austin Service Area, the water supply available from each, and their estimated unit cost. The supply alternatives in Figure S-20 are listed in order from lowest cost to highest cost. The two most economical supply alternatives are L-5D, Reclaimed Water Reuse at Decker Lake and L-9, Accelerated and Additional Conservation. The conservation alternative is potentially an integral part of the long term water supply plan. The Decker Lake option may have some long term benefit, but is of less value while available uncommitted stored water remains in the Highland Lakes. Among the available reuse projects, alternative L-5A, Reclaimed Water Reuse — Central would be the most favorable in the near to

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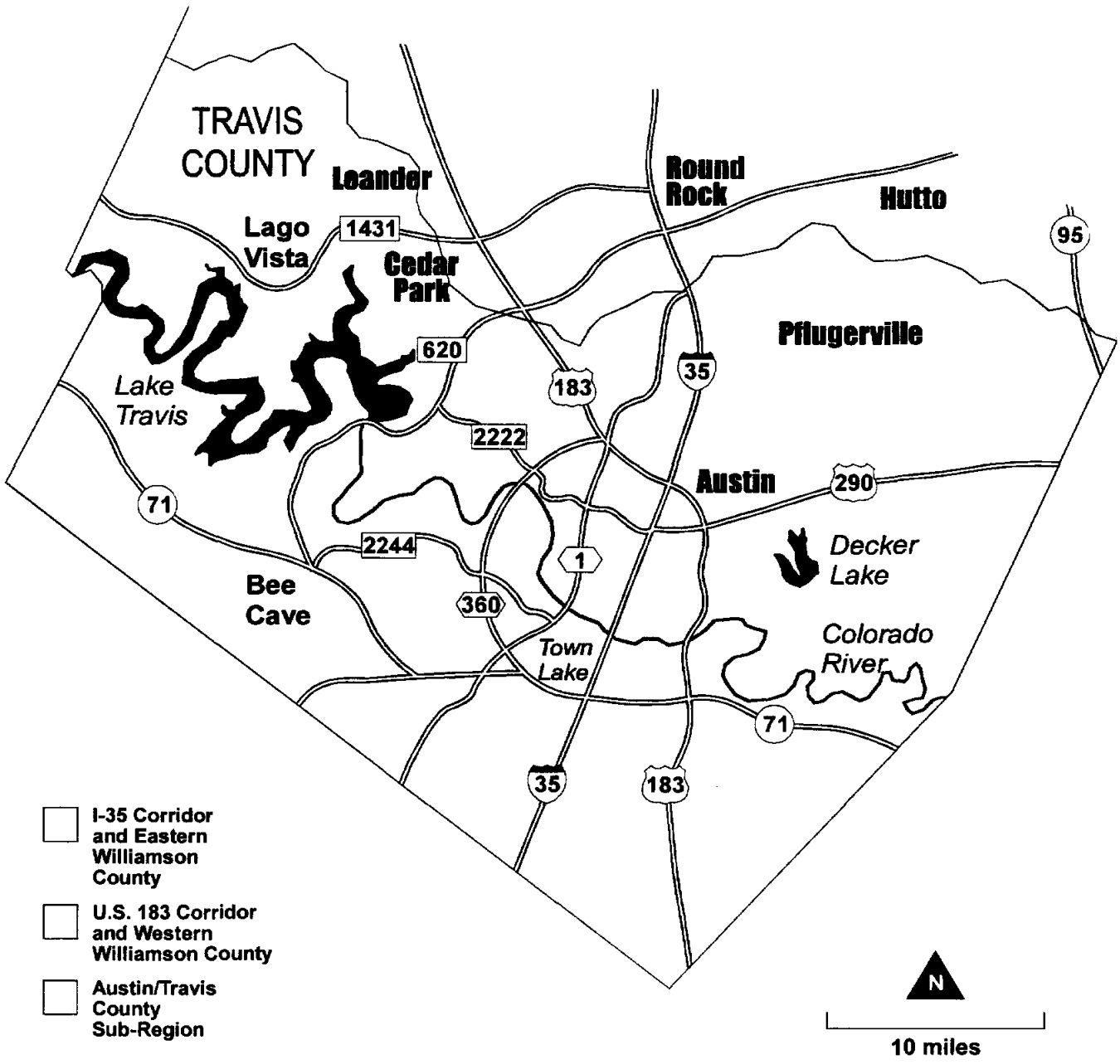

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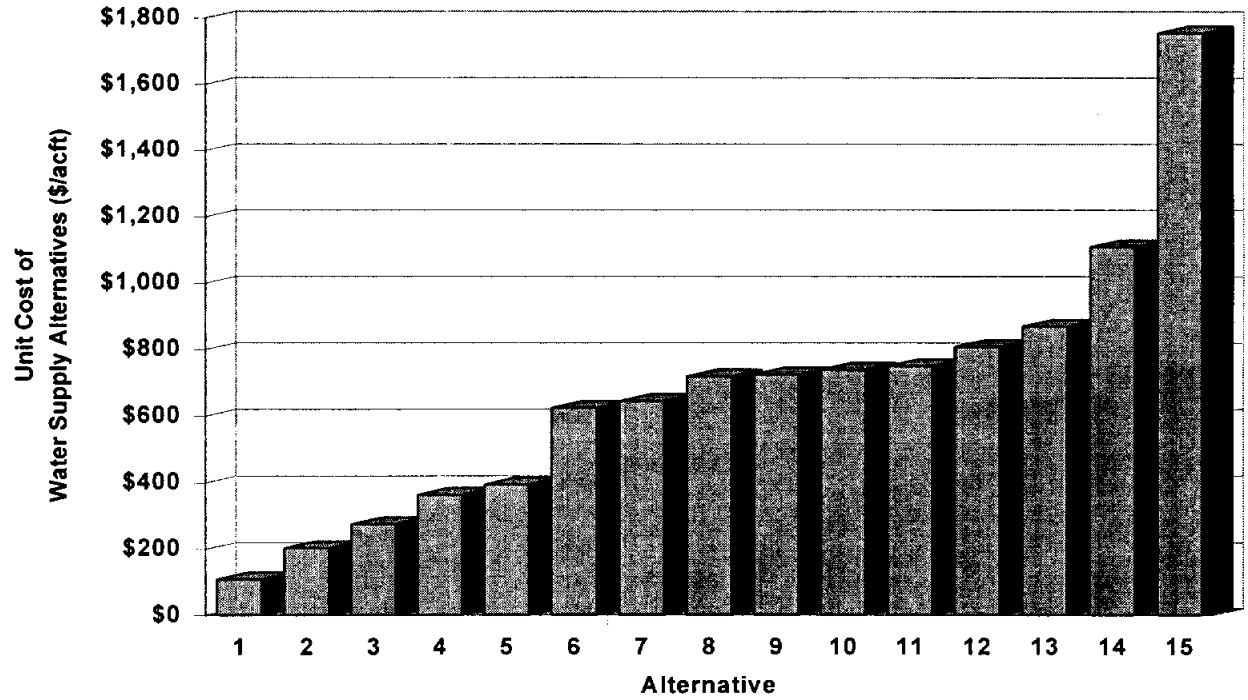
AUSTIN / TRAVIS COUNTY SUBREGION

FIGURE S-19

Water Supply Alternatives Available to the Austin Service Area (Year 2050 Projected Shortage: 92,731 acft/yr)			
	Alternative	Unit Cost[1] ($/acft)	Available Supply or Project Capacity (acft/yr)
1.	Reclaimed Water Reuse at Decker Lake (L-5D)	$109	4,505
2.	Accelerated and Advanced Conservation (L-9)	$203	11,000
3.	Use of Austin's Steam-Electric Water Rights (C-6)	$275	11,656
4.	Reclaimed Water Reuse — Central (L-5A)	$363	2,590
5.	Reclaimed Water Reuse — Central w/ L. Austin (L-5A)	$394	14,900
6.	Purchase Water from LCRA (C-2(1)) — Austin WTP4 (207 mgd)	$624	104,967
7.	Use of Carrizo-Wilcox Aquifer to Augment Colorado River — Direct to River (CZ-1A)	$644	69,100
8.	L. Somerville to Colorado River (B-7)	$719	29,100
9.	Off-Channel Storage in Lower Basin w/ River Diversion and Purchase of Irrigation (C-5D)	$724	105,200
10.	Off-Channel Storage in Lower Basin w/ Purchase of Irrigation Rights (C-5C)	$739	67,400
11.	Use of Carrizo-Wilcox Aquifer to Augment Colorado River — through Off-Channel Storage (CZ-1B)	$750	90,400
12.	Off-Channel Storage in Lower Basin w/ River Diversion (C-5B)	$808	67,300
13.	Off-Channel Storage in Lower Colorado River Basin (C-5A)	$869	36,600
14.	Reclaimed Water Reuse — South (L-5B)	$807	1,938
15.	Reclaimed Water reuse — Northwest (L-5C)	$3,105	1,000

(1) Costs include water treatment plant, major transmission and storage facilities, (and purchase of raw water where applicable).



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WATER SUPPLY ALTERNATIVES AVAILABLE TO THE AUSTIN SERVICE AREA
FIGURE S-20

medium time frame. The next most economical Alternative C-6, Use of Austin's Steam-Electric Water Rights would cost about $275 for expansion of existing water treatment plants and could potentially satisfy about 10 percent of Austin's year 2050 projected water shortage.[5] After conservation, use of existing water rights and reuse projects, the most cost effective new water supply appears to be construction of Water Treatment Plant No. 4 (WTP 4) at Lake Travis. WTP 4 would be able to utilize the remainder of Austin's water supply firmed up by the Settlement Agreement and could treat additional raw water supplies purchased from LCRA.

Several scenarios for differing-size Austin water service areas were examined in the Trans-Texas study efforts, ranging from a conservative scenario of just accommodating Austin growth and assisting Pflugerville with its future water shortages to a broader scheme of serving Travis County and portions of North Hays and Southern Williamson counties. As the breadth of the potential Austin service area increases across these scenarios, it was found that the types of water management tools needed to meet these future demands do not change, but may vary in the amount of program required to meet future needs and the timing of implementation.

Figure S-21 and Table S-10 illustrate the relatively conservative scenario that addresses Austin's current service area needs, growth within the current service area, expansion due to new annexations, and a continuing arrangement with service to the City of Pflugerville and other current and anticipated Austin wholesale water customer. The water demand for this Austin service area would reach about 192,000 acre-feet per year (acft/yr) by the year 2000, 268,000 by the year 2020 and 353,000 acft/yr by the year 2050, an increase of about 84 percent over the 50-year period. The more moderate increase in water demand versus that of the population growth is due to savings anticipated from a continuation of *current* water conservation programs.

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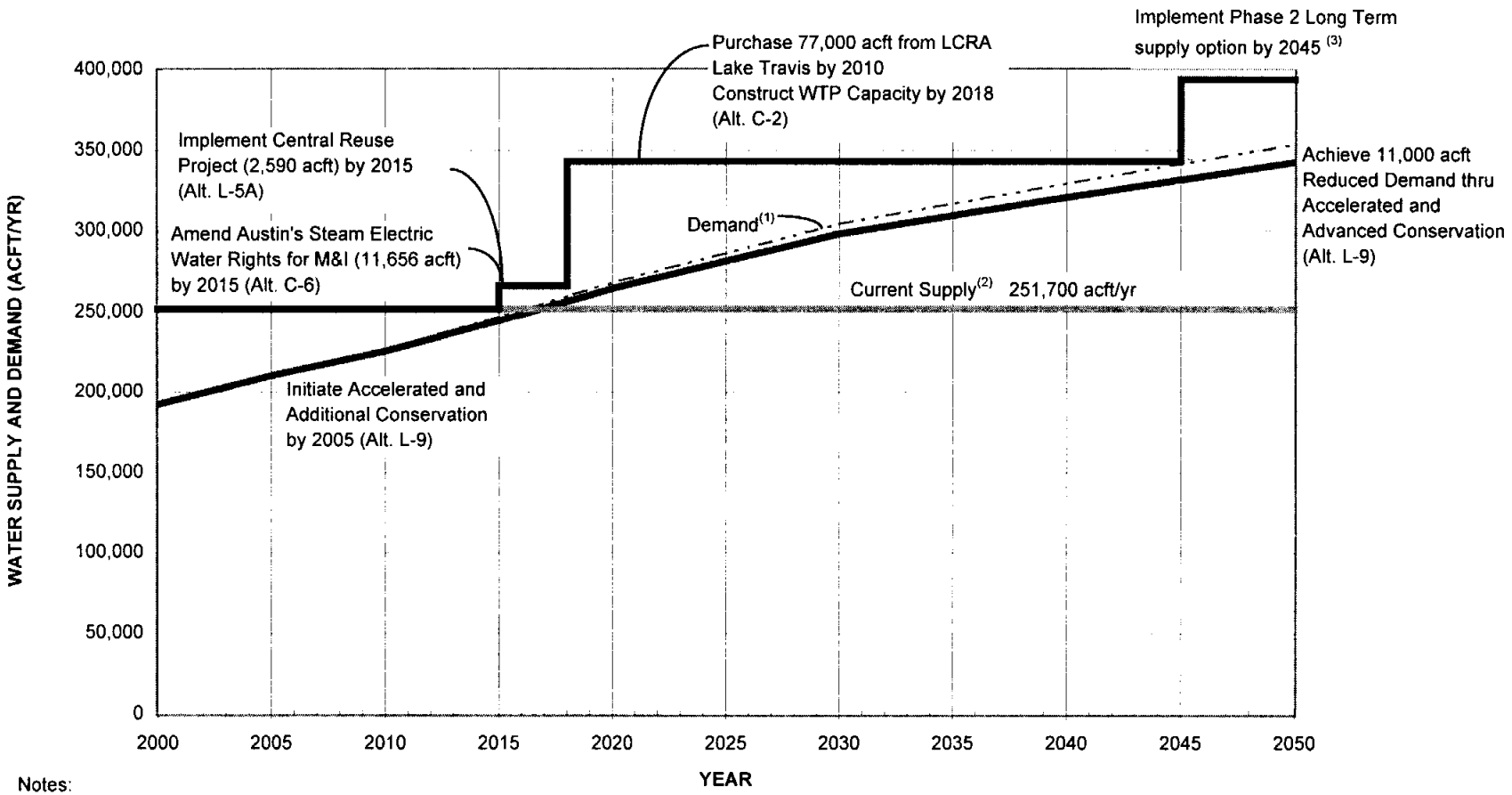
[5] Dual purpose use of the City of Austin's steam electric cooling water rights for municipal use as well as steam-electric cooling allows for the most flexibility in water planning for the City of Austin. However, utilization of the steam electric cooling water rights for municipal use is intended to make full use of the City's current water rights without causing a shortfall in water available for cooling water for electric power generation by the City's Electric Utility. Should unanticipated expansion of the generating facility at Decker Lake occur, or should the City of Austin permanently utilize a portion of its steam-electric cooling water right at the Fayette Power Plant downstream of Austin, then the City of Austin may need to secure additional future municipal water from the other recommended alternatives.



Notes:
(1) Includes City of Pflugerville projected demands.
(2) Current supply for municipal and industrial use under Austin/LCRA Settlement Agreement plus Pflugerville groundwater. Steam electric demand and supply not shown.
(3) Phase 2 Water Supply Options could include augmentation of Lower Colorado River with off-channel storage (C-5), Carrizo-Wilcox Aquifer (CZ-1), Reuse Projects (L-5), or Purchase of Additional Highland Lakes Water, if available.

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
AUSTIN SERVICE AREA

FIGURE S-21

Table S-10
Integrated Water Supply Plan
City of Austin Service Area

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)		Unit Cost[3] ($/acft) 1997$
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply	
2000	192,351	251,700	52,349	Develop accelerated/ additional water conservation program (Alt L-9)	2003			
				Initiate permit amendment to use steam-electric rights (Alt C-6)	2005			
2005	210,117	251,700	41,583	Initiate accelerated/ additional water conservation program (Alt. L-9)	2005			$203
2010	225,397	251,700	26,303	Purchase LCRA stored water (Alt. C-2); Initiate final design/ construction of WTP and transmission CIP program;[4] Initiate final design/construction of Central Reuse Project.	2010	1,222		$53
2015	244,359	265,946	21,587	Utilize Central Reuse Project (Alt. L-5A)	2015	2,444	2,590	$363
				Utilize Remaining Steam-Electric Water Rights (Alt C-6)	2015		11,656	$275
				Utilize LCRA Stored Water (Alt. C-2) treated at WTP4	2018	3,667	77,000	$624
2020	264,365	342,946	78,581					
2025	28,173	342,946	61,773			4,889		
2030	297,920	342,946	45,026			6,111		
2035	309,290	342,946	33,657	*Initiate planning and evaluation of longer-term alternatives*[4]		7,334		
2040	320,600	342,946	22,346	*Initiate final design/ construction of longer-term alternatives*[4]	2040	8,556		
2045	331,488	393,732	62,244	*Utilize supply of longer-term alternative*[4]	2045	9,778	50,786	
2050	342,376	393,732	51,356		2051	11,000		

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use; include Pflugerville.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term supply increment sized to provide 15% surplus by 2050

Long-term major options available: Carrizo-Wilcox Aquifer to:		
Colorado River/swap from Lake Travis (Alt. CZ-1A)	69,100	$644
Off-channel Colorado/swap from Lake Travis (Alt, CZ-1B)	90,400	$750
Off-channel Colorado Reservoir/purchase irrigation rights (Alt. C-5C)	67,400	$739
Off-channel Colo. Reservoir/river diversion/purchase irrigation rights (Alt. C-5D)	105,200	$724
Reclaimed water reuse at Decker Lake (Alt. L-5D)	4,505	$109
Purchase additional Highland Lakes water (if available)		

By about the year 2005, Austin should implement additional programs for advanced water conservation and wastewater reuse. With the implementation of these measures, Austin should be able to defer the next increment of new supplies until about the year 2018. By 2005, Austin should acquire a permit amendment to utilize its remaining unused steam-electric water rights, which would allow for approximately 3 years or more of growth. By 2021, it is projected that Austin would be fully utilizing all of the 250,000 acft/yr of water supply firmed-up under an agreement with the LCRA. In order to meet project needs after 2021, Austin should negotiate a water purchase from LCRA for additional supplies of Highland Lakes water. Several possibilities exist for developing this additional increment of water supply, including treatment and distribution from the potential WTP 4 or possibly through innovative treatment methods at existing Austin facility locations.

As shown in Table S-10, major water supply options that would be available to the sub-region in the long-term include: development of additional water from the Colorado River/Lake Travis through various measures to augmentation Colorado River flows or water marketing or trades; development of ground-water supplies, and expanded reuse opportunities. Other options were also identified but are generally less desirable due to supply availability, cost, or environmental reasons.

Further serious consideration should be given to the role of aquifer storage and recovery (ASR) program as another tool to address Austin's treated water delivery needs. Besides potential significant cost savings, ASR, if feasible, would provide for more efficient utilization of water treatment plant capacity and could noticeably delay the need for the construction of additional existing or new plant capacity by 7 to 12 years (Consultant Report, 1996).

The above plan recommendations are consistent with the City of Austin's Integrated Water Resources Planning (IWRP) program and reflects a mix of supply-side and demand-side management measures. The plan was developed with public involvement, reflects the inclusion of cost-effective strategies, and reflects the consideration of indirect costs and benefits, including minimizing environmental effects, lowering risks through diversifying supplies, addressing system efficiencies, and other issues.

Infrastructure Needs

Listed below are the physical facilities needed to implement the integrated water supply plan for the Austin area, the date the facilities need to be operating, and a reference to the section in Volume 2 specific to the supply alternative.

- Expansion of existing treatment capacity to accommodate use of steam-electric water rights; needed by 2015. (See Section 3.15, Vol 2)
- Central Reuse Project, including diversion structure and pump station at Walnut Creek WWTP, pipelines, and end user facilities; needed by 2015. (See Section 3.5, Vol 2)
- Water Treatment Plant No. 4, including Lake Travis raw water intake; needed by 2018. (See Section 3.12, Vol 2)
- Water pumping and transmission facilities, including NW-A pump station and NW-B pump station at WTP 4, Jollyville NW-A transmission main, Martin Hill transmission main, Howard Lane NW-A transmission main, Howard Lane NW-A pressure control station, Jollyville flow control station, RM 620 transmission main, NW-B reservoir, Four Points flow control station, and other associated facilities; most of these facilities would need to be operating when WTP 4 is completed (i.e., by 2018). (See Section 3.12, Vol 2)
- Longer term facilities: all of the longer-term supply options listed in Table S-10 result in increased water availability at Lake Travis; to utilize these sources, WTP 4 and associated transmission facilities would need to be expanded by 2045. Augmentation of the Colorado River system to achieve increased supply in Lake Travis would require construction of a Carrizo-Wilcox well field (See Section 3.16, Vol 2); an off-channel reservoir in the lower basin (See Section 3.14 and 3.16, Vol 2); or purchase of additional Highland Lakes water, if available.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Accelerated and Additional Water Conservation (Alt L-9)

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Use of Steam-Electric Water Rights (Alt C-6)

Environmental Issues: beneficial effect of increased return flows to Colorado River.
Studies Needed: confirm estimates of long-term water needs of the electric utility; permitting process may require study of in-stream flow effects.

Other Issues: probably requires approval of the Electric Utility; requires amendment of the Austin/LCRA Settlement Agreement.
Permits Needed: amendment of TNRCC water right permit.

Central Reuse Project (Alt L-5A)

Environmental Issues: slightly reduced return flows to Colorado River.
Studies Needed: none for Central Reuse Project; effects of increased nutrient loads on receiving water bodies would be needed for the supply augmentation options.
Other Issues: increased monitoring of water quality may be required; public information and education programs may be helpful to promote use of reclaimed water.
Permits Needed: amendment of TNRCC wastewater discharge permit.

Purchase of Uncommitted Stored Water from LCRA for Diversion at Lake Travis (Alt C-2)

Environmental Issues: endangered species issues associated with construction of water treatment plant and transmission pipelines.
Studies Needed: site specific studies for endangered species, karst geology, and cultural resources needed in construction areas.
Other Issues: purchase of Highland Lakes stored water from LCRA must be negotiated.
Permits Needed: Corps of Engineers 404, General Land Office, and Texas Parks and Wildlife Department permits needed for intake, treatment plant, and pipeline construction; may need amendment of TNRCC diversion permit to divert at Lake Travis.

