THE TEXAS A&M UNIVERSITY SYSTEM
NEW MEXICO STATE UNIVERSITY

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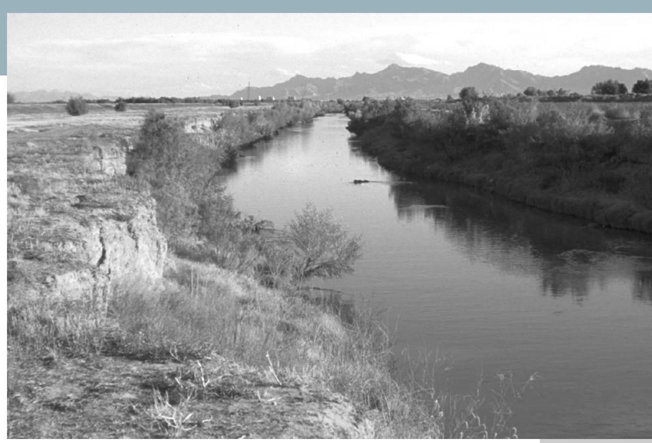
Urban Water Conservation along the Rio Grande

An Inventory of Water Conservation Programs



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Introduction

Not long ago, conversations on urban water demand were not only rare but dull. Today, especially in the West and Southwest, these conversations can turn into heated debates. The question of who has enough water for the future has pitted urban interests against agriculture and financial resources against cultural values.

Water supply is finite, even if it is part of a cycle. Water may be plentiful in some places and scarce in others. Until we are ready to make water conservation a pattern of behavior to use less water, our demand will continue to grow as our population grows. Although water conservation is not an answer to all growth, it does offer an alternative to acquiring some new water supplies.

Water conservation is almost always the least expensive water supply alternative. Water conservation can have two definitions. First and most often, conservation is considered a reduction in the amount of water used. Each person uses less. An alternative definition implies more efficient use of water. We waste less. Less waste can be attributed to best management practices, more efficient hardware or literally less water running into the streets from irrigation systems.

Urban water conservation incorporates water-saving measures and incentives for the home, on the landscape and throughout the city water distribution system. It is easy to differentiate between water-saving measures and incentives. A water-saving measure such as a water-efficient toilet reduces the amount used each and every time it is flushed. Or, a rain sensor turns off a sprinkler system during rain showers.

In contrast, incentives encourage the wise use of water through education, ordinances or scheduling. Educational programs suggest water reductions in the landscape, ordinances mandate how much turf is planted, and schedules tell homeowners when to irrigate. Combined, measures and incentives provide a water conservation program.

The Rio Grande

The Rio Grande supplies water to two nations: three states in the United States and five in Mexico. Beginning in the San Juan Mountains of Colorado, the river travels 1,824 miles before emptying into the Gulf of Mexico. The terrain varies from the mountains to the desert and into the tropics. The river no longer consistently flows into the Gulf of Mexico due to fluctuations in dam releases, drought and overallocation of water.

Throughout New Mexico and Texas, the river flows through desert conditions with some of the consistently highest temperatures and lowest amounts of precipitation in each state. Precipitation in northern New Mexico provides significant but infrequent flow to the river. Rainfall is scarce in the central valley with an average of

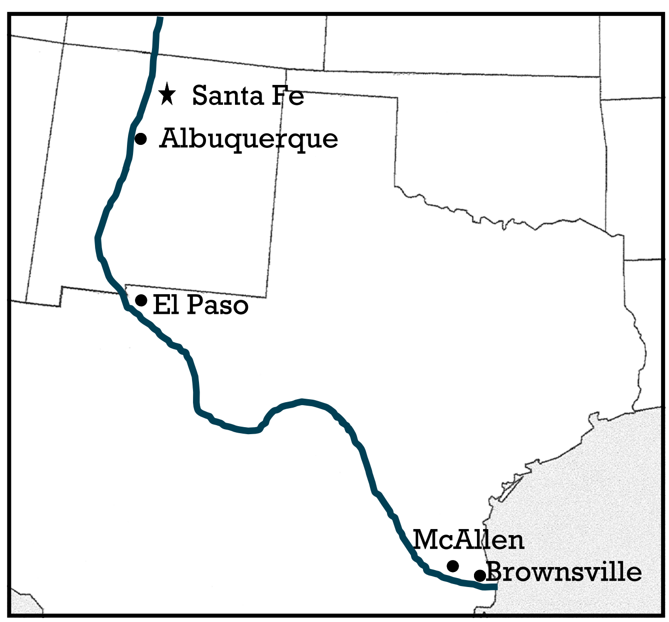


Figure 1: The Rio Grande travels 1,824 miles from Colorado through New Mexico and Texas.

