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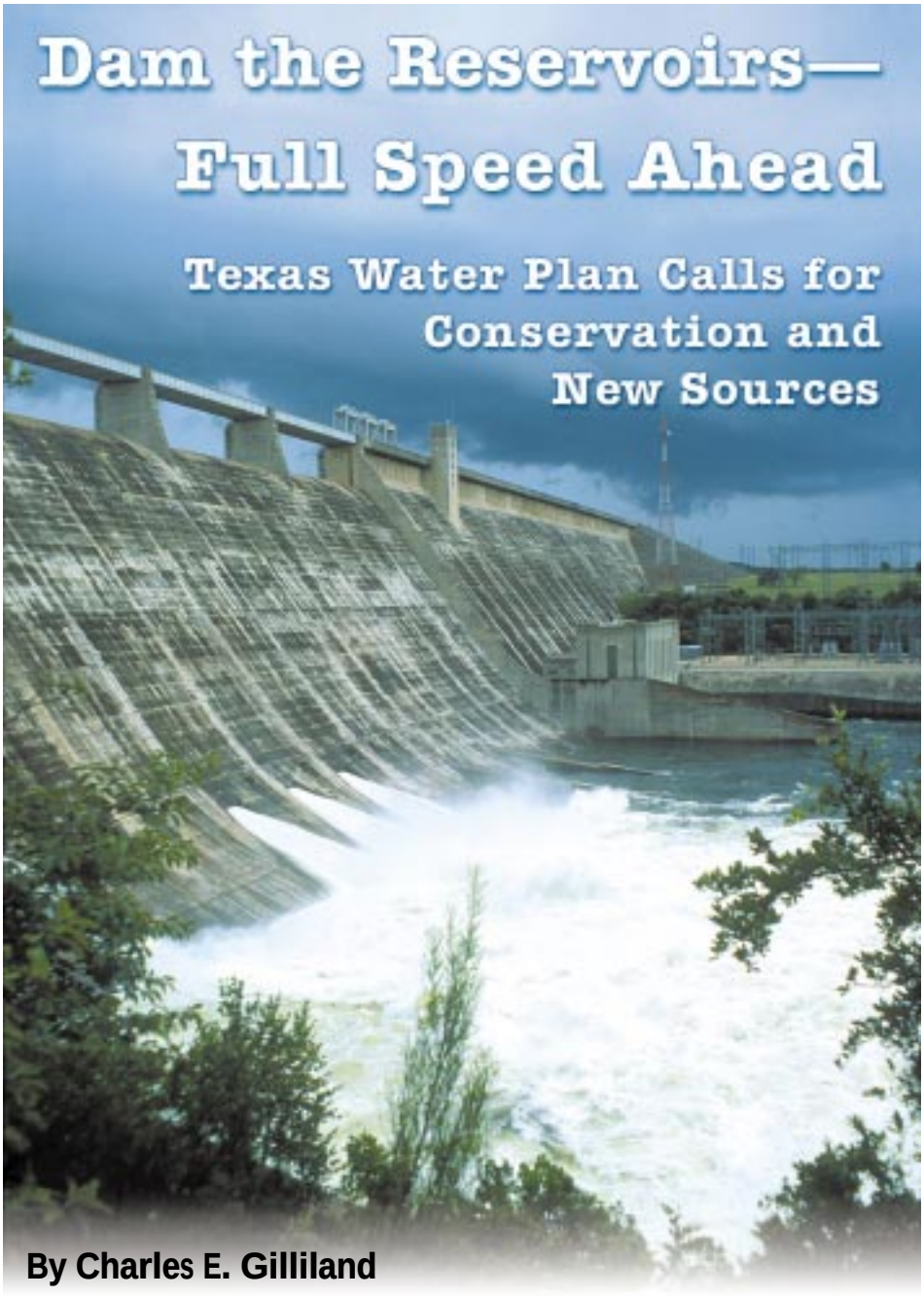

As a new century approaches, Texas faces a future threatened by water shortages because of the growing population. Without prudent planning, water demand to support expanding cities and manufacturing operations will exceed projected supplies. This potential for debilitating shortages prompted the state government to undertake a proactive planning approach in dealing with water policy before those shortages reach a crisis stage in some future drought.

Earlier this century, the United States met looming shortages with ambitious public projects that expanded current supplies through construction of large reservoirs. Dam building spread throughout the country, bringing life to the deserts of the arid West.

Those projects, however, involved substantial investments of public funds and, unquestionably, altered the environment. As the century draws to a close, public support for such projects has waned, and water policy has shifted from supply augmentation strategies to planning for more effective use of existing supplies.

