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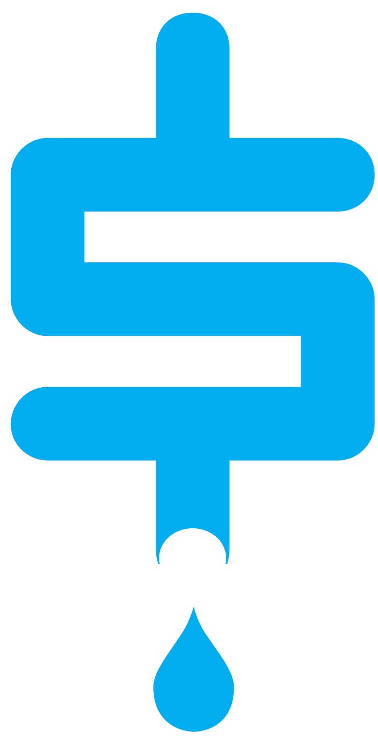
ASSESSING WATER SYSTEM REVENUE RISK:

Considerations for Market Analysts

August 2013



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Executive Summary

Water utilities are on the brink of extraordinary investments to replace aging infrastructure—the Environmental Protection Agency estimates that by 2030, capital expenditures of more than $300 billion will be needed to safeguard drinking water. Yet this investment comes at a time when Americans' water use habits are changing[1]—resulting in considerable uncertainty for water systems planning capital programs to replace or expand their assets.

At the heart of the issue is the inherent mismatch between the largely fixed cost structure of drinking water service providers and the highly variable revenues they receive, which depend largely on the amount of water their customers use. This volumetric pricing model worked well in the past, when per capita water usage in the United States was much higher and more predictable than it is today. But appliance standards, conservation programs and even the price of water have changed across the nation, precipitating declines in household use that have led to much more variable—and in many cases, unexpectedly reduced—revenue streams.

Now more than ever, utilities must enact intentional pricing structures that contribute to financial stability. Yet while pricing structures can be engineered to assure revenue stability even within a volatile or declining demand environment, real political resistance may prevent water systems from implementing technically feasible solutions. In most American communities, how water services are priced is a community decision, one that is subject to political processes. Political leaders must be responsive to community concerns about resource stewardship, affordability for low-income populations and economic competitiveness. The financial necessity of implementing rate adjustments to adequately recover costs and maintain financial targets is balanced with (and sometimes pitted against) these important community priorities.

At the heart of the issue is the inherent mismatch between the largely fixed cost structure of drinking water service providers and the highly variable revenues they receive, which depend largely on the amount of water their customers use.

For municipal bond investors, the vulnerability of water systems' revenues to demand changes is a matter of credit risk. Yet the credit metrics used by most analysts in today's market may not sufficiently assess revenue vulnerability for many utilities. These metrics, which may examine the proportion of sales from the system's largest users, or benchmark the price of water services at a given level of volumetric use, do not help to illuminate how significant changes in use across a wider customer base—whether driven by technological change, weather, pricing sensitivity or policy implementation—may affect revenue sufficiency. To truly understand the revenue resilience of water systems' pricing structures to demand downturns—whether ephemeral or persistent—analysts may need additional metrics. This report characterizes the challenges facing many utilities and identifies potential metrics that may be used by bond analysts, including credit rating agencies, bond insurers and credit assurance providers and buyers.

We offer an analysis of revenue risk using actual utility data in three states that are experiencing changing water use patterns: Colorado, North Carolina and Texas. As our analysis demonstrates, utilities with the same generic pricing structure can have widely variable exposure to revenue instability from changes in customer use. This analysis reinforces the need for a continued focus by market analysts on the pricing structures of utilities and the relationship of those practices to fiscal condition and public policy imperatives including conservation and affordability.

We invite bond analysts to consider this analysis and potentially incorporate these metrics or similar metrics into their own assessment frameworks. We also encourage water systems to continue to incorporate revenue vulnerability considerations and metrics into their fiscal planning and board education efforts to help safeguard the financial stability of their communities' most critical infrastructure, for present and future generations.

1 Water Research Foundation, 2009. "Surviving or Thriving in Economic Recession: Strategies of Water Utility Leaders-4296." Denver, Colorado.

SAMPLE METRICS FOR ASSESSING DRINKING WATER PROVIDER PRICING STRUCTURE			
Issue of Concern	**Commonly Used Metric**	**Alternative or Additional Metrics**	**Rationale**
Competitiveness. Comparison of household expenditures for water service between systems. How much does a utility charge versus another utility?	Residential customer water bill at consumption level of 7,500 gallons per month.	Residential customer water bill at consumption level of 5,000 gallons per month.	Average household use for utilities has declined significantly in recent years, and in many places is now much lower than 7,500 gal/mo. Many utilities see the vast majority of their customers using 5,000 gallons or less per month.
Affordability. Might households have trouble making payments and governing boards be under political pressure to limit price adjustments?	Typical household monthly water bill divided by Median Household Income (MHI) for community	Typical household monthly water bill divided by the poverty income for a family of four at time of analysis. Percentage of households in service area that are at or below poverty line.	As income distributions have dispersed and water service bills have increased in real and nominal terms, understanding affordability stresses requires additional metrics beyond simply the percentage of expenditure over MHI. By looking at the percentage of expenditure for an at-risk family and assessing the relative number of those types of families in a service area, an analyst would learn more about challenges facing a particular area.
Revenue Sufficiency. Does the pricing in place provide investors with confidence that it generates sufficient revenues to meet debt requirements?	Debt Service Coverage (DSC)—typically expect range of 1.2 to 2	Modified annual DSC that incorporates annual operating revenues plus annual drawdowns from a sufficiently funded rate stabilization fund (e.g. withdrawals in a given year never exceed more than 25% of rate stabilization fund). Alternatively, if a utility maintains a rate stabilization fund, DSC could be analyzed as a rolling three-year average to allow for natural revenue variation.	Under current pricing structures, the inherent revenue swings due to normal usage changes make maintaining high DSC year in and year out much more challenging. Utilities that take steps to cushion this variation with a rate stabilization fund are arguably reducing investor risk, while at the same time minimizing pressure to over charge to compensate for revenue variability.
Revenue Vulnerability. Does the utility's pricing structure expose it to excessive revenue reduction from adoption of basic water efficiency measures, such as fixture and appliance replacements?	Rate structure defined by the change in commodity price over different consumption blocks. (e.g. decreasing vs. uniform vs. increasing block)	Percent of household charge at 5,000 gallons per month attributed to fixed fee. Percent of operational revenue attributed to fixed charges.	Some simplified characterizations of pricing focus primarily on block structure. But rate structure may have less significance on pricing signals and revenue variability than does the size of the base charge or fixed fee.
Revenue Vulnerability. Does the utility's demand profile expose the utility to excessive revenue variability from changes in customer composition or use patterns?	Revenue from top 10 customers.	Average amount of revenue attributed to irrigation as a percentage of total revenue.	Investors should remain aware of dependence on a small number of customers and should continue to document the percent of revenue attributed to top customers. But heavy dependence on outdoor irrigation for revenue can also be a risk driver, since drought-induced watering restrictions or even pricing responsiveness in inclining block rate structure may cause significant reductions in revenue as customers reduce outdoor usage.
Revenue Vulnerability. Does the utility's pricing structure expose the utility to excessive revenue variability in the event of outdoor watering reductions?	Rate structure defined by the change in commodity price over different consumption blocks.	Percent of household bill at 10,000 gallons per month that is attributed to fixed fee.	Similar to above, but provides insight into vulnerability of revenues to usage changes by water users in higher tiers.
Conservation Pricing Signals. How strong an incentive does pricing structure create for reduced usage?	Presence of inclining block rate structure.	Percentage of household charge at a given consumption point that is attributed to variable charge. Percentage change in bill for a set change in consumption. Absolute change in charge for a set change in consumption.	Some dialogue around conservation pricing signals focuses on the general block structure of the pricing. The block structure can influence pricing signal, but these other factors can have a more significant role in influencing the price incentive for reducing usage.

