# Designing Water Rate Structures for Conservation & Revenue Stability

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February 2014

UNC ENVIRONMENTAL FINANCE CENTER
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The Environmental Finance Center at the University of North Carolina, Chapel Hill works to build the capacity of governments and other organizations to provide environmental programs and services in fair, effective and financially sustainable ways.

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The Sierra Club is a national environmental organization, and the Lone Star Chapter is the state level entity for the Sierra Club in Texas. The Sierra Club, Lone Star Chapter is a partner with the National Wildlife Federation (NWF) in the Texas Living Waters Project. The Texas Living Waters Project works with water policy specialists, public officials, and communities in Texas to ensure adequate water for both people and the environment. The Project works to reduce future demand for water through advocating for efficient use of existing supplies. A key goal of the Project is to involve citizens in decisions about water resource management at the local and state levels.

## Acknowledgements

Written by Mary Tiger, Shadi Eskaf, and Jeff Hughes.

This report was a collaborative effort within the EFC and with the Sierra Club, Lone Star Chapter. This analysis would not have been possible without the expertise of Jennifer Walker, Water Resources Coordinator for the Sierra Club, Lone Star Chapter. Editorial assistance was provided by Alexandra Kay. Tyson Broad & Ken Kramer of Sierra Club and Myron Hess of NWF also reviewed report drafts and provided feedback.

This report is a product of the Environmental Finance Center at the University of North Carolina, Chapel Hill. Findings, interpretations, and conclusions included in this report are those of the authors and do not necessarily reflect the views of EFC funders, the University of North Carolina, the School of Government, or those who provided review.

We are grateful to the Sierra Club, Lone Star Chapter and the Texas Living Waters Project for funding this research.

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## Executive Summary

Water conservation is critical to meeting the water needs of Texas. Many programs may be implemented to reduce water use, and a number of utilities across the State are making strong efforts to advance water conservation. This report focuses on how a utility may use its water rates and financial policies to encourage customers to reduce their water use while maintaining the financial viability of the utility.

It is a fundamental economic theory that the more you charge, the less people use (at least for most goods). That's what makes water pricing such a compelling and convincing tool to use in advancing water conservation. The principle is simple: to achieve conservation, just charge high rates. But of course, the reality of rates is far more complex.

First and foremost, water utilities must set rates to collect the revenue they need to operate the water utility, invest in its infrastructure, and protect public health. After that, utilities can and do tweak and tailor the structure of rates to meet any number of objectives, including customer affordability, economic development, and water conservation. And this is where it can get complicated. Some of these objectives can come in direct conflict with one another and with the primary objective of balancing the budget. One common conflict is the tension that arises between promoting water conservation and ensuring a stable revenue stream to cover the predominantly fixed charges of running a water utility. The relationship is complex; the solutions numerous.

This report explores the relationship between water pricing, water use, and revenue stability in the State of Texas using water rate data predominantly collected by the Texas Municipal League. Trends show that higher water prices are associated with lower average residential water use for water utilities that:

- increase rates from one year to the next (2012 to 2013),
- charge more for water at 5,000 gallons per month, and
- charge more at higher levels of water use.

Additionally, water rates in Texas show a range of revenue vulnerability across the state, which is influenced by marginal pricing and the level of base charges.

These trends are only a cursory exploration of the relationship between water use, water pricing, and revenue stability, but they confirm trends seen in other states and studies. There are many factors that contribute to a customer's water use from one year to the next and from one water utility to another. In addition to pricing, weather, economic factors, and customer demographics influence water use, and subsequently revenue. Similarly, there are many factors that impact the revenue stability for a water utility, such as cost drivers, service area characteristics, and demand projections.

Given the range of operating environments for water utilities, this report introduces a menu of rate structure, billing, and financial practice options that can be adopted to promote conservation AND ensure revenue stability. Water utilities can use locally-appropriate combinations of these options to promote water conservation without undercutting the bottom line. The specific mix of practices

appropriate for a utility will be influenced by local conditions, as explored in three hypothetical scenarios.

There is no one-size-fits-all approach to using rate structures to achieve water conservation goals, but there are some general principles to keep mind when developing such rate structures:

- **The rate level itself matters more than the rate structure.** Prices that are artificially kept low and ignore key components of cost, (such as deferred maintenance) send inaccurate and shortsighted price signals to customers. Utilities should balance short- and long-term revenue and expenditure balance in setting rates. While different rate structures target specific types of water use, the overall price level is influential on demand.
- **Small details matter.** Pricing dialogue is often dominated by what type of block pricing is used when other design decisions, such as the size of the flat charge or the way wastewater charges are calculated, can have significant impact of pricing signals and revenue generation.
- **Utility methods matter.** Rate setting of any kind should begin with accurate demand projections that take into consideration the impact of pricing on consumption. Projections for revenue and demand should be reviewed annually and recalibrated to match current thinking. Furthermore, revenue risk can be mitigated with reserves (such as a rate stabilization fund) and conservative budgeting.
- **Rate awareness matters.** A better and more frequent understanding of pricing levels and water use by utilities and their customers will assist utilities in using pricing to achieve strategic objectives, such as conservation and revenue stability.

Texas utilities are not the first and only organizations dealing with the tension between water pricing, conservation, and revenues. This report concludes with a summary of the great body of work that addresses and investigates this issue across the country and recent times. Although some reports go back to the mid-1990s, the increase of thinking and writing on the topic reflects increasing interest and need for solutions as water supply constraints demand conservation and water infrastructure needs demand revenue.

## Introduction

The purpose of this guide is to explore the balance between conservation and revenue stability in Texas' water structures and introduce rate structures, billing options, and financial practices that will help utilities advance water conservation objectives without undercutting needed revenue stability. Water utilities and their stakeholders will find it useful in evaluating how water rates compare within the state and identifying additional steps that can be taken to promote conservation and ensure revenue stability for water utilities.

Part One acknowledges the myriad of considerations that water utilities undertake in setting strategic rates and the need to balance these considerations. Part Two provides an assessment of the balance between pricing and revenue stability in the State of Texas with a statewide summary of pricing and case studies on two of the state's largest utilities (San Antonio Water System and the Austin Water Utility) that have strategically used water rates to promote conservation while at the same time seeking

more revenue stability. Part Three provides guidance on water utility rate structure design and billing practices that promote conservation and help ensure revenue stability, given the various operating environments for utilities across the state. Part Four summarizes the primary resources on this topic. This document is not designed to address every aspect of rate making, but the appendix does define some of the basic elements of water rate structure design.

## Part I. Considerations for Strategic Pricing for Water Utilities in Texas

**First and foremost, water utilities set rates to balance budgets.**

Revenue sufficiency is the primary financial objective for most water utilities that operate as enterprises. They must be financially self-sufficient, recovering not only the cost of daily operations but also funding capital improvements to fulfill their central public health mission. They strive to design rate structures and set rate levels in a manner that equitably charges a customer based on the cost-of-service. However, rates and rate structures can go well beyond these main objectives and provide an excellent avenue to help a utility achieve some of its goals and policies.

**Some of the more prevalent secondary objectives of water pricing are:**

- ***Conservation Promotion*:** The amount that customers pay for water service acts as a price signal, often encouraging the customers to decrease consumption. A utility charging high rates typically discourages large volume use among many residential customers. In fact, many utilities in Texas have adopted increasing block rate structures (where the rate increases with increasing block rates of usage). The rationale behind conservation-oriented rates is that customers using a lot of water or those with large seasonal variations in consumption should pay their fair share, since distribution networks are sized to meet peak demands.

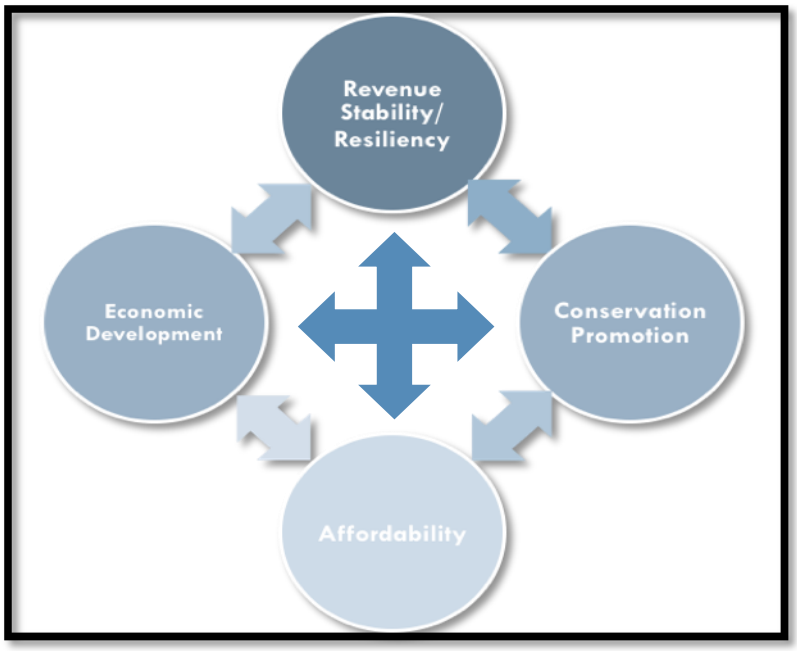
- ***Affordability:*** Ensuring that water is affordable to a community for basic services is a priority of many utilities and their governing boards. A "lifeline" rate as part of an increasing block rate structure, as well as low base charges, is a method employed by utilities to meet this objective. Maintaining "affordable" rates should almost never take precedence over charging rates that are necessary to recover the full costs of service. Artificially maintaining low rates will lead to deferring maintenance, rehabilitation and replacement, deteriorating infrastructure and creating public health hazards in the future, as well as masking the true cost (and value) of water. There are financial tools that can be used to maintain affordability for basic water needs while meeting the full cost of service.

- ***Economic Development:*** Utilities may strive to attract new or maintain existing commercial customers through water rates to foster greater community benefit. Historically, water utilities have done this with low rates targeted at very high levels of consumption that no household or average commercial customer would use.

- ***Short-Term Revenue Stability*:** Year to year, most water utilities in Texas rely on revenue from water consumption charges to cover the predominantly fixed costs of the utility. Yet water consumption can vary and is on the decline for many utilities, undermining water utility revenue stability – which some are calling the "new normal."

Other objectives, such as ease of customer understanding, are explored in further detail in the "Recommended Reading" section of this report.

## Striking a Balance




**In setting rates, utilities must prioritize and balance objectives that are sometimes complementary and sometimes contradictory. A utility (in conjunction with its customers and stakeholders) must decide the objectives that take precedence and design a rate structure and level that reflects those priorities.** For example, a utility wishing to encourage conservation and foster business-friendly practices might be conflicted over the use of a single increasing block rate structure for all its customers. A balance must also be considered when prioritizing affordability and revenue stability. A utility wishing to maintain affordability by keeping base charges and rates low for low use might have to sacrifice its need for month-to-month and year-to-year revenue stability that can be maintained through higher base charges.

One of the most notorious conflicts in balancing rate setting objectives is between the goal of revenue stability and that of customer conservation. The most prevalent retail pricing model in the industry relies on a modest base charge coupled with a much larger variable charge that is based on volumetric use. This highly variable structure provides an incentive for customer conservation and efficiency. Generally, the larger the ratio of variable revenue to fixed revenue, the greater the conservation incentive. A utility that incorporates the majority of its predominantly fixed utility costs into variable customer charges will do fine as long as sales projections are met or exceeded. But when there is an unexpected decline in sales volume (due to drought restrictions, economic recession, wet weather, etc.) and the sharp drop in revenue does not correspond to a reduction in costs, utilities expecting the majority of their revenues from variable charges will struggle to recover costs. Furthermore, if in response to gradual declines in demand, a utility continually focuses on increasing the variable portion of its charges to meet shortfalls it may very well be increasing future revenue vulnerability due to price elasticity. This phenomenon has been coined the "conservation conundrum[1]".