Longer-term Alternatives *(i.e. Carrizo-Wilcox Aquifer to Augment Lower Colorado River Basin (CZ-1A and CZ-1B), Off-Channel Storage in Lower Colorado River Basin (C-5), Reclaimed Water Reuse projects (L-5), Purchase of additional Lake Travis water, if available).* Each of these alternatives would result in increased water availability at Lake Travis and would require expansion of treatment facilities and transmission pipelines in the Lake Travis area.

Environmental Issues: potential endangered species issues with development of Carrizo-Wilcox aquifer; terrestrial and aquatic impact in area of potential off-channel reservoir; bay and estuary inflow effects resulting in lower basin management changes; endangered species issues associated with expansion of water treatment plant and transmission pipelines at Lake Travis.
Studies Needed: hydrologic studies of augmentation methods of lower basin supplies and resulting increased availability at Highland Lakes; site specific studies for endangered species, karst geology, and cultural resources needed in construction areas; endangered species studies of potential effects of groundwater development.
Other Issues: future implementation decisions will be affected by the regulatory environment, water demand, treatment and reuse technology, and perhaps the actions of other municipalities.
Permits Needed: TNRCC permit(s) needed for lower basin augmentation and for diversion of increased supplies at Lake Travis.

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City of Pflugerville — Integrated Water Supply Plan

Listed in Table S-11 are the water supply alternatives that could potentially supply Pflugerville in the integrated plan. The alternatives presented in Table S-11 for consideration in the integrated plan are the supply options of reasonable cost that could feasibly be permitted and implemented. High cost alternatives and alternatives with significant implementation hurdles have not been included.

Table S-11
Water Supply Alternatives Available to Pflugerville for Integrated Supply Planning
Projected Shortage, Year 2050: 8,945 acft/yr

Alternative	Treatment Facility	Unit Cost ($/acft)	Available Supply or Project Capacity (acft/yr)
1. Purchase Water from LCRA at L. Travis (C-2(3)) (291 mgd)	Austin WTP4	$611 – $665	14,541
2. Purchase Water from LCRA at L. Travis Delivered to L. Georgetown (BC-2)	Will Co Regional WTP	$550 – $600	42,721
3. Purchase Water from LCRA at L. Travis (C-2(8)) (34 mgd)	Will Co Regional WTP	$681 – $731	19,000
4. Carrizo-Wilcox Aquifer to Will Co Regional WTP (CZ-2C)	Will Co Regional WTP	$737 – $787	25,000
5. Purchase Water from LCRA at L. Buchanan to L. Georgetown (C-4B)	Will Co Regional WTP	$596 – $646	42,000
6. Accelerated and Advanced Water Conservation (L-21)	n/a	~ $400	—

With rapid growth of the later 1980s and early 1990s and Austin urban and suburban development moving towards the northeast, the City of Pflugerville experienced significant growth in population and water demand. This resulted in a doubling of its water use in 5 years, and by 1995, potentially exceeding the supply availability of its groundwater sources through a protracted drought. In the early 1990s, Pflugerville contracted with the City of Austin for 5,600 acft/yr and developed an interconnect with the COA system.

As shown in Figure S-22 and Table S-12, near-term water demand for Pflugerville is expected to doubled again to about 3,400 acft/yr by the year 2000, and increase to over 16,000 acft/yr by 2050, an increase of 370 percent! It is projected that the current wholesale supply agreement with Austin should last Pflugerville until the period 2005-2008.

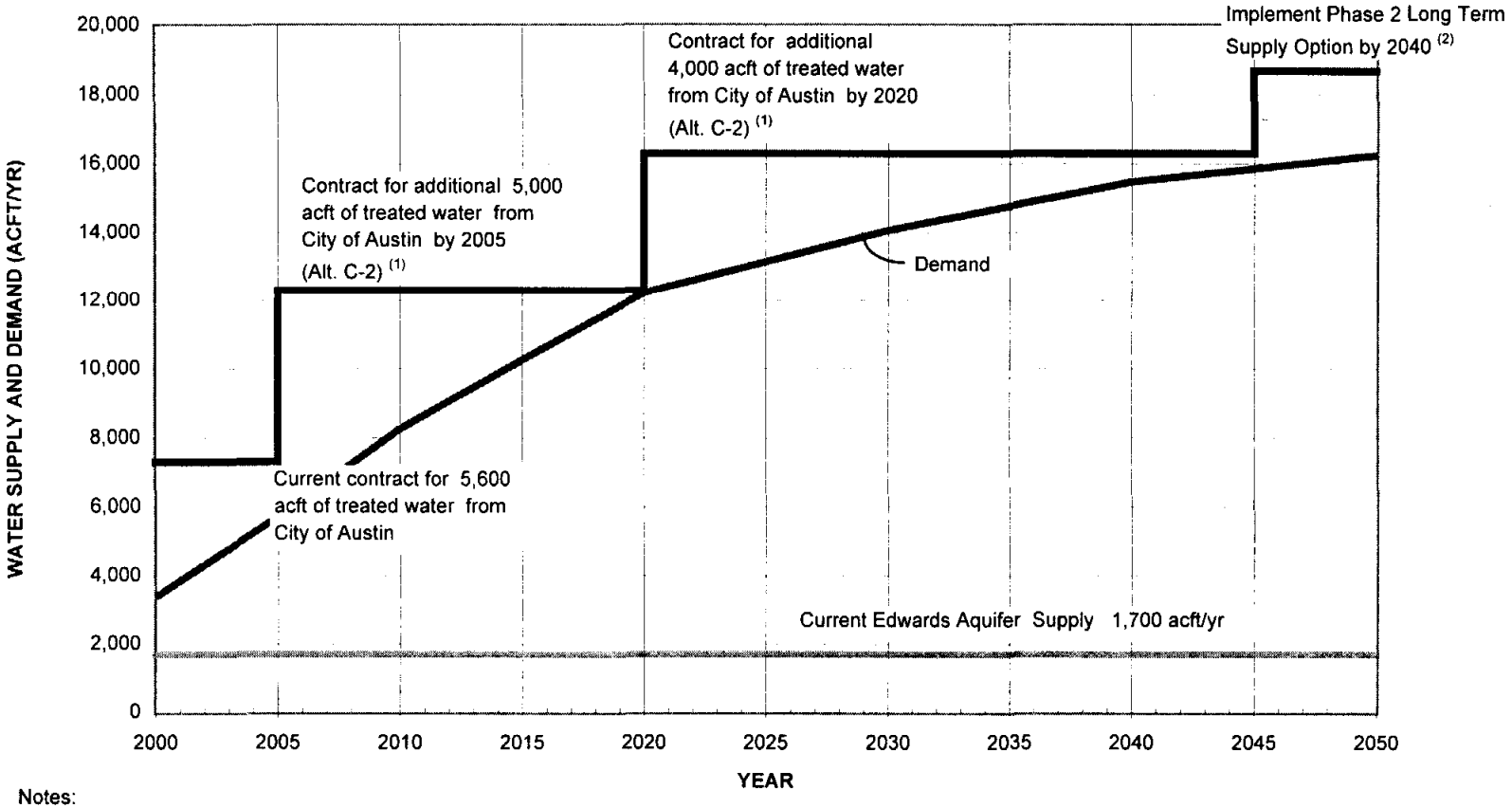
Given the encroachment of the Austin-area growth from the south, its Travis County and Colorado Basin location, and the lack of any other proximate regional facilities or affordable alternatives, it is recommended that Pflugerville soon begin negotiations with the City of Austin for an expansion in its current wholesale supply agreement for an additional 5,000 acft/yr. This additional supply would last Pflugerville until the 2020 time frame when an additional contract expansion of about 4,000 acft/yr would be needed to last until the year 2050. At about the year 2040, Pflugerville should participate in another round of regional planning to ascertain the best course of action for new water supplies in the very long-term.

Infrastructure Needs

In order to utilize increased supplies from Austin, Pflugerville will need to construct water transmission pipelines from the Austin distribution system into the Pflugerville system. Additional storage tanks will also be needed as Pflugerville's demand grows. The upper range of unit costs listed in Table S-12 includes estimates of the cost of new delivery and storage facilities.

In order for the City of Austin to be able to supply Pflugerville's needs through year 2040, as well as Austin's projected growth, Austin must construct the infrastructure described in the preceding section.

Considering projected demands beyond year 2040, all of the longer-term supply options listed in Table S-12 result in increased water availability at Lake Travis. To utilize these sources, WTP 4 and associated transmission facilities would need to be expanded by Austin or possibly by an Austin-Pflugerville partnership. Augmentation of the Colorado River system to achieve increased supply in Lake Travis would require construction of a Carrizo-Wilcox well field (See Section 3.16, Vol 2) and/or an off-channel reservoir in the lower basin. (See Section 3.14 and 3.16, Vol 2)



Notes:
(1) Water Purchase contract with Austin would include payment for raw water commitment from LCRA. WTP expansions and transmission CIP program would be phased with the demand curve.
(2) Phase 2 Water Supply Options could include augmentation of Lower Colorado River with off-channel storage (C-5) or Carrizo-Wilcox Aquifer (CZ-1), Reuse Projects (L-5) or Little River Diversion (B-8), or Purchase of Additional Lake Travis Water, if available.

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
CITY OF PFLUGERVILLE

FIGURE S-22

Table S-12
Integrated Water Supply Plan
City of Pflugerville

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)		Unit Cost[3] ($/acft) 1997$
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply	
2000	3,385	7,300	3,915	Negotiate contract for treated water from City of Austin	2000			
				Implement accelerated and additional water conservation	2000			
2005	5,714	12,300	6,586	Utilize wholesale water from the City of Austin (Alt. C-2.2)	2005		5,000	$611 – $665
2010	8,258	12,300	4,042					
2015	10,257	12,300	2,043					
2020	12,230	16,300	4,070	Utilize additional water from the City of Austin (Alt. C-2.2)	2020		4,000	$611 – $665
2025	13,146	16,300	3,154					
2030	14,061	16,300	2,239					
2035	14,766	16,300	1,534					
2040	15,471	16,300	829	*Initiate planning and evaluation of longer-term alternatives*[4]	2040			
2045	15,858	16,300	442	*Initiate final design/construction of longer-term alternative*[4]	2045			
2050	16,245	18,682	2,437	*Utilize supply of longer-term alternatives*[4]	2050		2,382	

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term major options available: Participate with regional entity, such as COA, in one of the following projects

Carrizo-Wilcox Aquifer to:		
Colorado River/swap from Lake Travis (Alt. CZ-1A)	69,100	$644
Off-channel Colorado/swap from Lake Travis (Alt, CZ-1B)	90,400	$750
Off-channel Colorado Reservoir/purchase irrigation rights (Alt. C-5C)	67,400	$739
Off-channel Colo. Reservoir/river diversion/purchase irrigation rights (Alt. C-5D)	105,200	$724
Purchase additional Lake Travis water, if available		

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Accelerated and Additional Water Conservation (Alt L-9)

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Longer-term Alternatives *(i.e. Carrizo-Wilcox Aquifer to Augment Lower Colorado River Basin, (CZ-1A and CZ-1B), Off-Channel Storage in Lower Colorado River Basin, (C-5), Purchase Additional Lake Travis Water, if available).* Each of these alternatives would result in increased water availability at Lake Travis and would require expansion of treatment facilities and transmission pipelines in the Lake Travis area.

Environmental Issues: potential endangered species issues with development of Carrizo-Wilcox aquifer; terrestrial and aquatic impact in area of potential off-channel reservoir; bay and estuary inflow effects resulting in lower basin management changes; endangered species issues associated with expansion of water treatment plant and transmission pipelines at Lake Travis.
Studies Needed: hydrologic studies of augmentation methods of lower basin supplies and resulting increased availability at Highland Lakes; site specific studies for endangered species, karst geology, and cultural resources needed in construction areas; endangered species studies of potential effects of groundwater development.
Other Issues: a partnership arrangement or an amended water purchase contract with the City of Austin or other regional entity would probably be necessary to implement one of these alternatives.
Permits Needed: TNRCC permit(s) needed for lower basin augmentation and for diversion of increased supplies at Lake Travis.

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Manville Water Supply Corporation — Integrated Water Supply Plan

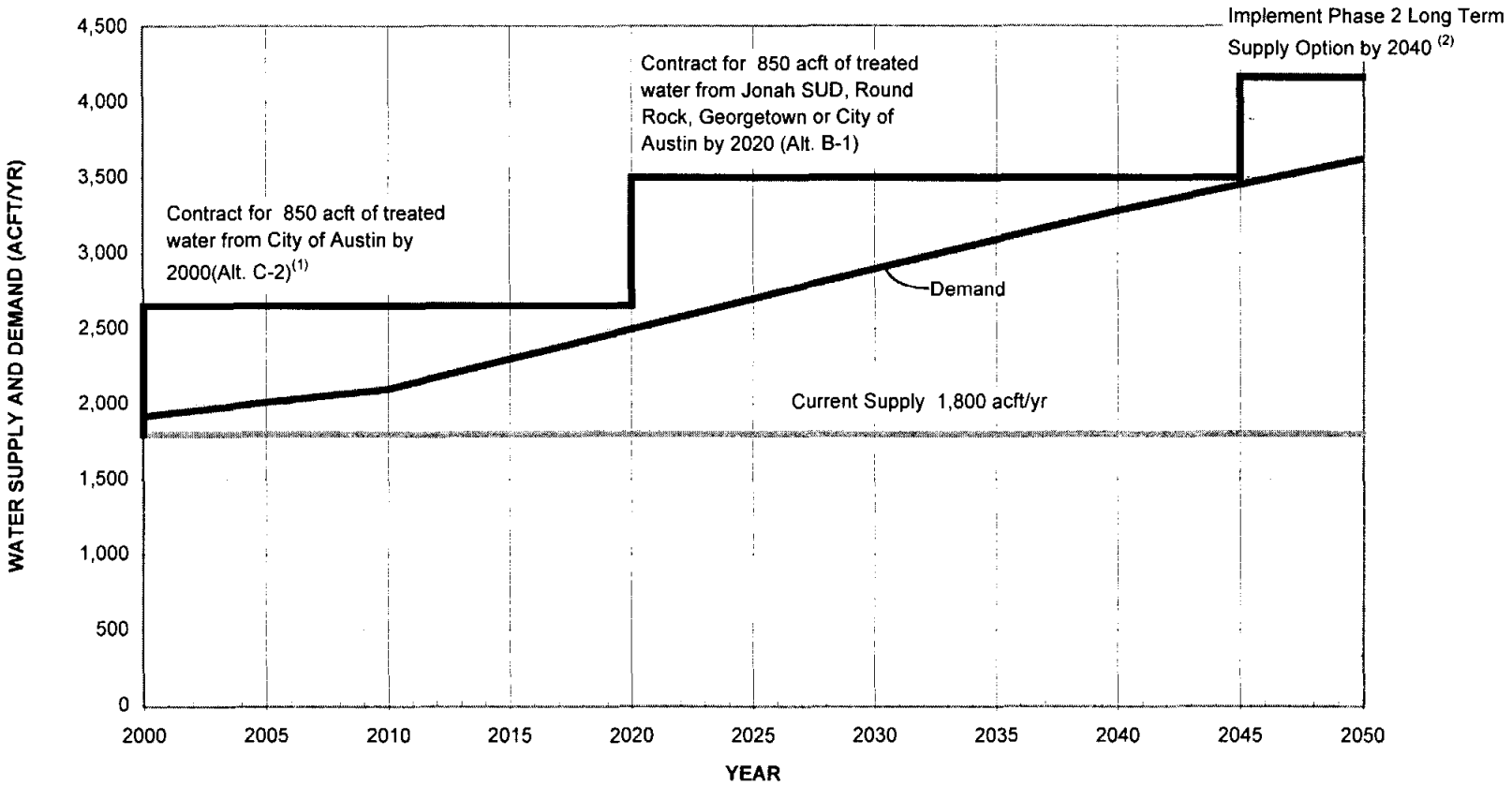
Listed in Table S-13 are the water supply alternatives that could potentially supply Manville WSC in the integrated plan. The alternatives presented in Table S-13 for consideration in the integrated plan are the supply options of reasonable cost that could feasibly be permitted and implemented. High cost alternatives and alternatives with significant implementation hurdles have not been included.

Table S-13
Water Supply Alternatives Available to Manville WSC
for Integrated Supply Planning
Projected Shortage, Year 2050: 1,823 acft

Alternative	Treatment Facility	Unit Cost ($/acft)	Available Supply or Project Capacity (acft/yr)
1. Purchase Water from LCRA at L. Travis (C-2(3)) (291 mgd)	Austin WTP4	$611 – $665	186,764
2. Purchase Water from LCRA at L. Travis Delivered to L. Georgetown (BC-2)	RR WTP	$550 – $600	42,721
3. Purchase Water from LCRA at L. Travis (C-2(8)) (34 mgd)	Will Co Regional WTP	$681 – $731	19,000
4. Carrizo-Wilcox Aquifer to RR WTP (CZ-2C)	RR WTP	$737 – $787	25,000
5. Purchase Water from LCRA at L. Buchanan to L. Georgetown (C-4B)	Will Co Regional WTP	$596 – $646	42,000

The projected growth in Manville is anticipated to be more subdued than in Pflugerville, but still sufficient to create additional and near-term water supply needs. Based on current use and supply availability figures, Manville WSC is in current need of additional supplies. To further regionalize supplies, the Trans Texas recommendation is that Manville also negotiate a small water supply contract of 850 acft/yr with the City of Austin (see Figure S-23 and Table S-14).

Manville has recently further developed their Edwards Aquifer supply and has agreed to supply the Town of Hutto with 336 acft/yr. There is concern, however, over the longer-term supply availability of the Edwards in this area. Manville has also expressed interest in exploring options of developing a small well field in the Carrizo-Wilcox aquifers, which may also prove cost-effective for the utility in the future. Whether a contract with COA or a small well field



Notes:
(1) Water purchase contract with Austin would include payment for raw water commitment from LCRA.
((2) Phase 2 Water Supply Options could include augmentation of Lower Colorado River with off-channel storage (C-5) or Carrizo-Wilcox Aquifer (CZ-1), Reuse Projects (L-5) or Little River Diversion (B-8), or Purchase of Additional Lake Travis Water, if available.

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
MANVILLE WSC

FIGURE S-23

Table S-14
Integrated Water Supply Plan
Manville WSC

Year	Water (acft/yr) Demand[1]	Supply	Surplus (Deficit)	Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr) Conservation[2]	Supply	Unit Cost[3] ($/acft) 1997$
2000	1,919	2,650	731	Negotiate contract for treated water from City of Austin	1998			
				Utilize wholesale water from the City of Austin (Alt. C-2.2)	2000		850	$611 – $655
				Implement accelerated and additional conservation	2000			
2005	2,012	2,650	638					
2010	2,099	2,650	551					
2015	2,297	2,650	353	Negotiate contract for treated water from regional entity	2015			
2020	2,496	3,500	1,004	Utilize treated water from a regional entity	2020		850	$550 – $650
2025	2,696	3,500	804					
2030	2,876	3,500	603	*Initiate planning and evaluation of longer-term alternatives*[4]				
2035	3,088	3,500	412	*Initiate planning and evaluation of longer-term alternatives*[4]	2035			
2040	3,280	3,500	220	*Initiate final design/construction of longer-term alternative*[4]	2040			
2045	3,452	4,166	714	*Utilize supply of longer-term alternative*[4]	2045		666	
2050	3,623	4,166	543					

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term major options available: Participate with regional entity, such as COA, in one of the following projects

Carrizo-Wilcox Aquifer to:		
Colorado River/swap from Lake Travis (Alt. CZ-1A)	69,100	$694
Off-channel Colorado/swap from Lake Travis (Alt. CZ-1B)	90,400	$800
Off-channel Colorado Reservoir/purchase irrigation rights (Alt. C-5C)	67,400	$789
Off-channel Colo. Reservoir/river diversion/purchase irrigation rights (Alt. C-5D)	105,200	$774
Little River or Brushy Creek to Lake Georgetown (Alt. B8)	19,160	$687
Carrizo-Wilcox to Lake Georgetown to Round Rock (Alt. CZ-2B)	25,000	$623
Purchase of additional Lake Travis water, if available		

provides the next increment of supply, Manville will again need to seek more water by about 2020 and then again in 2045. These further increments could also be supplied by Austin, from potential regional service providers in Williamson County, or a further expansion of a potential Carrizo-Wilcox well field.

Infrastructure Needs

In order to utilize increased supplies from Austin, Manville would need to construct water transmission pipelines from the Austin distribution system into the Manville system by about year 2000. Additional storage tanks will also be needed as Manville's demand grows. The upper range of unit costs listed in Table S-14 includes estimates of the cost of new delivery and storage facilities.

Alternatively, in order to utilize a new water supply from the Carrizo-Wilcox aquifer, Manville would need to construct the following facilities by year 2000:

- Wells into the Carrizo-Wilcox aquifer.
- Water treatment plant if iron and/or hydrogen sulfide is present.
- Water transmission pipeline.
- Storage tank(s).

Considering projected demands beyond year 2045, the longer-term supply options listed in Table S-14 result in increased water availability from the Carrizo-Wilcox aquifer, at Lake Georgetown, or at Lake Travis. To utilize one of these sources, Manville should plan to work with another entity to regionalize the project and build joint facilities.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Water Purchase Contract with City of Austin

A long-term water purchase contract would need to be negotiated with the City of Austin. Contract terms would probably include payment for raw water commitments from LCRA. Implementation of Austin's CIP program for WTP 4 and associated pipelines would be accelerated.

Development of Carrizo-Wilcox Aquifer

A small development of the Carrizo-Wilcox aquifer to supply Manville's needs has little anticipated environmental, regulatory, or other implementation issues.
Studies Needed: groundwater hydrology and quality studies needed to confirm well capacities and treatability requirements of recovered water.
Permits Needed: no underground water district exists in the Central Texas portion of the Carrizo-Wilcox aquifer and no permit is needed for well construction; post-construction information must be filed with TNRCC.

Longer-term Alternatives *(i.e. Carrizo-Wilcox Aquifer to Augment Lower Colorado River Basin, (CZ-1A and CZ-1B), Carrizo-Wilcox Aquifer to Lake Georgetown (CZ-2), Off-Channel Storage in Lower Colorado River Basin, (C-5), Little River or Brushy Creek Diversion to Lake Georgetown (B-8), Purchase of Additional Lake Travis Water, if available).* Refer to the implementation sections for the City of Austin, City of Pflugerville, and City of Round Rock.