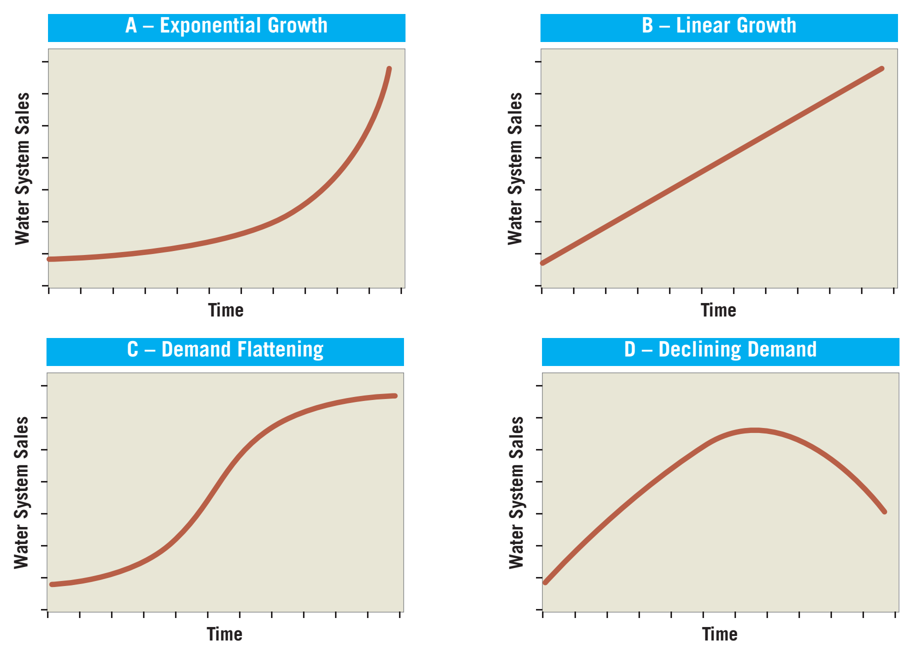
Reshaping Demand Expectations

It is nearly impossible to attend a water sector conference today without hearing about "The New Normal," a reckoning with the financial assumptions that have guided billions of dollars of water infrastructure decisions over the past few decades. What really lurks behind this phrase is something that must be acknowledged by water utility managers and the investors whose capital finances the continued improvement and expansion of their systems: the demand curve for water, in terms of system wide usage variation over time, has shifted as household demand has declined almost universally across the country.

Of course there is no single demand trend for water—the drinking water market in the United States is highly decentralized and the forces of supply and demand subject to local particularities of hydrology, weather and land use. Yet the demands of local water users are also shaped by exogenous trends, most importantly water-efficient appliance technologies mandated at the federal level that went into effect in the mid-1990s. These federal mandates have removed less water efficient options from the marketplace, nearly halving the amount of water used for each toilet flushed or load of laundry run.

On top of this shift brought by exogenous technological change, some water systems have also implemented conservation programs that have permanently altered customer behavior, creating a further shift in usage. Sometimes these programs are intended to create long-term change, and other times they are the lasting and unintended result of short-term drought response—customers who move from five day a week watering to two day a week watering, never to return. Figure 1

Figure 1: Variations in Water Sales Trends



shows a representation of shifting system wide sales trends occurring in many parts of the country. Many utilities based their infrastructure expansion plans and financial plans on assuming water sales would grow exponentially (1-a) or at least linearly (1-b), when the reality for many utilities has become a flattening of overall growth (1-c) or even a net decline (1-d).

As part of this shift in demand, many water systems are seeing evidence that customers are more price-responsive. This creates a challenging environment in which to plan capital improvement programs that routinely run into the hundreds of millions or billions of dollars and require both pricing increases and reliable sales predictions for financial planning purposes.

When market changes like this have taken hold in other sectors, most industries carefully examine their historic pricing practices and shift to new approaches. Consider the market changes and evolution of pricing in sectors such as telecommunications or personal financial advising—pricing for those services today has little resemblance to how they priced 15 years ago.

There is ample evidence that such an imperative for market transformation exists in the drinking water service industry today, as illustrated by recent years of revenue volatility and shortfalls deriving from declining sales patterns. Take, for example, the disruption of predictable revenue growth experienced by the Orange Water and Sewer Authority (OWASA), a utility in the central Piedmont region of North Carolina (Figure 2). The utility sold as much water in 2012 as it did in 1991, despite seeing accounts grow from 13,000 to 21,000 during the same time period. One contributing factor to the loss of sales can be tied to the major droughts North Carolina has experienced over the past 10 years and the resulting long term impact mandatory usage restrictions and long term education campaigns have had consumer use patterns. According to the Executive Director of OWASA, it took staff 5 years to finally come to terms with the realization that demand "was not going to come back." Only then did the organization fully recalibrate its sales projections, pricing, and revenue expectations.[2]

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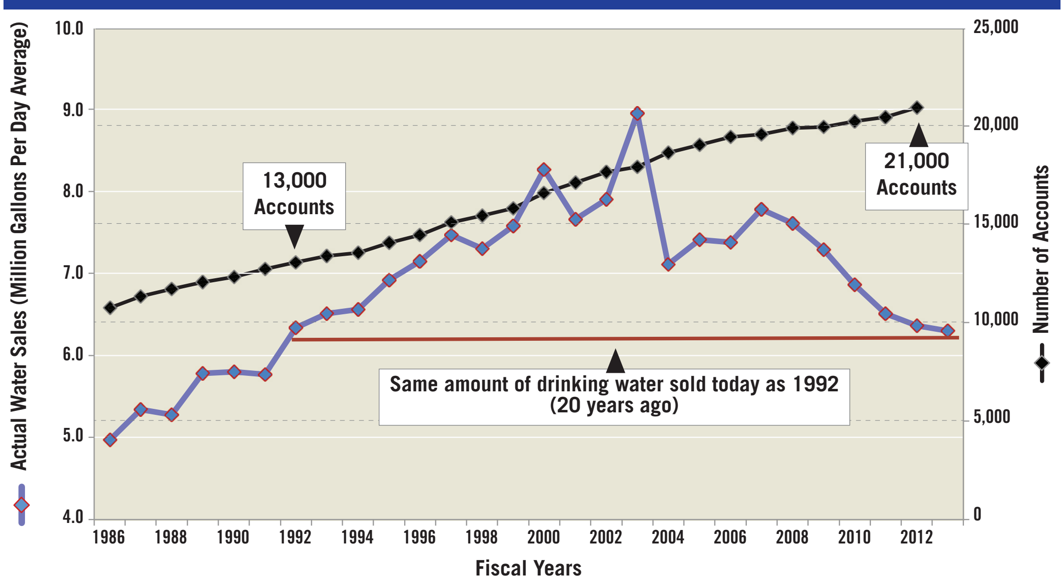
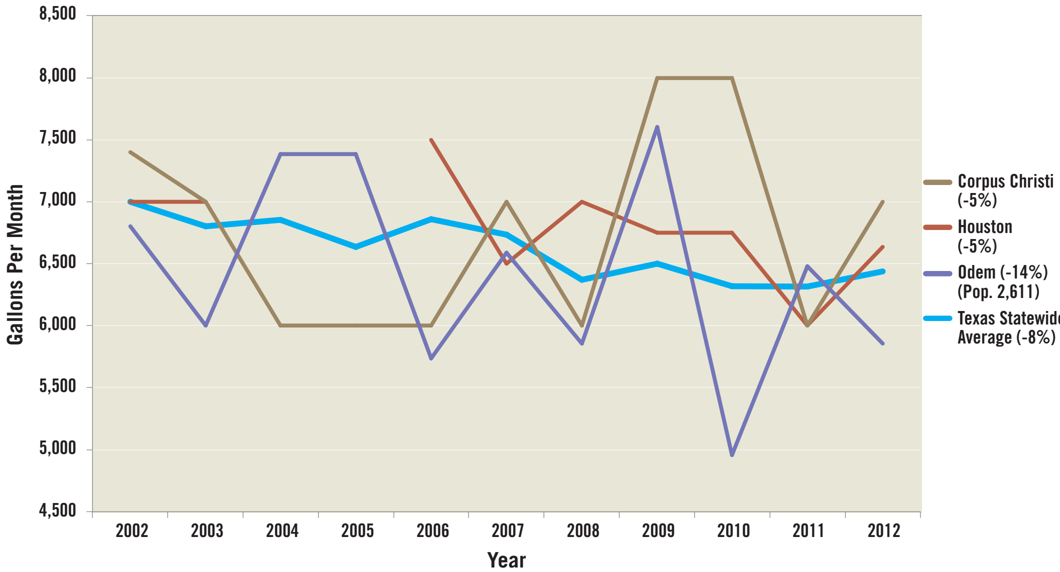
Figure 2: OWASA Water Sales & Number of Accounts Served



Source: Orange Water and Sewer Authority (NC)

2 Presentation by Ed Kerwin of Orange Water and Sewer Authority at the Utility Management Conference in Phoenix, Arizona. March 11, 2013.