[1]Beecher, J. 2011. The Conservation Conundrum: How Declining Demand Affects Water Utilities. *Jour. AWWA*, 102(2): 78-80

## Part II. Water Pricing in Texas

**It is a fundamental challenge for water utilities (or any industry) to price a product such that it encourages customers to use less of it while at the same time recovering enough revenue to operate its business while not overcharging the customer.**

Recently much has been written and studied regarding the "conservation conundrum", but it is not a new issue for the industry. (See Recommended Reading at end of report for older accounts of the conservation conundrum.) The following section provides an assessment of the balance between pricing and revenue stability in the State of Texas with a statewide summary of pricing and case studies of two of the state's largest utilities (San Antonio Water System and the Austin Water Utility) that have strategically used water rates to promote conservation while at the same time seeking more revenue stability.

### Statewide Pricing

Each year, the Texas Municipal League (TML) conducts a survey of water and wastewater charges of the state's municipalities. Additionally, the Texas Water Development Board (TWDB) maintains a database of financial information on all the local governments that have outstanding debt with TWDB. The Environmental Finance Center has combined and analyzed this data to shed light on the state of rates and revenues, conservation pricing, and revenue stability with Texas water utilities.

Although this report discusses utility pricing from the perspective of the water utility engaged in supplying water, it is important to point out that the majority of wastewater utilities calculate charges based on water consumption, thereby compounding the financial impact of water consumption to the customer. Most customers are unlikely to distinguish the nuances of the charges, but rather respond to the absolute dollar impact of changes in water use.

Many utilities in Texas use a customer's average winter time water consumption to calculate monthly wastewater charges for an entire year. As a general practice, wastewater is not metered and so wastewater utilities use wintertime water consumption to equitably bill for the water that goes down the drain. This practice is likely to have two major impacts on customer demand. It reduces the price signal to customers to reduce water demand in the summer because the wastewater charge component is fixed. Nonetheless, it does enhance the pricing incentive to reduce water demand in the winter (likely indoor, less discretionary water demand) because a customer will be paying for that winter-time consumption all year long. Although the following analysis focuses on water pricing, it is important to consider that the rate for wastewater is likely to impact customer demand.

The concept of price elasticity explains why and how utilities use rates to encourage the conservation of water. Like most economic goods, there is an inverse relationship between price and the quantity of water demanded; i.e., price increases lead to reductions in demand. Price elasticity varies by geographic region, water end use, customer class, demographics, and weather, but for the most part,

water demand is relatively inelastic. This means that a 10% change in price will cause less than a 10% change in demand.

Although there have been a number of studies on price elasticity of water, including one done for single-family residents in Texas[2], confounding factors make it difficult for individual utility managers to predict customer response to rates in the next year. Even harder is predicting how customers will respond to rate increases in the long-term because the long-term impacts of pricing are less known and studied[3]. Customer response to pricing could be behavioral (i.e. shorter showers or drier lawn) or structural (i.e. low-flow showerhead or replacement of lawn with xeriscape landscape), and behavioral responses are likely to diminish over time.

Although there are many other factors that influence water use, the following analysis provides narrow snapshots into the impact of water pricing on water use in the State of Texas and is introduced to provide context and explore concepts related to price elasticity. The trends shown in the analysis reiterate the impact of water pricing on water use; they do not contradict the numerous studies on price elasticity.

The data displayed in Figure 1 show the difficulty in driving revenue increases through rate increases. The utilities reflected in the graph below are those that took the Texas Municipal League's rate survey in 2007 and 2010 and have outstanding loans with the Texas Water Development Board. The change in the Consumer Price Index between 2007 and 2010 is plotted on the graph to provide scale to the degree of rate adjustments. Those utilities to the right of the vertical dotted line increased water rates more than inflation. Raising rates by a fixed percentage did not generate corresponding increases in revenues between 2007 and 2010 for all of these 103 utilities. In some cases, the divergence of rate increase percentages and revenue growth rates is severe. For some utilities, relatively significant rate increases corresponded to a period with no revenue growth or even a decline in overall revenues.

The data reveal that:

1) Revenues usually increase when rates increase, despite a downward pressure on customer demand due to elasticity;
2) Generally, larger rate increases are associated with disproportionately lower revenue increases;
3) The relationship between rate and revenue increases is complicated and varies from utility to utility.

[2] Stratus Consulting. Water Price Elasticities for Single-Family Homes in Texas. August 1999.
[3] Vista Consulting. Long-Term Effects of Conservation Rates. 1997. American Water Works Association. ISBN 0-89867-904-4

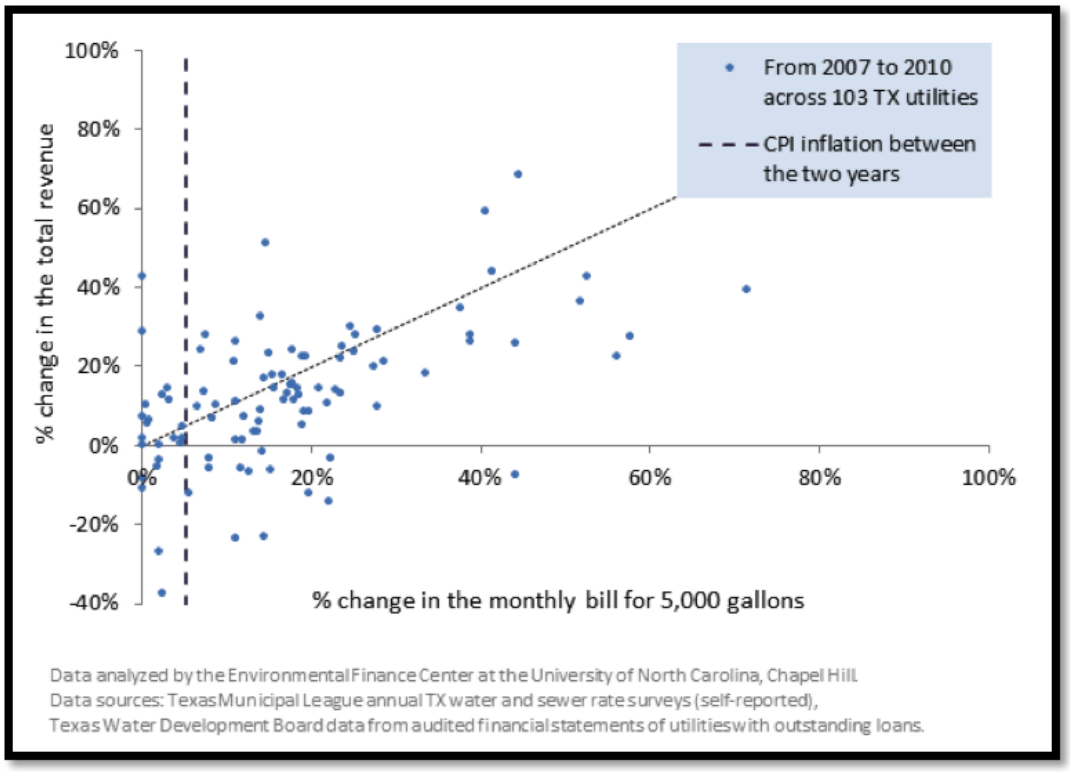



**Figure 1. Driving Revenue Through Rate Increases**

Of course, there are many factors beyond just price that affect this relationship (for utilities above and below the dotted line). Two utilities with identical rate increases may have very different outcomes in terms of revenue increases, even in the same state or region. **There is no single rule-of-thumb equation that utilities can use to accurately predict the effect of a rate increase on revenues, given that many other factors beyond the control of the utility will affect revenues.** Furthermore, the relationship between rate increases and revenue increases works in both directions; rate increases may drive down demand, which will lower revenue increases, and lower revenue increases may necessitate higher rate increases. **Utilities will probably find it difficult to raise rates fast enough to navigate their way out of a large revenue shortfall, since higher rate increases tend to yield disproportionately lower revenue increases[4].** As long as these trends are incorporated into revenue projections and pricing modifications, a utility should be able to maintain financial stability if they are willing to adjust rates accordingly. Problems can arise when utilities fail to consider scenarios that involve significant declines in usage and fail to set rates as realistic levels. Raising rates across-the-board is one tool to address revenue shortfalls, but this guide suggests other approaches as well.

[4] Hughes, J., and Leurig, S. 2013. Assessing Water System Revenue Risk: Considerations for Market Analysis. Ceres. http://www.ceres.org/resources/reports/assessing-water-system-revenue-risk-considerations-for-market-analysts

Figure 2 illustrates this effect by showing the change in a 5,000 gallon per month water bill between 2012 and 2013 versus the change in average household water use for the same time period. Although there are many more price points other than 5,000 gallons per month that could influence average household water use for an entire service area, **the trend shows a slight negative impact of pricing on water demand. In other words, as price increased, water use decreased.** The 512 Texas municipalities represented in the graph below are those that reported water rates in the Texas Municipal League's 2012 and 2013 water and sewer rate survey. This trend, however, is only cursory. There are many other factors that can influence water demand from one year to the next, predominantly weather.