Drafted in this atmosphere, the Texas Water Plan described in *Water For Texas*, published by the Texas Water Development Board, seeks primarily to facilitate the transfer of water from agricultural irrigation to urban uses. The plan also strives to provide for geographic movement of water from areas with surplus supplies to areas facing chronic shortages while minimizing adverse impacts on the environment.

Despite the current aversion to new dam construction, the plan includes provisions for eight new reservoirs and provides for conveyance of water from surplus water locales to areas facing shortages. These envisioned solutions imply many changes including projects that create new infrastructure, with the potential for recreation as well as environmental implications.

Looming Water Shortages

The state-wide water plan establishes estimates of current usage as well as projected requirements through 2050. Examining those estimates reveals the problems that will impact Texans, as well as the magnitude of change facing various regions of the state. Tables 1 and 2 present a summary of changes envisioned by state-wide water planners for the next 50 years. Analysis of the trends conveys an appreciation for the immense difficulties ahead. The tables also reveal the specific geographic shifts in water supplies required to avoid future regional shortages.

The water volume used in each Texas region, along with its percentage of state-wide usage, is described in Table 1. At 5.7 million acre feet per year, used largely for crop irrigation, the Panhandle represents the most prolific user of Texas water, comprising 36.5 percent of state-wide usage in 1990. By 2050, the Texas

Table 1. Current and Projected Texas Water Use

Region	Water Use			
	1990 Total (Acre Feet)	2050 Total (Acre Feet)	1990 Percent of State	2050 Percent of State
Panhandle	5,742,754	2,196,483	36.51	14.73
Rolling Plains	310,896	287,030	1.98	1.92
North Central Texas	1,016,084	1,926,993	6.46	12.92
North East Texas	551,362	784,812	3.51	5.26
East Texas	682,133	840,339	4.34	5.63
Houston Region	1,897,678	2,906,601	12.06	19.49
Mid-Coast	1,126,282	986,251	7.16	6.61
Coastal Bend	188,402	302,913	1.20	2.03
Lower Rio Grande	1,557,159	1,479,866	9.90	9.92
Winter Garden	309,144	140,664	1.97	0.94
Southern Edwards	676,571	879,084	4.30	5.89
Hill Country	78,754	91,309	0.50	0.61
Austin	175,613	524,066	1.12	3.51
Heart of Texas	414,179	588,421	2.63	3.94
Upper Colorado	344,245	346,134	2.18	2.31
Upper Rio Grande	657,754	630,140	4.18	4.22
State-wide	**15,729,010**	**14,911,106**	**100**	**100**

Source: Texas Water Development Board

water required just 30 years ago.

As genetic engineering and new techniques of applying irrigation water develop, demands on the aquifer will likely decline. Second, by developing their water resources, these users have established a right to the water that prospective urban and industrial users must recognize. Marketing their water rights to urban and industrial interests with more profitable uses will compensate for abandoning its use in irrigation.

Some water-planning groups have taken issue with this projection, contending that it overstates the magnitude of reduction facing the region. Nonetheless, most observers agree that groundwater resources will continue to decline, reducing available total supplies. Clearly, this region faces demanding challenges to meet future water needs.

Water Development Board plan projects usage to drop 2.2 million acre feet with the region's total percentage of statewide use decreasing to 14.7 percent.

This regional 61.7 percent decline in water usage will occur as the population expands by 45.5 percent (Table 2). That population growth will boost municipal requirements by 24 percent and industrial usage by 68.4 percent because of combined effects of aquifer depletion and development of water-saving technology and crops. The plan projects agricultural demand to slip by 16.9 percent; however, changes in the aquifer, coupled with changing conditions in agricultural markets, will reduce substantially the available amount of groundwater. If agriculture absorbs all of the forecast decline in available groundwater, farmers will reduce their water use by 66.1 percent during the 50-year period.