Figure 3: Average Household Water Use for the State of Texas & Selected Municipal Utilities, 2002-2012 (Gallons per Month) (Texas annual *n* from 365 to 661)



Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill.
Data source: Texas Municipal League annual TX water and sewer rate surveys (self-reported).

OWASA is not alone in seeing decreased revenue due to a drop in sales. Utilities across the nation have reported similar trends, as seen in Texas utilities' water sales over the past decade (Figure 3). While water use in Texas naturally fluctuates from year to year and is also influenced by prolonged drought (a third of the state's municipal use is for outdoor irrigation, which depends greatly on rainfall), the downward trend outlined in the figure is still pronounced. Overall, Texas utilities report an 8% drop in per-account usage over the past decade.

From one perspective, the trend in reduced water usage can be viewed as a huge success in government and industry efforts to increase water efficiency; however, the speed of the decline has caught some utilities and their investors off-guard.

From one perspective, the trend in reduced water usage can be viewed as a huge success in government and industry efforts to increase water efficiency; however, the speed of the decline has caught some utilities and their investors off-guard. Rating agencies have recognized the impact of these falling sales on some credits, citing the tension between the need for higher than planned rate increases and the political will needed to implement those increases as a factor in credit downgrades.[3] Researchers and water managers have also documented the potential financial repercussions of successful conservation programs when rate structures and financial policies are not adjusted to compensate for revenue lost to diminished water sales.[4]

At leadership forums bringing together senior managers from the nation's largest utilities in 2009 and 2011, concern over pricing and revenue dominated the discussions.[5] When asked at one of these events to assess the impact of sales drops on their business operations, over two-thirds of industry leaders from among the nation's 20 largest water utilities indicated that falling sales have had a significant negative impact on their operations.

While some utilities continue to wait for demand to return, many utilities have stopped asking whether there is a new normal and have started focusing on better understanding the nuances of pricing, the impact of changing usage trends, and the resiliency of their existing volume-based pricing and revenue structures.

3 Julie Seebach and Teri Wenck. "Fitch Downgrades Fort Worth, Texas' Water and Sewer Revs to 'AA'; Outlook Stable." *Fitch Ratings.* April 2013.

4 Examples include: Jeff Hughes, Peiffer Brandt, Mary Tiger, Shadi Eskaf, and Stacey Berahzer, 2014. "Defining a Resilient Business Model for Water Utilities-4366." Water Research Foundation, Denver, Colorado. Forthcoming. Edward Armatetti, 1993. "Meeting Future Financing Needs of Water Utilities-707". AwwaRF, Denver, Colorado. http://www.allianceforwaterefficiency.org/Declining-Sales-and-Revenues.aspx

5 Scott Haskins, Jeff Hughes, and Mary Tiger, 2011." Rates and Revenues: Water Utility Leadership Forum on Challenges of Meeting Revenue Gaps-4405." Water Research Foundation, Denver, Colorado.

Research Area and Methodology

In order to advance the state of knowledge on pricing and demand trends in the drinking water sector, Ceres partnered with the Environmental Finance Center at the University of North Carolina at Chapel Hill to characterize existing pricing practices and orient analysts to ways of assessing pricing structures in terms of revenue stability, conservation pricing signal and affordability.

This paper draws on original research, as well as expanding on ongoing work carried out by the research team on behalf of the Water Research Foundation.[6] While the recommendations are crafted for use by the analyst community, they are equally relevant for utilities and their advisors charged with overseeing utility pricing and financial decisions.

The majority of analysis outlined in this paper is based on studying current pricing, financial and usage data of approximately 1,400 utilities in three states: Colorado, North Carolina and Texas. These states were chosen due to the availability of key pricing and finance data for a relatively large number of diverse utilities. In all of these three states, water conservation is a policy priority, both because of the severity of drought potential and the extent of persistent supply challenges.

Table 1 summarizes the available data in each state.

Table 1: Summary of Pricing Data in Three States

State	Types and Approximate Number of Utilities	Available Data	Notes
Colorado	Municipal owned and districts (100)	Detailed pricing and basic financial data for 2012	Pricing survey completed by Colorado Municipal League for first time in 2012.
North Carolina	Government-owned and rural cooperatives (500)	Detailed pricing, finance, and usage data for multiple years	Pricing survey completed by Environmental Finance Center and the NC League of Municipalities. Finance data provided by State Treasurer. Usage data from NC Division of Water Resources.
Texas	Municipal owned (800)	Basic pricing, finance, and usage data for multiple years	Pricing survey completed by Texas Municipal League, and finance data provided by Texas Water Development Board.
Total	1400		

6 Jeff Hughes, Peiffer Brandt, Mary Tiger, Shadi Eskaf, and Stacey Berahzer, 2014. “Defining a Resilient Business Model for Water Utilities-4366.” Water Research Foundation, Denver, Colorado. Forthcoming.

Factors Driving Current Pricing Practices Among Drinking Water Providers

How a water system prices its services is one of the most important tools for carrying out the objectives of the enterprise. Public enterprises that sell water services pursue financial and non-financial objectives that are influenced by many factors, among them:

- Financial Requirements
- Public Policy Goals
- Ease of Implementation
- Political Constraints

FINANCIAL REQUIREMENTS

Pricing is one of the primary tools used by water service enterprises to balance their budgets. The most commonly promoted pricing methodology is the "cost-of-service" approach, which allocates the revenue required to meet financial goals among customers. Most large utilities use this approach, yet the practice is far from universal, especially among small utilities.

Pricing must be set to cover the cost of operations and capital programs, but also to cover the costs of financing those improvements. Most large systems rely primarily on debt to finance capital programs that exceed cash on hand. For this reason, their ability to honor debt payments is a critical financial indicator for market participants.

Debt service coverage is arguably the key driving financial indicator for utilities that rely on capital markets for their debt, and it plays an important role in the quantitative analysis conducted by rating agencies. Debt service coverage is the ratio of annually generated revenue available to cover debt service after paying other essential costs, divided by the debt service payments. There are variations in the types of revenue that are included in debt service coverage calculations, but typically, rating agency analysts view coverage ratios between 1.25 and 1.5 as good and above 1.5 as very strong.[7]

The pressure placed on utilities by investors to generate specific amounts of revenue dictated by loan agreements and bond covenants with high coverage requirements can be much greater (and more binding) than self-imposed revenue requirements, cost-of-service pricing policies or internal financial strategies. In other words, a utility may be quite satisfied with collecting enough revenue to meet its basic cash expenditure requirements without trying to collect excess revenue, as they would be driven to do under debt service coverage requirements. Some utilities may even have a financial strategy that involves spending down reserves for a fixed period of time such that their short-term revenue generation falls below their annual operating and capital expenditures, thereby leading to a debt service coverage ratio of less than 1.0.

7 Theodore Chapman and James Wiemken, 2008. "Key Water and Sewer Utility Credit Ratio Ranges." Standard & Poor's, Dallas, Texas.

Elevated debt service coverage ratios that drive price over a short-term period are not necessarily the only path to long-term financial sustainability or economic optimization. A utility can follow a path of lower debt service coverage ratios and still be financially sustainable as long as it adheres to other conditions and strategies. For example, a water system may target a lower coverage ratio during a limited period of time when it is drawing down a reserve fund dedicated to a planned capital improvement. Or a water system may elect to reduce its coverage ratio in order to maintain a target of annual rate adjustments, and draw down a rate stabilization fund designed and funded over time for that purpose. In these instances, a strict debt coverage ratio would not tell the whole story of a utility's financial management.

Utilities facing significant incremental water or wastewater capacity investments have a financial incentive for pricing their service in a way that puts downward pressure on capacity growth so as to manage future expenditures and debt.