Other Areas of Travis County

By the end of the 50-year planning period, it is likely that much of Travis County will be urbanized and essentially comprise a large metropolitan area. Considering this potential future, a more aggressive expansion of the Austin water service area was assessed. This second scenario would encompass the plan described above and would also include providing potable water to the remainder of Travis County in need, to current city residents and wholesale customers in southern Williamson County, and possibly to entities in Northern Hays County within the Barton Springs-Edwards Aquifer Conservation District (BSEACD). This larger service area scenario could increase water demand over the more conservative service area scenario by about 21,000 acft/yr by 2020 and 28,000 acft/yr by 2050. Under this broader scenario, total water demand for the Austin service area would reach about 289,000 acft/yr by the year 2020, and 381,000 acft/yr by the year 2050. Under this second scenario, the timing for the new water management measures identified above would be advanced approximately four to seven years, and an additional 28,000 acft/yr of supply would be required by the year 2040.

After considering the LCRA/Austin supply agreement, other current LCRA contractual commitments, and potential service to entities along the U.S. Hwy 183 corridor in Williamson County, it is anticipated that the existing firm yield supplies of Lake Travis (i.e., not considering purchase and transfer of downstream water rights) would be fully committed by the end of the planning period. If Austin acts to serve other existing development in West Travis County, it is

possible that some existing supply contracts could revert back to LCRA and be made available for purchase by Austin. Beyond this, new water supply development could add up to 90,000 acft to the area's water supply availability, including: development of groundwater providing water directly to the Austin area; developing groundwater to supply the lower basin, thus offsetting the need for Lake Travis irrigation releases; increasing the efficiency of Lake Travis releases through re-regulation further downstream; purchase and transfer of downstream water rights; or other possible management options.

The BSEACD, encompassing areas of Southern Travis and Northern Hays counties, recently completed a regional water plan that evaluated alternatives for the area (BSEACD, 1997). Four major options were assessed including water supplies from the Guadalupe-Blanco River Authority (GBRA), the Lower Colorado River Authority, the City of Austin, and a District well field alternative. While the District well field option provided the lowest cost option, there are concerns about its water availability and impact on springflow during drought conditions. The GBRA alternative reflected the next lowest cost option, but there are questions about whether there is sufficient water available for sale. The City of Austin option ranked next in terms of unit costs, but Austin has concerns over the potential for inducing growth over the Edwards Aquifer recharge zone. Considerable growth has already occurred, however, and is utilizing the limited Edwards water for its supply. The LCRA option cost slightly more than the COA alternative, and since much of the service area is in the Austin ETJ, this alternative would be faced with the same growth issues as the COA options.

S-6.5.2 U.S. 183 Corridor/Western Williamson County Sub-Region — Integrated Water Supply Plan

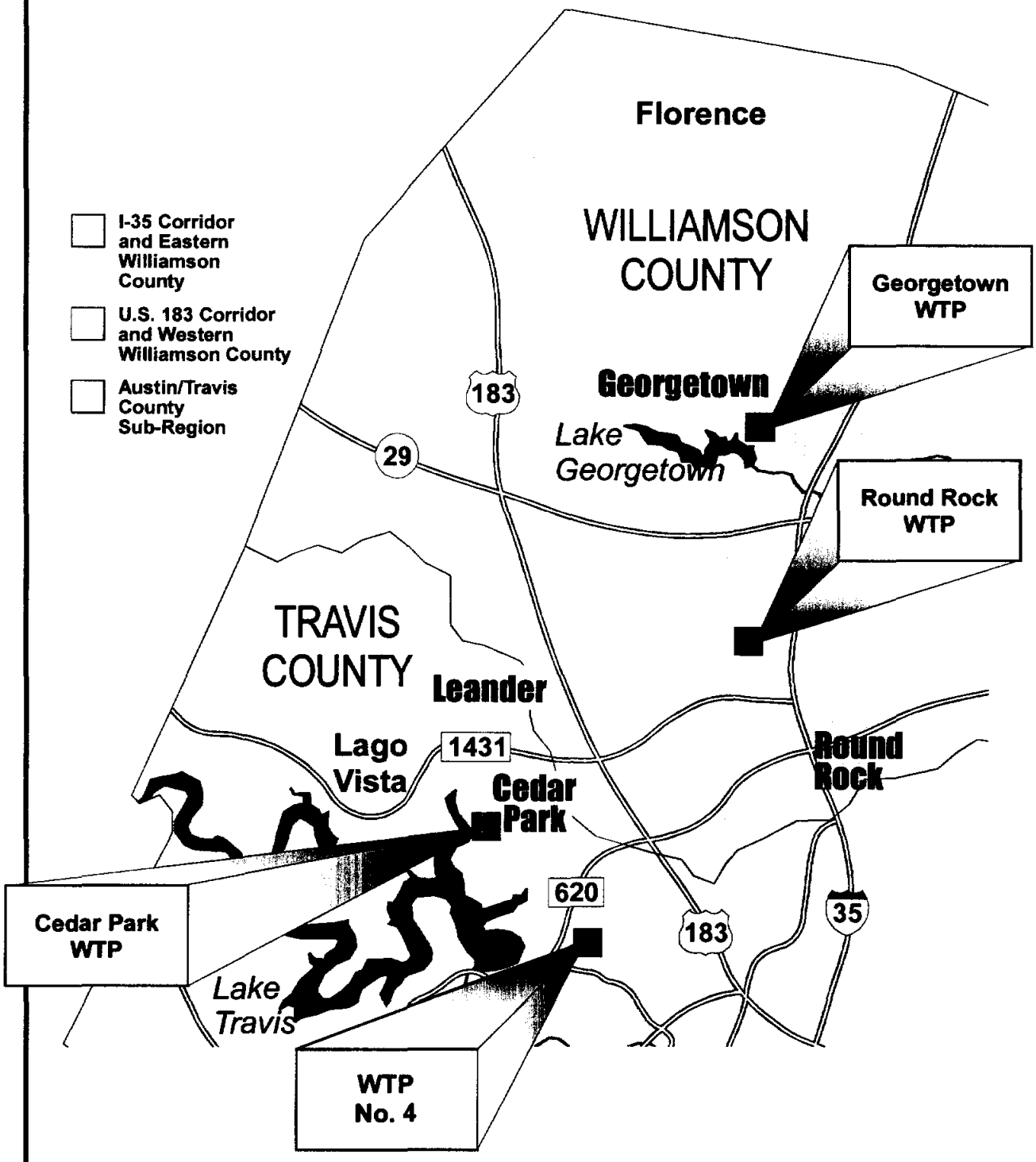
The U.S. 183 Corridor/Western Williamson County Sub-region, comprised of Williamson County cities and developments near U.S. Highway 183 and other smaller towns, utilities, and rural areas in the western portion of the county, is graphically portrayed in Figure S-24.

As seen from the dates in Table S-15. the municipalities of Cedar Park, Leander, and Liberty Hill and a number of the utilities in the suburban and rural areas are facing rapid growth and population and water use and near-term water supply needs. Some of these entities are currently in individual negotiations for additional supplies. The various recommendations and timing sequence of recommendations identified in Figure S-25 and Table S-15 offer significant opportunities for regional cooperation in pursuing new water supply and treatment projects.

Action is recommended in the very near-term to contract an additional 20,600 acft/yr of LCRA stored water for Leander and Cedar Park, and Liberty Hill, and various rural portions of western Williamson County. Expanding the Cedar Park plant or constructing a new regional plant would likely provide cost savings through economies of scale; allow for future interim sharing of supplies, if needed; and help promote cooperation for future joint water supply actions. Further LCRA supplies of about 4,900 acft/yr would be needed by 2010 to meet the needs developing supply deficits of small utilities in the western Williamson County.

Accelerated and additional water conservation and reuse projects are recommended for Cedar Park and Leander in the near- and medium-term. These actions are typically cost-effective and will help to defer the future expansion of water treatment plant capacity.

These above efforts will generally suffice for the sub-region until about the 2040 to 2045 timeframe. Prior to this time, the entities in the area and/or regional provider must again begin the planning and development necessary to have the new supplies available when needed. Most of the major options available to the U.S. 183 Corridor/Western Williamson County Sub-region are the same as those for the City of Austin, so further opportunities exist for regional cooperation, or competition, at that time. It is also recommended that during the course of urbanization of this area that inter-connects be developed between the utility systems of the U.S. 183 and IH-35 corridors. Descriptions of individual system expansions recommended for Cedar Park, Leander, and other areas of western Williamson County are presented in the following sections.



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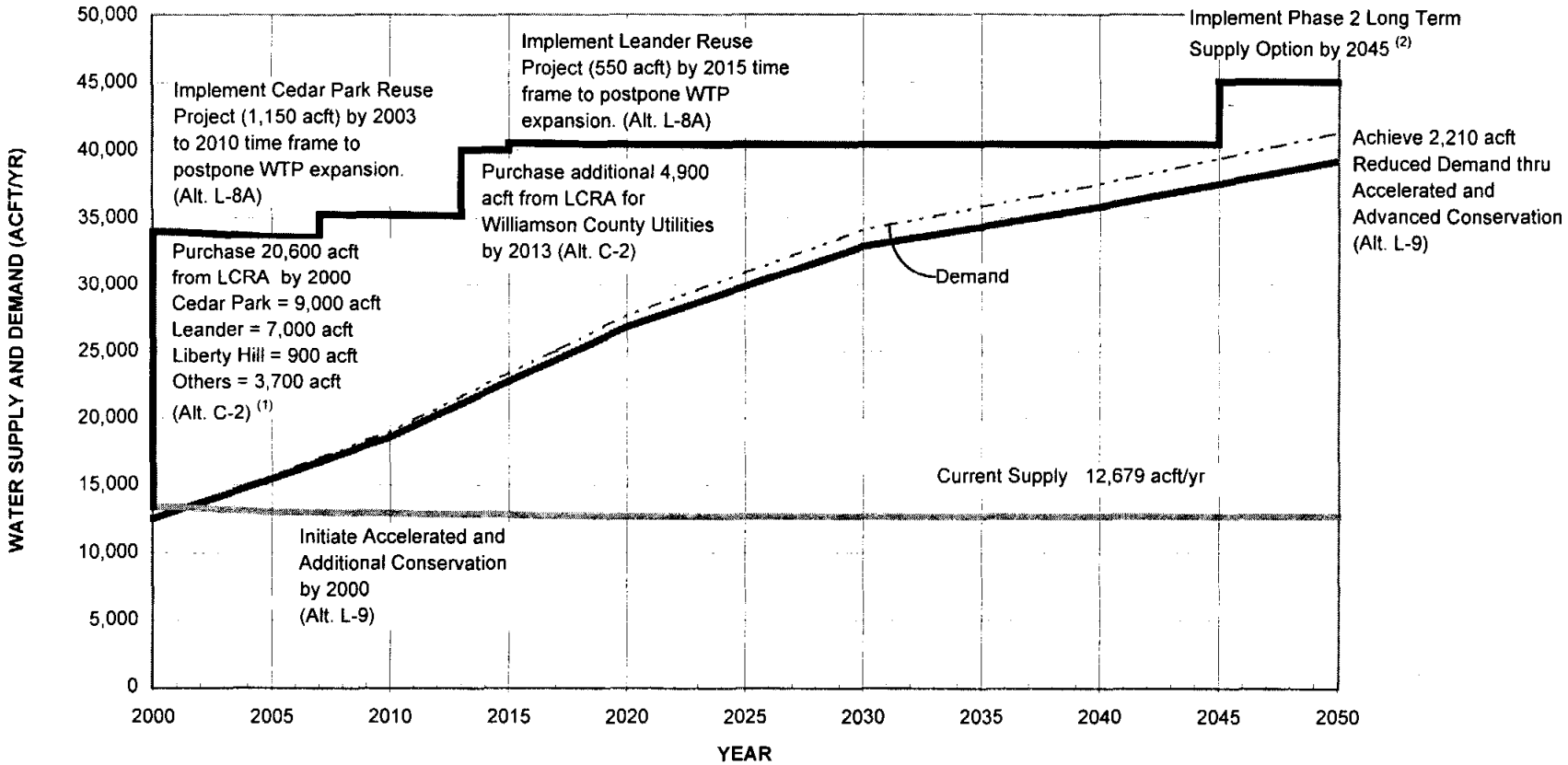
TRANS-TEXAS WATER PROGRAM/ NORTH CENTRAL STUDY AREA

U.S. 183 CORRIDOR AND WESTERN WILLIAMSON COUNTY SUBREGION

FIGURE S-24



Notes:
(1) Potential LCRA - BRA - Alliance regional water system
(2) Phase 2 Water Supply Options could include augmentation of Lower Colorado River with off-channel storage (C-5) or Carrizo-Wilcox Aquifer (CZ-1), Reuse Projects (L-5), interconnection with Williamson County Regional Entity (i.e. Georgetown, Round Rock and others), or Purchase of Additional Lake Travis Water, if available

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
US 183 CORRIDOR &
WESTERN WILLIAMSON COUNTY SUBREGION

FIGURE S-25

Table S-15
Integrated Water Supply Plan
U.S. 183 Corridor and Western Williamson County Sub-Region
(Cedar Park, Leander, Liberty Hill, and Western Williamson County)

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)	
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply
				Develop accelerated/additional water conservation programs	1998		
				Negotiate purchase of LCRA water for western Williamson County	1998		
2000	12,528	34,074	21,546	Purchase stored water from LCRA (Alt. C-2.6) for western Williamson County entities	2000		20,600
2005	15,447	34,742	19,295	Implement Cedar Park reuse project (Alt L-8A)	2003	221	1,150
2010	18,544	34,653	16,109	Purchase additional stored water from LCRA (Alt. C-2.6) for Western Williamson County entities	2014		4,900
				Implement Leander reuse project (Alt. L-8A)	2015		550
2015	22,710	39,991	17,281			663	
2020	26,794	39,879	13,085			884	
2025	29,795	39,879	10,084			1,105	
2030	32,795	39,879	7,084			1,326	
2035	34,241	39,879	5,638	*Initiate planning and evaluation of longer-term alternatives*[4]	2035	1,547	
2040	35,687	39,879	4,192	*Initiate final design/construction of longer-term alternative*[4]	2040	1,768	
2045	37,369	44,907	7,538	*Utilize supply of longer-term alternative*[4]	2045	1,989	5,028
2050	39,050	44,707	5,857			2,210	

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term supply increment sized to provide 15% surplus by 2050

Long-term major options available:	
Participate with regional entity, such as COA, in one of the following projects	
Carrizo-Wilcox Aquifer to:	69,100
Colorado River/swap from Lake Travis (Alt. CZ-1A)	90,400
Off-channel Colorado/swap from Lake Travis (Alt, CZ-1B)	67,400
Off-channel Colorado Reservoir/purchase irrigation rights (Alt. C-5C)	105,200
Off-channel Colo. Reservoir/river diversion/purchase irrigation rights (Alt. C-5D)	
Interconnect with eastern Williamson County regional entity (i.e., RR. Georgetown, others)	
Purchase of additional Lake Travis water, if available	

City of Cedar Park — Integrated Water Supply Plan

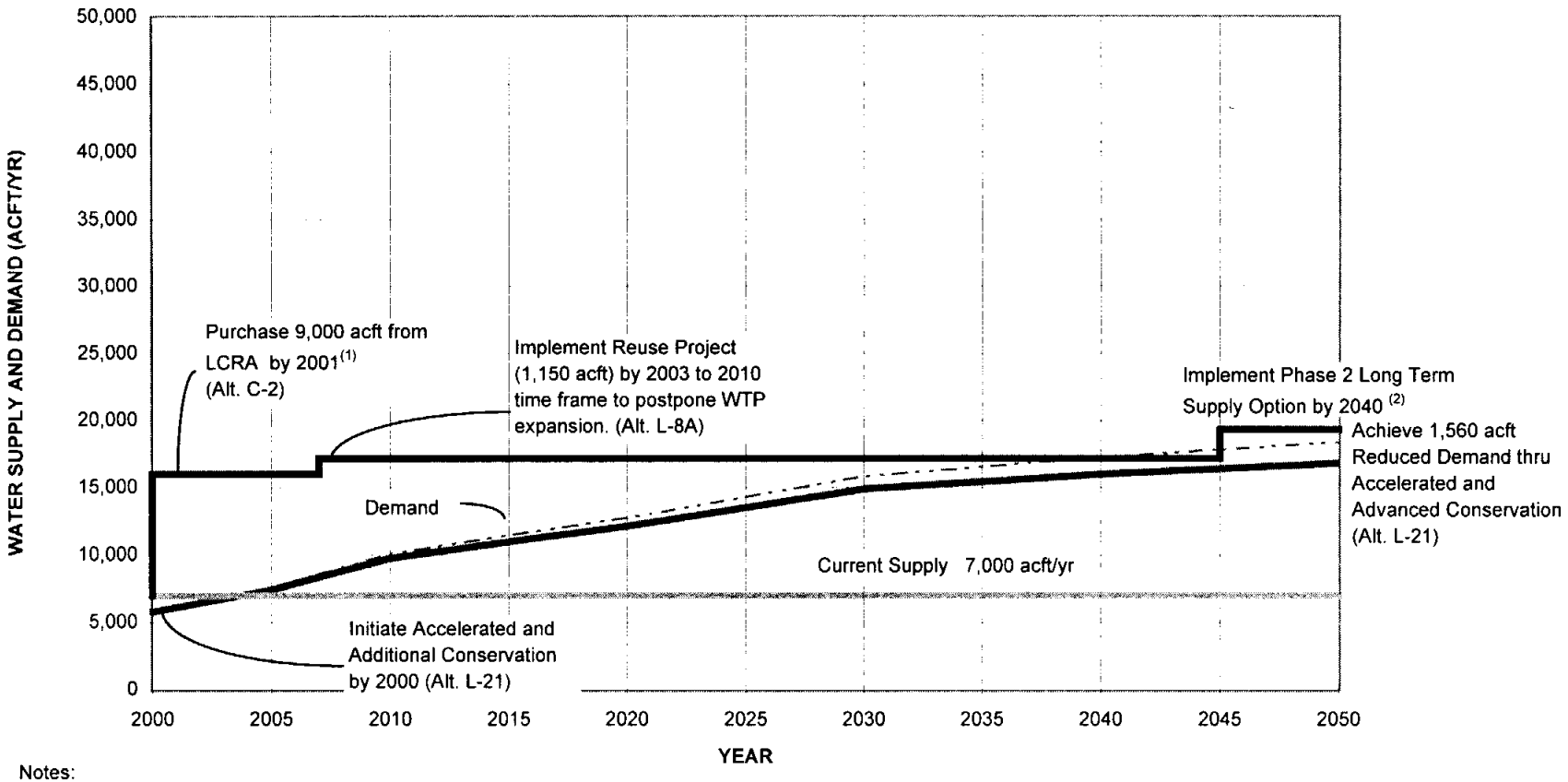
In addition to northwest Austin and its ETJ in this area, the City of Cedar Park has experienced the brunt of rapid growth and development along the U.S. Highway 183 corridor. Within 10 years from 1990 to 2000, its water use is expected to more than double, and then increase about three-fold again to almost 17,000 acft/yr by the year 2050 (see Figure S-27 and Table S-16). At this rate of growth, their 7,000 acft/yr contract with the LCRA will soon be fully utilized and create a need for the City to obtain additional water supplies by about the year 2004.

Water supply alternatives available to the Cedar Park area and adjacent entities are listed in Figure S-26 and range in cost from $263 per acft to $719 per acft. The upper portion of Figure S-26 lists the water supply alternatives available to the Cedar Park area grouped as follows: Lake Travis Alternatives, Augmentation Sources for Lake Travis, and Reclaimed Water Reuse and Conservation. Within each group, the supply alternatives in Figure S-26 are listed in order from lowest cost to highest cost. Listed for each alternative is the water supply available and the estimated unit cost.

It is recommended that, prior to 2004, Cedar Park negotiate for an expansion of their LCRA agreement to obtain an additional 9,000 acft/yr. It is also recommended that the City initiates an accelerated and advanced water conservation program in the near-term and implements a reuse project by about the year 2007 to delay the need for expansion of their water treatment plant. Implementation of these measures will ensure Cedar Park an adequate water supply until about the year 2050 when additional water supplies would be required.

The timing and extent of these various actions could also be affected by regionalization. It is strongly recommended that Cedar Park, Leander, and other U.S. 183 entities consider, in the near-term, joint participation in expansion of the Cedar Park WTP or in development of a new regional treatment facility.

The suggested 9,000 acft/yr contract expansion with the LCRA will create some degree of excess supplies, lasting Cedar Park for many years. However, this quantity of additional supply is recommended for two reasons: (1) the remaining available water in Lake Travis will likely be fully committed in the foreseeable future and may not be available 20 or 30 years from now; and (2) this quantity of additional supply (and the other recommended measures) will carry



Notes:
(1) WTP capacity 19 mgd by 2003, 21 mgd by 2005. Additional 7.6 mgd WTP capacity needed in the planning horizon.
(2) Phase 2 Water Supply Options could include augmentation of Lower Colorado River with off-channel storage (C-5) or Carrizo-Wilcox Aquifer (CZ-1), Reuse Projects (L-5), or interconnection with Williamson County Regional Entity (i.e. Georgetown, Round Rock and others), or Purchase of Additional Lake Travis Water, if available

HDR Engineering, Inc.