At first glance, these projections appear to threaten current water users in the agricultural sector. However, the projected changes will not likely come at the expense of landowners for two reasons. First, farmers in this region have pioneered development of water-conserving technological advances in irrigation. Current farmers already produce crops with a fraction of the

Both the Winter Garden (including Crystal City, Carrizo Springs, Pleasanton and Floresville) and Southern Edwards regions (San Antonio, San Marcos, New Braunfels and Seguin) face similarly dramatic declines in agricultural water use because municipal and industrial uses are expected to rapidly expand to support sizable population gains. On the opposite end of the spectrum, the North Central Texas (Dallas-Fort Worth), Houston, Coastal Bend (Corpus Christi) and Austin regions anticipate sizable percentage increases in total water use to match their rapidly expanding urban populations,

Table 2. Projected Changes in Texas Water Use, 1990-2050

Region	Population (Percent Change)	Water Use			Agricultural	
		Total (Percent Change)	Municipal (Percent Change)	Industrial (Percent Change)	Demand (Percent Change)	Use* (Percent Change)
Panhandle	45.5	-61.7	24.0	68.4	-16.9	-66.1
Rolling Plains	20.1	-7.7	13.8	29.9	-14.4	-20.9
North Central Texas	119.4	89.6	92.4	91.7	2.4	2.4
North East Texas	29.6	42.3	15.2	56.7	0.1	0.1
East Texas	41.2	23.2	26.7	69.1	-43.5	-43.5
Houston Region	122.7	53.2	103.4	65.5	-29.3	-31.1
Mid-Coast	61.0	-12.4	39.2	100.3	-32.7	-34.1
Coastal Bend	85.8	68.8	48.2	127.5	-27.5	-27.5
Lower Rio Grande	228.5	-4.9	170.9	48.2	-14.3	-29.7
Winter Garden	81.5	-54.5	76.1	187.8	-23.7	-71.3
Southern Edwards	174.5	30.0	153.3	123.6	-22.5	-77.8
Hill Country	76.6	15.9	51.6	46.1	-8.0	-8.0
Austin	222.4	198.4	218.9	114.5	-13.1	-13.1
Heart of Texas	62.7	42.0	53.7	157.8	-5.5	-24.2
Upper Colorado	64.5	0.6	59.2	8.0	-11.4	-27.3
Upper Rio Grande	151.6	-4.2	105.9	41.5	-16.7	-35.6

*Calculated assuming agriculture will sustain any shortfalls.
Source: Texas Water Development Board

Table 3. Water Projects Required to Complete the Texas Water Plan

Reservoirs	Location County	Supply in Acre Feet	Date Needed	Total Projected Cost 1996	Projected Cost Per Acre Foot
Paluxy	Hood-Somervell	12,000	2010	$74,600,000	$6,217
Cibolo	Wilson	122,000	2010	236,800,000	1,941
Parkhouse II	Delta	134,000	2020	120,500,000	899
Rio Grande Weir	Cameron	40,000	2010	35,000,000	875
Sandies Creek	De Witt-Gonzales	97,600	2025	267,200,000	2,738
Allens Creek	Austin	74,000	2025	169,000,000	2,284
Nichols I	Red River	470,400	2035	318,000,000	676
Tehuacana	Freestone	65,500	2050	135,700,000	2,072
Total		**1,015,500**		**$1,356,800,000**	**$1,336**

Source: Texas Water Development Board

with more modest adjustments to regional agricultural water use.

In nearly all regions, agriculture will see its water use decline while urban water usage expands. In addition, four of the major urban areas in Texas anticipate a need for sizable expansion of their total water usage.

Reservoirs to Meet Growth

To meet some of the projected water demand in urban areas, the Texas water plan forecasts construction of eight reservoirs designed to add more than one million acre feet of water to Texas supplies, at a cost of $1.3 billion. Table 3 lists the projects along with their location, size, projected completion dates and cost. Virtually all of the projects are slated for construction in the eastern half of Texas and will supply water to growing municipal and industrial users.

A number of issues are faced by the builders and operators of these reservoirs. Most importantly, the management at each reservoir must meet preset limits on the amount of water that can be captured by the dam and provide for a required amount of *flow-through*—or water that passes through the dam and continues on for other uses downstream.

The quantity of flow-through is determined in part by the downstream environmental concerns. Sufficient flow-through must be provided to meet the needs of wildlife and fish that live and breed downstream. For example, some rivers where reservoirs are proposed may have wetland areas or endangered species downstream from the dam.

Furthermore, each reservoir must release enough flow-through to satisfy the water rights of downstream property owners. *Water rights*, granted by the state, endow property owners with a legal claim to a specific amount of water from a river, stream or reservoir. Water rights were discussed in detail in the January issue of *Tierra Grande*.

Paluxy. Situated on the Paluxy River between Somervell and Hood counties near Glen Rose, this reservoir will supply water to Erath (Stephenville) and Somervell Counties. A lake capable of supplying 12,000 acre feet of water, this 3,838-acre reservoir has the highest per-unit price tag of all of the planned projects, at $6,217 per acre foot.