Paradoxically, some financial goals require selling less, not more, product. For some utilities, conservation programs are driven as much by financial concerns as by resource stewardship concerns. Utilities facing significant incremental water or wastewater capacity investments have a financial incentive for pricing their service in a way that puts downward pressure on capacity growth so as to manage future expenditures and debt.[8] Such is the case, for example, for New York City's Department of Environmental Protection, which has pursued a long-term demand management program despite excess water supply in order to avoid the cost of expanding its wastewater treatment capacity.

PUBLIC POLICY GOALS

Public enterprises intrinsically experience a tension between the desire to be financially thriving while at the same time promoting public policies. Unlike the incentive for some private businesses to strive for "low cost" as a strategy to sell more product, utilities must be concerned that their customers are not paying too much for an essential service on which public goods like public health and fire suppression depend.

In many cases, a utility's public policy goals may take priority in pricing. Though non-financial public policy goals vary based on circumstance, some type of concern for customer affordability is almost uniform among utilities. Thus, utilities may address this concern both in how they price a service for all customers (pressure to keep all prices as low as possible) and how they structure their prices for different customers, for example, for low-income customers.

Water and wastewater utilities sell an environmental good, so it is not surprising that environmental policy goals have increasingly driven service pricing in many areas. As mentioned earlier, the use of conservation pricing to drive down consumption may be a bottom-line financial concern. Yet even in areas without compelling supply-side financial reasons to drive down demand, providers may feel pressure to price their product with an eye towards promoting conservation as a component of community resource stewardship. In these areas, conservation may be driven by the belief that water is a natural resource that should be used wisely and one in which there are secondary impacts to wasteful use, such as energy use or surface water pollution from wastewater. For these reasons, some state and regional governments have banned the use of declining block rate pricing, which prices higher marginal units at lower marginal cost.[9] The tension between pricing to encourage less consumption versus pricing to encourage more sales and more revenue can lead to battles between water system managers and elected boards, and even within water systems between conservation program directors and financial directors.

8 Presentation by Ed Cebron of Cascade Water Alliance at the Bond Buyer Conference in Houston, Texas. May 12, 2013.

9 Examples: General Assembly of North Carolina. 2007. North Carolina Session Law 2008-143. Metropolitan North Georgia Water Planning District, May 2009. Water Supply and Water Conservation Management Plan. http://documents.northgeorgiawater.org/Water_Supply_Water_Conservation_Plan_May2009.pdf

EASE OF IMPLEMENTATION

Like any of today's financial transactions, pricing is significantly influenced by technology, software and customer sentiment. Thus, the structure of a particular pricing approach, regardless of how supportive it is to other pricing criteria, must meet certain basic implementation criteria. For example, a well thought-out, carefully designed block structure that is beyond the capabilities of a utility's billing software cannot succeed. In extreme cases, utilities that wish to change some aspect of their pricing strategy (e.g., more frequent billing, different block structure) feel entrapped by existing technology and billing processes. Even for the most adept utility, it is far easier to conceive of "optimal" or improved pricing structures than it is to implement them.

With competing public policy and financial drivers, it is not surprising that pricing specialists have developed complex approaches that meet multiple objectives, but which hit a brick wall in terms of the "keep it simple" implementation criteria. Whereas other service industries such as health care, cell phones and airlines seem not to be overly hindered in their pricing by a need for simplicity, this implementation driver remains very compelling for many water utilities. If a city council member charged with approving pricing structures cannot readily understand a pricing approach, its chances for implementation diminish. From a sheer numbers standpoint, for every utility that is willing to try some type of pricing innovation, there are dozens if not hundreds that prefer much more incremental basic pricing changes.

POLITICAL CONSTRAINTS

Most government utilities are not unregulated, but rather self-regulated, with the "self" primarily consisting of an integrated system of customer pressure on elected governing board members.

Finally, governmental utilities are often referred to as "unregulated," meaning not subject to Public Utility Commission rules. This can seem to imply that their pricing is unregulated as well. In truth, most government utilities are not unregulated, but rather self-regulated, with the "self" primarily consisting of an integrated system of customer pressure on elected governing board members, who must balance the above drivers with the political reality that water pricing decisions can lead to early "forced" retirement from public service. Political pricing pressure comes in all shapes and sizes, ranging from low-income advocacy organizations pushing for low rates, to wealthy gardeners questioning why maintaining their horticultural passion is being "penalized" by conservation standards, to members of the environmental community asking their normally pro-environment commissioners why they did not adopt an aggressive conservation pricing structure. These political forces shape not just the unit price of water but how the cost of service is allocated across user classes. And for better or worse, the short-term feedback cycle of electoral politics also determines what financial policies water managers can implement to preserve the utility's longer-term financial health.

Characterizing Current Pricing Structures

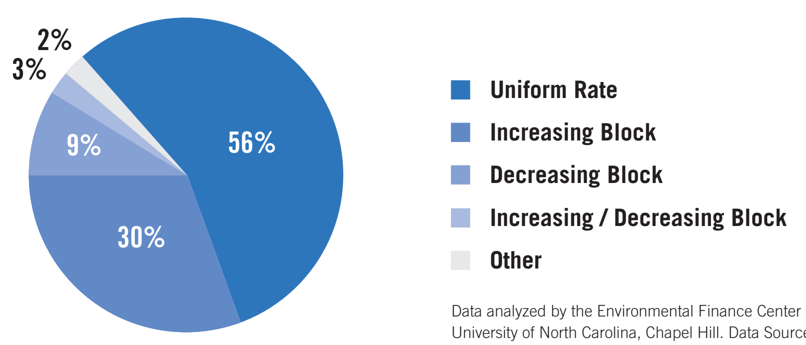
Financial analysts working in many commercial sectors pay careful attention to the role of pricing when assessing the overall health of the industry and the financial viability of entities within it. Water infrastructure investors in the municipal bond market should bring the same attention to the pricing structures of water service providers.

The pricing framework within the industry is largely standardized, to the extent that the industry's largest professional organization, the American Water Works Association, has produced detailed water pricing "standards" for pricing that describes industry-vetted pricing procedures and approaches.[10] Yet while the industry does not have widely divergent pricing models competing to establish an altogether new business model, examples of innovation are surfacing as a result of technological advances and business disruption trends, such as the proliferation of water-efficient appliances. The most common method of naming and distinguishing rate structures relies on how the variable charge changes as a customer uses more water. Uniform block rates include the same variable charge regardless of how much a customer consumes. Decreasing block rates see the unit price of water at higher consumption levels decline and increasing block rates have unit prices that increase as consumption increases (see distribution of block structure among North Carolina Utility rates in Figure 4). However, even among nominally similar rate structures—for example, inclining block rate structures—there is tremendous variability in the way these structures apportion fixed cost, the proportion of revenue or customers that fit within each tier, and the pricing difference between tiers. As a result, even the industry standards may give an analyst relatively little guidance in evaluating the revenue implications of a rate structure.

Examples of innovation are surfacing as a result of technological advances and business disruption trends, such as the proliferation of water-efficient appliances.

The vast majority of water and wastewater utilities analyzed in this three-state study adhere to a basic two-component model in which customers pay a recurring bill that includes a base charge independent of volumetric usage and a variable charge that is a function of consumption (sometimes called a commodity charge). Variations of this model exist that involve altering the base charge or volumetric unit cost at different times of the year (seasonal rates that reflect

Figure 4: Rate Structures in North Carolina



Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill. Data Sources: NCLM/EFC 2012 NC Water & Wastewater Rate Survey.