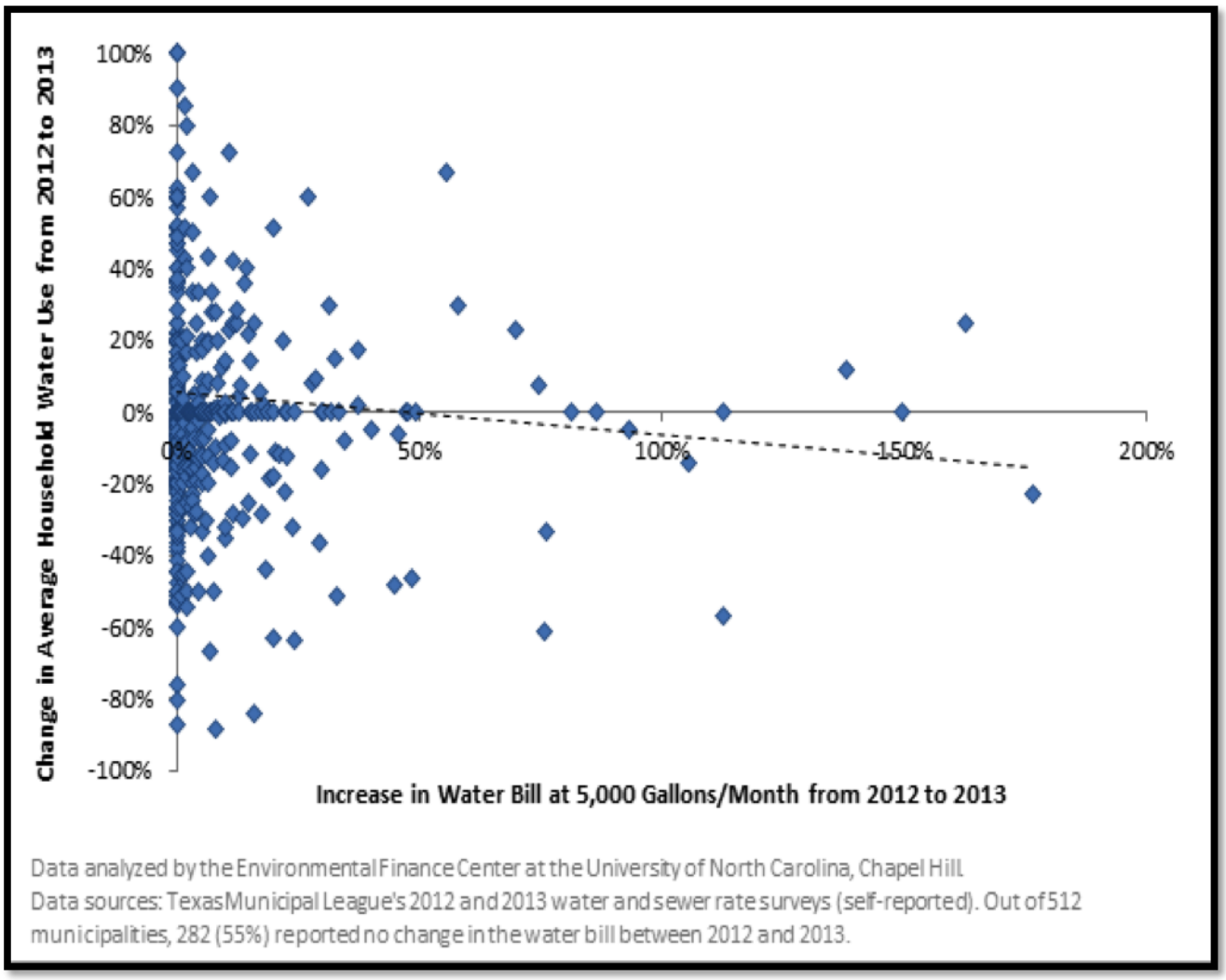



**Figure 2. Changes to Water Prices and Average Household Water Use between 2012 and 2013 among 512 TX Municipalities**

A simple comparison of prices versus average household water use demonstrates the pressure higher prices put on usage. Figure 3 summarizes water charges and average household water use by Texas water planning regions. The graph is arranged from highest-charging region to lowest-charging region. **Those regions with the higher charges tend to have the lowest trends in water use (i.e., Brazos G, Region B, North East Texas, and East Texas) while those that have lower charges tend to have the highest trends in water use (Rio Grande, Region H, and Panhandle).** The 528 Texas Municipalities included in the graph are those that reported water use and rates in the Texas Municipal League's 2013 water and sewer survey for which water planning region could be identified (excluding the Far West, Lavaca, and Plateau Regions due to an insufficient number of utilities with adequate data). And again, while the trend is interesting and insightful, there are many factors that influence usage beyond price including regional rainfall, economic condition, conservation ethos, etc. that may also be driving the usage differences.

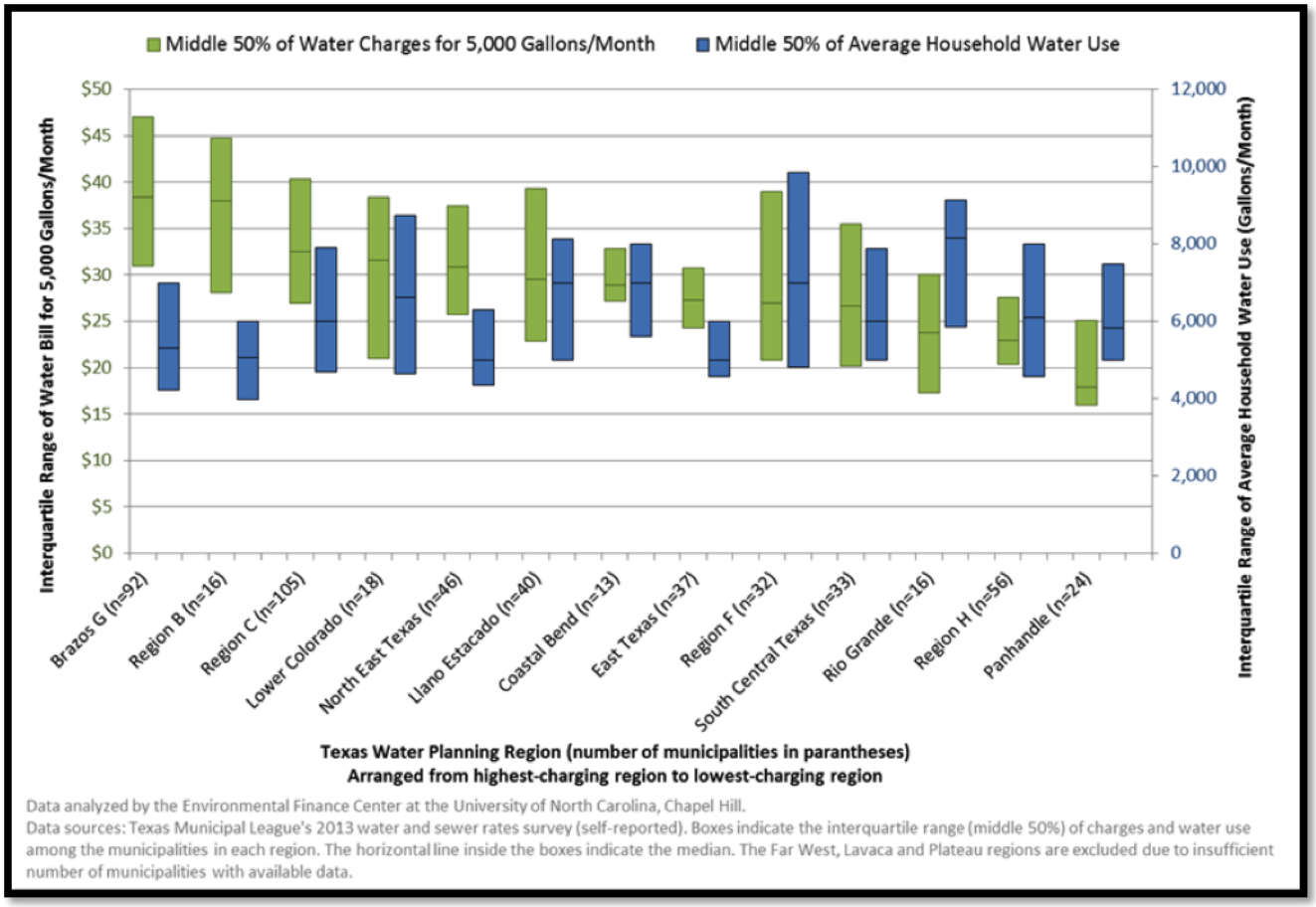



**Figure 3. Water Charges and Average Household Water Use by Texas Water Planning Region Among 528 Texas Municipalities in 2013**

Beyond the actual charge for a product, economists argue that it is the change in charge that a customer experiences when they use less or more of product that influences changes in use[5]. Figure 4 below shows the correlation between the change in charge between 10,000 gallons and 5,000 gallons per month (i.e. the marginal price of water between 5,000 and 10,000 gallons of use per month) versus a utility's average household water use**. It shows a downward trend between a utility's marginal price for water between these two consumption points and the average household water use for that utility, which suggests that as price increases water use decreases.** The 681 Texas Municipalities included in the graph are those that reported water rates and water use in the Texas Municipal League's 2013 water and sewer rate survey.

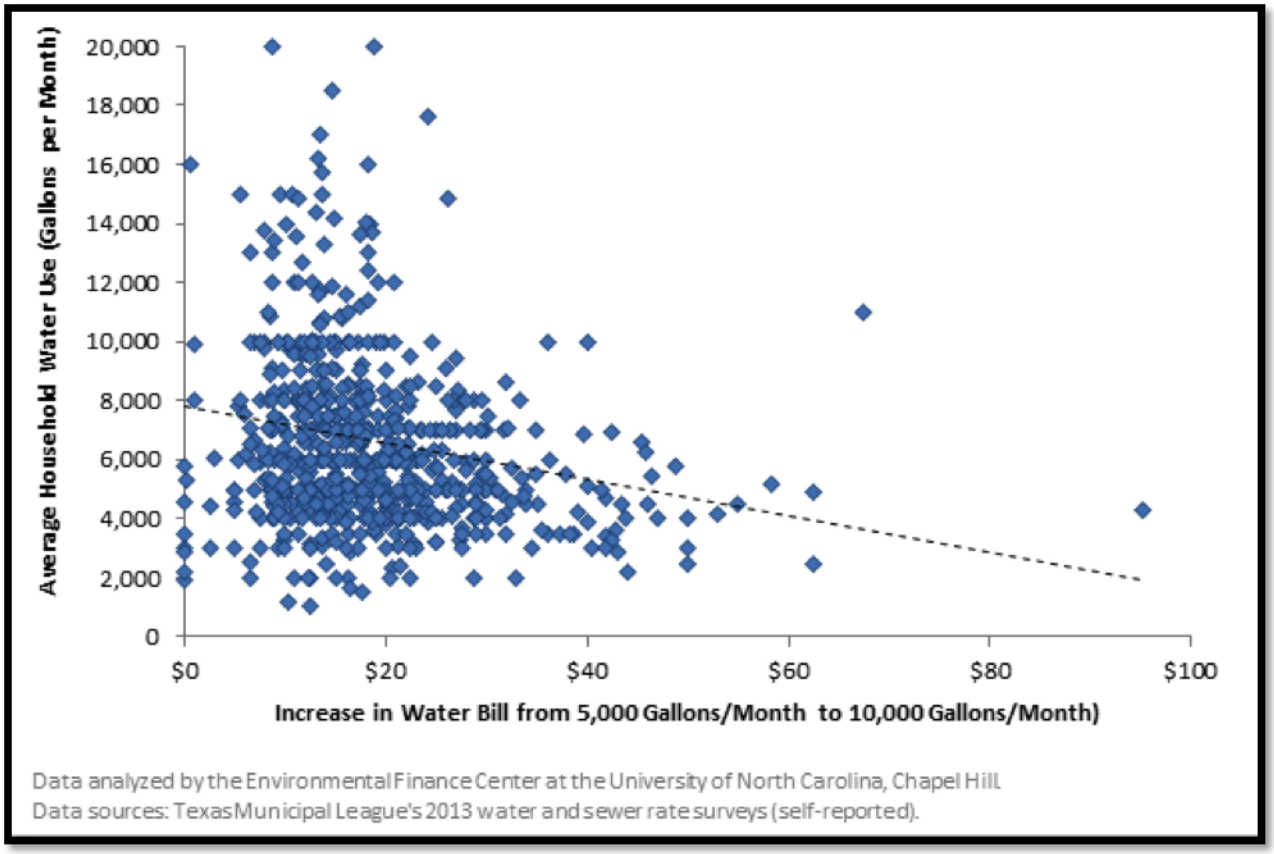



**Figure 4. Correlation between Average Monthly Household Water Use and the Increase in Water Monthly Bill between 5,000 Gallons and 10,000 Gallons in 2013 (681 TX Municipalities)**

[5] Howe, Charles. 2005. The Functions, Impacts and Effectiveness of Water Pricing: Evidence from the United States and Canada. Water Resources Development, Vol. 21, No. 1, 43–53, March 2005,