The Texas Natural Resource Conservation Commission (TNRCC) cleared this project for construction; however, legal difficulties have forced reconsideration of the permit. Scheduled for completion in 2010, this reservoir would allow 5,285 acre feet of water per year to flow downstream to satisfy environmental concerns.

Cibolo. This project will help address the shortfall forecast for San Antonio as urban population expands. Built on the Cibolo Creek near Stockdale in Wilson County, this reservoir could contribute as much as 122,000 acre feet of added supplies, including wastewater return flows diverted from the San Antonio River.

Inundating 9,896 acres, this reservoir would pass a flow of 25,000 acre feet each year to satisfy environmental needs. In addition, water from Cibolo would supply future needs in the San Antonio area.

Parkhouse II. The George Parkhouse II reservoir would supply the needs of the Dallas-Fort Worth metroplex for 25 years, following its scheduled completion in 2015. Situated on the North Fork of the Sulphur River in Delta and Lamar counties, the reservoir will have no major water supply projects upstream and only 102 acre feet of water rights upstream that could offset the inflow to the reservoir.

Downstream water rights totaling 24,771 acre feet and an environmental allocation of 3,981 acre feet will require substantial annual flow-throughs. Covering 1,865 acres, Parkhouse would contain 134,000 acre feet when completed. A water supply line system would be needed to deliver water to the metroplex.

Rio Grande Weir. A weir is a dam in a stream that raises the water level without creating a large reservoir out of the river banks. This weir would flood 422 acres along the Rio Grande River approximately eight miles below Brownsville to compound water that would normally flow into the Gulf of Mexico.

The small lake behind the weir would capture 40,000 acre feet of water for use by Brownsville after 2010. Because it forms the international boundary between Mexico and the United States, this project would require an adjustment to an existing treaty.

Sandies Creek. Situated in Gonzales and DeWitt counties on Sandies Creek, a tributary of the Guadalupe River, this reservoir would supply more than 97,600 acre feet of water, assuming that only the water used by downstream water rights holders would be delivered to them.

Downstream users hold rights to more water than they currently use and fully supplying these rights would reduce resources to 80,000 acre feet per year. San Antonio would use this water in lieu of water needed to ensure spring-flows at the springs in San Marcos and New Braunfels. This project should be completed before 2030.

Allen's Creek. Built in the Brazos River Basin, the Allen's Creek Reservoir will inundate 8,670 acres to capture 74,000 acre feet of water from Allen's Creek, southeast of Sealy. In addition to the Allen's Creek water, the reservoir would receive water diverted from the Brazos River when supplies exceed downstream water right and environmental flow requirements. Fort Bend and Brazoria Counties would use the water from this reservoir.

SOME TEXANS UNDOUBTEDLY *will find opportunities for profit in the new reservoirs.*

Nichols I. Located on the Sulphur River in Red River County, the Marvin Nichols I Reservoir would form a large lake covering 67,957 acres and contain 470,413 acre feet in available water. Planners anticipate completion of Nichols in 2035 to supply demand in the Dallas-Fort Worth area.

Nichols would release a total of 103,570 acre feet of water each year to satisfy downstream water rights, plus an added 37,144 acre feet for environmental needs. As with the earlier Parkhouse II Reservoir, conveyance projects would be needed to deliver water to the Metroplex.

Tehuacana. This reservoir, situated on Tehuacana Creek in Freestone County, lies just south of the existing Richland-Chambers Reservoir. The project could supply more than 65,000 acre feet of water from its 315 square-mile drainage area.

Covering 14,804 acres, by 2050, Tehuacana would supply the Tarrant Regional Water District, including Fort Worth, Arlington and Mansfield as well as the Trinity River Authority. The reservoir would provide 2,876 acre feet of water each year for environmental needs.

Planners have proposed these new projects. However, few have proceeded to the stage of acquiring permits needed to begin construction. Each project will face challenges and amendments as they proceed through a permitting process with TNRCC. That process will address a host of legal and environmental concerns.

This list of public works projects and schedule of completion dates ensures on-going dam construction in Texas well into the next century. Some of the projects must begin soon to meet 2010 deadlines, while others will commence much later. Nevertheless, the program will mean increased business activity at the chosen sites and in the surrounding communities while construction continues.

After completion, some of the sites may offer continuing benefits from recreational opportunities, in addition to the increased water supply. With that increased activity, some Texans will undoubtedly find an opportunity for profits in development. The added water supply should go far toward ending potential shortfalls in the growing cities and towns of Texas.

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REAL ESTATE CENTER

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