10 American Water Works Association, 2012. M1 Principals of Water Rates, Fees, and Charges, 6th ed. Denver, Colorado.

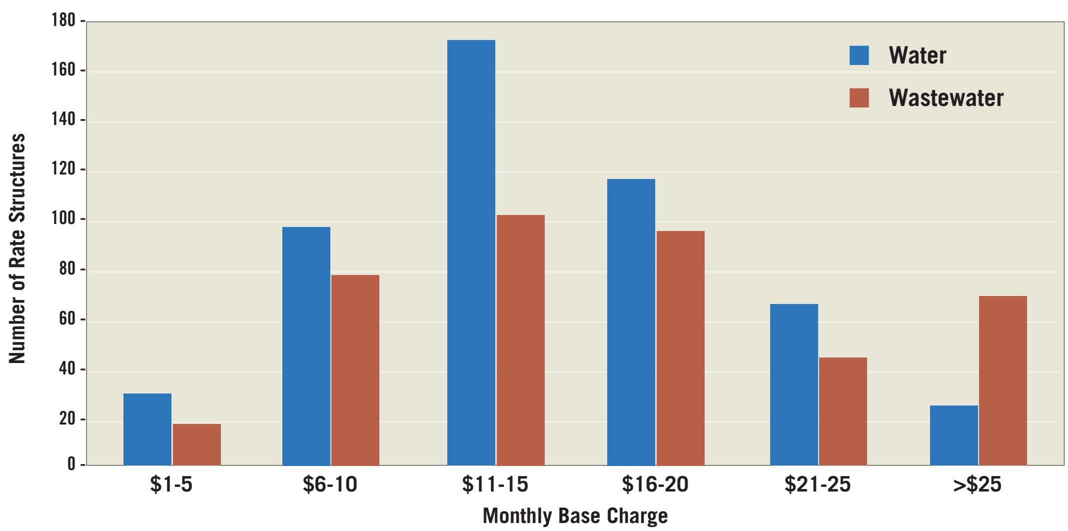
seasonal peak demand), or basing charges on property characteristics such as budget-based rates that consider yard size and grass type. But these alternative models, in terms of the number of utilities or market penetration in the study area, are extremely rare.

Analysts assessing the ability of a utility with aggressive conservation goals to repay its debts must look beyond the general characteristic of a rate structure to understand how strong a conservation pricing signal is sent to its customers, and what tools the utility has in place to stabilize revenue in response to the customers' conservation response. Despite adhering to a fairly basic pricing model, several design variations can lead to significant differences in how much customers of differing usage patterns pay and the conservation pricing signals they experience.

One of the most important design parameters that drives pricing signals relates to how high a utility sets the fixed charge component of its bills.

One of the most important design parameters that drives pricing signals relates to how high a utility sets the fixed charge component of its bills. From the vantage of a water utility manager, a high fixed component of the customer bill is highly desirable, since it reduces the volatility of revenue from one month to the next. The bar graph presented in Figure 5 outlines the significant variation in the base charges throughout North Carolina. The graph shows many utilities with base charges that are two or three times the base charges employed by their peers. Utilities with high base charges (right side of the graph) can count on a sizable revenue inflow each month, regardless of the variation in water sales.

Figure 5: Variation in Monthly Base Charge Across North Carolina

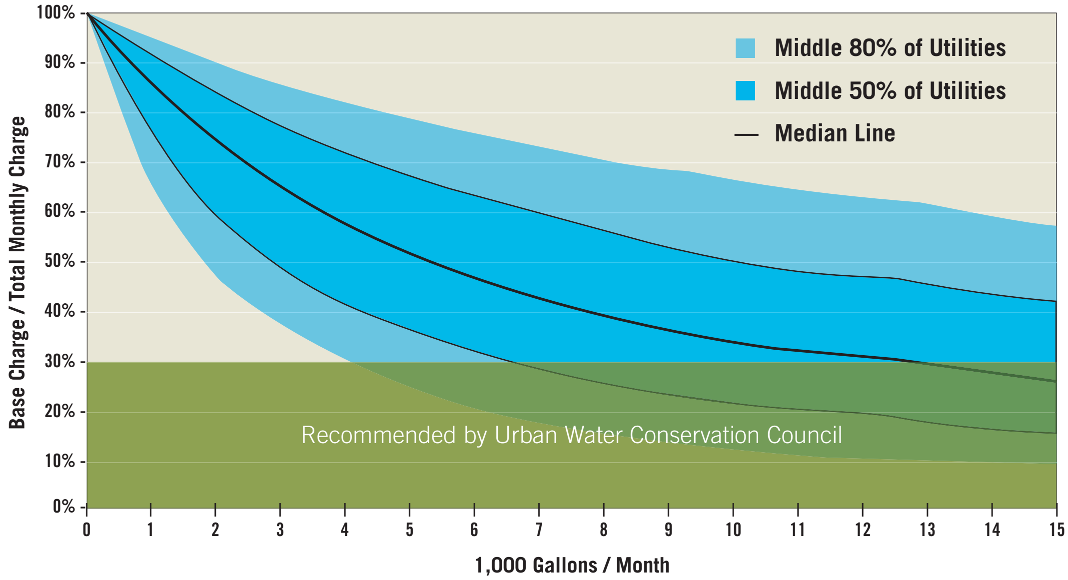


Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill.
Data Sources: NCLM/EFC 2012 NC Water & Wastewater Rate Survey.

Yet from the vantage of a customer, the proportion of the monthly bill attributable to the fixed charge may not be desirable, as this structure limits the potential savings the customer can achieve by reducing water use. Figure 6 (page 14) shows the relative impact that base charges have on what customers pay for water services in California, a state which has adopted a framework for structuring rates. The figure provides insight into the wide array of approaches among different utilities; in this case, California has experienced significant water supply stress and has enacted voluntary limits on rate structure design.[11] The first thing to notice is the extreme variation in pricing as practiced; for customers that use 5,000 gallons per month—the average monthly household sale for many utilities—the proportion of the bill accounted for by the base charge varies from 35% to 65% among the median 50% utilities.

11 California Urban Water Conservation Council, 2011. Utility Operations Programs. http://www.cuwcc.org/mou/bmp1-utility-operations-programs.aspx

Figure 6: Portion of Monthly Bill that is Fixed (Base Charge) Across 84 CA Utilities in 2011



Data analyzed by the Environmental Finance Center at the University of North Carolina. Data Source: AW WA and RFC CA Rates Survey, 2011.

Unfortunately as this illustrates, the "optimal" approaches to conservation pricing and revenue stability are diametrically opposed.

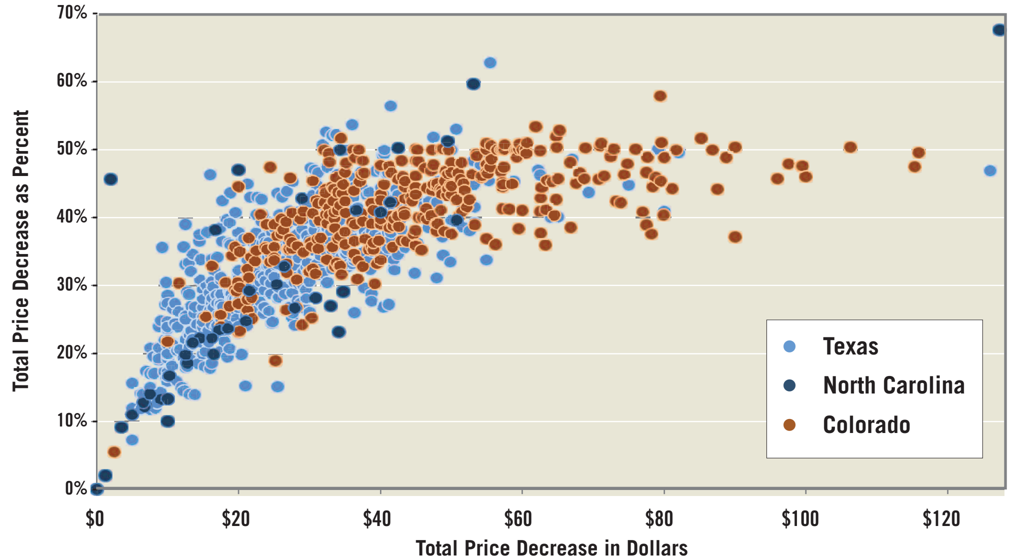
For a utility at the low end of this band, a significant change in use from year to year for a customer will result in a very significant revenue change. A utility in the higher part of this band will see variations in usage having a more diluted impact on overall revenue.

As illustrated in Figure 6 under the prevailing pricing model of almost all utilities, customers that use a lot of water pay a total bill that is almost completely dependent on the volume of water they use. This high volumetric dependence is one of the origins of sudden, and in some cases pronounced, revenue drop for utilities during a period of mandatory reduction. Unfortunately as this illustrates, the "optimal" approaches to conservation pricing and revenue stability are diametrically opposed. (Ceres and the EFC intend to analyze pricing models for jointly optimizing conservation pricing and revenue stability in a future issue paper.)