**While a high marginal price may impact water use, it can mean more revenue volatility when customers reduce consumption.** Figure 5 shows the wide range of price signals across Texas in terms of both the percent of bill and absolute expenditures. The figure reverses the marginal price metric shown in Figure 4 to show the percentage that a customer's bill is reduced when water use decreases by 5,000 gallons per month (from 10,000 gallons per month) along with the actual dollar amount of the decrease. For example, a customer served by Utility A will see their bill go down $24 dollars (representing 22% percent of their bill) when they reduce their water use from 10,000 to 5,000 gallons per month. Conversely, when a customer served by Utility B reduces their water use by half (from 10,000 to 5,000 gallons per month), they will see their bill go down $32 dollars which represents 62% in terms of percent of their bill. **The higher a point falls on the graph, the stronger the price signal in terms of percent change in bill and, consequently, the revenue vulnerability for the utility.** The average utility represented in the graph below will recover 36% less revenue from a customer using 5,000 gallons per month than one using 10,000 gallons per month. **But for 47 of the 693 utilities, a customer that reduces their water use by 50% (from 10,000 to 5,000 gallons per month) will reduce their bill by more than 50% signaling revenue vulnerability.**

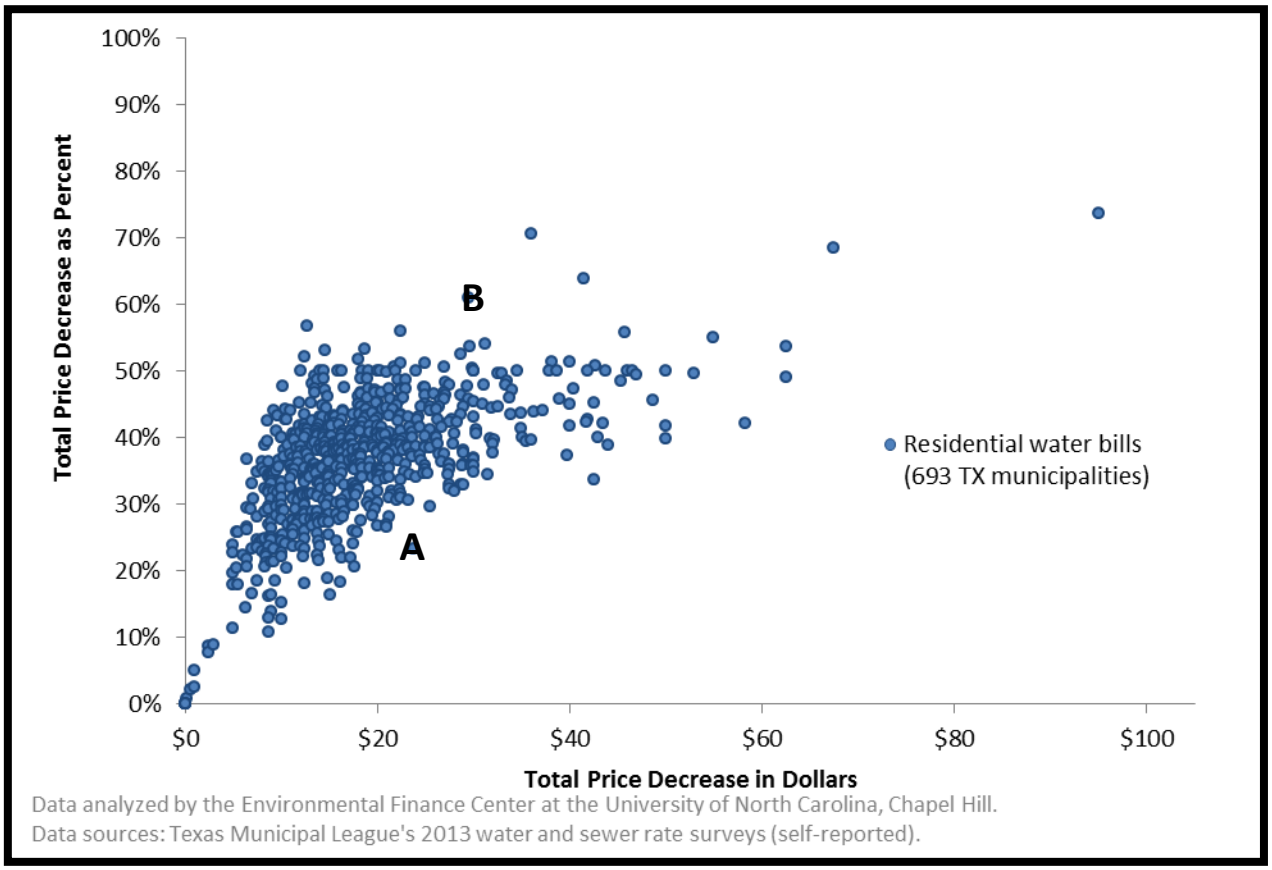



**Figure 5. Reductions in Residential Monthly Water Bills for Decrease in Consumption from 10,000 to 5,000 Gallons in Texas in 2013**

This can cause a revenue stability issue for utilities who derive more than 90% of their revenues from operating revenues and 80% of their operating revenues from consumption charges (a common situation for most utilities in the US)[6]. The 693 Texas utilities in the graphs are those that reported rates in the Texas Municipal League's 2013 water and sewer rates survey. Note: the 10,000 and 5,000 consumption points were chosen based on available data, but they also correspond to a realistic drop in usage that a family might see by implementing conservation initiatives particularly involving outdoor landscape irrigation.

The primary reason why this relationship between revenue and usage is not a 1:1 relationship (i.e. a 50% consumption reduction equates to a 50% bill reduction) is that volumetric rates are typically partnered with base rates (a fixed price that is charged no matter how much water used). The presence of a sizable base charge not only reduces the bill impact of conservation, but also helps to ensure a more fixed revenue stream for the utility. The 2013 Texas Municipal League rate survey did not collect base rate data. So the Environmental Finance Center collected base charge data from a geographically diverse group of fifty municipalities included in the 2013 Texas Municipal League rate survey (with an average population size of 22,707,and average household water use of 6,858 gallons per month) to compare "fixed versus variable" charges for customers and revenues for utilities. The figure below shows the range of bill (and to some extent revenue) stability at 5,000 gallons per month for each of these 50 utilities, with the median percent of residential water bill "fixed" falling between 51% and 60%. **In general, the higher the percent of residential water bill that is "fixed", the weaker the conservation signal and stronger the revenue stability.**

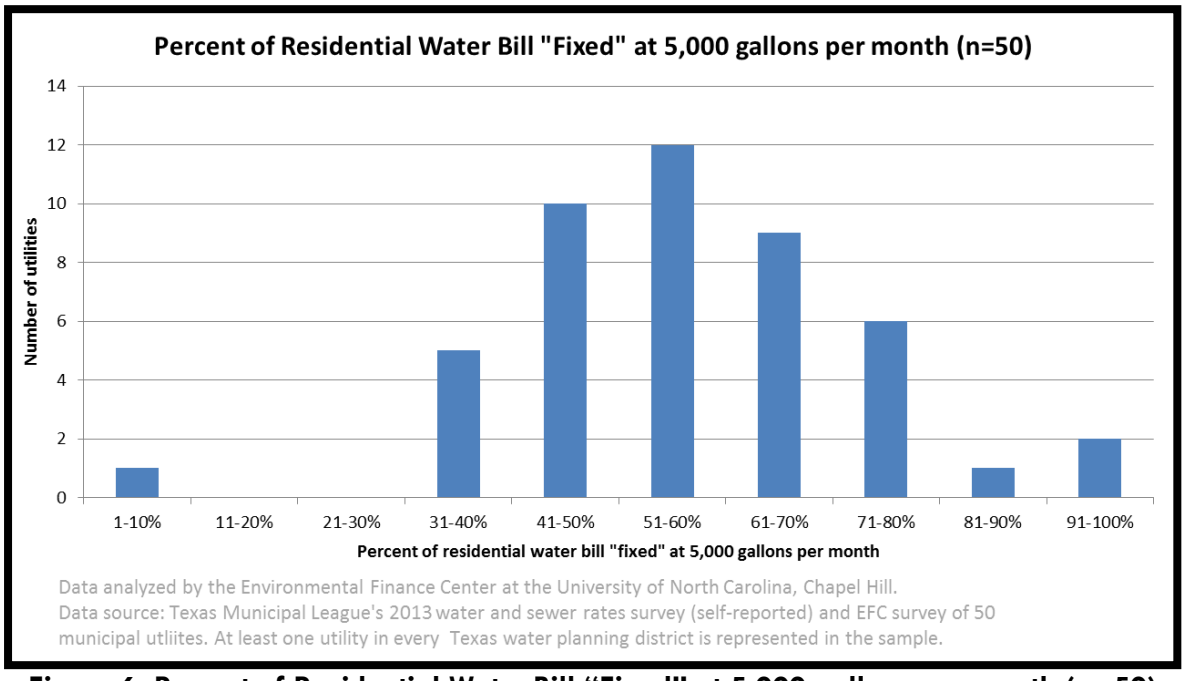



**Figure 6. Percent of Residential Water Bill "Fixed" at 5,000 gallons per month (n=50)**

[6] Hughes et al. Defining a Resilient Business Model for Water Utilities. Water Research Foundation Report. January 2014.

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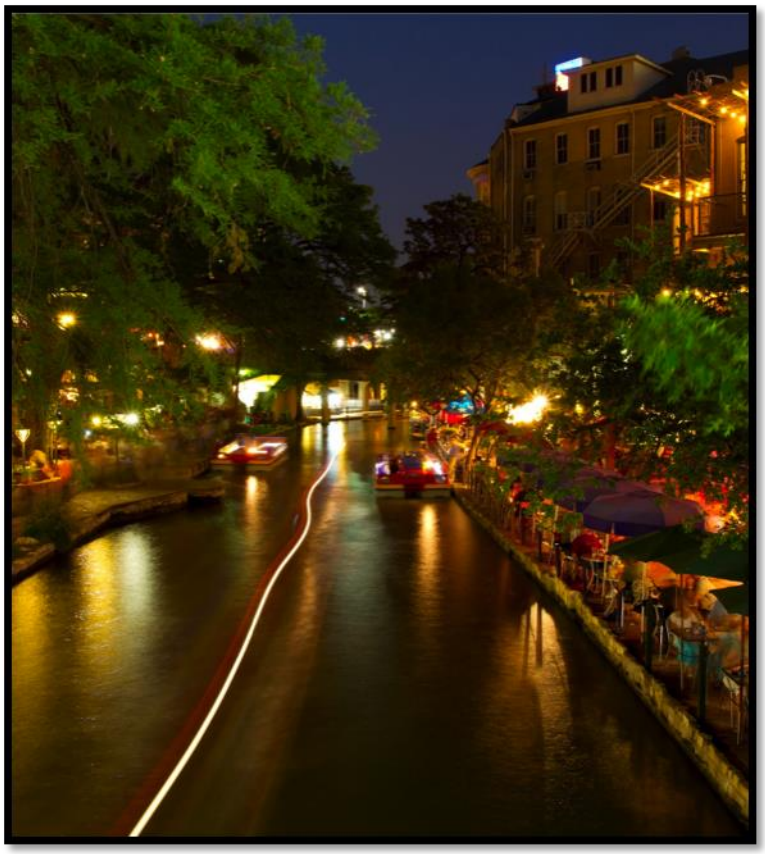
## A Tale of Two Texas Cities

**As two of Texas' largest water utilities, the cities of San Antonio and Austin have a long history of using rates to promote customer conservation. Their backgrounds reveal a combination of large and incremental rate adjustments to drive down demand and drive up revenue stability.**

### San Antonio Water System



*San Antonio Water System (SAWS)* has been using increasing block rates to incentivize water efficiency and conservation since the 1980s. Though SAWS has maintained an increasing block rate structure, it has made modifications to encourage conservation over the years. In 1988, SAWS added a fourth block on its increasing block rate structure and a seasonal differential (i.e. higher volumetric rates in the summer) to account for fluctuations in usage at different times of the year. SAWS has also made great efforts to educate its customers on water use and the price of water. Since the 1990s, customer bills have included an individualized chart showing water use for the previous 12 months and a comparison to neighborhood and overall SAWS average residential water use for that month[7]. In addition, the utility has a policy to conduct a complete rate study every five years; the last one was performed during 2009[8]. A new study is currently underway and a Rates Advisory Committee, comprised of local stakeholders, has been appointed[9].