8.8 inches in Las Cruces and El Paso, increasing to 26.6 inches in Brownsville. Although the river flowing through the El Paso area receives some snowmelt from the mountains, nearly all water downstream comes from rainfall.[1]

New Mexico has experienced a 20 percent population growth from 1990 to 2000. In 2000, the seven counties along the Rio Grande accounted for more than 1 million people or 52 percent of the entire New Mexico population. The Rio Grande Basin is home to the largest city in the state, Albuquerque, and the state capital, Santa Fe.[2]

In Texas, the population within the 32 counties along the Rio Grande represents 10 percent of the state's population. In those counties, large cities represent only 10 percent of the communities. Most of the remaining communities are rural and represent only 17 percent of the region's population. Whereas small communities are often losing populations, urban populations are growing rapidly, with growth expected to continue.

Three border cities rank among the fastest growing cities in the United States. McAllen-Edinburg-Mission ranked fourth, Laredo ranked ninth, and Brownsville-Harlingen-San Benito ranked twenty-eighth. McAllen has grown by 49 percent since 1990, Laredo by 45 percent and Brownsville by 29 percent. Likewise, growth on the Mexican side of the border is increasing quickly.[1]

The Study

The goal of this project was to help cities in the Rio Grande Basin of Texas and New Mexico develop water conservation programs that meet their needs and are successful by their standards. Data were collected on per capita city water use, existing water conservation measures, ordinances and incentive programs. Through the inventory of practices, baseline data can be set for future study, commonalities can be determined, and future needs can be identified.

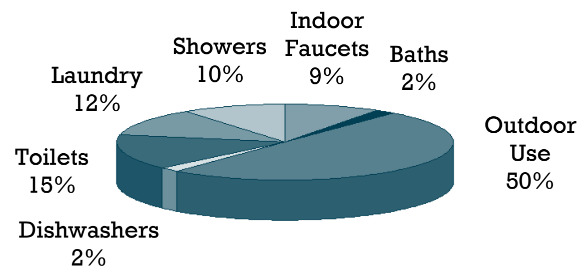
Methods

A telephone survey was used to contact city utilities. The water conservation officer, water supply director or utilities director was asked about the city water conservation plan and implementation of programs. Each city was asked if conservation plans and drought plans were in place. Although questions about participation in the programs were open ended, follow-up questions requested information on programs not initially mentioned. In all, more than 80 potential programs were listed in four major areas: city services, in-home water use, outdoor water use and educational efforts. Additional data were gathered from outside resources such as city Web pages, surveys conducted by the Texas and New Mexico municipal leagues, and news media documentation.

Per Capita Water Use

Per capita water use is a standard measure used by planners to compare water consumption. It is also a benchmark to determine the efficacy of water conservation programs. According to the Texas Water Development Board (TWDB), per capita use is the average amount of water used by each person based on total amount of reported water use divided by the population. Water use includes residential, institutional (i.e. schools, hospitals) and commercial consumption.

Residential Water Use



Source: American Water Works Association

Variations in per capita use can be extreme based on climate and culture. Typically, hot, arid areas have a higher per capita use than others. Housing styles, types of landscapes, and income or affluence can also dramatically affect consumption. Traditionally, use is higher in large, affluent homes.