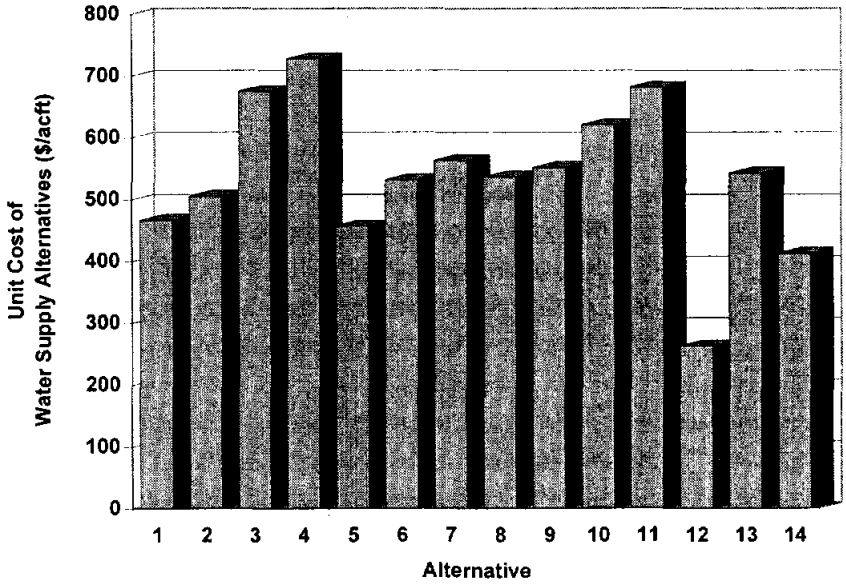
TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
CITY OF CEDAR PARK

FIGURE S-27

Water Supply Alternatives Available to the Cedar Park Area (Year 2050 Projected Shortage: 11,349 acft/yr)		
Alternative	**Unit Cost[1] ($/acft)**	**Available Supply or Project Capacity (acft/yr)**
Lake Travis Alternatives		
1. Purchase from LCRA at Lake Travis — Cedar Park WTP (C-2(7)) (w/ Leander and Round Rock) (46 mgd)	$467	25,456
2. Purchase from LCRA at Lake Travis — Cedar Park WTP (C-2(6)) (w/ Leander) (25 mgd)	$506	13,998
3. Purchase from LCRA at Lake Travis — Austin WTP4 (324 mgd) (C-2(4))	$675	10,436
4. Purchase from LCRA at Lake Travis — Austin WTP4 (356 mgd) (C-2(5))	$728	10,436
Augmentation Sources for Lake Travis		
5. Carrizo-Wilcox Aquifer to Colorado River — Direct Discharge (CZ-1A)	$457	69,100
6. Lake Somerville to Colorado River (B-7)	$532	29,100
7. Carrizo-Wilcox Aquifer to Colorado River — through Off-Channel Storage (CZ-1B)	$563	90,400
8. Off-Channel Storage in Lower Basin w/ River Diversion and Purchase of Irrigation (C-5D)	$537	105,200
9. Off-Channel Storage in Lower Basin w/ Purchase of Irrigation Rights (C-5C)	$552	67,400
10. Off-Channel Storage in Lower Basin w/ River Diversion (C-5B)	$621	67,300
11. Off-Channel Storage in Lower Colorado River Basin (C-5A)	$682	36,600
Reclaimed Water Reuse and Conservation		
12. Reclaimed Water Reuse — Restricted Access (C-8A)	$263	1,150
13. Reclaimed Water Reuse — Industrial Use (C-8B)	$543	1,150
14. Accelerated and Advanced Conservation (L-21)	$413	1,560

(1) Costs are inclusive of all treatment plant components and purchase of raw water (where applicable). Distribution costs not included.



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WATER SUPPLY ALTERNATIVES AVAILABLE TO THE CEDAR PARK AREA

FIGURE S-26

Table S-16
Water Management Plan
City of Cedar Park

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)		Unit Cost[3] ($/acft) 1997$
	Demand[1]	Supply	Surplus (Deficit)			Conserva-tion[2]	Supply	
				Develop accelerated/additional water conservation program	1998			
				Negotiate purchase of LCRA water	1998			
				Consider participation in regional project	1998			
2000	5,782	7,000	1,218	Accelerated and additional water conservation (Alt. C-2.6)	2000			$400
				Purchase LCRA stored water (Alt. C-2.6)	2001	156		$53
				Initiate final design/construction of reuse project	2002			
				Utilize LCRA stored water (Alt. C2.6)	2004		9,000	$506
2005	7,415	16,000	8,585					
2010	9,751	17,150	7,399	Implement reuse project (Alt. L-8A) to avoid WTP expansion	2007	312	1,150	$263
2015	10,983	17,150	6,167			468		
2020	12,118	17,150	5,032			624		
2025	13,499	17,150	3,651			780		
2030	14,879	17,150	2,271			936		
2035	15,425	17,150	1,725			1,092		
2040	15,971	17,150	1,179	*Initiate planning and evaluation of longer-term alternatives*[4]	2040	1,248		
2045	16,380	17,150	770	*Initiate final design/construction of longer-term alternative*[4]	2045	1,404		
2050	16,789	19,307	2,518	*Utilize supply of longer-term alternative*[4]	2050	1,560	2,157	

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term major options available:

Carrizo-Wilcox Aquifer to:		
Colorado River/swap from Lake Travis (Alt. CZ-1A)	69,100	$644
Off-channel Colorado/swap from Lake Travis (Alt. CZ-1B)	90,400	$750
Off-channel Colorado Reservoir/purchase irrigation rights (Alt. C-5C)	67,400	$739
Off-channel Colo. Reservoir/river diversion/purchase irrigation rights (Alt. C-5D)	105,200	$724
Inter-connect with eastern Williamson County regional entity (i.e., RR, Georgetown, & others)		
Purchase of additional Lake Travis water, if available		

Cedar Park until about the year 2050 at which time Austin and other U.S. 183 entities are also predicted to need new supplies, presenting a further opportunity for regional project development.

Key longer-term options (35-40 year planning horizon) facing Cedar Park and its neighbors are shown in Table S-16 and briefly discussed in Section 6.5.2.

Infrastructure Needs

Listed below are the physical facilities needed to implement the integrated water supply plan for the City of Cedar Park (or a regional U.S. 183 system), the date the facilities need to be operating, and a reference to the section in Volume 2 specific to the supply alternative.

- Reuse Project, including diversion structure and pump station at the City's WWTP, pipelines, and end user facilities; needed by 2007. (See Section 3.6, Vol 2)
- Regional water treatment plant or water treatment plant expansion; needed by 2015. (See Section 3.12, Vol 2)
- Water pumping and transmission facilities to move new Lake Travis water supplies from the treatment plant into the Cedar Park system. (See Section 3.12, Vol 2)
- Longer term facilities: all of the longer-term supply options listed in Table S-16 result in increased water availability at Lake Travis; to utilize these sources, WTP and associated transmission facilities would need to be expanded by 2050. Augmentation of the Colorado River system to achieve increased supply in Lake Travis would require construction of a Carrizo-Wilcox well field (See Section 3.16, Vol 2) and/or an off-channel reservoir in the lower basin. (See Section 3.14 and 3.16, Vol 2)
- Treated water transmission pipelines to interconnect with other regional providers (i.e. Round Rock, Georgetown, and Austin) should be constructed in the 2005 to 2015 timeframe. These interconnections are needed for potential sharing of interim surplus water supplies and to increase reliability of water supply to customers of the participating utilities.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

<u>Accelerated and Additional Water Conservation (Alt L-21)</u>

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Reuse Project (Alt L-8)

Environmental Issues: slightly reduced return flows to Brushy Creek system.
Studies Needed: market analysis and user identification survey.
Other Issues: increased monitoring of water quality may be required; public information and education programs may be helpful to promote use of reclaimed water.
Permits Needed: amendment of TNRCC wastewater discharge permit.

Purchase of Uncommitted Stored Water from LCRA for Diversion at Lake Travis (Alt C-2)

Environmental Issues: endangered species issues associated with construction of water treatment plant and transmission pipelines.
Studies Needed: site specific studies for endangered species, karst geology, and cultural resources needed in construction areas.
Other Issues: purchase of Highland Lakes stored water from LCRA must be negotiated.
Permits Needed: Corps of Engineers 404, General Land Office, and Texas Parks and Wildlife Department permits needed for intake, treatment plant, and pipeline construction; may need amendment of TNRCC diversion permit to increase diversions at Lake Travis.

Longer-term Alternatives (i.e. Carrizo-Wilcox Aquifer to Augment Lower Colorado River Basin, *(CZ-1A and CZ-1B), Off-Channel Storage in Lower Colorado River Basin, (C-5), Reclaimed Water Reuse projects (L-5), Purchase of Additional Lake Travis Water, if available).* Each of these alternatives would result in increased water availability at Lake Travis and would require expansion of treatment facilities and transmission pipelines in the Lake Travis area.

Environmental Issues: potential endangered species issues with development of Carrizo-Wilcox aquifer; terrestrial and aquatic impact in area of potential off-channel reservoir; bay and estuary inflow effects resulting in lower basin management changes; endangered species issues associated with expansion of water treatment plant and transmission pipelines at Lake Travis.
Studies Needed: hydrologic studies of augmentation methods of lower basin supplies and resulting increased availability at Highland Lakes; site specific studies for endangered species, karst geology, and cultural resources needed in construction areas; endangered species studies of potential effects of groundwater development.
Other Issues: future implementation decisions will be affected by the regulatory environment, water demand, treatment and reuse technology, and perhaps the actions of other municipalities.
Permits Needed: TNRCC permit(s) needed for lower basin augmentation and for diversion of increased supplies at Lake Travis.

City of Leander
IWSP

City of Leander — Integrated Water Supply Plan

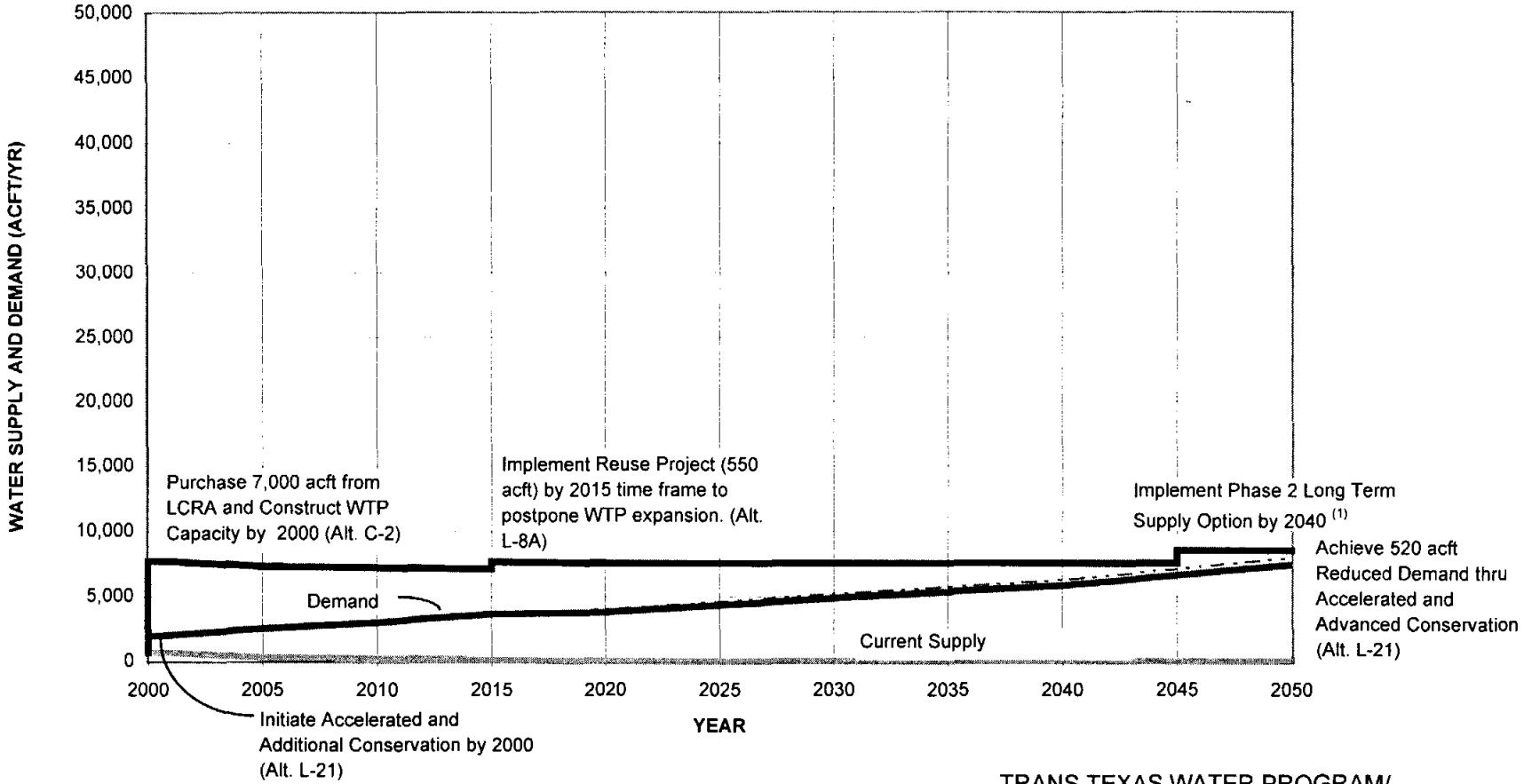
The City of Leander has also experienced very rapid growth. From 1990 to 2000, its water use is also projected to double and then increase about four-fold again, reaching about 7,500 acft/yr by 2050 (see Figure S-28 and Table S-18). Once its interim agreement with Cedar Park expires, Leander will face an immediate water shortage.

Listed in Table S-17 are the water supply alternatives that could potentially supply Leander in the integrated plan. The alternatives presented in Table S-17 for consideration in the integrated plan are the supply options of reasonable cost that could feasibly be permitted and implemented. High cost alternatives and alternatives with significant implementation hurdles have not been included.

Table S-17
Potential Water Supply Alternatives Available to Leander for Integrated Supply Planning
Projected Shortage[1], Year 2050: 5,234 acft/yr

Alternative	Treatment Facility	Unit Cost ($/acft)	Available Supply or Project Capacity (acft/yr)
1. Purchase Water from BRA at L. Stillhouse Hollow Delivered to L. Georgetown (B-1)	Will Co Regional WTP	$600 – $650	2,700
2. Purchase Water from LCRA at L. Travis (C-2(6)) (25 mgd)	CP WTP	$528	5,182
3. Purchase Water from LCRA at L. Travis (C-2(7)) (46 mgd)	CP WTP	$489	5,182
4. Carrizo-Wilcox Aquifer to Will Co Regional WTP (CZ-2C)	Will Co Regional WTP	$737 – $787	25,000
5. Purchase Water from LCRA at L. Travis (C-2(4)) (324 mgd)	Austin WTP4	$699	7,934
6. Accelerated and Advanced Water Conservation (L-21)	n/a	~ $400	—
7. Reclaimed Water Reuse — Restricted Use	n/a	$263	1,000

(1) Projected shortage does not include 2,700 acft/yr of supply purchased from BRA at Lake Stillhouse Hollow. The BRA supply source is listed as a supply alternative; treatment and delivery facilities are to be considered in development of an integrated plan.



Notes:
(1) Phase 2 Water Supply Options could include augmentation of Lower Colorado River with off-channel storage (C-5) or Carrizo-Wilcox Aquifer (CZ-1), Reuse Projects (L-5), interconnection with Williamson County Regional Entity (i.e. Georgetown, Round Rock and others), or Purchase of Additional Lake Travis Water, if available.

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
CITY OF LEANDER

FIGURE S-28

Table S-18
Integrated Water Supply Plan
City of Leander

Year	Water (acft/yr) Demand[1]	Supply	Surplus (Deficit)	Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr) Conservation[2]	Supply	Unit Cost[3] ($/acft) 1997$
				Develop accelerated/additional water conservation program	1998			
				Negotiate purchase of LCRA water (Alt C-2.6)[5]	1998		7,000	$528
				Final design/construction of WTP	1998			
2000	1,931	7,795	5,864	Accelerated and additional water conservation (Alt. L-21)	2000			$400
2005	2,534	7,313	4,779			52		
2010	3,000	7,224	4,224	Initiate final design/construction of reuse project	2010	104		
2015	3,649	7,662	4,013	Implement reuse project (Alt. L-8A) to avoid WTP expansion	2015	156	550	$263
2020	3,778	7,550	3,772			208		
2025	4,324	7,550	3,226			260		
2030	4,870	7,550	2,680			312		
2035	5,359	7,550	2,191			362		
2040	5,847	7,550	1,703	*Initiate planning and evaluation of longer-term alternatives*[4]	2040	412		
2045	6,631	7,550	919	*Initiate final design/construction of longer-term alternative*[4]	2045	466		
2050	7,414	8,526	1,112	*Utilize supply of longer-term alternative*[4]	2050	520	976	

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term major options available: Carrizo-Wilcox Aquifer to:

Colorado River/swap from Lake Travis (Alt. CZ-1A)	69,100	$644
Off-channel Colorado/swap from Lake Travis (Alt. CZ-1B)	90,400	$750
Off-channel Colorado Reservoir/purchase irrigation rights (Alt. C-5C)	67,400	$739
Off-channel Colo. Reservoir/river diversion/purchase irrigation rights (Alt. C-5D)	105,200	$724
Inter-connect with eastern Williamson County regional entity (i.e., RR, Georgetown, & others)		
Purchase of additional Lake Travis water, if available		

[5]In lieu of development of 2,700 acft of Stillhouse water contracted by Leander.

It is recommended that Leander immediately negotiate with the LCRA to obtain additional water supplies. It is estimated that a 7,000 acft/yr contract with the LCRA, combined with an advanced water conservation program and a reuse project should last Cedar Park until the year 2050 when additional water supplies would be required. Even with excess supply from the potential LCRA contract, a reuse project is recommended for Leander in the medium-term to defer the need for additional water treatment capacity. The timing of such action would be dependent upon whether Leander participates with others in a regional treatment system or builds its own facility. For the same reasons mentioned above for Cedar Park, Leander should strongly consider securing enough supplies for the long-term and participation in a regional water system with its neighbors

Key longer-term options (35-40 year planning horizon) facing Leander and its neighbors are shown in Table S-18 and briefly discussed in Section 6.5.2.

Infrastructure Needs

Listed below are the physical facilities needed to implement the integrated water supply plan for the City of Leander (or a regional U.S. 183 system), the date the facilities need to be operating, and a reference to the section in Volume 2 specific to the supply alternative.

- Water treatment plant or water treatment plant expansion; needed by 2000. (See Section 3.12, Vol 2)
- Water pumping and transmission facilities to move Lake Travis water supplies from the treatment plant into the Cedar Park system. (See Section 3.12, Vol 2)
- Reuse Project, including diversion structure and pump station at the City's WWTP, pipelines, and end user facilities; needed by 2010. (See Section 3.6, Vol 2)
- Longer term facilities: all of the longer-term supply options listed in Table S-18 result in increased water availability at Lake Travis; to utilize these sources, WTP and associated transmission facilities would need to be expanded by 2050. Augmentation of the Colorado River system to achieve increased supply in Lake Travis would require construction of a Carrizo-Wilcox well field (See Section 3.16, Vol 2) and/or an off-channel reservoir in the lower basin. (See Section 3.14 and 3.16, Vol 2)
- Treated water transmission pipelines to interconnect with other regional providers (i.e. Round Rock, Georgetown, and Cedar Park) should be constructed in the 2005 to 2015 timeframe. These interconnections are needed for potential sharing of interim surplus water supplies and to increase reliability of water supply to customers of the participating utilities.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Accelerated and Additional Water Conservation (Alt L-21)

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Purchase of Uncommitted Stored Water from LCRA for Diversion at Lake Travis (Alt C-2)

Environmental Issues: endangered species issues associated with construction of water treatment plant and transmission pipelines.
Studies Needed: site specific studies for endangered species, karst geology, and cultural resources needed in construction areas.
Other Issues: purchase of Highland Lakes stored water from LCRA must be negotiated.
Permits Needed: Corps of Engineers 404, General Land Office, and Texas Parks and Wildlife Department permits needed for intake, treatment plant, and pipeline construction; may need amendment of TNRCC diversion permit to increase diversions at Lake Travis.

Reuse Project (Alt L-8)

Environmental Issues: slightly reduced return flows to Brushy Creek system.
Studies Needed: market analysis and user identification survey.
Other Issues: increased monitoring of water quality may be required; public information and education programs may be helpful to promote use of reclaimed water.
Permits Needed: amendment of TNRCC wastewater discharge permit.

Longer-term Alternatives (i.e. Carrizo-Wilcox Aquifer to Augment Lower Colorado River Basin, *(CZ-1A and CZ-1B), Off-Channel Storage in Lower Colorado River Basin, (C-5), Reclaimed Water Reuse projects (L-5), Purchased Additional Lake Travis Water, if available).* Each of these alternatives would result in increased water availability at Lake Travis and would require expansion of treatment facilities and transmission pipelines in the Lake Travis area.

Environmental Issues: potential endangered species issues with development of Carrizo-Wilcox aquifer; terrestrial and aquatic impact in area of potential off-channel reservoir; bay and estuary inflow effects resulting in lower basin management changes; endangered species issues associated with expansion of water treatment plant and transmission pipelines at Lake Travis.
Studies Needed: hydrologic studies of augmentation methods of lower basin supplies and resulting increased availability at Highland Lakes; site specific studies for

endangered species, karst geology, and cultural resources needed in construction areas; endangered species studies of potential effects of groundwater development.

Other Issues: future implementation decisions will be affected by the regulatory environment, water demand, treatment and reuse technology, and perhaps the actions of other municipalities.