[7] Stratus Consulting. Water Price Elasticities for Single-Family Homes in Texas. August 1999.
[8] Guz, Karen. A Rate Structure that Promotes Conservation. A PowerPoint Presentation given for the Gulf Coast Conservation Symposium on March 2, 2011 by Karen Guz, Director of Water Conservation for the San Antonio Water System.
[9] Rate Advisory Committee Web site: https://www.saws.org/Who_we_are/community/rac/.

The utility uses its rate structure as a water conservation tool to:

- Send a price signal so customers become more conscious of their lawn and landscape water use
- Reward those who conserve water with lower bills
- Acknowledge that it is not fair to ask all customers to pay more for the lawn watering demands of a few. Rather, it is fairer to ask those who demand large amounts of water for irrigation purposes to pay for a higher cost of service[10].

In addition to conservation/demand management, SAWS identified two additional primary objectives for its rate structure in its 2009 rate study: financial sufficiency and rate stability[11]. The utility restructured its rates to reduce costs for low-using customers, helping to make water pricing more affordable for basic uses. Through its rate setting, the utility strives to fairly divide the "cost of service" across all customers.

SAWS funds operation and maintenance costs associated with conservation efforts through revenue generated from rates charged against the highest block of consumption, as well as a portion of the fixed monthly meter charges for general and irrigation class customers[12]. In addition, the utility has a drought surcharge that activates in stage four of drought, assessed for residential use greater than 12,717 gallons per month and commercial irrigation use greater than 5,236 gallons per month.[13] Drought surcharges are temporary charges additional to the existing rate structure. They can be effective at both promoting conservation (through increased charges for water use) and maintaining adequate revenues during times of drastic water use reductions[14]. Typically, the revenue recovered from a drought surcharge covers the revenue shortfall that occurs when customers conserve expectantly.

In 2001, SAWS added a flat water supply fee to fund the development, construction, and management of additional water supplies. Although, this helped the utility secure a more stable revenue base, it reduced the utility's conservation pricing signal. In 2010, the utility transitioned the water supply fee from a flat fee charged to all residential customers to a tiered, fixed water supply fee based on consumption. When it did this, it decreased the water delivery fee (variable rate) for residential consumption less than 12,717 gallons per month and increased the fee for consumption greater than 12,717 gallons per month. (The water supply fee is still flat for commercial customers.)[15] From its inception in 2001 through June 2013, the water supply fee has generated $862 million toward the investment in a diversified water supply portfolio.[16]

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[10] Guz, Karen. A Rate Structure that Promotes Conservation. A PowerPoint Presentation given for the Gulf Coast Conservation Symposium on March 2, 2011 by Karen Guz, Director of Water Conservation for the San Antonio Water System.
[11] Raftelis Financial Consultants. Comprehensive Cost of Service and Rate Design Study. Presentation to Rate Advisory Committee. October 30, 2008.
[12] Ibid
[13] San Antonio Water System Drought Operations Plan. Available at: http://www.sanantonio.gov/Portals/0/Files/Sustainability/DroughtOperationsPlan.pdf
[14] American Water Works Association. 2012. Principles of Water Rates, Fees and Charges (M1). 6th Edition. http://www.awwa.org/store/productdetail.aspx?productid=28731
[15] Guz, Karen. A Rate Structure that Promotes Conservation. A PowerPoint Presentation given for the Gulf Coast Conservation Symposium on March 2, 2011 by Karen Guz, Director of Water Conservation for the San Antonio Water System.
[16] San Antonio Water System. Water Management Plan Semiannual Report. January – June 2013.

Isolating the impact of SAWS' rate structure on water demand requires a detailed statistical study, but in its 2013 Water Management Plan Update, SAWS asserted that its customers would save more than 5 billion gallons of water per year by 2020 through its entire conservation program which includes rate structures[17].

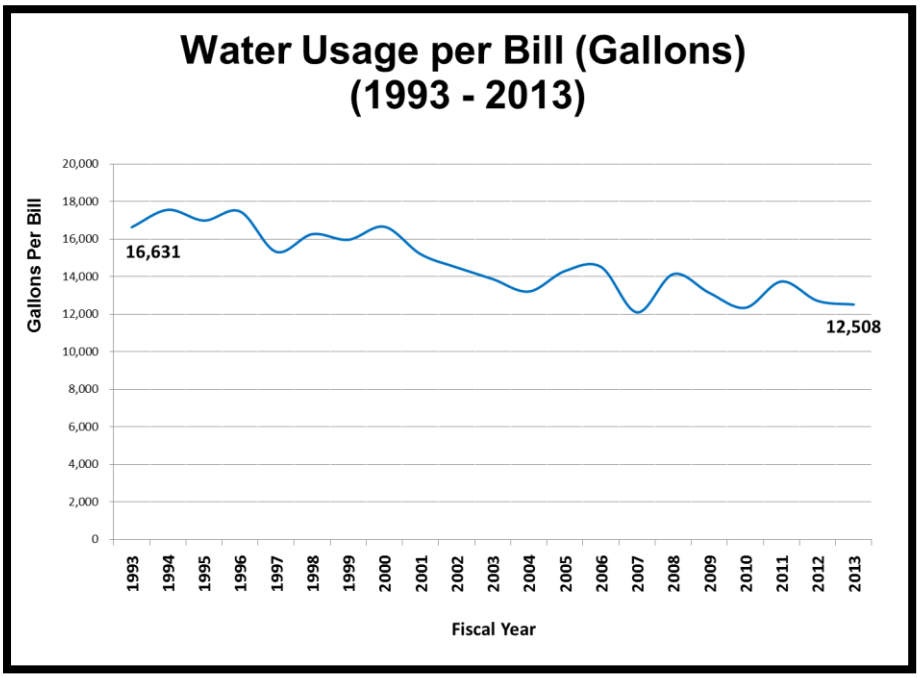


**Figure 7. Changes in Water Use per Bill for the San Antonio Water System (1996 – 2013)[18]**

Figure 7 shows a significant downward trend in water use per bill, volatility around that trend due to weather variation, and the downward effects of conservation drought restrictions from 1996 through 2013[19]. Average winter consumption (which is used to calculate wastewater charges) has also dramatically declined over the last decade as a result of indoor conservation efforts and growing public awareness about the winter averaging method and measurement period. In an effort to address a multitude of utility objectives through its rates, the San Antonio Water System has developed a fairly complicated rate structure over time. They are utilizing their rate structure for more than revenue recovery and have incorporated the predicted savings in response to increased rates into their water management plan. SAWS continues to grapple with the tradeoff between conservation promotion and revenue stability but have taken great strides to better align these often conflicting objectives.

[17] San Antonio Water System. Water Management Plan Semiannual Report. January – June 2013.
[18] Data provided by Doug Evanson, Chief Financial Officer for SAWS, February 14, 2014.
[19] SAWS. 2012 Annual Budget Report. Fiscal Year Ending December 31, 2012.

## Austin Water Utility

Much can be learned about rate setting for conservation and revenue stability through the deliberations and recommendations of the Joint Committee on Austin Water Utility's Financial Plan that was convened in 2012[20] to "develop recommendations for short-term and long-term financial plans to strengthen the financial stability of the Austin Water Utility while continuing the city's goals of ensuring affordability of water rates and increasing water conservation."

The Joint Committee considered over 30 rate design options and compared each rate structure using a volatility, affordability and conservation ranking. This allowed the Committee members to see the impact of their recommendations.

Among the recommendations by the Joint Committee, two addressed the balance between conservation and rate stability objectives, including that the utility should:

- Increase fixed revenue goal to 20% of total water revenue requirements. Fixed revenues will be allocated to each customer class based on its relative water cost of service after the monthly minimum charge. The recommended increase will come from replacing a flat "revenue stability fee" with a tiered fixed fee based on volume of water used. *(Background: Prior to instituting a revenue stability fee in 2012, fixed revenue was about 11%. This effort was recently praised by Standard and Poor's Rating Agency[21].)*

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[20] Austin City Council Resolution that created the Joint Subcommittee. Available online at: http://www.austintexas.gov/sites/default/files/files/Water/JointSubcommittee/resolutionno20120112-063.pdf

[21] Hughes, Jeff, Peiffer Brandt, Mary Tiger, and Shadi Eskaf. 2014. Defining A Resilient Business Model for Water Utilities. Available at: http://www.waterrf.org/Pages/Projects.aspx?PID=4366

- Create an "as-needed" Revenue Stability Reserve Fund, which will be funded by a reserve fund surcharge (a volumetric surcharge charged to all customer classes in order to build or replenish the reserve fund), excess operating cash balances, and other sources. *(Background: The Revenue Stability Reserve Fund is only to be used to offset a current year water service revenue shortfall where actual water service revenue is less than the budgeted level by at least 10%. The utility can't use more than 50% of the Fund's existing balance at the time of the request.)*

Although the utility did not accept all of the committee's recommendations, it did accept these two. The utility anticipates some significant rate increases over the next few years to achieve these revenue stability objectives and manage the system's declining and fluctuating demand, as depicted in Figure 7.

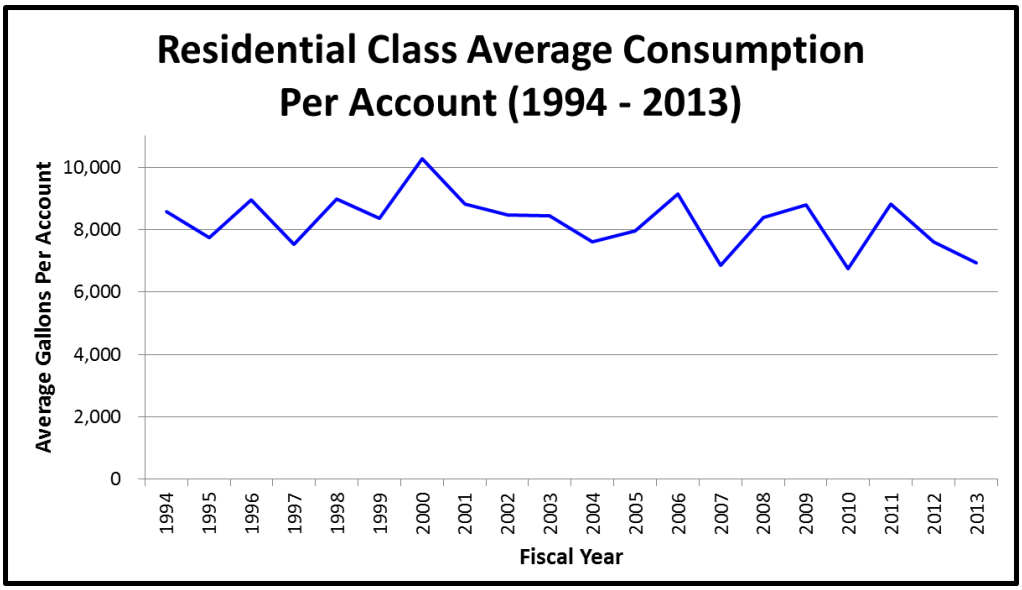



**Figure 7. AWU Residential Class Average Consumption Per Account[22]**

In recent years, declining demand is partially attributed to the intended and unintended water savings from watering restrictions enacted in response to drought[23]. As intended, the restrictions have helped reduce peak water use. However, an unintended consequence of the restrictions is that they (in combination with increasing water rates) have incentivized large irrigators to drill private wells to water freely from underground aquifers, further exacerbating water stresses in the region and reducing revenue for the utility. This experience highlights the fine line that water utilities walk between promoting conservation and ensuring revenue stability. As with SAWS, AWU's deliberation with and evolution of the balance between revenue stability and conservation promotion highlights both the need for and reality of financially dealing with conservation and the thoughtful considerations of the outcomes of policy and pricing.