Per capita data in Texas are compiled annually by TWDB for two sources: (1) residential, commercial and institutional, and (2) manufacturing. TWDB requests information from each city utility for both categories. The city supplies all the raw numbers for calculation. This report relies on Texas data as reported over a 10-year period to TWDB. The average per capita water use as reported for residential, commercial and institutional use in Texas is 181 gallons for 2000.[4]

Data for New Mexico were gathered by the New Mexico Office of the State Engineer (NMOSE). Per capita data for New Mexico were taken from the NMOSE technical report *Water Use by Categories in New Mexico Counties, River Basins and Irrigated Acreage in 2000* and the NMOSE Annual Report.[5,6]

Data were derived from water supply or utility companies as opposed to city figures. These numbers may reflect some rural as well as city consumption. Data are available for the year 2000.

Cities in Texas and New Mexico were identified and categorized according to location and size. To be included in the study, a city must be within the river basin and have a population greater than 5,000 as listed in the Texas or New Mexico Municipal League. The northern most point was Taos, extending south to the Gulf of Mexico.

Conservation Plans

Cities in Texas and New Mexico are required to develop water conservation plans and drought plans, although there is often confusion between the two. Water conservation plans are implemented throughout the year without immediacy. Drought plans are triggered by climatic conditions or stored water levels.

When conditions warrant, cities switch from traditional water utility operations (with or without conservation measures) to more strict water conservation measures. Drought programs get press coverage; conservation programs are ongoing without urgency. Drought programs increasingly restrict water use; conservation programs are activated and maintained without much change. Although both programs are required, drought plans are triggered by restricted water availability and consequences of those conditions.

Programs identified in this study are parts of a conservation plan. However, many respondents

Table 1: Gallons Per Capita (gpc) Water Consumption for New Mexico in 2000

	2000 (gpc)
Albuquerque	204
Belen	226
Las Cruces	251
Rio Rancho	181
Santa Fe	145
Socorro	207
Taos	141
Truth or Consequences	151

Table 2: Gallons Per Capita (gpc) Water Consumption for Texas in 2000 and Average Gallons Per Capita Water Consumption from 1991 to 2000

	2000 (gpc)	1991-2000 (average gpc)
Alamo	104	119
Brownsville	229	183
Del Rio	316	272
Eagle Pass	188	140
Edinburg	120	133
Elsa	171	144
El Paso	173	176
Harlingen	157	154
Hidalgo	89	126
La Feria	102	105
Laredo	200	201
McAllen	205	188
Mission	149	168
Pharr	132	129
Raymondville	153	453
Rio Grande City	180	166
San Benito	167	228
San Juan	85	124
Weslaco	165	141

used the plans interchangeably. Therefore, some of the results of participation may reflect a drought plan program but are cited as a conservation plan.

Survey Results

Seven conservation programs were selected for emphasis. Programs with widespread participation were selected as an obvious choice for other cities in the region. Other programs were also selected that had low participation but a demonstrated success in other areas, such as (1) potential to save large amounts of water, (2) availability for cities of all sizes and (3) high ratio of water savings per effort extended. (See Table 3). These include:

- Leak detection on city water lines
- Availability of residential water audits
- Landscape requirements and incentives
- Retrofits/rebates for water-efficient appliances
- Educational programs for schools, customers and specific audiences
- Pricing of water
- Fugitive water ordinances

Leak detection for water supply systems

Leak detection is focused on the water unaccounted for in a water supply system. Leakage occurs in the pipes and valves located between measurement meters. It is not uncommon for 20 to 30 percent of all water to be unaccounted for within a system.

Leakage and spills, metering errors, and illegal connections can all lead to unaccounted water. Leaks and spills can cause additional injury to infrastructures, such as pavements and buildings, and place an inordinate demand on wastewater treatment systems. Leaks can be found before a meter in the water supply system structures or after the meter traveling to a home, business or industry.

Leaks can be corrected in two ways: mending the leaks and reducing pressure. Both require identification of the leaks with modeling programs, sound-sensitive equipment or physical discovery. Once a leak is discovered, it should be repaired. Pressure reduction can considerably reduce the amount of water leaking, but it is only useful if it does not affect the customers. Metering errors and illegal connections require modeling efforts or accounting procedures to compare baseline data and use.

All cities had leak detection programs except Alamo, Edinburg, Elsa, Mission, Pharr, San Juan and Weslaco in Texas, and Las Cruces and Truth or Consequences in New Mexico.