Some water utilities have sought to minimize the revenue destabilizing effects of drought-induced restrictions or persistent demand changes with fees or surcharges to stock reserve funds in advance of a probable and unavoidable downturn in demand. These funds may be called rate stabilization funds, though utilities account for them differently—some have distinct funds that appear on the balance sheet, while others keep extra days cash on hand without an earmark. Others have implemented mechanisms like drought surcharges that kick in only when the system must curtail customer use, to offset some of the revenue lost to outdoor watering reductions. These sorts of fees, funds and surcharges can certainly help to smooth the revenue effects a water system feels but do not address the larger structural issue of a highly fixed cost service that is largely priced volumetrically.

Figure 7 (page 15) shows the enormous variation in pricing signals that typical residential customers experience across utilities in North Carolina, Colorado and Texas. For each utility in the sample, the authors calculated the drop a customer would see in his or her bill if monthly usage were decreased from 10,000 gallons to 5,000 gallons. The utilities in the upper right area of the graph have the strongest conservation pricing signals, and the utilities in the lower left have some of the weakest signals.

Figure 7: Colorado, North Carolina & Texas Reductions in 2012 Water & Sewer Bill for Decrease in Consumption from 10,000-5,000 Gal/Month



Data analyzed by the Environmental Finance Center at The University of North Carolina, Chapel Hill. Data sources: Texas Municipal League annual TX water and sewer rate surveys (self-reported); NCLM/EFC 2012 NC Water & Wastewater Rate Survey; AWWA and RFC 2013 CA Rates Survey.

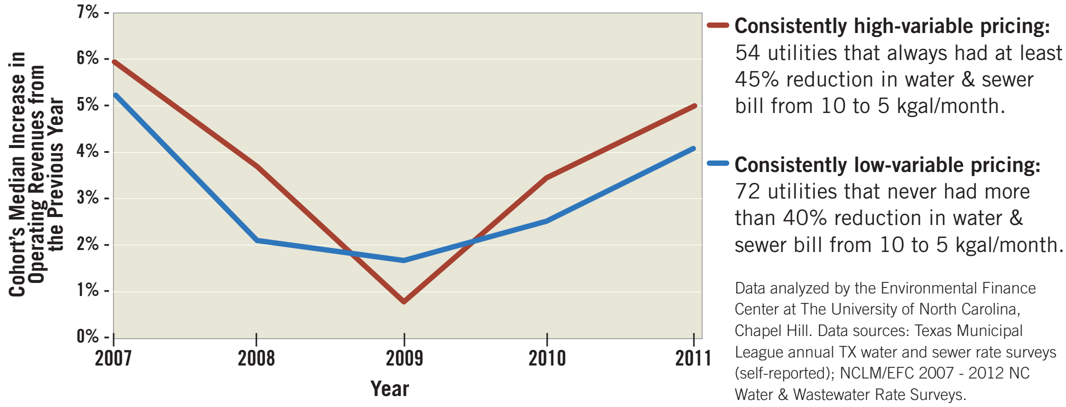
Described another way, consider the financial incentive for a family that uses 10,000 gallons per month to modify their behavior to reduce their usage to 5,000 gallons per month, which is more in line with average use in North Carolina and Texas. A drop of this magnitude could result in the family's decision to curtail irrigation or to invest in water-efficient appliances. This shift, whether over time or suddenly, would lead to a lower bill. The figure shows this drop in terms of absolute dollars versus percent of bill. For some families, knowing that a sizable amount of money can be saved ($10 rather than $3 dollars) may drive conservation, while for others, a perception that the bill is decreasing sharply in percentage terms may be enough.

The structure of pricing tiers is hugely influential on revenue variability when customers change behavior. Figure 8 (page 16) illustrates the link between pricing structure and revenue variability. For this figure, utilities were divided into two groups—those in which a significant drop in usage (from 10,000 gallons per month to 5,000 gallons per month) led to a significant drop in household charges, and those where the same change in usage was rewarded by a much more modest change in household charges. The figure shows that the revenue variability, both in terms of year-to-year increases and year-to-year decreases, was significantly greater for the utilities with stronger price signals.

PRICING CONSERVATION SIGNALS AND REVENUE IMPACTS

Clearly, one of the defining pricing challenges faced by utilities is balancing the need for sufficient revenue and stability with demand management goals. Managing demand growth from population gains is a financial imperative for many systems whose long-term capital costs are driven by peak demands that dictate treatment and transmission capacity needs and which even may necessitate investment in new supplies orders of magnitude more expensive than the existing supply base.

Figure 8: Variability of Operating Revenues by Cohorts of Utilities with Varying Emphasis on Volumetric Pricing (n = 126 North Carolina & Texas Utilities)

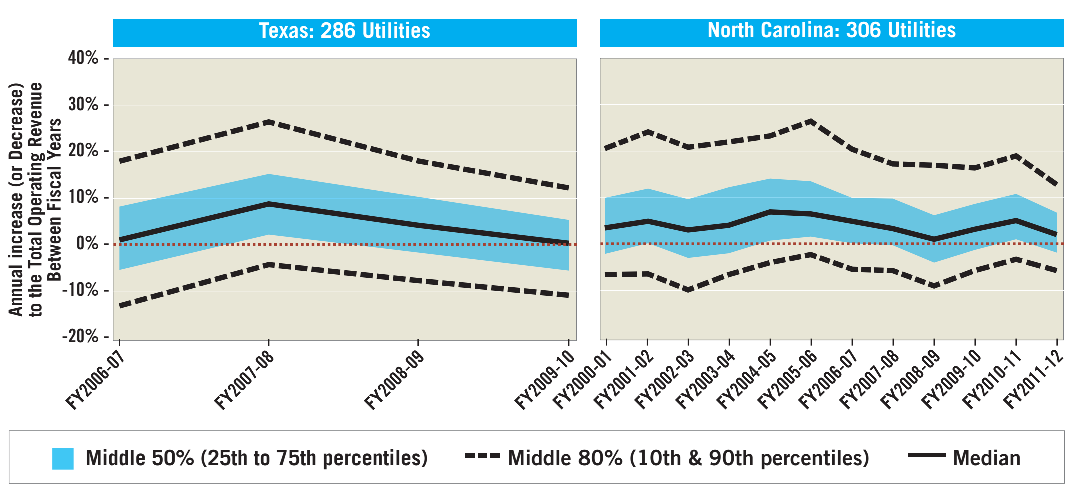


Data analyzed by the Environmental Finance Center at The University of North Carolina, Chapel Hill. Data sources: Texas Municipal League annual TX water and sewer rate surveys (self-reported); NCLM/EFC 2007 - 2012 NC Water & Wastewater Rate Surveys.

Managing growth to avoid costly capital expenditures is a compelling argument for the continued use of pricing as a method to encourage efficiency. Demand management can have the added benefit of reducing revenue instability during times of drought, smoothing the weather-induced fluctuations in usage in states like North Carolina, Texas and Colorado. Yet utility rate structures are not created equal in their ability to recover sufficient revenue in a declining demand environment, whatever the cause.

Figure 9 shows annual revenue trends for utilities in Texas and North Carolina. The figure shows the vulnerability of utilities to weather events and declining usage. Both states have experienced notable revenue downturns during drought periods (although the initial months of a drought may actually lead to revenue increases as customers increase irrigation to make up for low rainfall; this revenue surge can easily be offset by a persistent drought that necessitates emergency conservation).[12]

Figure 9: Revenues for Texas and North Carolina Utilities



Data analyzed by the Environmental Finance Center at The University of North Carolina, Chapel Hill.
Data sources: Texas Municipal League annual TX water and sewer rate surveys (self-reported); NCLM/EFC NC Water & Wastewater Rate Surveys.

12 Christine E. Boyle and Mary Tiger, 2012. "Shifting Baselines in Water Management: Using customer-level analysis to understand the interplay between utility policy, pricing, and household demand." Environmental Finance Center, Chapel Hill, North Carolina. http://efc.unc.edu/publications/2012/ShiftingBaselines.pdf

Figure 10: North Carolina Operating Ratios in 2012

Data analyzed by the Environmental Finance Center at The University of North Carolina, Chapel Hill.
Data sources: NCLM/EFC 2012 NC Water & Wastewater Rate Survey.