[22] Data provided by Michael Castillo, Utility Budget and Finance Manager at Austin Water Utility, February 11, 2014
[23] Interview with Michael Castillo, Utility Budget and Finance Manager at Austin Water Utility, February 11, 2014

## Part III. Recommendations and Considerations for Designing Water Rate Structures for Conservation and Revenue Stability

The following section provides guidance on rate structure design and billing practices for water utilities that are attempting to decrease water usage among primarily their residential customers. There may be additional rate structure design and billing practices that utilities can implement to encourage water conservation among non-residential customers, but these are not addressed below. In 2004, the Water Conservation Implementation Task Force created by the Texas Legislature and appointed by the Texas Water Development Board produced a guide on water conservation Best Management Practices (BMPs). Many of the conservation guidelines listed below follow suit with the water conservation pricing BMPs in that guide.[24]

### Rate Structure, Billing Options, and Financial Practices for Conservation and Revenue Stability

**The following rate structures, billing options, and financial practices are designed to promote customer conservation and/or revenue stability. In many cases, a combination may be necessary to meet both objectives. All utilities should determine the cost to deliver service in the short and long term, and establish a baseline revenue requirement prior to engaging in additional rate deliberations.**

[24] The Texas water conservation Best Management Practices are now available online and are updated periodically. https://www.twdb.texas.gov/conservation/BMPs/index.asp

## Approaches to Ensure a Pricing Signal is Being Sent

1. **Use monthly billing period.** The more frequently a customer receives utility bills, the more aware they are of their consumption and the more price-responsive they are in their conservation efforts. Utilities are encouraged to use monthly billing when fiscally feasible.

2. **Provide price and use information on customers' bills.** Use the bill itself as a document to share information with the customer. Customers that can view their current and/or historic water use along with their utility's rates on the bill itself often adjust their consumption behavior and use less water. The 2004 Texas water conservation Best Management Practices Guide recommended at least 12 months of consumption history on a bill.

3. **Encourage sub-metering in existing apartment complexes and other master-metered multi-family residential housing areas.** Customers that receive their own utility bill directly have a greater financial incentive to repair leaks and conserve on water usage.

4. **Incorporate all the costs of water into price setting.** Many utilities fail to consider the true cost of their capital in pricing leading to artificially low prices that send inaccurate signals to customers about the value of the service.

5. **Understand the relative price signal**. Texas utilities can benefit from the body of rate and pricing information collected by the Texas Municipal League to allow utilities to understand how their pricing structures and signals compare across the state. A dashboard prepared by the Environmental Finance Center allows utilities to generate customized benchmarking analyses relatively quickly[25].

[25] Available online at: http://www.efc.sog.unc.edu/project/utility-financial-sustainability-and-rates-dashboards

## Evaluation of the Pricing Signal at Various Consumption Points and Targeting Specific Types of Water Use

1. **Set prices that encourage water conservation at the average as well as high levels of residential customer consumption.** A price targeted at the average level of residential customer consumption will influence the water use of many more customers.
2. **Design a rate structure that significantly reduces total bills for customers that reduce water use – marginal price consideration.** This will have a great impact on the total bill for customers and have a higher potential to change behavioral and structure water use.
3. **Use an increasing block rate structure with 3 or 4 blocks within the first 20,000 gallons/month.** Having increasing block rate structures alone does not ensure a "conservation-oriented" rate structure. The first block beyond the base charge should be set near the wintertime average residential water use at the utility, or less than 5,000 gallons/month by default. If the difference between block rates is insubstantial, the customer will likely not notice any changes to their monthly bills as they move in and out of later blocks of usage. For a block rate structure to be effective in communicating the higher (or lower) price of water at different consumption levels, the difference in the block rates should be significant.
4. **As an alternative to an increasing block rate structure, use a higher uniform rate structure or a seasonal rate structure that permanently charges higher rates in the summertime than in the wintertime.** Seasonal rate structures can also be combined with increasing block rate structures.
5. **If irrigation water is metered separately, create an irrigation meter rate structure and charge a higher volumetric price for irrigation water than for standard household water.** Although this is likely to somewhat dissuade the use of a separate irrigation meter (thereby reducing the ability of the utility to measure irrigation water use), it will target pricing to peak-day consumption. The 2004 Texas water conservation Best Management Practices Guide suggested the adoption of a rule/ordinance requiring new commercial and institutional customers to install separate irrigation meters.
6. **Consider temporary rate adjustments (e.g. "drought surcharges") that are tied to drought conditions and water storage levels.** The implementation of these temporary rate adjustments should be clearly tied to water storage triggers identified in a utility's drought contingency plan. Utilities should develop and adopt temporary rate adjustment policies and communicate them with their customers before the next drought or water shortage period. This strategy can compensate for lost revenue due to the imposition of other water conservation measures, while at the same time encourage customer conservation when a water supply most needs it.
7. **Do not charge residential customers (or usage below 20,000 gallons/month) using decreasing block rate structures.** A "decreasing block rate structure" is one where the volumetric price for water ($/1,000 gallons or $/ccf) decreases for higher levels of consumption, thereby reducing the conservation signal for the most discretionary water uses. Some utilities with one price structure for all customers will use a decreasing block rate structure for usage at high levels to incentivize commercial and industrial customers.

## Complementary Practices for Revenue Stability

1. **Review rates each year and adjust rates as needed to meet both operating and long-term costs**. Rates should be reviewed at least once a year to ensure that rates meet system costs. Increases also may be used to encourage conservation actions that respond to rate structure.

2. **Improve accuracy of demand and revenue projections.** Pricing that takes into consideration potential significant demand reductions are less likely to produce unexpected revenue shortfalls. While this worse case planning may lead to short term cash surpluses, in most cases these funds can be deployed effectively and efficiently to stabilize future rate increases or fund capital improvements that otherwise would have been debt financed.

3. Repeated - **Consider temporary rate adjustments (e.g. "drought surcharges") that are tied to drought conditions and water storage levels.** The revenue generated from these temporary rate adjustments can be used to off-set revenue shortfalls as a result of drought-time water use restrictions.

4. **Consider the establishment of and funding strategy for a rate stabilization fund.** Reserve funds have become an increasingly important part of water utilities' efforts to ensure financial stability and resiliency. Reserves dedicated as "rate stabilization funds" are used to create a monetary buffer to offset the financial risks of customer consumption reduction.

5. **Consider a fixed charge based on consumption, in addition to a fixed meter charge and volumetric charge.** Both the San Antonio Water System and the Austin Water Utility have adapted their increasing block rate structures to incorporate a "tiered" base charge based on a customer's consumption. This approach helps "levelize" charges and revenues, while still sending a conservation signal. You can read more about "Alternative Rate Designs" that promote conservation and advance revenue stability in the so-named chapter in "Defining a Resilient Business Model for Water Utilities" report cited in the "Recommended Reading" Section.

6. **Consider revenue generated from consumption at the highest tiers to be more vulnerable than other revenue (especially when paired with customer conservation).** Given a stronger pricing signal and a likely more discretionary water use that can be curtailed under the right pricing signal, revenue generated from higher levels of consumption (particularly when increasing block rate structures are used) are more volatile. Utilities should consider a use for this revenue beyond operations, maintenance, and debt service expenses.

## Choosing the Right Practices to Match Local Conditions

**While all utilities are encouraged to promote efficient use of water resources, there are varying degrees to which utilities may need to actively promote conservation in order to ensure adequate supply to meet their demands. Furthermore, some strategies may be more or less effective given various cost-drivers, supply projections, utility size, and demand projections.**

One standard rate structure or set of pricing practices will not fit all utilities in the State of Texas. Hence, these guidelines represent good practice in many circumstances but are not necessarily all suitable for all water utilities or even the same water utility at different points in time. The following utility-specific scenarios are likely to influence the degree and approach of conservation-oriented rates by an individual utility. Most importantly, they are likely to influence the revenue per account required by the utility, which will influence the overall price of water across its service area and, subsequently, the conservation signal sent via rates.

Although these are not the only considerations in rate structure and financial practice design, they will largely drive the degree and approach of conservation-oriented rates at individual utilities.

- **Cost drivers for the utility.** In the short-term, water utility costs are largely fixed regardless of how much water is delivered to customers. But, in the long-run (depending on a utility's specific water supply projections, options to increase water supply, and state of capital needed to treat and deliver the supply), conservation can be a more cost-effective option than supply and capital expansion. This is the case for a utility facing expansion of either supply or capital (or both) within their planning horizon as opposed to a utility with adequate forecasted supply and capital. Additionally, the source of water can influence the cost-drivers for a utility. Water systems that purchase treated water will likely have much more variable costs than their counterparts that treat water. Depending on the purchase contract, utilities that purchase water will not likely suffer from the "conservation conundrum" (i.e. costs will align more with consumption). However, they are also not as likely to directly benefit from the long-term financial savings associated with conservation[26]. In 2011, 69% of the utilities that submitted total municipal water use surveys to the Texas Water Development Board used self-supplied water, 19% used purchase water, and 11% used a combination[27].

- **Size and characteristics of service area.** Perhaps one of the most generalizable determinants of utility financial performance and rate setting is facility size and customer base. Larger utilities

[26] Clarke, Margot. 2012. Thirsting for Less: Water Conservation Progress and Potential in North Central Texas. Sierra Club and theTexas Living Waters Project. Available at: http://www.texas.sierraclub.org/water/20121213ThirstingforLess.pdf
[27] Email exchange with Kevin Kluge, Acting Manager, Water Use, Projections & Planning, Texas Water Development Board. January 7, 2013.

can take advantage of economies of scale and spread their costs (which are mostly fixed) over a greater number of customers, thereby reducing costs per account. Smaller utilities have many of the same fixed costs and requirements with fewer customers to cover costs. Smaller utilities are likely to charge high base rates to their customers. Additionally, a smaller utility staff may lack time and expertise to set strategic rates. Larger systems are also more likely to have a diverse customer base (i.e. a healthy mix of residential, commercial, industrial, and wholesale customers) and are less vulnerable to revenue fluctuations as a result of individual customer behavior change.

- **Demand projections.** Demand projections, in conjunction with supply projections, drive much of the need for capital and water resource expansions. Water utilities have typically erred on the side of over-estimating customer demand for multiple reasons including:

  (1) The risk to public health of over-projecting demand are much less than of under-projecting demand;

  (2) A historic trend of increasing demand, and

  (3) Assurance that the system will have capacity to support community development and growth that may or may not have been accurately forecast[28].