Availability of residential water audits

Residents can request that a city utility representative review the water consumption inside and on the landscape. Residential water audits can include detection of leaks and waste, identification of inefficient hardware and practices, and guidance for more effective and efficient use of water. Residential water audits take 1 to 4 hours, can save hundreds of gallons per day, and cost from $100 to $400 for a water auditor.[3] Additional costs can be incurred for retrofits, supplies and equipment. The higher costs and savings are associated with an irrigation system.

In-home audits often include an estimate of use based on number of residents, appliances and meter readings. Leaks can be detected if all water devices are shut off and the water meter is still running. Specific leaks can be detected in toilets with dye tablets, and observed with faucets and showers. Supplies such as faucet aerators and toilet tank flappers can be distributed for a low cost-to-savings ratio. Suggestions can be made on water-saving appliances and practices.

Landscape audits review irrigation systems, turf-to-planting ratios, soil amendments and other outdoor water uses such as pools. All customers need to be aware of ordinances such as watering schedules that govern landscapes or incentive programs that provide guidance for efficient water use. Irrigation systems can be examined for leaks, reprogrammed for water efficiency and retrofitted with rain shutoff sensors.

Customers without automated systems can be advised on watering patterns and hose shut-off valves. Landscape suggestions include lists of low water-use plants and information on turf replacement programs. Rain gauges and information on evapotranspiration are included. Irrigation customers should be reminded that 1 inch of water applied over 1,000 square feet equals 624 gallons.[3]

Audits conclude with documentation of findings, suggestions for water conservation, and educational materials available on climate, city ordinances, hardware or landscapes. A follow-up visit or call is normal procedure to clarify conservation questions.

Cities that offered residential water audits are Del Rio, El Paso, La Feria, Mission and San Juan in Texas, and Albuquerque, Rio Rancho and Santa Fe in New Mexico.

Landscape requirements and incentives

Landscape programs can focus on soil mediums, plantings, turf and irrigation. Of all the water used for outdoor activities, 80 to 90 percent is used on watering lawns, plants and gardens.[3] Because outdoor water consumption represents more than 30 percent of all residential water use, landscape programs can save large amounts of water. Landscape programs can be in the form of ordinances, incentives and rebates, audits, and education. The first step is to analyze existing trends and patterns.

Ordinances and schedules often cover irrigation by penalizing runoff, or requiring watering during times of less evaporation or on a limited timetable. Texas recently passed a law which forbids subdivisions from requiring certain grasses. Restrictions can be placed on new subdivisions to reduce turf, and can require native or low water-use plants and grasses. Rainwater harvesting and graywater systems for landscapes are being encouraged, and barriers are being reduced.

Incentives and rebates may focus on reducing the turf-to-planting ratio, encouraging water-wise plantings and xeriscaping, and working with developers to landscape for reduced water use. Turf amendments to provide a fertile, water-absorbent base for planting are becoming increasingly accepted. Educational programs are wide and varied. They can focus on irrigation system efficiency, appropriate plant selection and landscape design water efficiency. Cities can work with nurseries in providing drought-tolerant plants and turf. Public programs include seminars, planting lists and demonstration gardens.

Texas cities that had landscape programs are El Paso and Mission. New Mexico cities are Albuquerque and Santa Fe.

Retrofits and rebates for water-efficient appliances

Appliances are the largest indoor users of water. Residents can save water by using it more efficiently or by simply using less. A reduced-flow showerhead, for example, increases efficiency. Washing dishes less often, in comparison, reduces actual use. Both styles of water conservation are important, but water-saving appliances ensure consistent savings. The 1992 U.S. Energy Policy Act set maximum allowable rates for water use in toilets, urinals, showerheads and faucets. Newer designs of clothes washers and dishwashers have greatly improved water use.

Rebate programs are generally administered in two forms: citizens receive either a refund check or a bill reduction for purchasing a water-efficient appliance. Rebate programs can be offered for toilets, clothes and dishwashers, and quick water heaters. Retrofit programs usually include the purchase of water-saving toilets from the city or a nongovernment organization at reduced costs. Cities often work with plumbers to offer a fixed charge for installation. Other cities have targeted older or less expensive housing. Faucet aerators and low-flow showerheads are often given away as part of an educational program.