The slowed growth and, in many cases, decline in revenue being encountered by many utilities in the water sector is problematic for an industry that faces rapidly rising labor, construction and energy costs and future capital needs to replace failing infrastructure.

The slowed growth and, in many cases, decline in revenue being encountered by many utilities in the water sector is problematic for an industry that faces rapidly rising labor, construction and energy costs and future capital needs to replace failing infrastructure.[13] When considering costs, the revenue picture under existing pricing structures is troubling, particularly for smaller utilities that have deferred capital investments or have benefited from now dwindling public capital subsidies. Figure 10 shows the ratio of revenues over expenses[14] based on audited financial reports in North Carolina, one of the relatively few states where historic audited financial data for a large number of utilities is readily available in electronic form. The revenue shortfall is likely similar in many other states where statistics are less readily available.

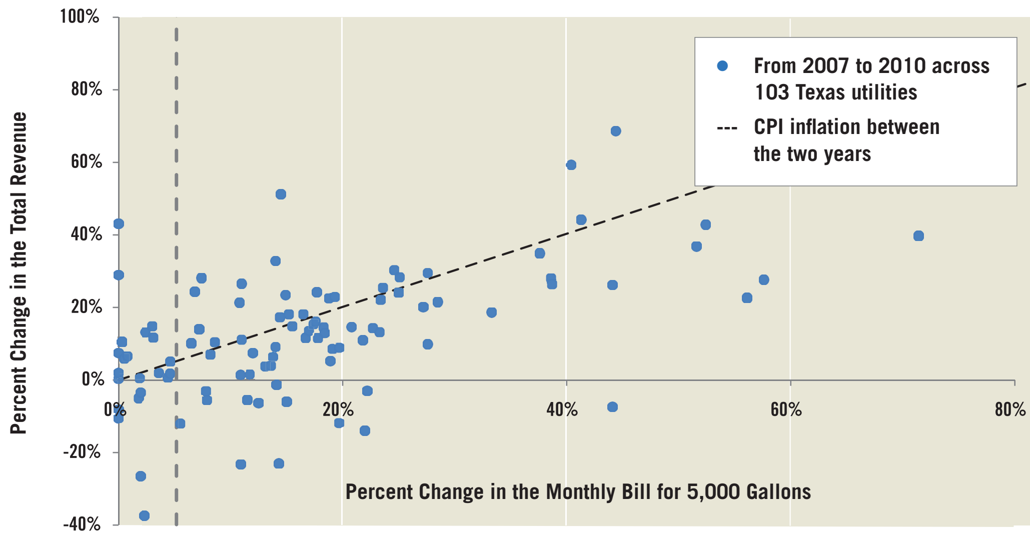
By comparing operating ratio to current average household bills, the analysis portrays the different financial challenges faced by utilities. Some utilities that are on the left-hand side of the chart likely can raise revenues by shifting rates more to statewide averages; however, the utilities in the lower right corner appear to be in fiscal despair, with rates that are some of the highest in the state and still insufficient revenue.

When water service sales followed more predictable steady growth patterns, readjusting revenue generation was typically done by some form of across-the-board rate hikes; however, the declining household usage trends that utilities are experiencing make filling the revenue gaps more challenging. Figure 11 (page 18) shows the evolution of revenue plotted against household rate adjustments in Texas. Clearly, raising rates by a fixed percentage does not generate corresponding increases in revenues for many utilities. In some cases, the divergence of rate increase percentages and revenue growth rates is severe; relatively significant upward rate adjustments occurred for utilities corresponding to a period with no revenue growth or even a decline in overall revenues. These trends could be attributed to several causes, including overall falling consumption due to the implementation of national efficiency standards and the

13 American Water Works Association, 2012. "Buried No Longer: Confronting America's Water Infrastructure Challenge." Denver, Colorado. http://www.awwa.org/Portals/0/files/legreg/documents/BuriedNoLonger.pdf

14 Expense figures include depreciation. Under NC law, utilities are required to balance their expenditure budget but are not required to set revenues at levels to cover non-cash expenses such as depreciation.

Figure 11: Driving Revenue Through Rate Increases



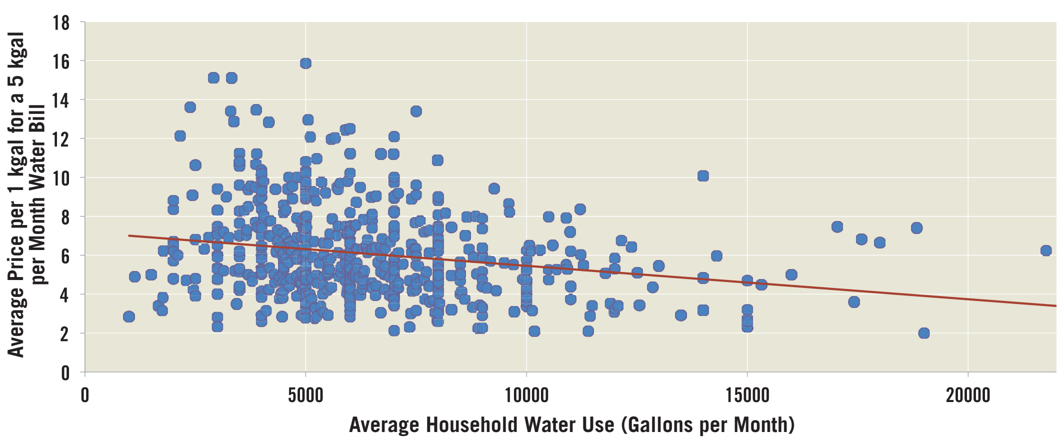
Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill. Data sources: Texas Municipal League annual TX water and sewer rate surveys (self-reported), Texas Water Development Board data from audited financial statements of utilities with outstanding loans.

Rising volumetric prices also increase the incentives for customers to change usage behavior, possibly leading to a downward revenue spiral.

loss of industrial customers. The figure suggests future challenges for utilities facing increasing political pressure to avoid rate modifications and increasing revenue demands.

Rising volumetric prices also increase the incentives for customers to change usage behavior, possibly leading to a downward revenue spiral. There is an enormous amount of literature that tries to predict how customers actually respond to pricing signals. As with most social science research, while there are some compelling findings, the reliability of the findings does not lend itself to highly accurate modeling at a specific utility. However, this does not mean utilities should not consider elasticity in their planning. An analysis done in North Carolina studied the impact of average price on usage across utilities and showed a statistically significant impact, but with lots of variation among individual utilities.[15] Figure 12 shows the relationship between household price

Figure 12: Correlation between 2012 Average Monthly Household Water Use and Average Price/1,000 Gallons for a 5,000 GPM Water Bill (661 Texas Municipalities)



Data analyzed by the Environmental Finance Center at The University of North Carolina, Chapel Hill.
Data sources: Texas Municipal League annual TX water and sewer rate surveys (self-reported)

15 Shadi Eskaf, June 2009. "Utility Rate Setting for Cost Recovery and Conservation." Environmental Finance Center, Chapel Hill, North Carolina. http://efc.unc.edu/publications/2009/2009_SWIC_FullReport.pdf

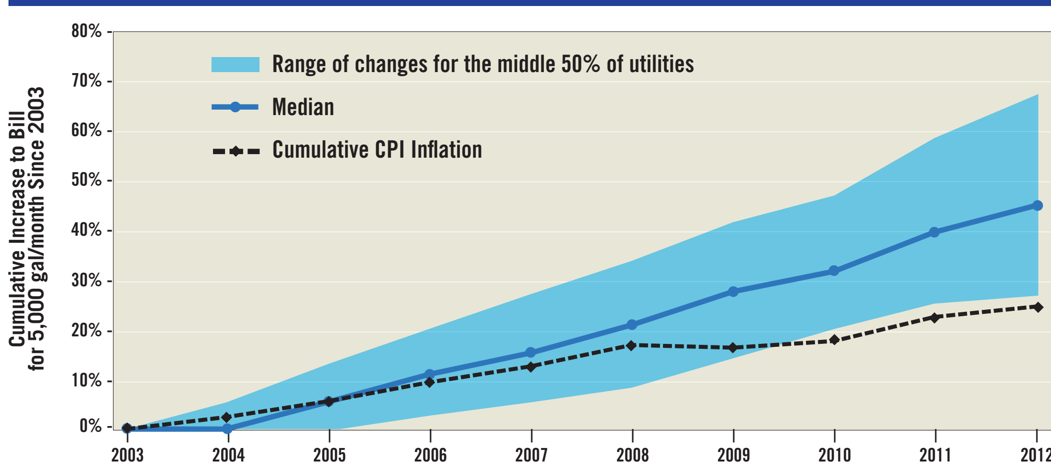
and self-reported usage by account for Texas utilities. While there is a definite inverse relationship between high prices and water use, you can see that high prices do not always bring along with them low water use. The sensitivity of customers to price changes depend on income and the availability of alternative sources of supply (such as rainfall captured and stored for later use, groundwater that can be pumped from underneath the property owner's home or in some places, water that can be trucked in and stored onsite). The sensitivity of customers to pricing also depends on whether they are using water for indoor, essential uses or outdoor uses—outdoor, discretionary uses tend to be subject to greater pricing sensitivity.