[28] Hughes, Jeff, Peiffer Brandt, Mary Tiger, and Shadi Eskaf. 2014. Defining A Resilient Business Model for Water Utilities. Available at: http://www.waterrf.org/Pages/Projects.aspx?PID=4366

Although the public health risks still remain if a utility under-predicts demand, financial pressures are increasingly leading utilities to become more conservative with their sales projections. Additionally, over-predicting sales and investing in infrastructure to meet that demand can risk public health if a utility forsakes expansion over infrastructure repair and replacement. Nonetheless, demand and population growth (in conjunction with water supply projections) will impact the degree and approach of conservation-oriented rates. These projections, compiled for each Texas Water Planning Region, are summarized in Table 1 below.

**Table 1. Projected Water Supply, Water Demand, and Population Growth from 2020-2030**

| Texas Water Planning Region | Changes in Regional Water Supply from 2020 to 2030[29] | Municipal Water Demand Growth from 2020 to 2030[30] | Population Growth from 2020 to 2030[31] |
|---|---|---|---|
| Panhandle (A) | Decrease (-8%) | Moderate (8%) | Moderate (10%) |
| Region B | Decrease (-1%) | Low (1%) | Low (4%) |
| Region C | Stable (0%) | High (13%) | High (15%) |
| North East Texas (D) | Decrease (-1%) | Moderate (6%) | Moderate (9%) |
| Far West Texas (E) | Stable (0%) | Moderate (10%) | Moderate (14%) |
| Region F | Stable (0%) | Moderate (7%) | Moderate (9%) |
| Brazos (G) | Stable (0%) | High (12%) | High (15%) |
| Region H | Increase (2%) | Moderate (10%) | Moderate (12%) |
| East Texas (I) | Stable (0%) | Moderate (4%) | Moderate (7%) |
| Plateau (J) | Stable (0%) | Moderate (5%) | Moderate (9%) |
| Lower Colorado (K) | Decrease (-1%) | High (17%) | High (19%) |
| South Central Texas (L) | Decrease (-1%) | High (12%) | High (16%) |
| Rio Grande (M) | Stable (0%) | High (18%) | High (21%) |
| Costal Bend (N) | Increase (2%) | Moderate (5%) | Moderate (8%) |
| Llano Estacado (O) | Decrease (-15%) | Moderate (7%) | Moderate (10%) |
| Lavaca (P) | Stable (0%) | Low (0%) | Low (3%) |
| Texas Total | Decrease (-12%) | Moderate (11%) | Moderate (14%) |

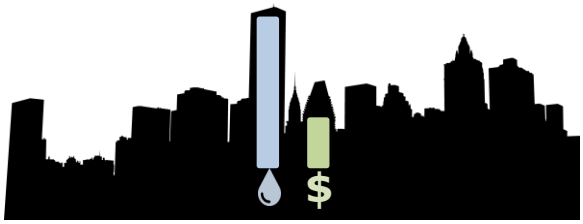
[29] Summarized from Regional Water Supply Summary and Projections in 2011 Regional Water Plans. http://www.twdb.state.tx.us/waterplanning/rwp/plans/2011/index.asp

[30] 2016 Regional Water Plan: Regional Summary of Water Demand Projections for 2020-2070 in acre-feet. Municipal Water Demand Growth calculated as the percent differences between municipal demand projections in 2020 and 2030. http://www.twdb.state.tx.us/waterplanning/data/projections/2017/demandproj.asp

[31] 2016 Regional Water Plan: State and Regional Population Projection for 2020-2070. "Population Growth" calculated as the percent differences between regional population in 2020 and 2030. http://www.twdb.state.tx.us/waterplanning/data/projections/2017/popproj.asp

**Utilities with different cost drivers, customer characteristics, and supply and demand issues will come to different conclusions on the rate structure design that is most appropriate for them. Below are three hypothetical scenarios followed by a discussion of how each hypothetical utility can utilize rate setting and structure to promote conservation and ensure revenue stability.**

## Scenario #1: Urban Utility with Relatively Low Costs, High Demand, and Water Supply Challenges

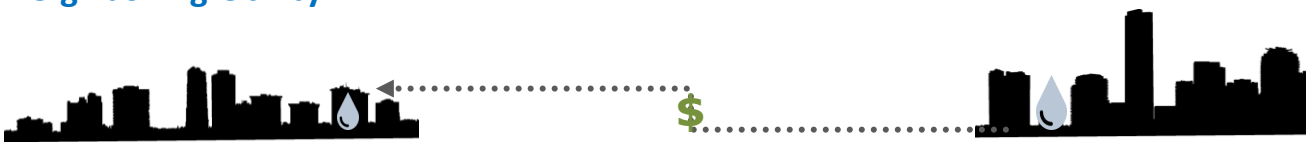



In this scenario, an urban utility with low per-customer costs of service and high peak demand wishes to encourage conservation. Their primary rate-setting objective for rates is to recover costs of service, and their second highest objective is to encourage conservation.

Urban utilities typically have a very large and diverse customer base over which they can spread more of the fixed costs of water treatment and delivery. As such, this utility can have lower base charges and build more cost recovery into the variable charge, ensuring that customer bills are sensitive to use reductions. Furthermore, larger utilities typically have the staff and billing software capacity to utilize increasing block rates, bill monthly, and provide detailed usage information.

Although they may already have increasing block rates in place, they can do more to promote conservation by making the differences in rates between the blocks greater and setting rates high for the highest level of consumption. But if they are pricing the highest tiers of consumption at levels to promote conservation, they should be financially ready for it. They will likely want to budget for the revenue from the highest tiers of consumption to be vulnerable and variable and/or maintain a rate stabilization fund to mitigate revenue fluctuations.

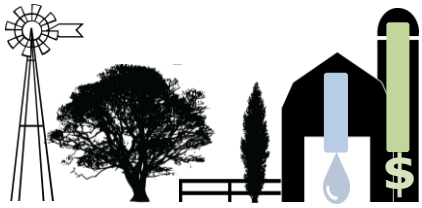
## Scenario #2: Mid-Size Water System That Purchases Treated Water from Neighboring Utility




The water system in this scenario has about 25,000 customers and purchases treated water from a neighboring utility. While they still have the fixed costs associated with the distribution system, the majority of their costs are dependent on how much water is delivered. For this utility, there is much more of a direct relationship between costs and revenues than its counterparts that secure and treat water; conservation will have a much more immediate impact on the utility's expenses without a great deal of financial risk. As such, this mid-size purchase system can have a very low flat fee and a significant variable charge to promote

conservation. It will likely want to align its customers' rate structure with the utility's rate structure for the purchased water.

## Scenario #3: Rural Water Utility with Naturally High Costs That Wants to Maintain Affordability




This rural utility with naturally high rates wants to maintain water affordability, while also helping to send a signal to its customers to not waste water. In this case, water will be naturally more expensive for all users and there is much less of a need for an aggressive increasing block rate structures to send a pricing signal.

Uniform rates are simple to design and implement, and cost recovery of the naturally high costs of water will practically require a pricing level that sends a conservation signal. The tradeoff occurs between base charges and consumption allowances. Since the utility has high costs of service, it may be forced to set a high base charge. If this happens, the utility can offset some of that impact on low income customers by including a consumption allowance with the base charge. However, if possible, the utility will want to set as low a base charge as possible to keep bills low for low consumption customers and send a conservation signal. Monthly billing should be used to send out smaller bills more frequently to their customers instead of larger bimonthly or quarterly bills, which could be difficult to pay for some customers. In the case of maintaining residential affordability, utilities can look beyond their rates and rate structures and implement customer assistance programs. This would assist the customer who needs assistance the most, while also ensuring that the utility collects the revenue it needs to protect public health.

**Texas utilities are not the only ones that deal with the "conservation conundrum." Utilities across the country are grappling with the same issues and there are a number of good rate setting guides and documents available that have been prepared for specific regions or states. The following resources contain material applicable to Texas utilities.**

## Part IV. Recommended Reading

### Assessing Water System Revenue Risk: Considerations for Market Analysis

Hughes, J., and Leurig, S. 2013. Assessing Water System Revenue Risk: Considerations for Market Analysis. Ceres. http://www.ceres.org/resources/reports/assessing-water-system-revenue-risk-considerations-for-market-analysts

This report is a result of a partnership between The Environmental Finance Center at UNC and Ceres that investigates water system revenue risk and offers considerations for market analysts. The report offers an analysis of revenue risk using actual utility data in three states that are experiencing changing water use patterns: Colorado, North Carolina, and Texas. The analysis demonstrates that utilities with the same generic pricing structure can have widely variable exposure to revenue instability from changes in customer use. This report characterizes the challenges facing many utilities and identifies potential metrics that may be used by bond analysts to understand the revenue resilience of water systems' pricing structures. The report describes factors driving current pricing practices among drinking water providers, including financial requirements, public policy goals, ease of implementation, and political constraints, and offers analysis of pricing structures. Finally, the report proposes metrics for assessing rate structures, which include competitiveness, affordability, revenue sufficiency, revenue vulnerability, and conservation pricing signals.

### California Water Rates and the "New Normal"

Donnelly, K., and Christian-Smith, J. 2013. California Water Rates and the "New Normal". The Pacific Institute. http://www.pacinst.org/publication/water-rates-series/

The first in a series of white papers to help water service providers cope with the "new normal" of decreased water demand and rising costs, this paper offers analysis of different rate structures that can be used to meet costs and ensure revenue resiliency. This paper is structured to support providers in evaluating common water rate structures (e.g. flat rate/fee, uniform volumetric rate, block or tiered rate) by examining rate structures and the characteristics of the new normal, which includes more uncertain water supply; new legislation, codes, and standards; and overall increasing costs to provide a safe drinking water supply. The report also prepares managers to educate their customers about how water is priced, and provides case studies highlighting challenges associated with adopting new rate structures.

### Declining Water Sales and Utility Revenues: A Framework for Understanding and Adapting

Beecher, J., and Chesnutt, T. 2012. Declining Water Sales and Utility Revenues: A Framework for Understanding and Adapting. Alliance for Water Efficiency. http://www.ipu.msu.edu/research/pdfs/Summit-Summary-and-Declining-Water-Sales-and-Utility-Revenues-2012-12-16.pdf

This white paper offers a discussions of the root causes of and potential solutions to the revenue shortfalls and fiscal distress associated with declining water sales and utility revenues. The paper examines how and why water sales are declining, the degree to which water utility revenues are falling short of revenue requirements, communications strategies for water utilities and the conservation community, methods to improve fiscal stability, and the role of industry standards, practices, and policy reforms.

### Defining a Resilient Business Model for Water Utilities, Water Research Foundation Project 4366

Hughes, J. et. al. 2013. Defining a Resilient Business Model for Water Utilities. Water Research Foundation. http://www.waterrf.org/Pages/Projects.aspx?PID=4366

This report provides an assessment of the revenue model and resulting financial condition of water utilities in North America, considers factors influencing financial performance, and discusses practices that have the potential to improve financial resiliency. This report primarily addresses the revenue and rates side of financial balance that utilities must navigate. It first summarizes the financial condition and state of revenues in the water industry, goes on to consider trends in the context of the factors that influence a utility's business model, and presents option for revenue resiliency strategy, policy, and practices. Additionally, the report presents a potential methodology and tool for assessing the risk of revenue losses. The analysis shows that there is no one generalizable financial outcome for the industry, as there are clear differences between regions, states, and utilities.