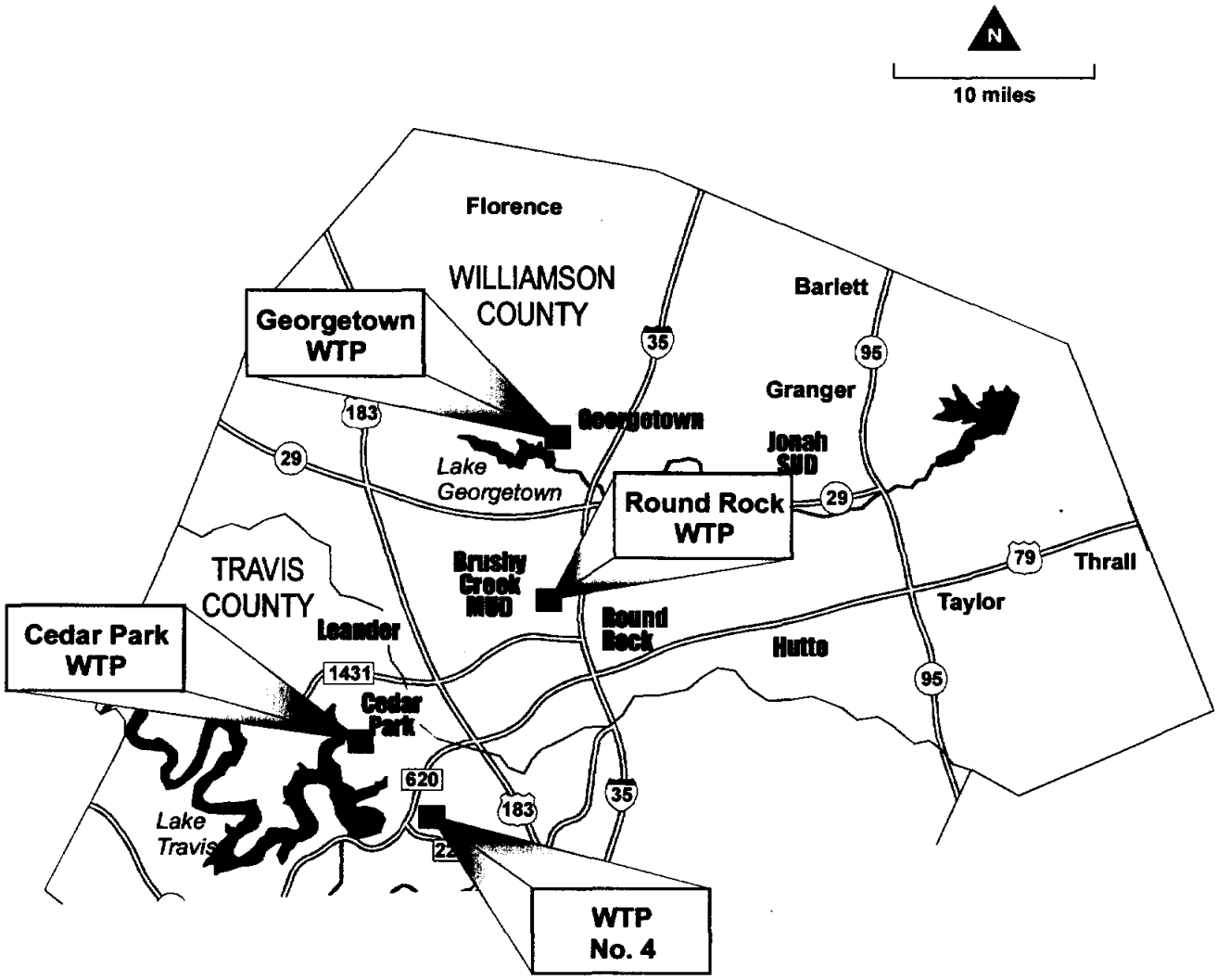
Permits Needed: TNRCC permit(s) needed for lower basin augmentation and for diversion of increased supplies at Lake Travis.

Other Areas of Western Williamson County

The town of Liberty Hill, Chisholm Trail SUD, and in general, other areas of western Williamson County are expected to experience water shortages in the near-term. Much of this area is reliant on Trinity Aquifer supplies, which, for the most part, are limited in quantity and declining in quality. With the rapid growth of the area, Chisholm Trail SUD has already been experiencing water supply and delivery problems, and has taken efforts to upgrade it system and contract for 1,600 acft/yr of new surface water supplies from the Stillhouse Hollow Reservoir. This additional supply will address much of the near- and medium-term needs of the western areas of the county that Chisholm serves, but will not accommodate other entities and rural areas outside their service area nor likely be adequate to meet Chisholm Trail's needs in the longer-term.

To this end, it is recommended that the remaining needs of the western Williamson County area be supplied with the purchase of stored water from the LCRA with treatment at a regional facility such as WTP4 or an expansion of the Cedar Park WTP. Some of the current rural areas will be served by Cedar Park or Leander as they annex or provide water service into their ETJs. For the remainder of the western county, a regional utility provider would likely be the best option for organized water service to these less developed areas. Because LCRA is allowed to only sell water to Cedar Park and Leander (SB 1879, 75th Legislature), further legislative action would be required to extend LCRA supplies into the western areas north of Cedar Park and Leander.

Key longer-term options (35-40 year planning horizon) for entities in western Williamson County and their neighbors are briefly discussed in Section 6.5.2.



- I-35 Corridor and Eastern Williamson County
- U.S. 183 Corridor and Western Williamson County
- Austin/Travis County Sub-Region

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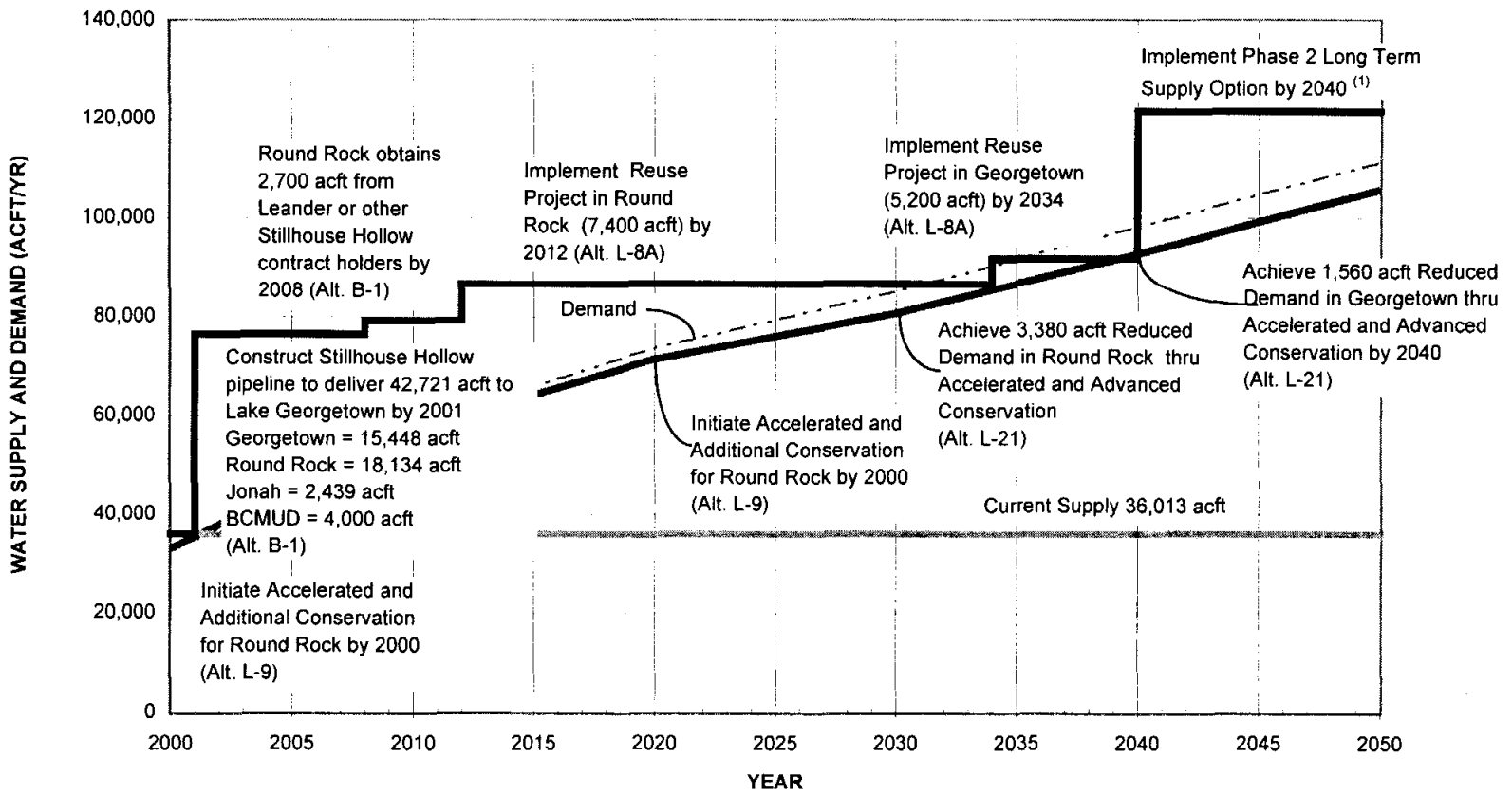
TRANS-TEXAS WATER PROGRAM/ NORTH CENTRAL STUDY AREA

I-35 CORRIDOR AND EASTERN WILLIAMSON COUNTY

FIGURE S-29



Notes:
(1) Phase 2 supply options could include Carrizo-Wilcox Aquifer (CZ-2), Little River Diversion (B-8), or Purchase from LCRA with Augmentation (CZ-1, B-7, C-5, C-4) or interconnection with Williamson County Regional Entity (i.e. Georgetown, Round Rock and others).

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
I-35 CORRIDOR &
EASTERN WILLIAMSON COUNTY

FIGURE S-30

Table S-19
Integrated Water Supply Plan
IH-35 Corridor and Eastern Williamson County Sub-Region
(Round Rock, Georgetown, Jonah SUD, Hutto, Brushy Creek MUD)

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)	
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply
				Complete final design/initiate construction of Stillhouse pipeline	1999		
2000	33,039	74,354	41,315	Initiate accelerated/additional conservation in Round Rock	2000		
				Stillhouse water available and being used			40,021
2005	45,094	76,034	30,940			563	
2010	54,377	78,734	24,357	Round Rock utilizes Stillhouse water from Leander or others	2008	1,127	2,700
2015	64,214	86,134	21,920	Implement Round Rock reuse project	2012	1,690	7,400
2020	71,423	86,134	14,711			2,253	
2025	76,066	86,134	10,069	*Initiate planning and evaluation of longer-term alternatives*[4]	2025	3,337	
2030	80,708	86,134	5,426			4,420	
2035	86,725	91,334	4,609	Implement Georgetown reuse project	2034	4,940	5,200
2040	92,742	121,542	28,800	*Utilize supply of longer-term alternative*[4]	2040	5,460	30,208
2045	92,216	121,542	22,326			5,460	
2050	105,689	121,542	15,853			5,460	

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term supply increment sized to provide 15% surplus by 2050

Long-term major options available: Carrizo-Wilcox Aquifer to:

Lake Georgetown (Alt. CZ-2B)	25,000
Colorado River/swap from Lake Travis (Alt. CZ-1A)	69,100
Off-channel Colorado/swap from Lake Travis (Alt, CZ-1B)	90,400
Off-channel Colorado/swap with Lake Georgetown (Alt. B8)	36,000 - 105,000
Lake Somerville to Colorado/swap with Lake Travis (Alt. B-7)	19,160
Lake Buchanan to Lake Georgetown (Alt. C-4)	29,100
Inter-connect with western Wm. Co. regional entity (i.e., Cedar Park, Alliance, WTP4)	19,000

some of Georgetown's surplus water from Stillhouse Hollow, and facilitate these excess supplies being available through assisting Georgetown financially in implementing its accelerated and advanced water conservation program (2020) and reuse project (2034).

With the implementation of these local initiatives and sharing of supplies, the major demand centers along the IH-35 Corridor would then require their next major increment of supply at the same time about the year 2040. This is opportune for continuing to work on regional solutions for what, by that time, will constitute a large substantially developed metropolitan area along IH-35 facing the same long-term supply choices. Already having implemented water conservation, reuse, and expanded use of existing supplies should help facilitate the regulatory and political consideration of any new water development projects at this later date.

As shown in Table S-19, major water supply options that would be available to the sub-region in the long-term include: development of ground-water supplies; obtaining water from the Colorado River through various measures to augmentation Colorado River flows or water marketing/trades; and indirect reuse through diversion of Brushy Creek or Little River flows back to Lake Georgetown. Other options were also identified in the prior alternatives report, but are generally less desirable due to supply availability, cost, or environmental reasons.

In the eastern portion of the county, entities such as the Manville WSC (with a portion of its service area in southeast Williamson County), the Town of Hutto, some other small utilities, and rural areas have been or are currently experiencing additional water supply needs. Manville is pursuing further ground-water development and an agreement to serve the Town of Hutto with 336 acft/yr. Later, Manville could potentially develop Carrizo-Wilcox supplies or inter-connect with the City of Austin system. For utilities in the upper northeast portion of the county, potential inter-connects with the Georgetown or Jonah SUD systems could address their unmet supply situation.

Still another option for these rural utilities (or potentially for the larger municipalities as well) would be to access "surplus" water resulting from the mine dewatering efforts at the near-by Alcoa facility, either at the Alcoa wells or through acquisition of Alcoa water rights in Lake Granger. If the long-term supply option of choice for the IH-35 Corridor were the development of Carrizo-Wilcox ground-water supplies, then a strategically-sited treatment and pipeline system

could route potable water supplies through the middle portion of eastern Williamson County, proximate to Taylor, Hutto, and other entities, and promoting further inter-connection and diversity of supply in this area.

City of Round Rock — Integrated Water Supply Plan

Water supply alternatives available to the Round Rock area and adjacent entities are listed in Figure S-31 and range in cost from $250 per acft to $980 per acft. The first page of Figure S-31 lists the water supply alternatives available to Round Rock grouped as follows: Surface Water and Groundwater Development Alternatives, Augmentation Sources for Lake Travis, and Reclaimed Water Reuse and Conservation. Within each group, the supply alternatives in Figure S-31 are listed in order from lowest cost to highest cost. Listed for each alternative is the water supply available and the estimated unit cost.

Water use in Round Rock is expected to double from 1990 to 2000, and then increase three-fold again to over 46,000 acft/yr by 2050 (see Figure S-32 and Table S-20). Its current water supply in Lake Georgetown is essentially fully committed and an interim supply agreement with the City of Austin is due to expire in the year 2000. Round Rock has immediate water supply needs and could experience near-term shortfalls should sustained dry conditions again prevail before new supplies are accessed. Round Rock is seeking to "fast track" the construction of the facilities needed to deliver its contracted water from Stillhouse Hollow Reservoir.

It is recommended that the Stillhouse water be available to Round Rock by the year 2001 or sooner. It is also recommended that Round Rock seek to acquire Leander's share of Stillhouse Hollow water (assuming Leander can gain adequate supplies from the LCRA) or lease Stillhouse Hollow water unused by other participants in the longer-term. It is also recommended that Round Rock initiate an accelerated and additional water conservation program (by the year 2000), implement an aggressive reuse program (by 2012), and negotiate and affect an interim use of Georgetown's Stillhouse water for a period of about 6 years beginning in 2034. Key to Georgetown being able to provide this water on an interim basis is their ability to implement aggressive water conservation and reuse program on or before this time. Round Rock's compensation for interim use of its Stillhouse supplies should be adequate to provide for an appropriate share of Georgetown's conservation and reuse program.

Key longer-term options (35-40 year planning horizon) for Round Rock and other entities along IH-35 and in eastern Williamson County are briefly discussed in Section 6.5.3.

Water Supply Alternatives Available to the Round Rock Area (Year 2050 Projected Shortage: 19,774 acft/yr)[1]		
Alternative	**Unit Cost[2] ($/acft)**	**Available Supply or Project Capacity (acft/yr)**
Surface Water and Groundwater Development Alternatives		
1. Purchase Water from LCRA Delivered to Lake Georgetown (BC-2)	$496	42,721
2. Purchase Water from BRA at Stillhouse Hollow Delivered to Lake Georgetown (B-1)	$555	18,134
3. Carrizo-Wilcox Aquifer to RR WTP (CZ-2D)	$573	25,000
4. Purchase Water from LCRA at Lake Travis — Austin WTP4 (222 mgd) (C-2(2))	$611	6,160[3]
5. Purchase Water from LCRA at Lake Travis — Will Co Regional WTP (C-2(8)) (34 mgd)	$631	19,000
6. Purchase Water from LCRA at Lake Travis — CP WTP (C-2(7)) (46 mgd)	$632	11,458
7. Brushy Creek or Little River Diversion (B-8)	$637	19,160
8. Purchase Water from LCRA at Lake Buchanan Delivered to Lake Georgetown (C-4A)	$649	19,000
9. Purchase Water from LCRA at Lake Travis — Austin WTP4 (291 mgd) (C-2(3))	$684	29,774
10. Purchase Water from LCRA at Lake Travis — Austin WTP4 (324 mgd) (C-2(4))	$685	29,774
11. Purchase Water from LCRA at Lake Travis — Austin WTP4 (356 mgd) (C-2(5))	$736	29,774
12. Carrizo-Wilcox Aquifer to Lake Georgetown (CZ-2A)	$777	25,000
13. Purchase Water from BRA at Lake Granger (B-6)	$980	4,060
Augmentation Sources for Lake Travis		
14. Carrizo-Wilcox Aquifer to Colorado River — Direct Discharge (CZ-1A)	$486	69,100
15. Lake Somerville to Colorado River (B-7)	$561	29,100
16. Off-Channel Storage in Lower Basin w/ River Diversion and Purchase of Irrigation (C-5D)	$566	105,200
17. Off-Channel Storage in Lower Basin w/ Purchase of Irrigation Rights (C-5C)	$581	67,400
18. Carrizo-Wilcox aquifer to Colorado River — through Off-Channel Storage (CZ-1B)	$592	90,400
19. Off-Channel Storage in Lower Basin w/ River Diversion (C-5B)	$650	67,300
20. Off-Channel Storage in Lower Basin (C-5A)	$711	36,600
Reclaimed Water Reuse and Conservation		
21. Reclaimed Water Reuse — Restricted Access (L-8A)	$263	7,400
22. Accelerated and Advanced Conservation (L-21)	$413	3,380
23. Reclaimed Water Reuse — Industrial Use (L-8B)	$543	7,400

(1) Projected shortage estimate includes BRA-L. Stillhouse Hollow supply.
(2) Costs are inclusive of all treatment plant components and purchase of raw water (where applicable). Distribution costs not included.
(3) Current supply contract with City of Austin.

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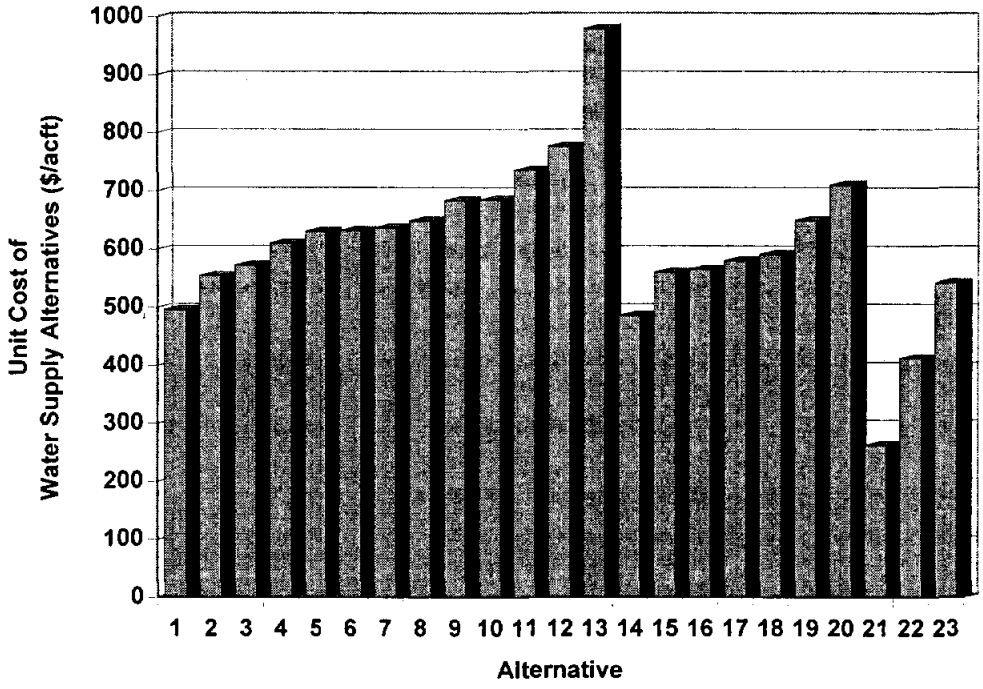
WATER SUPPLY ALTERNATIVES AVAILABLE TO THE ROUND ROCK AREA

FIGURE S-31 (Page 1)



WATER SUPPLY ALTERNATIVES AVAILABLE TO THE ROUND ROCK AREA

FIGURE S-31 (Page 2)

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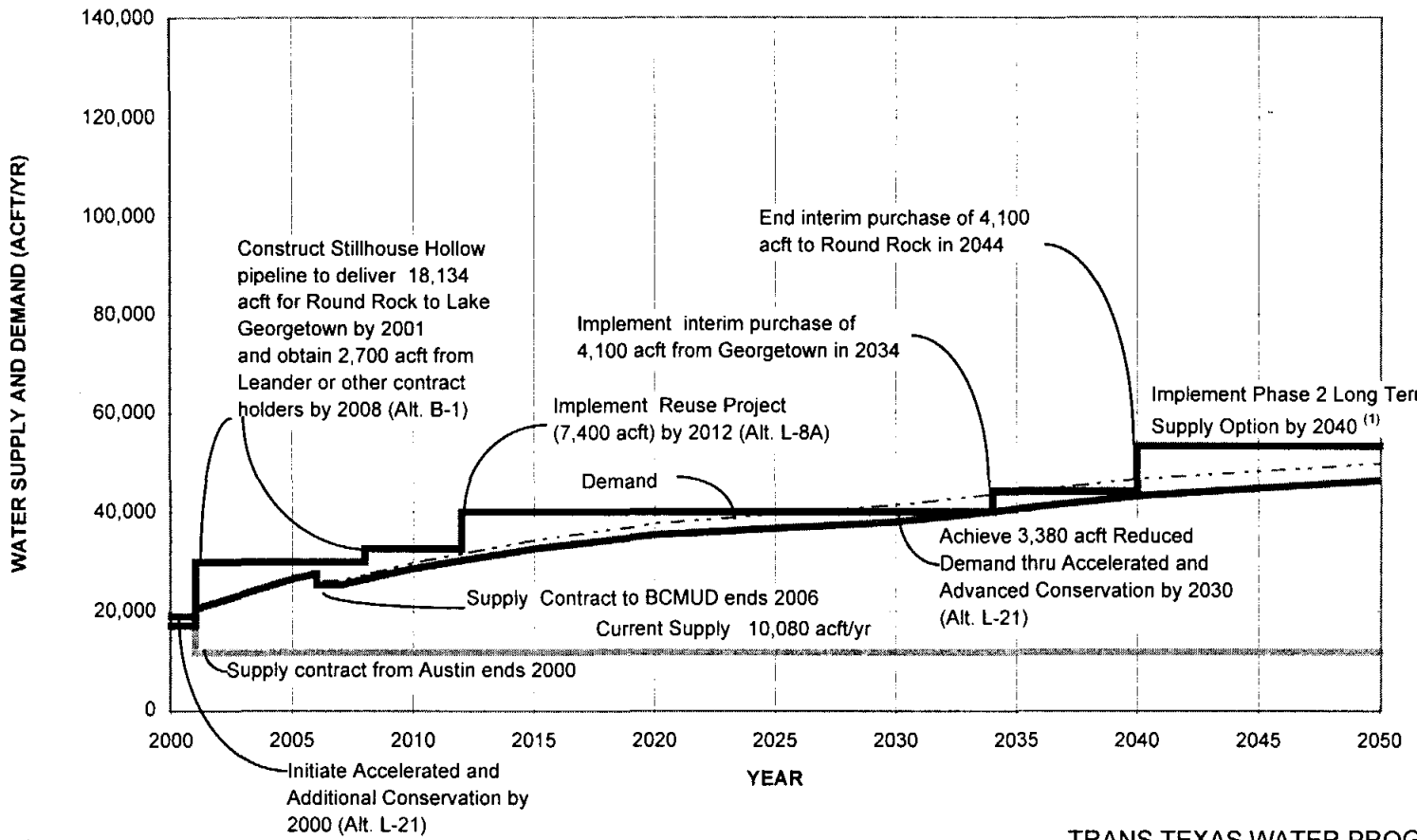

Notes:
(1) Phase 2 supply options could include Carrizo-Wilcox Aquifer (CZ-2), Little River Diversion (B-8), or Purchase from LCRA with Augmentation (CZ-1, B-7, C-5, C-4).