A retrofit and rebate program was offered in El Paso, Texas. Cities in New Mexico with retrofit and rebate programs are Albuquerque, Rio Rancho and Santa Fe.

Educational programs

Educational efforts are attractive to many cities as demands on resources and time can vary according to availability. There are many accessible education packages. A review of current consumption can help in targeting an effective educational program. Programs can be found or developed for schools, customers, specific professions such as irrigators or landscape professionals, or general audiences such as festival attendees. Public information campaigns delivered in the media or with direct mail can also be successful if appropriate to the message.

Many educational efforts are focused on specific programs such as rebates, ordinances or schedules. Ongoing efforts are targeted to landscape changes and more efficient water use practices. Public information programs can include bill histories which show use for the year or past years.

All Texas cities participated in educational programs except Del Rio, Elsa, La Feria, Raymondville and Weslaco. All New Mexico cities participated except Taos, and Truth or Consequences.

Differential water pricing

The theory behind differential pricing is to reduce use by increasing cost. Historically, many cities offered a block rate in which the cost decreased as use increased. Today, most cities offer inverted block pricing in which prices are higher as use increases. Some cities are turning to price increases during the peak demands of a seasonal change or scarcity to discourage water consumption.

Other pricing schemes such as water budgets require additional accounting for the city. Residents on a water budget have a designated water allocation based on weather conditions. Because normal in-home use is always covered, the fluctuations occur in outdoor watering. Water consumption beyond the budgeted amount is increased. This system can work in newer residential areas where the best available technology is required.

All cities charged a higher price for higher water use beyond a beginning block except Edinburg, Hidalgo, McAllen, Pharr, San Benito, San Juan and Weslaco in Texas, and Taos, Truth or Consequences and Socorro in New Mexico.

Fugitive water ordinances

Fugitive water is runoff flowing into a gutter or street often caused by inefficient landscape watering. Runoff can be seen on sidewalks, streets and other nonpermeable surfaces. Irrigation systems can be malfunctioning or have improper schedules. Sprinklers can be misplaced, or turf can be saturated. Ordinances generally include prohibition and enforcement clauses. Some cities hire water police to monitor, document and notify customers. Cities can fine a customer either with a ticket or an additional charge to the water bill.

Texas cities with fugitive water ordinances include Del Rio, El Paso, Mission and Rio Grande City. All New Mexico cities had ordinances except Socorro and Taos.

Concluding Remarks

- Larger cities tend to use a variety of water conservation programs.
- Cities are required to have conservation plans and drought plans, but most programs outside of the largest cities are only active during drought periods.
- Cities in the Rio Grande Basin have such extended drought conditions that they often maintain a drought plan over years instead of seasons.
- New Mexico cities participate in more water conservation programs than Texas cities.
- Municipal programs require a high degree of commitment to create incentives, maintain the existing system and enforce program compliance.
- Hardware and landscape programs often require ordinances to initiate change.
- The most significant amount of water to be saved would come from changes in landscapes. Landscape programs had the lowest participation.
- Educational programs had the highest participation.

Table 3: Urban Water Conservation Practices of Texas and New Mexico Cities along the Rio Grande							
Water Conservation Practices	Leak Detection	Water Audits	Landscape Programs	Appliance Rebates	Educational Programs	Pricing	Runoff Restrictions
Texas Cities							
Alamo					√	√	
Brownsville	√				√	√	
Del Rio	√	√				√	√
Eagle Pass	√				√	√	
Edinburg					√		
El Paso	√	√	√	√	√	√	√
Elsa						√	
Harlingen	√				√	√	
Hidalgo	√				√		
La Feria	√	√				√	
Laredo	√				√	√	
McAllen	√				√		
Mission		√	√		√	√	√
Pharr					√		
Raymondville	√					√	
Rio Grande City	√				√	√	√
San Benito	√				√		
San Juan		√			√		
Weslaco							
New Mexico Cities							
Albuquerque	√	√	√	√	√	√	√
Belen	√				√	√	√
Las Cruces					√	√	√
Rio Rancho	√	√		√	√	√	√
Santa Fe	√	√	√	√	√	√	√
Socorro	√				√		
Taos	√						
Truth or Consequences							√

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