### Designing, Evaluating, and Implementing Conservation Rate Structures

Chestnutt, T. 1997. Designing, Evaluating, and Implementing Conservation Rate Structures. California Urban Water Conservation Council. http://www.cuwcc.org/docDetail.aspx?id=720

This report sets forth information on innovative ways to price urban water service. This handbook provides practical assistance to utilities and their rate consultants implementing rate structures that promote more efficient use of water while taking into account the other functions a rate structure must fulfill.

## Forecasting Urban Water Demand, Second Edition

Billings, B. and Jones, C. 2008. Forecasting Urban Water Demand. 2nd Ed. American Water Works Association. http://www.awwa.org/store/productdetail.aspx?ProductId=6395

The American Water Works Association's *Forecasting Urban Water Demand* is a resource that provides detailed tools and strategies to assist water managers in forecasting short-, mid-, and long-term water demands. The book includes discussion on a variety of factors that impact urban water demand, including population, weather, climate, water rates, and conservation programs. It also includes guidance on how managers can tailor forecasting methods according to the purpose of the forecast, for example how forecasting for revenue may differ from forecasting for raw water supply or infrastructure improvements. In addition, the book incorporates instruction on data requirements and statistical analysis and is paired with a CD that contains daily water data, daily water use, an interactive demand curve chart, per capita water demand, and more.

## Gauging the Understanding and Support of a Drought Surcharge in Mecklenburg County

Tiger, M. 2009. Gauging the Understanding and Support of a Drought Surcharge in Mecklenburg County. The Environmental Finance Center at UNC. http://www.efc.sog.unc.edu/reslib/item/gauging-understanding-and-support-drought-surcharge-mecklenburg-county

A drought threatens both water supply and a utility's primary source of revenue. Consequently, many utilities explore the use of surcharges, which temporarily increase water rates during drought, as a way to stabilize revenues and promote conservation while keeping in mind the need for affordable water. Such was the case for Charlotte-Mecklenburg Utilities during the 2007-08 drought. The purpose of this research is to gauge common themes of customer and City Council member perspectives on a proposed drought surcharge in Mecklenburg County. Insight from this research helps utilities in their consideration, development and communication about drought surcharges in their own communities. The report concludes that effective communication about surcharges is imperative, and that a drought surcharge should be a part of a portfolio of other strategies to help ensure adequate water supply.

## Long-Term Effects of Conservation Rates

Long-Term Effects of Conservation Rates. 1997. American Water Works Association. ISBN 0-89867-904-4

This report from the AWWA recognizes the importance of conservation pricing and rate design in water conservation efforts. This early study examines the long-term effects of pricing for conservation on water demand and a utility's revenues. The report provides an overview of the relationship between rate design and conservation, as well as a summary of common conservation-oriented rate designs (peak/nonpeak rates, inverted rates, and seasonal rates). It includes a comprehensive discussion of price elasticity, the mathematical measure of demand response to price changes, longer-term effects of conservation rates, and analysis of different rate designs and strategies. The report also includes an example Conservation Rates Model and a User Manual that allow managers to test a variety of different rate design scenarios.

### Pricing Practices in the Electricity Sector to Promote Conservation and Efficiency: Lessons for the Water Sector

Donnelly, K., Christian-Smith, J., and Cooley, H. 2013. Pricing Practices in the Electricity Sector to Promote Conservation and Efficiency: Lessons for the Water Sector. The Pacific Institute. www.pacinst.org/publication/water-rates-pricing-practices

Water utilities are increasingly faced with the challenges of adapting to the "new normal" – a world in which declining water demand and increasing costs can result in deficits. Using data from California electric utilities, this report examines how other utilities have confronted these challenges to manage fiscal instability while providing fair pricing. Although there are certainly major differences between the water and electricity sectors, the study describes a number of electricity pricing practices could be implemented in the water sector. These practices include marginal pricing, tiered pricing, time-variant pricing, demand response contracts, decoupling, lost revenue adjustment mechanisms, rate stabilization funds, and straight fixed-variable pricing. This report is part of a series by the Pacific Institute on key issues related to water pricing practices and policies in California that is accessible through the Pacific Institute website.

### Principles of Water Rates, Fees, and Charges

American Water Works Association. 2012. Principles of Water Rates, Fees and Charges (M1). 6th Edition. http://www.awwa.org/store/productdetail.aspx?productid=28731

The American Water Works Association's manual on Principles of Water Rates, Fees, and Charges is a comprehensive resource that provides water managers with information needed to evaluate and set water rate structures, fees, charges, and pricing policies. The manual provides an overview of cost-based rate making, revenue requirements, cost allocation, rate design, capacity and development charges, and implementation issues. This includes in-depth discussion on rate structure considerations and analysis of the advantages and disadvantages of a variety of common rate structures.

### Revenue Instability and Conservation Rate Structures

Chestnutt, T., Christianson, J., Bamezai, A., McSpadden, C., Hanemann, W. 1995. Revenue Instability and Conservation Rate Structures. American Water Works Association. http://www.waterrf.org/PublicReportLibrary/RFR90681_1995_839.pdf

In response to the growing popularity of conservation rate structures, this report details how revenue stability is affected by changes in water demand and provides strategies to cope with revenue uncertainty in the face of changing costs. It outlines managerial strategies necessary to cope with uncertainty brought on by conservation rate structures, and illustrates how empirical analysis can support the design of better rate structures. The study focuses on the experience of and available data from Los Angeles, CA, and Phoenix, AZ, to create a conceptual framework for how to develop coping strategies. It concludes that revenue volatility can be quantified, that coping mechanisms can be developed, and that rate structures can be used as a conservation device.

## Water Conservation-Oriented Rates: Strategies to Extend Supply, Promote Equity, and Meet Minimum Flow Levels

Wang, Y., Smith, W. and Byrne, J. 2004. Water Conservation-Oriented Rates: Strategies to Extend Supply, Promote Equity, and Meet Minimum Flow Levels. American Water Works Association. http://www.awwa.org/store/productdetail.aspx?productid=6544

Water conservation-oriented rates are an effective tool for reducing water use in states and cities that are faced with drought, shrinking water supplies, or other reasons to conserve water. This book discusses rate structures that encourage water conservation: drought demand rates, excess use rates or excess surcharges, inclining block rates, and seasonal rates. The book explores implementation issues, economic issues for the utility and the consumer (especially low-income consumers), advantages and disadvantages, which rate type is suitable for specific customer groups or situations, and real-world utility experiences with conservation rates.

# Appendix A. Elements of Rate Structure Design

## Customer Classes/ Distinction

Utilities have several options in deciding how to charge different sets of customers. However, utilities can only legally charge different rates for customers based on cost-related factors, such as usage. Hence, it is possible to set a rate structure for residential customers and a separate rate structure for commercial or industrial customers, since the non-residential customers use a lot more water and the marginal cost of providing them with additional units of water is very low.

One advantage to creating different rate classes of customers is that it provides the utility with greater flexibility in targeting different objectives for different types of customers. For example, a utility could charge increasing block rate structures for residential customers to encourage conservation but also charge uniform rates for non-residential customers to avoid overburdening them with excessively high rates.

Residential irrigation meters provide the utility with an ability to charge residential customers a different rate structure for their outdoor (mostly seasonal and discretionary) water use for regular, indoor household use.

Before adding new rate structure classes, utility managers should first assess the ability of their billing software to handle the complexity of this switch, and also the staff's ability to make the conversion and continuously monitor, assess and correct the inevitable increase in billing errors.

## Billing Period

The billing period refers the length of time between meter reads and bills. From a customer perspective, monthly billing provides greater advantages than any other billing period. A utility must evaluate the tradeoff between increased operating costs for meter reading and billing against the advantages of monthly billing, including providing a much more stable month-to-month revenue stream. Additionally, EFC research finds that customers who are billed quarterly or bimonthly use more water on average than customers who are billed monthly. Hence, to a conservation-oriented rate structure would use monthly billing when possible.

## Base Charges

A base charge is the amount a customer is required to pay each billing period, regardless of the amount of water that is used. This is oftentimes called a "minimum charge." Base charges are highly stable sources of revenue for utilities, since they are immune to water use behavior. There is an incentive to charge as much of the fixed costs of running the utility in the base charge as possible, tempered only by affordability (since all customers pay this charge). The higher the base charge, the more stable the utility's revenues will be, but the less sensitive the total customer bill will be to changes in usage patterns. Hence, a customer reducing use significantly will not see a proportional decline in their bill if the base charge is a large component of the total bill. Utilities concerned about setting conservation-oriented rates by utilizing usage-sensitive rate structures are more likely to charge lower base charges (and higher volumetric rates). Also, utilities concerned about affordability may find it difficult to set high base charges. Due to the capital intensive nature of water utility costs, and because of economies of scale, large utilities are able to spread their costs over large customer bases and thus are often able to charge low base charges. Smaller utilities, however, typically rely on higher base charges to recover some of their fixed costs.

## Consumption Allowance with Base Charge

In order to offset some of the burden of high base charges on their customers, utilities sometimes include a minimum consumption allowance with the base charge such that any use within the consumption allowance is "already paid for" by the base charge. As with base charges, the higher the amount included in the consumption allowance, the less sensitive the total bill will be to water use reductions, and the less conservation-oriented the rate structure will be.

Unlike with base charges however, the utility has no revenue stability incentive to include higher amounts of water in the consumption allowance. In fact, the more water is included in the consumption allowance, the less revenue the utility can expect to collect from the majority of its customers if the base charge is not adjusted similarly.

## Volumetric Rate Structure

Water utilities use a variety of volumetric rate structure types. Volumetric rates are those charged based on a customer's water use. The most common are uniform rates (often called flat rates), increasing block rates and decreasing block rates.

Uniform rate structures charge the same rate, no matter what level of consumption. They are relatively simple to implement and communicate. Increasing block rate structures are volumetric rates that increase with increasing block rates of consumption; decreasing block rate structures are volumetric rates that decrease with increasing block rates of consumption. Water utilities should avoid using decreasing block rate structures for residential consumption.

Additionally, some utilities adopt different volumetric rate structures for summer months than in the rest of the year. This discourages residents from increasing use significantly during the summer months when the majority of irrigation occurs. Seasonal rates are also appropriate for seasonal communities where demand for water is high in certain months and very low in others. The utility manager should select the type of rate structure that best fits the primary rate setting objectives.

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| **Block Designs (If Applicable)** | Increasing block rate structures, alone, are not sufficient to encourage conservation. The design of block rate structures is critical to set the appropriate price signals to the customers, not unduly overburden certain segments of the service population, and to provide sufficient revenue stability for the utility. For a utility to target residential consumption with increasing block rates, it should use at least 2 blocks within the normal range of residential use, from 0 through 15,000 gallons/month. It does not do any good to start the second block at a usage level that only a very small number of customers use.<br><br>In determining the number and size of blocks, it is very useful to analyze from billing records the number of bills sent out each month for different usage levels. Increasing block rate structures for residential use should at least start the second block just over the average residential usage level. If the utility only uses one rate structure for all of its customers, the block sizes at much higher levels of use should be carefully considered from the commercial and industrial customers' perspective.<br><br>Some utilities have a single decreasing block rate structure for all customers, but set the first block size to cover a large amount of water (e.g.: 50,000 gallons/month) in order to essentially charge residential use at a uniform rate, while providing decreasing block rates to commercial and industrial customers. |
| **Frequency of rate changes** | Although the frequency of rate changes is not an element of the rate structure design itself, it is an important policy objective that should be addressed by the utility. Ideally, utilities would review their rates and rate structures annually to adjust them to changes to the utility or customer characteristics. At the very least, utilities should review their financial performance indicators annually and review their rates and rate structures when any of the indicators reflect poor financing. |