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
CITY OF ROUND ROCK

FIGURE S-32

Table S-20
Integrated Water Supply Plan
City of Round Rock

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)		Unit Cost[3]
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply	($/acft) 1997$
				Develop accelerated/additional water conservation program	1998			
				Complete final design/construction of Stillhouse pipeline	1998			
2000	15,695	11,760	(3,935)	Initiate advanced conservation (Alt. L-21)	2000			$400
2005	23,105	29,894	6,789	Utilize Stillhouse Hollow water (Alt. B-1)	2001	563	18,134	$555
2010	28,636	32,594	3,958	Utilize Stillhouse water from Leander or others	2008	1,127	2,700	$555
2015	32,598	39,994	7,396	Implement reuse project (Alt L-8)	2012	1,690	7,400	$263
2020	35,392	39,994	4,602			2,253		
2025	36,682	39,994	3,312	*Initiate planning of longer-term alternatives*[4]	2025	2,817		
				Negotiate interim sale of Georgetown's Stillhouse water	2025			
2030	37,972	39,994	2,022			3,380		
2035	40,558	44,094	3,536	Interim purchase of Georgetown's Stillhouse water[5]	2034	3,380	4,100	$556
				Initiate final design/construction of longer-term alternative[4]	2035			
2040	43,144	52,231	10,087	*Utilize supply of longer-term alternative*[4]	2040	3,380	13,237	
				End interim use of 4,100 acft of Stillhouse water			(4,100)	
2045	44,716	53,231	8,515		2044	3,380		
2050	46,288	53,231	6,943			3,380		

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.

[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.

[3]Unit cost for full utilization of project capacity.

[4]Long-term major options available:

Carrizo-Wilcox Aquifer to:	25,000	$573
Lake Georgetown (Alt. CZ-2B)	69,100	$486
Colorado River/swap with Lake Travis (Alt. CZ-1A)	90,400	$592
Off-channel Colorado/swap with Lake Travis (Alt. CZ-1B)	36,000 – 105,000	$581 – $711
Off-Channel Colorado/swap with Lake Travis (Alt. C-5)	19,160	$637
Little River or Brushy Creek to Lake Georgetown (Alt. B8)	29,100	$561
Lake Somerville to Colorado/swap with Lake Travis (Alt. B-7)	19,000	$649
Lake Buchanan to Lake Georgetown (Alt C-4)		
Inter-connect with western Wm. Co. regional entity (i.e., Cedar Park, Alliance, WTP4)		

[5]Reflects weighted cost of raw water cost plus reimbursement to Georgetown for implementing reuse and accel/addit. conservation.

Infrastructure Needs

Listed below are the physical facilities needed to implement the integrated water supply plan for the City of Round Rock (or a regional IH-35 system), the date the facilities need to be operating, and a reference to the section in Volume 2 specific to the supply alternative.

- Williamson County Raw Waterline from Lake Stillhouse Hollow, needed by 2001. (See Section 3.7, Vol 2)
- Reuse Project, including diversion structure and pump station at the Brushy Creek Regional WWTP, pipelines, and end user facilities; needed by 2012. (See Section 3.6, Vol 2)
- Regional water treatment plant or Round Rock water treatment plant expansion; needed by 2006.
- Longer term facilities: the longer-term supply options listed in Table S-20 result in increased water availability at Lake Georgetown or at Lake Travis and expansion of the Round Rock (or a regional) WTP and associated transmission facilities would be needed by 2050. Each of the long-term supply options would require infrastructure as follows:
    * Carrizo-Wilcox aquifer direct to Williamson County would require: development of a well field in western Lee County, pumping and transmission facilities, and a water treatment plant. (See Section 3.17, Vol 2)
    * Carrizo-Wilcox aquifer to augment Colorado River system would require: construction of a Carrizo-Wilcox well field (See Section 3.16, Vol 2) and/or an off-channel reservoir in the lower basin. (See Section 3.14 and 3.16, Vol 2)
    * Lake Somerville to augment Colorado River system would require: lake intake and pump station, raw water transmission pipeline, and possibly an off-channel reservoir in the lower basin. (See Section 3.9, Vol 2)
    * Little River or Brushy Creek Diversion would require: river intake and pump station, raw water transmission pipeline, lake intake and pump station. (See Section 3.10, Vol 2)
    * Lake Buchanan to Lake Georgetown would require: lake intake, pump station, and raw water transmission pipeline. (See Section 3.13, Vol 2)
- Treated water transmission pipelines to interconnect with other regional providers (e.g., Cedar Park, Georgetown, and Austin) should be constructed in the 2005 to 2015 timeframe. These interconnections are needed for potential sharing of interim surplus water supplies and to increase reliability of water supply to customers of the participating utilities.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan

elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Accelerated and Additional Water Conservation (Alt L-21)

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Purchase of Water from Brazos River Authority at Lake Stillhouse Hollow Delivered to Lake Georgetown (Alt B-1)

Environmental Issues: potential effects on endangered and important species can be mitigated with pipeline alignment.
Studies Needed: site specific studies for endangered species, karst geology, and cultural resources in construction areas are mostly complete; potential minor water quality changes in Lake Georgetown may need study.
Other Issues: phasing study, financing plan, and rate analysis needed.
Permits Needed: Corps of Engineers 404, General Land Office, and Texas Parks and Wildlife Department permits needed for intake, treatment plant, and pipeline construction; may need amendment of TNRCC diversion permits to add point of diversion at Lake Stillhouse Hollow and increase annual diversions at Lake Georgetown.

Reuse Project (Alt L-8)

Environmental Issues: slightly reduced return flows to Brushy Creek system.
Studies Needed: market analysis and user identification survey.
Other Issues: increased monitoring of water quality may be required; public information and education programs may be helpful to promote use of reclaimed water.
Permits Needed: amendment of TNRCC wastewater discharge permit.

Longer-term Alternatives (i.e. Carrizo-Wilcox Aquifer to Augment Lower Colorado River Basin, *(CZ-1A and CZ-1B), Off-Channel Storage in Lower Colorado River Basin, (C-5), Reclaimed Water Reuse projects (L-5))* Each of these alternatives would result in increased water availability at Lake Travis and would require expansion of treatment facilities and transmission pipelines in the Lake Travis area.

Environmental Issues: potential endangered species issues with development of Carrizo-Wilcox aquifer; terrestrial and aquatic impact in area of potential off-channel reservoir; bay and estuary inflow effects resulting in lower basin management changes; endangered species issues associated with expansion of water treatment plant and transmission pipelines at Lake Travis.
Studies Needed: hydrologic studies of augmentation methods of lower basin supplies and resulting increased availability at Highland Lakes; site specific studies for endangered species, karst geology, and cultural resources needed in construction areas; endangered species studies of potential effects of groundwater development.

Other Issues: future implementation decisions will be affected by the regulatory environment, water demand, treatment and reuse technology, and perhaps the actions of other municipalities.

Permits Needed: TNRCC permit(s) needed for lower basin augmentation and for diversion of increased supplies at Lake Travis.

City of Georgetown — Integrated Water Supply Plan

The City of Georgetown is also experiencing good growth, but a lesser rate than those entities closer to Austin. The new Sun City development and other projects have noticeably increased water use from the Georgetown utility in recent years. While water use is expected to increase slightly less than double between the year's 1990 and 2000, it is expected to increase almost seven-fold to about 34,000 acft/yr by 2050 (see Figure S-34 and Table S-21).

Water supply alternatives available to the Georgetown area and adjacent entities are listed in Figure S-33 and range in cost from $263 per acft to $854 per acft. The upper portion of Figure S-33 lists the water supply alternatives available to Georgetown grouped as follows: Surface Water and Groundwater Development Alternatives, and Reclaimed Water Reuse and Conservation. Within each group, the supply alternatives in Figure S-33 are listed in order from lowest to highest cost. Listed for each alternative is the water supply available and the estimated unit cost.

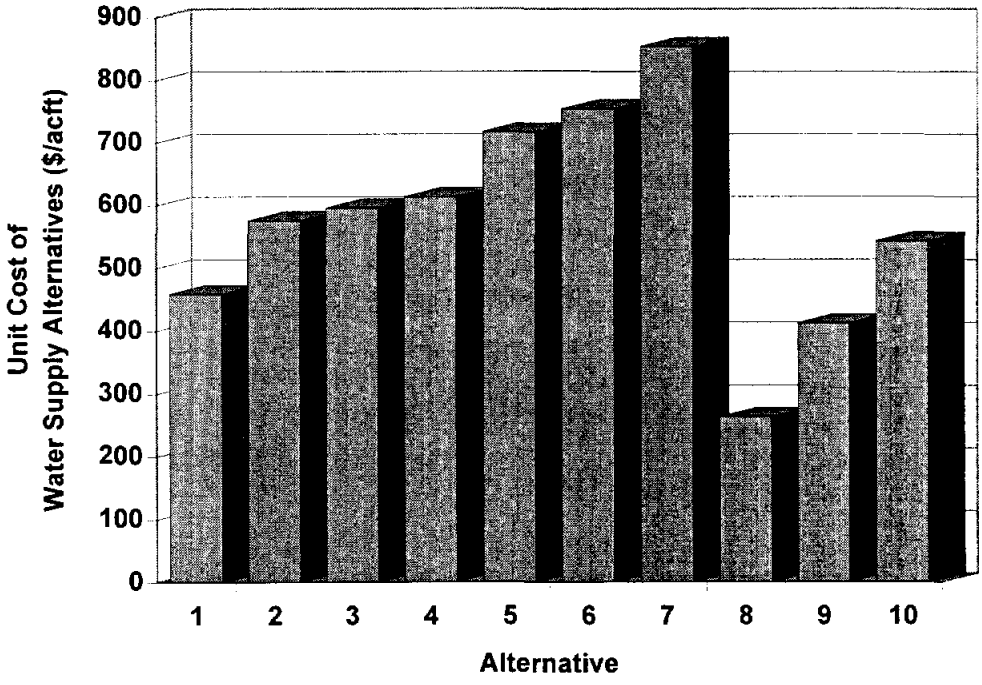
Fortunately, Georgetown is in relatively good shape with respect to water supplies. Its developed supplies should last until about the year 2008, and the current regional efforts to develop the Stillhouse pipeline in the near-term should provide another 15,450 acft/yr of supply for the City well in advance of 2008 (refer to Figure S-34). Even with the predicted dramatic increase in water use, the additional supply from Stillhouse should be sufficient to last Georgetown until the year 2038.

As was discussed earlier for Round Rock, there are opportunities for the two cities and others to participate in a second future regional project if the timing of need for these larger entities can be brought into proximity. Round Rock, after the Stillhouse line is completed and if left on its own accord, will again be faced with developing new supplies by the year 2011, about 25 years before Georgetown's next increment of supply need.

Several key factors, however, suggest that this disparity of timing be given a second look. Both Round Rock and Georgetown will have likely substantially in-filled towards one another and are facing the same set of major new supply alternatives in the future. Thus, the desirability and feasibility of developing parallel or duplicative systems seems very questionable. Also, Georgetown is faced with rather significant carrying costs of the unused Stillhouse supplies over this period and would likely welcome some interim financial relief.

Water Supply Alternatives Available to Georgetown (Year 2050 Projected Shortage: 8,072 acft/yr)		
Alternative	**Unit Cost[1] ($/acft)**	**Available Supply or Project Capacity (acft/yr)**
Surface Water and Groundwater Development Alternatives		
1. Purchase Water from BRA at Lake Stillhouse Hollow and Deliver to Lake Georgetown (B-1)	$459	15,448
2. Brushy Creek or Little River Diversion to Augment Lake Georgetown(B-8)	$576	19,160
3. Purchase Water from LCRA at Lake Buchanan and Deliver to Lake Georgetown (C-4A)	$596	19,000
4. Carrizo-Wilcox Aquifer to Georgetown WTP (CZ-2B)	$614	25,000
5. Carrizo-Wilcox Aquifer to Lake Georgetown (CZ-2A)	$718	25,000
6. Purchase Water from LCRA at Lake Travis — Austin WTP4 (356 mgd) (C-2(5))	$755	18,072
7. Purchase Water from BRA at Lake Granger (B-6	$854	4,060
Reclaimed Water Reuse and Conservation		
8. Reclaimed Water Reuse — Restricted Access (L-8A)	$263	5,200
9. Accelerated and Advanced Conservation (L-21)	$413	2,080
10. Reclaimed Water Reuse — Industrial Use (L-8B)	$543	5,200

(1) Costs are inclusive of all treatment plant components and raw water purchase (where applicable). Distribution costs are not included



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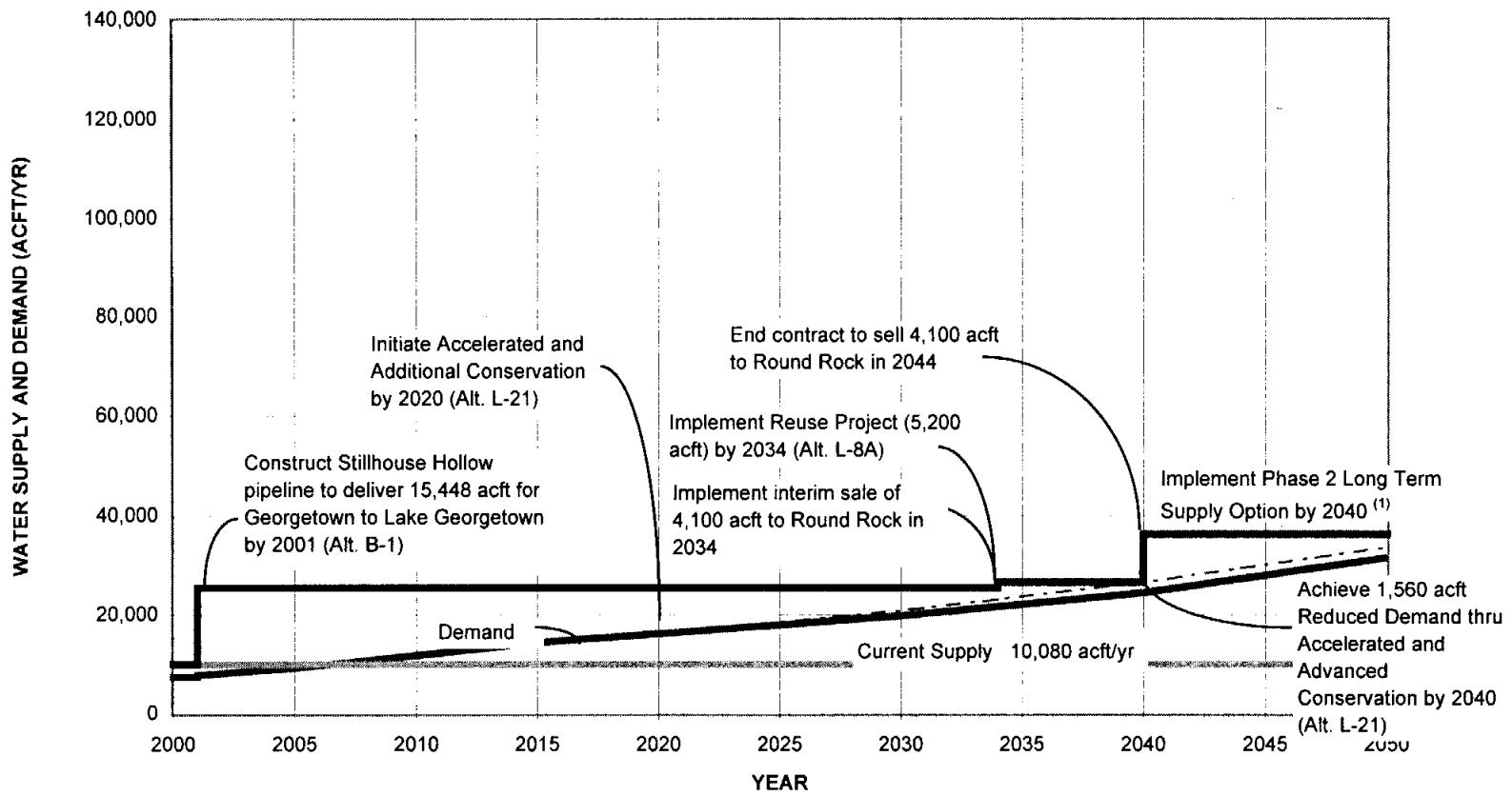
WATER SUPPLY ALTERNATIVES AVAILABLE TO GEORGETOWN
FIGURE S-33



Notes:
(1) Phase 2 supply options could include Carrizo-Wilcox Aquifer (CZ-2), Little River Diversion (B-8), or Purchase from LCRA with Augmentation (CZ-1, B-7, C-5, C-4).

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
CITY OF GEORGETOWN

FIGURE S-34

Table S-21
Integrated Water Supply Plan
City of Georgetown

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)		Unit Cost[3] ($/acft) 1997$
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply	
2000	7,450	10,080	2,630	Complete final design/initiate construction of Stillhouse pipeline	1999			
				Stillhouse water available	2001		15,448	$459
2005	9,322	25,528	16,206					
2010	11,869	25,528	13,659	Utilize Stillhouse water	2007			
2015	14,510	25,238	11,018					
2020	16,269	25,528	9,259	Develop accelerated/additional water conservation program	2020			
				Initiate accelerated/additional water conservation program	2020			$400
2025	18,063	25,528	7,465	*Initiate planning of longer-term alternatives*[4]	2025	520		
				Negotiate interim sale of Stillhouse water to Round Rock	2025			
2030	19,857	25,528	5,671		2030	1,040		
2035	22,170	26,628	4,458	Interim sale of Stillhouse water to Round Rock	2034	1,560	(4,100)	$(459)
				Implement Reuse Project (Alt. L-8A)	2034		5,200	$263
2040	24,482	36,248	11,766	*Utilize supply of longer-term alternative*[4]	2040	2,080	5,520	
				End interim sale of water to Round Rock	2040		4,100	$20
2045	28,001	36,248	8,247			2,080		
2050	31,520	36,248	4,728			2,080		

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term major options available: Carrizo-Wilcox Aquifer to:

Lake Georgetown (Alt. CZ-2B)	25,000	$614
Colorado River/swap with Lake Travis (Alt. CZ-1A)	69,100	
Off-channel Colorado/swap with Lake Travis (Alt. CZ-1B)	90,400	
Off-channel Colorado/swap with Lake Travis (Alt. C-5)	36,000 – 105,000	
Little River or Brushy Creek to Lake Georgetown (Alt. B8)	19,160	$576
Lake Somerville to Colorado/swap with Lake Travis (Alt. B-7)	29,100	
Lake Buchanan to Lake Georgetown (Alt. C-4)	19,000	$596
Interconnect with western Wm Co. regional entity (i.e., Cedar Park, Alliance, WTP4)		

The timing of Round Rock and Georgetown's next needed increment of supply can be brought into proximity by the year 2040 with: Round Rock implementing water conservation and reuse, acquiring Leander's share of Stillhouse water; reaching contractual agreement with Georgetown for interim use of some of its unused Stillhouse water; and with these proceeds from this interim sale (and possibly other financial considerations), allowing Georgetown to implement its own conservation and reuse program and delay Georgetown's full utilization of its Stillhouse water.

The longer-term options (35-40 year planning horizon) for Georgetown, Round Rock, and other entities along IH-35 and in eastern Williamson County are briefly discussed in Section 6.5.3.

Infrastructure Needs

Listed below are the physical facilities needed to implement the integrated water supply plan for the City of Georgetown (or a regional IH-35 system), the date the facilities need to be operating, and a reference to the section in Volume 2 specific to the supply alternative.

- Williamson County Raw Waterline from Lake Stillhouse Hollow, needed by 2001. (See Section 3.7, Vol 2)
- Regional water treatment plant or Georgetown water treatment plant expansion; needed by 2007.
- Reuse Project, including diversion structure and pump station at WWTP, pipelines, and end user facilities; needed by 2034. (See Section 3.6, Vol 2)
- Longer term facilities: the longer-term supply options listed in Table S-21 result in increased water availability at Lake Georgetown or at Lake Travis and expansion of the Georgetown (or a regional) WTP and associated transmission facilities would be needed by 2050. Each of the long-term supply options would require infrastructure as follows:
    * Carrizo-Wilcox aquifer direct to Williamson County would require: development of a well field in western Lee County, pumping and transmission facilities, and a water treatment plant. (See Section 3.17, Vol 2)
    * Carrizo-Wilcox aquifer to augment Colorado River system would require: construction of a Carrizo-Wilcox well field (See Section 3.16, Vol 2) and/or an off-channel reservoir in the lower basin. (See Section 3.14 and 3.16, Vol 2)
    * Lake Somerville to augment Colorado River system would require: lake intake and pump station, raw water transmission pipeline, and possibly an off-channel reservoir in the lower basin. (See Section 3.9, Vol 2)
    * Little River or Brushy Creek Diversion would require: river intake and pump station, raw water transmission pipeline, lake intake and pump station. (See Section 3.10, Vol 2)

    * Lake Buchanan to Lake Georgetown would require: lake intake, pump station, and raw water transmission pipeline. (See Section 3.13, Vol 2)
- Treated water transmission pipelines to interconnect with other regional providers (i.e. Round Rock, Cedar Park, and Leander) should be constructed in the 2005 to 2015 timeframe. These interconnections are needed for potential sharing of interim surplus water supplies and to increase reliability of water supply to customers of the participating utilities.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Accelerated and Additional Water Conservation (Alt L-21)

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Purchase of Water from Brazos River Authority at Lake Stillhouse Hollow Delivered to Lake Georgetown (Alt B-1)

Environmental Issues: potential effects on endangered and important species can be mitigated with pipeline alignment.
Studies Needed: site specific studies for endangered species, karst geology, and cultural resources in construction areas are mostly complete; potential water quality changes in Lake Georgetown may need study.
Other Issues: phasing study, financing plan, and rate analysis needed.
Permits Needed: Corps of Engineers 404, General Land Office, and Texas Parks and Wildlife Department permits needed for intake, treatment plant, and pipeline construction; may need amendment of TNRCC diversion permits to add point of diversion at Lake Stillhouse Hollow and increase annual diversions at Lake Georgetown.

Reuse Project (Alt L-8)

Environmental Issues: slightly reduced return flows to San Gabriel River system.
Studies Needed: market analysis and user identification survey.
Other Issues: increased monitoring of water quality may be required; public information and education programs may be helpful to promote use of reclaimed water.
Permits Needed: amendment of TNRCC wastewater discharge permit.

Longer-term Alternatives (i.e. Carrizo-Wilcox Aquifer to Augment Lower Colorado River Basin, *(CZ-1A and CZ-1B), Off-Channel Storage in Lower Colorado River Basin, (C-5), Reclaimed Water Reuse projects (L-5))* Each of these alternatives would result in increased water availability at Lake Travis and would require expansion of treatment facilities and transmission pipelines in the Lake Travis area.

Environmental Issues: potential endangered species issues with development of Carrizo-Wilcox aquifer; terrestrial and aquatic impact in area of potential off-channel reservoir; bay and estuary inflow effects resulting in lower basin management changes; endangered species issues associated with expansion of water treatment plant and transmission pipelines at Lake Travis.

Studies Needed: hydrologic studies of augmentation methods of lower basin supplies and resulting increased availability at Highland Lakes; site specific studies for endangered species, karst geology, and cultural resources needed in construction areas; endangered species studies of potential effects of groundwater development.

Other Issues: future implementation decisions will be affected by the regulatory environment, water demand, treatment and reuse technology, and perhaps the actions of other municipalities.

Permits Needed: TNRCC permit(s) needed for lower basin augmentation and for diversion of increased supplies at Lake Travis.

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Jonah SUD
IWSP

Jonah Special Utility District — Integrated Supply Plan

The Jonah Special Utility District (SUD) is expected to grow somewhat rapidly in the near-term, increasing its water use by about 50 percent between 1990-2000. While this near-term expected growth is not as rapid as for other entities along the IH-35 Corridor, its longer-term growth is significant, increasing four-fold to over 3,600 acft/yr by 2050 (see Figure S-35 and Table S-22).

The District is in good shape water-wise with current supplies and those pending from Stillhouse (and Georgetown treatment) sufficient to last throughout the planning period and beyond.

Unfortunately, its neighbors to the north (various WSCs) are not as well supplied. Jonah or Georgetown should also consider extending treated water supplies to various WSCs to the north. If Carrizo-Wilcox supplies are ultimately developed for the sub-region as a longer-term option, it is very possible that its conveyance system could be designed to intercept these inter-connections.

The Carrizo and other longer-term options (35-40 year planning horizon) for the Jonah SUD and other entities in the sub-region are briefly discussed in Section 6.5.3.

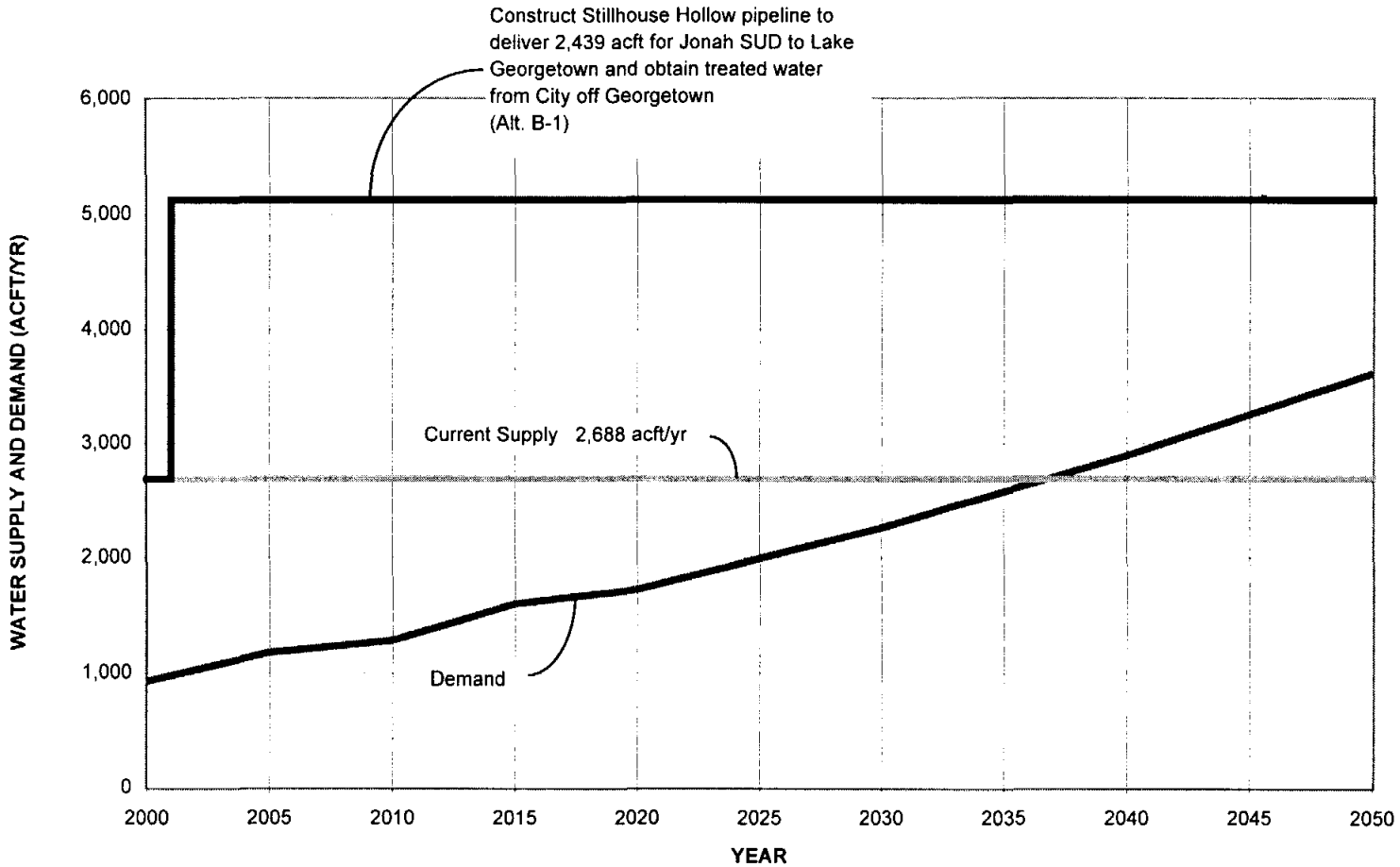
Infrastructure Needs

Listed below are the physical facilities needed to implement the integrated water supply plan for Jonah SUD, the date the facilities need to be operating, and a reference to the section in Volume 2 specific to the supply alternative.

- Williamson County Raw Waterline from Lake Stillhouse Hollow, needed by 2001. (See Section 3.7, Vol 2)
- Regional water treatment plant or Georgetown water treatment plant expansion; needed by 2007.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.



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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
JONAH SPECIAL UTILITY DISTRICT

FIGURE S-35

Table S-22
Integrated Water Supply Plan
Jonah SUD

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)		Unit Cost[3] ($/acft) 1997$
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply	
2000	930	2,688	1,758	Complete final design/initiate construction of Stillhouse pipeline	1999			
				Implement accelerated and additional conservation	2000			
				Negotiate treated water contract with Georgetown	2002			
2005	1,177	4,690	3,513	Obtain treated Stillhouse water from Georgetown	2002		2,439	$459+
2010	1,281	4,690	3,409					
2015	1,600	4,690	3,090					
2020	1,722	4,690	2,968					
2025	1,990	4,690	2,700					
2030	2,258	4,690	2,432					
2035	2,575	4,690	2,115					
2040	2,891	4,690	1,799					
2045	3,251	4,690	1,439					
2050	3,611	4,690	1,079					

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.

Accelerated and Additional Water Conservation (Alt L-21)

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Purchase of Water from Brazos River Authority at Lake Stillhouse Hollow Delivered to Lake Georgetown (Alt B-1)

Environmental Issues: potential effects on endangered and important species can be mitigated with pipeline alignment.
Studies Needed: site specific studies for endangered species, karst geology, and cultural resources in construction areas are mostly complete; potential water quality changes in Lake Georgetown may need study.
Other Issues: phasing study, financing plan, and rate analysis needed.
Permits Needed: Corps of Engineers 404, General Land Office, and Texas Parks and Wildlife Department permits needed for intake, treatment plant, and pipeline construction; may need amendment of TNRCC diversion permits to add point of diversion at Lake Stillhouse Hollow and increase annual diversions at Lake Georgetown.

City of Hutto
IWSP

City of Hutto — Integrated Supply Plan

Listed in Table S-23 are the water supply alternatives that could potentially supply the City of Hutto in the integrated plan. The alternatives presented in Table S-23 for consideration in the integrated plan are the supply options of reasonable cost that could feasibly be permitted and implemented. High cost alternatives and alternatives with significant implementation hurdles have not been included. In some cases, water transmission costs are not included for delivery of treated water from the treatment facilities to Hutto. Transmission pipelines, pump stations, and other costs for each of the integrated plan options have been developed and are included in the integrated plans.

Table S-23
Potential Water Supply Alternatives Available to the City of Hutto for Integrated Supply Planning
Projected Shortage, Year 2050: 214 acft/yr

Alternative	Treatment Facility	Unit Cost ($/acft)	Available Supply or Project Capacity (acft/yr)
1. Purchase Water from LCRA at L. Travis Delivered to L. Georgetown (BC-2)	RR WTP	$496 – $546	42,721
2. Purchase Water from LCRA at L. Travis (C-2(7)) (46 mgd)	CP WTP	$632 – $682	25,456
3. Purchase Water from LCRA at L. Travis (C-2(8)) (34 mgd)	Will Co Regional WTP	$631 – $681	19,000
4. Carrizo-Wilcox Aquifer to RR WTP (CZ-2D)	RR WTP	$573 – $623	25,000
5. Purchase Water from LCRA at L. Buchanan to L. Georgetown (C-4B)	Will Co Regional WTP	$649 – $699	42,000
6. Purchase Water from LCRA at L. Travis (C-2(3)) (291 mgd)	Austin WTP4	$684 – $734	186,764
7. Accelerated and Advanced Water Conservation (L-21)	n/a	~ $400	—

While Hutto is not projected to experience a large absolute increase in population over the planning period, its current water use is expected to increase five to six times over current levels, reaching almost 700 acft/yr by 2050 (see Figure S-36 and Table S-24). Hutto has been experiencing problems with its Edwards Aquifer supply and has recently entered an agreement with the Manville WSC to receive up to 336 acft/yr of supply from the Corporation. This supply and continued use of its ground-water supplies would generally suffice for Hutto through most of the 50-year planning period.

Beyond this time, longer-term options for Hutto and other entities in the sub-region are discussed in Section 6.5.3.

Infrastructure Needs

In order to utilize increased supplies from Manville WSC, Jonah SUD, Round Rock, or Georgetown, Hutto would need to construct water transmission pipelines from the supplier's distribution system to the Hutto system by about year 2001. Additional storage tanks may also be needed as Hutto's demand grows. The upper range of unit costs listed in Table S-24 includes estimates of the cost of new delivery and storage facilities.

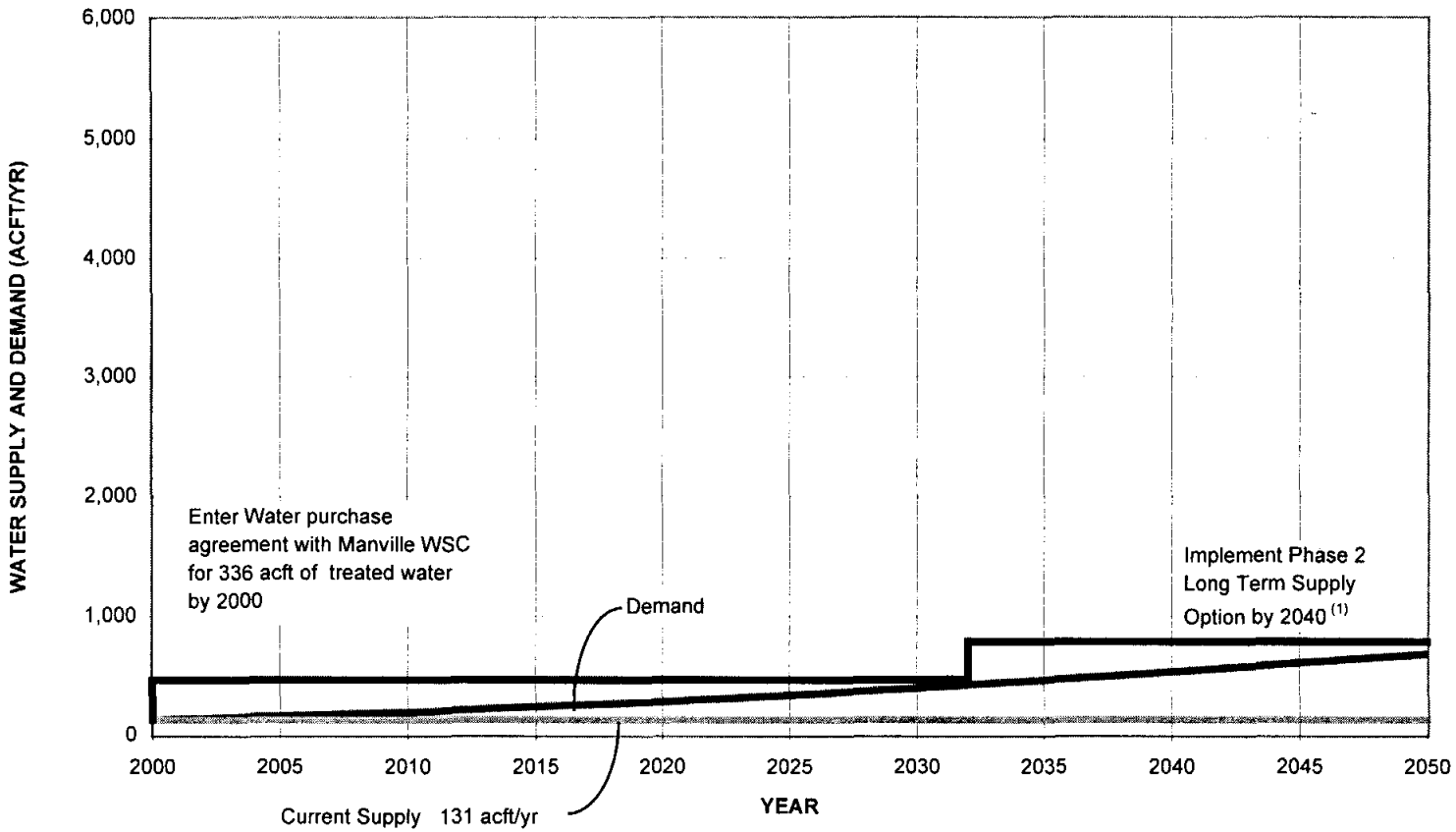
Considering projected demands beyond year 2040, the longer-term supply options listed in Figure S-36 result in increased water availability from the Carrizo-Wilcox aquifer, at Lake Georgetown, or at Lake Travis. To utilize one of these sources, Hutto should plan to work with another entity to regionalize the project and build joint facilities.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Water Purchase Contract with Manville WSC or Other

A long-term water purchase contract would need to be negotiated with the supplier. Contract terms may include participation in future projects needed to meet regional water demands.



Notes:
(1) Phase 2 supply options could include Carrizo-Wilcox Aquifer (CZ-2), Little River Diversion (B-8), or Purchase from LCRA with Augmentation (CZ-1, B-7, C-5, C-4).

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
CITY OF HUTTO

FIGURE S-36

Table S-24
Integrated Water Supply Plan
City of Hutto

Year	Water (acft/yr) Demand[1]	Supply	Surplus (Deficit)	Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr) Conservation[2]	Supply	Unit Cost[3] ($/acft) 1997$
				Purchase treated water from Manville WSC	1998		336	$550–$650
2000	131	131	0					
2005	166	467	301					
2010	1994	467	273					
2015	242	467	225					
2020	281	467	186					
2025	339	467	128	*Initiate planning of longer-term alternatives*[4]	2025			
2030	396	467	71	*Initiate final design/construction of longer-term alternative*[4]	2030			
2035	464	467	3	*Utilize supply of longer-term alternative*[4]	2032			
2040	532	783	251				316	
2045	607	783	176					
2050	681	783	102					

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.
[4]Long-term major options available: Carrizo-Wilcox Aquifer to:

Lake Georgetown (Alt. CZ-2B)	25,000	$623
Colorado River/swap with Lake Travis (Alt. CZ-1A)	69,100	$536
Off-channel Colorado/swap with Lake Travis (Alt. CZ-1B)	90,400	$642
Off-channel Colorado/swap with Lake Travis (Alt. C-5)	36,000 – 105,000	$616-$761
Little River or Brushy Creek to Lake Georgetown (Alt. B8)	19,160	$687
Lake Somerville to Colorado/swap with Lake Travis (Alt. B-7)	29,100	$611
Lake Buchanan to Lake Georgetown (Alt. C-4)	19,000	$699

Brushy Creek MUD
IWSP

Brushy Creek Municipal Utility District — Integrated Water Supply Plan

Listed in Table S-25 are the water supply alternatives that could potentially supply Brushy Creek MUD in the integrated plan. The alternatives presented in Table S-25 for consideration in the integrated plan are the supply options of reasonable cost that could feasibly be permitted and implemented. High cost alternatives and alternatives with significant implementation hurdles have not been included. In some cases, water transmission costs have not yet been estimated for delivery of treated water from the treatment facilities to Brushy Creek MUD. Transmission pipelines, pump stations, and other costs associated with each of the integrated plan options have been developed and are included in the integrated planning phase.

Table S-25
Potential Water Supply Alternatives Available to Brushy Creek MUD for Integrated Supply Planning

Alternative	Treatment Facility	Unit Cost ($/acft)	Available Supply or Project Capacity (acft/yr)
1. Purchase Water from BRA at L. Stillhouse Hollow Delivered to L. Georgetown (B-1)	Will Co Regional or RR WTP	$555 – $605	4,000
2. Purchase Water from LCRA at L. Travis Delivered to L. Georgetown (BC-2)	RR WTP	$496 – $546	42,721
3. Purchase Water from LCRA at L. Travis (C-2(7)) (46 mgd)	CP WTP	$632 – $682	25,456
4. Purchase Water from LCRA at L. Travis (C-2(8)) (34 mgd)	Will Co Regional WTP	$631 – $681	19,000
5. Carrizo-Wilcox Aquifer to RR WTP (CZ-2D)	RR WTP	$573 – $623	25,000
6. Purchase Water from LCRA at L. Buchanan to L. Georgetown (C-4B)	Will Co Regional WTP	$649 – $699	42,000
7. Purchase Water from LCRA at L. Travis (C-2(3)) (291 mgd)	Austin WTP4	$771	2,835
8. Accelerated and Advanced Water Conservation (L-21)	n/a	$413	337

(1) Projected shortage does not include 4,000 acft/yr of supply purchased from BRA at Lake Stillhouse Hollow. The BRA supply source is listed as a supply alternative; treatment and delivery facilities are to be considered in development of an integrated plan.

While similar to others in the area experiencing rapid growth resulting in near-term water supply needs, the Brushy Creek Municipal Utility District (BCMUD) faces a more defined ceiling on its ultimate growth and water use, given its fixed district boundaries and progression towards build-out of its available lots and tracts. It is projected that water use in BCMUD will more than doubled to 2,500 acft/yr in the current 1990-2000 time frame, and ultimately level out at about 4,200 acft/yr by the year 2020 (see Figure S-37 and Table S-26).

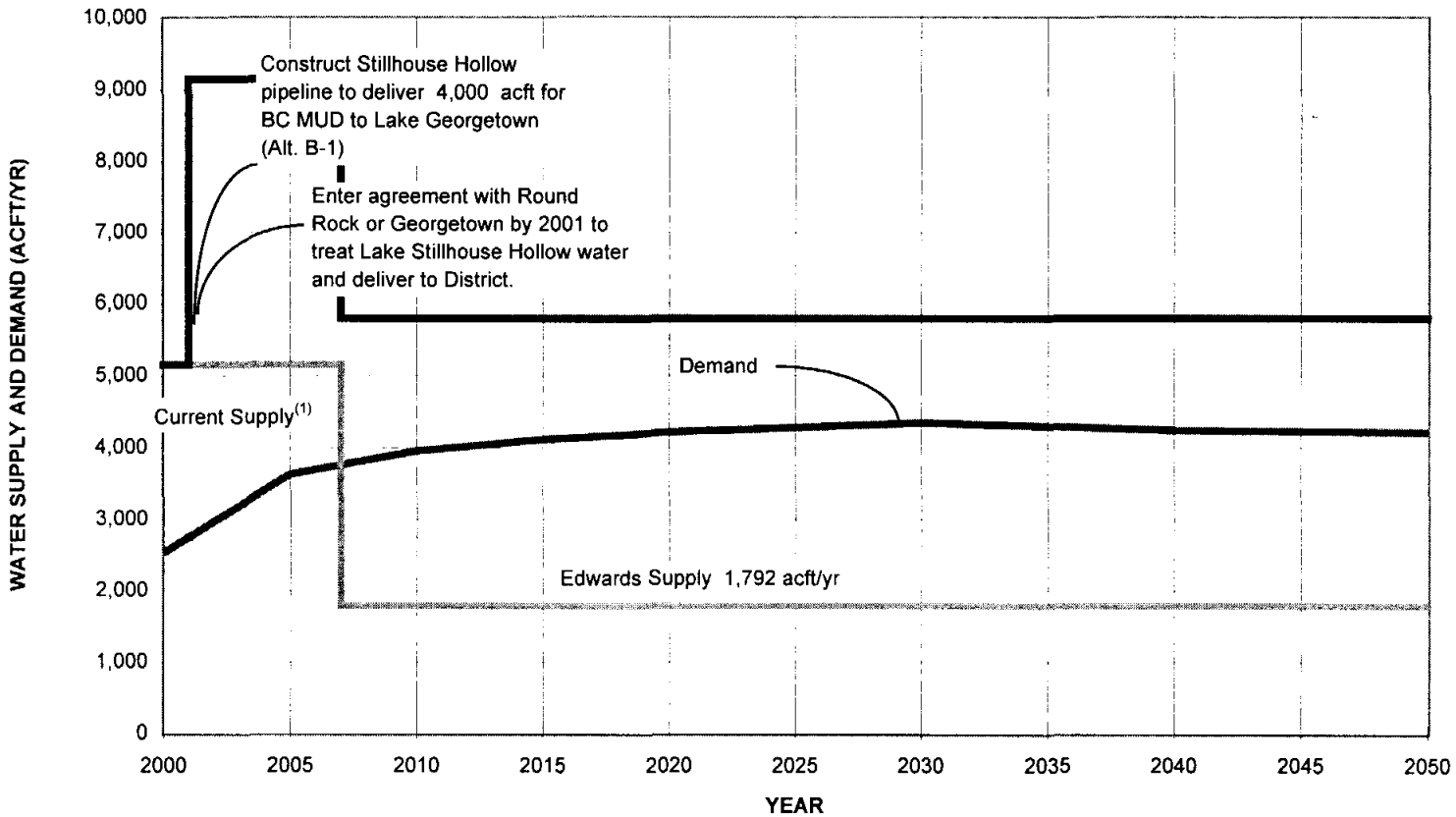
Given the pending supply shortage when its contract with Round Rock for 3,360 acft/yr terminates in 2006, the BCMUD is supporting the near-term construction of Stillhouse Hollow facilities. This 4,000 acft/yr additional supply, coupled with continued upkeep of its Edwards wells, should be adequate for the MUD through its build-out and the 50-year planning horizon. If the Edwards wells are kept operational and well yields are not reduced over time, the MUD's overall supply capability should create sufficient surplus to provide for some out-of-district service or some sale of raw water to other Stillhouse participants, if needed and appropriate.

The current significant issue for the BCMUD is the method of conveyance and treatment of the new surface water supplies. For cost efficiency, it is recommended that the BCMUD participate with Round Rock in the construction of a single conveyance system from Lake Georgetown and that Round Rock supply the MUD with treated water.

Infrastructure Needs

Listed below are the physical facilities needed to implement the integrated water supply plan for the Brushy Creek MUD (or a potential regional IH-35 system), the date the facilities need to be operating, and a reference to the section in Volume 2 specific to the supply alternative.

- Williamson County Raw Waterline from Lake Stillhouse Hollow, needed by 2001. (See Section 3.7, Vol 2)
- Regional water treatment plant or Round Rock water treatment plant expansion; needed by 2006.
- Treated water transmission pipelines to interconnect with other regional providers (e.g., Cedar Park, Georgetown, and Austin) should be constructed in the 2005 to 2015 timeframe. These interconnections are needed for potential sharing of interim surplus water supplies and to increase reliability of water supply to customers of the participating utilities.



Notes:
(1) Contract with Round Rock (3,360 acft) terminates in 2006

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TRANS TEXAS WATER PROGRAM/
NORTH CENTRAL STUDY AREA

INTEGRATED WATER SUPPLY PLAN
BRUSHY CREEK MUD

FIGURE S-37

Table S-26
Integrated Water Supply Plan
Brushy Creek MUD

Year	Water (acft/yr)			Management Action or Water Supply Alternative	Action Date	Management Measure Contribution (acft/yr)		Unit Cost[3] ($/acft) 1997$
	Demand[1]	Supply	Surplus (Deficit)			Conservation[2]	Supply	
2000	2,538	5,152	2,614	Complete final design/initiate construction of Stillhouse pipeline	1999			
				Implement accelerated and additional conservation	2000			
2005	3,626	5,792	2,166	Assume contract with RR is relinquished or not utilized	2001		(3,360)	$555
				Stillhouse water available	2001			
2010	3,955	5,792	1,837	Current supply contract with Round Rock terminates	2006			
				Utilize Stillhouse water	2006			
2015	4,112	5,792	1,680					
2020	4,214	5,792	1,578					
2025	4,280	5,792	1,512					
2030	4,345	5,792	1,447					
2035	4,292	5,792	1,500					
2040	4,239	5,792	1,553					
2045	4,226	5,792	1,566					
2050	4,212	5,792	1,580					

[1]1996 Consensus Water Plan projections; most likely case, as modified; dry year per capita use.
[2]Cumulative savings over time from accelerated and additional efforts beyond today's conservation program.
[3]Unit cost for full utilization of project capacity.

Implementation Issues

Implementation issues are discussed for water supply alternatives in the individual sections of Volume 2. The following is a summary of issues for the specific integrated plan elements. A phasing study, financing plan, and rate analysis will be needed to incorporate the integrated supply plan elements into the overall CIP program and rate structure of the utility.

Accelerated and Additional Water Conservation (Alt L-21)

Public acceptance and willingness will need to be promoted to overcome inconveniences and possible negative perceptions of the accelerated program.

Purchase of Water from Brazos River Authority at Lake Stillhouse Hollow Delivered to Lake Georgetown (Alt B-1)

Environmental Issues: potential effects on endangered and important species can be mitigated with pipeline alignment.
Studies Needed: site specific studies for endangered species, karst geology, and cultural resources in construction areas are mostly complete; potential water quality changes in Lake Georgetown may need study.
Other Issues: phasing study, financing plan, and rate analysis needed.
Permits Needed: Corps of Engineers 404, General Land Office, and Texas Parks and Wildlife Department permits needed for intake, treatment plant, and pipeline construction; may need amendment of TNRCC diversion permits to add point of diversion at Lake Stillhouse Hollow and increase annual diversions at Lake Georgetown.

Other Areas of Eastern Williamson County

In other generally rural areas of eastern Williamson County, the growth forecast is somewhat more subdued in the near-term, but growth will likely accelerate in this area over time. Water use for this area is eventually expected to increase three-fold to about 3,800 acft/yr by 2050. But even with this slower initial growth, water use is projected to exceed the limited ground-water supply availability by about the year 2005. Given that noticeable amounts of the more populated areas in the southeastern and east-central portions of this sub-region are served by the City of Taylor, Manville WSC, or Jonah SUD, much of the remaining population are located in the small communities and rural areas to the northeast of Georgetown. This area is served either by individual wells or small WSCs.

As previously discussed, it is recommended that either the Jonah SUD or Georgetown consider extending treated water service to this area to help address the pending supply shortfall. Other possibilities could include accessing Carrizo-Wilcox supplies further to the east or possible future water availability in Lake Granger (from Alcoa), although the small water supply entities in the area would likely have to collaborate to be able to afford and access these more expensive alternatives.

Water use in the City of Taylor is expected to increase about 50 percent from 1990 to 2000 and more than double again by the year 2050. However, its 6,700 acft/yr contract supplies from Lake Granger are adequate to address Taylor's water needs until about the year 2035. Prior to that time in about the year 2025, Taylor should participate in an evaluation of new supply options with Round Rock and Georgetown that would need to be developed and on-line in the 2035-2040 planning horizon. Should Carrizo-Wilcox supply options be pursued at that time, the routing of the major conveyance would likely be proximate to the Taylor area.

S-6.6 Summary and 50-Year Regional Perspective

A "plan," by definition, is forward-looking in time. In the case of the North Central Trans Texas study area, the magnitude of prospective growth implies much about rationale courses of actions to address water supply needs, both now and in the future.

The likelihood of a large urban area having developed across much of the two-county region by the end of the 50-year planning period begs the question of:

> *"what ultimate water supply system(s) makes good common sense to serve that large metropolitan area of the future, and can we get there from this point in time molding near- and medium-term actions towards that end?"*

If most entities are facing the same water supply choices and if larger projects are needed to extend service to those less capable of helping themselves, then individual un-coordinated actions to secure and develop new water supply and treatment facilities will likely result in conflict, high cost, greater environmental impact, and continuing pockets of water supply shortages. Much of this can be minimized, or hopefully avoided, with regional cooperation.

There are significant opportunities for the regionalization of water supply and treatment facilities for entities in the North Central Trans-Texas study area, both in the near- and longer-term. "Regionalization" is many times misunderstood... it need not necessarily imply service by a higher regional entity, but can also entail two or more communities working together or even a single municipality serving a large area. Its goal is the cost-effective consolidation of service to provide for economies of scale in facilities and/or operations and to reduce the degree of potential environmental impacts associated with the proliferation of facilities.

In summary, the overall plan recommended in this report proposes near-term regional planning cooperation and project opportunities in three identified sub-regions. Through a combination of local initiatives including water conservation and reuse and a cooperative sharing of unused water supplies, significant opportunities have been recommended for wise water management in the interim with potential regional project choices identified for the longer-term.

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Environmental Effects Summary

S-7 ENVIRONMENTAL EFFECTS SUMMARY

The water supply alternatives evaluated in this study can all be considered to consist of a combination of three categories of activity:

- Demand reduction, recycling/reuse, water purchase or trade;
- Pipeline construction and operation; and
- Reservoir construction and operation.

Detailed background information on project engineering, costing, environmental setting, and potential impacts specific to each alternative are provided in their respective report sections. A discussion of methods, a regional summary of the environmental setting, including tables of protected and important species, a regional cultural resources summary, and comparisons of the environmental consequences of implementing the various water supply alternatives are presented in an environmental overview section (Section 3.1.3 in Volume 2).

All alternatives that provide additional surface water for diversion and use, including demand reduction, or conservation (Alt L-9, Alt L-21) and reuse alternatives(Alt L-5, Alt L-8), will result in reduced streamflows below the point of diversion. For example, reuse programs commonly employ consumptive uses (irrigation, cooling water, etc.) that reduce return flows and provide treated water available for additional users. While additional users can be served without increasing diversions, the use of return flows results in reduced streamflows.

Most of the alternatives evaluated involve the construction of pipelines and other facilities to utilize existing water supplies, including surface water impoundments and groundwater. Since most of the alternatives studied involve previously authorized projects, the Trans-Texas environmental criteria for instream flows was not applied to these existing authorized sources. The lower Colorado River alternatives, likewise, were not subject to the criteria since there are existing instream flow operational rules for these stream segments. Impacts to streamflows are discussed in the environmental subsections for each alternative.

Water diverted from, and not returned to, the Colorado and Brazos Rivers and their tributaries (including diversions from impoundments) will affect streamflows below the diversion and be lost as inflow to their respective estuaries These transfers will have the net result of decreasing estuary inflows by an amount equivalent to the additional losses in the

system. Losses to a particular system may include additional consumptive uses, increased seepage and evaporation loss, and transfer of return flows to another basin.

A summary and comparison of the environmental issues associated with each water supply alternative is presented in Table S-27. To facilitate comparisons, the effects of each alternative on six environmental resource areas (endangered species, potential water quality changes, magnitude of interbasin transfer, instream flow effects, impacted woodlands, and inundation) have been identified and assigned a score on a scale of 0 to 3 according to the criteria listed in Table S-28. Indices are employed to allow comparisons of overall environmental consequence to be made among alternatives that exhibit a variety of effects difficult to equate; such as the comparison of the significance of disturbing 50 acres of Golden-Cheeked Warbler habitat relative to the conversion of 3 miles of stream habitat to an impoundment. Indices were scaled relative to the alternatives included in the evaluations, with the largest observed effect assigned a score of 3, and no effect assigned a score of zero. The individual scores are summed to give an overall score that is an index of potential environmental impact for each alternative.

It was assumed that implementation of any alternative would include compliance with state and federal regulations regarding the protection of environmental and cultural resources, that impacts to those resources would be avoided or mitigated to the extent possible, and that suitable compensation for unavoidable, significant impacts to protected resources would be accomplished.

The overall impact scores for the alternatives ranged in magnitude from 1 through 12 (Figure S-38). When alternatives are grouped into the three activity categories (Water Budget Alterations, Pipeline Construction, New Reservoirs), the conservation and reuse alternatives which would require the least construction have the lowest overall impact scores, ranging from 1 to 3, and averaging 1.6. A primary alternative involving a new reservoir, Alt. C-5, which

Table S-27

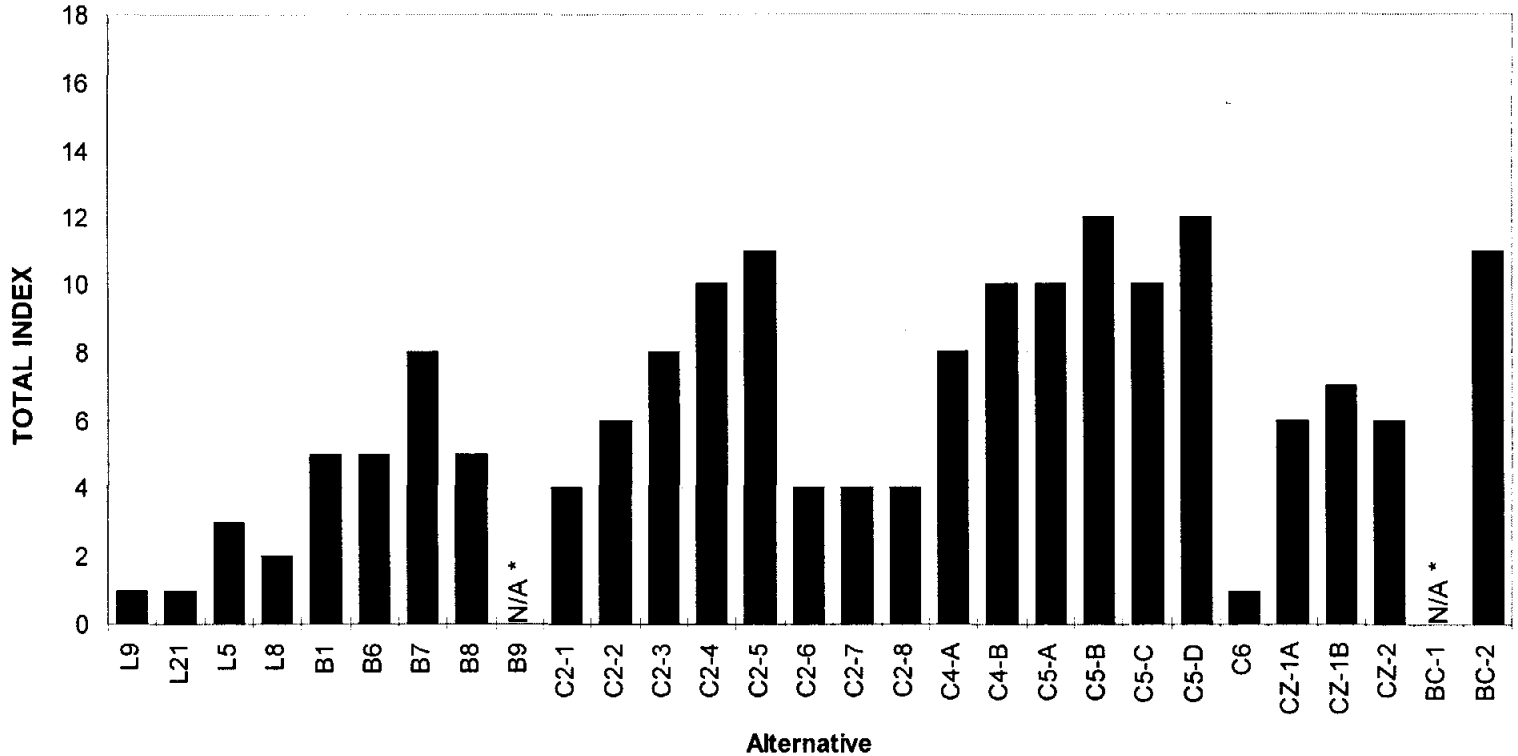
Summary of Potential Environmental Effects of Water Supply Alternatives
(See Table S-14 for Environmental Index Criteria)

Alternatives	Endangered Species	Water Quality	Inter-basin transfers	Instream Flow Effects	Impacted Woods **	Inundated Land	Total Score
L-9 Conservation - Austin Service Area	0	0	0	1	0	0	1
L-21 Conservation - Williamson County	0	0	0	1	0	0	1
L-5 Reuse - Austin Service Area	1	1	0	1	0	0	3
L-8 Reuse - Williamson County	1	0	0	1	0	0	2
B-1 L. Stillhouse Hollow to L. Georgetown	1	1	0	2	1	0	5
B-6 L. Granger to L. Georgetown	1	1	0	1	2	0	5
B-7 L. Sommerville to Colorado River	1	2	1	3	1	0	8
B-8 Brushy Creek Diversion	1	2	0	1	1	0	5
B-9 South Fork Reservoir *	NA	NA	NA	NA	NA	NA	NA
C-2 Water from LCRA L. Travis Scenario 1	2	0	0	2	0	0	4
C-2 Water from LCRA L. Travis Scenario 2	2	1	1	2	0	0	6
C-2 Water from LCRA L. Travis Scenario 3	2	1	2	2	1	0	8
C-2 Water from LCRA L. Travis Scenario 4	3	1	2	3	1	0	10
C-2 Water from LCRA L. Travis Scenario 5	3	1	3	3	1	0	11
C-2 Water from LCRA L. Travis Scenario 6	1	1	1	1	0	0	4
C-2 Water from LCRA L. Travis Scenario 7	1	1	1	1	0	0	4
C-2 Water from LCRA L. Travis Scenario 8	1	1	1	1	0	0	4
C-4 Water from LCRA to L. Georgetown A	0	2	1	3	2	0	8
C-4 Water from LCRA to L. Georgetown B	0	3	2	3	2	0	10
C-5 Off-Channel Storage A	1	0	0	3	3	3	10
C-5 Off-Channel Storage B	1	2	0	3	3	3	12
C-5 Off-Channel Storage C	1	0	0	3	3	3	10
C-5 Off-Channel Storage D	1	2	0	3	3	3	12
C-6 Austin Steam-Electric Water Rights	0	0	0	1	0	0	1
CZ-1 Carrizo-Wilcox to Colorado River A	1	1	0	3	1	0	6
CZ-1 Carrizo-Wilcox to Colorado River B	1	1	0	3	1	0	7
CZ-2 Carrizo-Wilcox to L. Georgetown	1	1	0	3	1	0	6
BC-1 System Operation of lakes *	NA	NA	NA	NA	NA	NA	NA
BC-2 Water from LCRA to L. Georgetown	3	1	2	2	3	0	11

* Engineering analysis concludes not feasible; environmental review not performed.

** Based on a uniform 140 ft. construction corridor for study purposes.

Table S-28 Environmental Index Criteria
Endangered Species Based on distributions and known occurrences of endangered species near the alternative and the potential of impacting those species based on proposed construction. 0 = no endangered species likely to be encountered 1 = slight possibility of encountering endangered species 2 = endangered species likely to be encountered, moderate potential impact 3 = endangered species known to occur, high potential impact
Water Quality Based on influx of nutrients, change in volume, and pre-alternative state of water bodies. 0 = no change in quality 1 = slight degradation, no expected impact on biota 2 = moderate degradation, possible impact on biota 3 = high degradation, likely impact on biota
Interbasin Transfer Based on acft/ yr water transfer between river basins. 0 = no transfer 1 = 0-25,000 acft/yr 2 = 25,001- 50,000 acft/yr 3 = greater than 50,000 acft/yr
Instream Flow Effects Based on increase or decrease in streamflow(s) resulting from alternative. 0 = no change 1 = 0-25,000 acft/yr 2 = 25,001- 50,000 acft/yr 3 = greater than 50,000 acft/yr or increase greater than 200% of current streamflow
Impacted Woods Based on acres of woodlands impacted during construction. 0 = none 1 = 0 to 50 acres 2 = 50 to 100 acres 3 = greater than 100 acres
Submerged Land Based on acreage submerged by reservoir in alternatives. 0 = none 1 = up to 2500 acres 2 = 2500 to 5000 acres 3 = greater than 5000



ALTERNATIVE

* Engineering analysis concludes not feasible; environmental review not performed

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / NORTH CENTRAL STUDY AREA

INDICES OF POTENTIAL IMPACT ASSOCIATED WITH DEVELOPMENT OF WATER SUPPLY ALTERNATIVES

FIGURE S-38

includes four scenarios involving an impoundment on Cummins Creek, exhibited uniformly high (on the relative scale used) potential impact scores, ranging from 10 to 12 (average=11).

The pipeline alternatives were the largest and most diverse group of alternatives evaluated, all consisting of transfers of water from existing supply sources to regional water treatment plants. Reflecting an order of magnitude range in the annual quantities of water to be transferred, potential environmental impact scores ranged from 3 to 11, and averaged 6.7.

With respect to Endangered and Threatened species, the alternatives exhibiting the greatest potential for significant effects are those involving construction in the area north of Lake Travis (Scenarios 1 through 8 of Alt. C-2). This situation is a result of the general spatial distributions of threatened species (Golden-Cheeked Warbler and several karst invertebrates) on the eastern margin of the Edwards Plateau. However, actual impacts depend to a large extent on facility siting and mitigation measures, and pipeline projects are generally sufficiently flexible that significant impacts can be avoided by careful selection of the treatment plant site and pipeline alignments. Potential impacts to endangered and threatened species, including federal and state listed species, species that are candidates for listing as endangered and threatened, and other resources of concern (e.g. TOES species) are addressed in the environmental issues subsections of each of the alternative discussions.

Potential water quality effects among the various alternatives includes the transport and storage of water with elevated nutrients (Alt. B-6, Alt. B-8) or dissolved solids levels (nearly all transfers to Lake Georgetown, Alt. CZ-1). The amount of water transferred relative to the size and nature (impoundment versus stream) of the receiving water was considered in water quality scoring.

The remaining environmental indices were similarly predicated on the volume of prospective water transfers relative to the water bodies they would discharge to, or to areas of land to be affected. Instream flow impacts are greatest where large volumes of water are withdrawn from a river system (e.g., Alts. C-2(4), C-2(5)), where new impoundments are proposed, or where transferred water is discharged to relatively small streams or reservoirs, either as raw water (Alts. B-7, C-4, C-5, CZ-1, CZ-2) or as treated wastewater (Alt. C-2).