AFFORDABILITY

Reliably benchmarking the affordability of existing pricing structures is one of the more challenging tasks facing analysts. First, there are many interpretations of what constitutes an affordability challenge. Historically, when water bills were low, comparing the annual expenditure for an average family over the median household income for the community provided an acceptable snapshot of affordability. Conventional wisdom among many in the water utility business is that water remains undervalued and is inexpensive in relation to services such as cable television and mobile phone service. While this may be true in absolute terms, data shows that the increases in water and sewer charges have begun to surpass inflation in recent years. This is not surprising given the low rate of inflation, but in many communities where incomes have remained static and cost increases of any kind have received attention, this trend may pose problems for utilities in the future. For example, as shown in Figure 13, rates in Texas have recently begun increasing faster than inflation and have become a legitimate burden for many low-income families.

Average expenditure as a percentage of median household income (MHI) continues to be widely used to determine eligibility for public funding or relief from regulatory compliance. Yet it is an insufficient indicator of household distress in many communities for a variety of reasons, and has been criticized by the regulated utility community when it is used to determine utility financial capacity.[16] The denominator of the indicator MHI is plagued with shortcomings as an indicator—it masks income distribution within a community and discounts the low-income part of a

Figure 13: Rising Rates — Texas: 194 Utilities



Data analyzed by the Environmental Finance Center at The University of North Carolina, Chapel Hill.
Data sources: Texas Municipal League annual TX water and sewer rate surveys (self-reported)

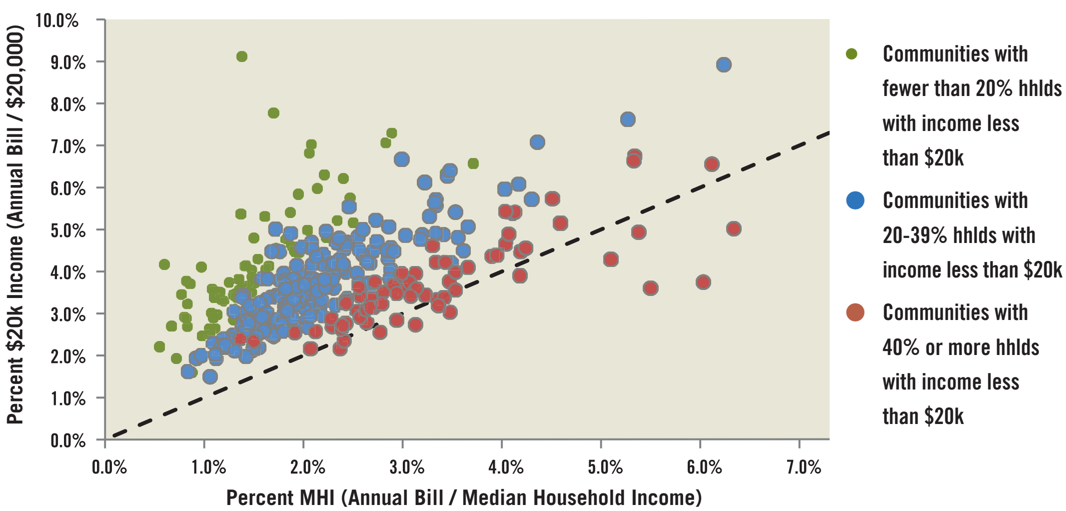
16 United States Conference of Mayors, American Water Works Association and The Water Environment Federation, 2013. Affordability Assessment Tool for Federal Water Mandates. http://www.mayors.org/urbanwater/media/2013/0529-report-WaterAffordability.pdf

community curve. A single parent family with two children earning just over minimum wage will earn less than $20,000 per year. These types of distressed families make up a percentage of almost every community, regardless of the community's median income. Both a community with an MHI of $75,000 and one with an MHI of $30,000 will experience the same affordability challenge related to this type of low-income family. Addressing the financial impacts of water service on low-income households is both a public policy issue and a financial issue; as distressed families have more difficulty paying bills, the amount of late payments and disconnections go up. In addition, as it becomes clear that some families are unable to pay for basic services, the pressure on elected boards to keep rates low for the entire customer base increases.

Addressing the financial impacts of water service on low-income households is both a public policy issue and a financial issue; as distressed families have more difficulty paying bills, the amount of late payments and disconnections go up.

Figure 14 portrays the complexity of assessing the affordability pressure in a particular service area with a single metric. The figure shows that even utilities whose average bills as a function of MHI are modest (less than 2% to 3%) have households (in some cases a large number) that are paying a significantly higher percentage of their income for services. In some communities in North Carolina, households earning $20,000 a year are paying as much as 7-9% for basic water services.

Figure 14: Annual Water & Sewer Bills at 5,000 Gallons/Month in 2012 Compared to Community's Income Levels in 2011 in North Carolina (n=365 utilities)



Analysis by the Environmental Finance Center at the University of North Carolina, Chapel Hill.
Data Sources: NCLM/EFC 2012 NC Water & Wastewater Rate Survey; U.S. Census Bureau 2007-2011 5-year American Community Survey.

Potential Metrics for Assessing Rate Structure and Pricing Effects

Rating agency and investor analysts incorporate pricing analysis into their assessments in terms of household bill at a given level of consumption, percentage of the typical household bill in comparison to median household income and generic pricing structure. Yet there are relatively few quantitative pricing and household expenditure metrics presented in standard rating criteria as compared to other types of finance and demographic data.[17]

As usage patterns continue to shift and more utilities experience revenue variability pressure, the role of pricing in understanding utility credit health will only increase.

These pricing quantitative metrics have not changed significantly as demands have changed.[18] For example, disclosure guidelines suggest a basic cost metric at a single household consumption point (7,500 gallons per month) that may have little relevance for many utilities with much lower customer usage patterns.[19] As usage patterns continue to shift and more utilities experience revenue variability pressure, the role of pricing in understanding utility credit health will only increase. For this reason, Ceres has urged utilities to disclose their pricing structures and affordability targets, and for analysts to use this information in more meaningful ways.[20] Table 2 (page 22) provides a list of possible pricing metrics that we believe can support analysts' assessments of overall utility fiscal health. Some of these metrics are already in use, while to our knowledge some are rarely, if ever, used.

While graphical analyses and suggested metrics will provide a more complete picture of utility pricing signals and potential revenue risk, the ultimate financial risk of different pricing structures depends not only on the structure but also the customer base and operating environment of a particular utility. For example, a utility pricing structure with high-volume prices for irrigation water in an area with lots of irrigators and variable weather will be more prone to swings than a similar pricing structure in an urban area with few lawns and more consistent weather. A utility with a low fixed fee in an area with older homes that use above-average amounts of water, but that are transitioning to more efficient fixtures, poses more of a risk than an area with a similar rate structure serving newer homes with lower use that have already transitioned or been constructed with efficiency fixtures and appliances.

These demographic and land use characteristics should be considered by analysts when assessing the vulnerability of pricing structures to revenue volatility. There is no singular rule of thumb to judge a resilient rate structure, but by asking these questions analysts will have a more complete picture of a water system's credit profile.

17 Fitch Ratings, August 2011. U.S. Water and Sewer Revenue Bond Criteria.— Standard & Poor's, 2008. Key Water and Sewer Utility Credit Ratio Ranges.— Moody's Research and Ratings, August 1999. Analytical Framework for Water and Sewer System Ratings.

18 Fitch Ratings, 2011. U.S. Water and Sewer Revenue Bond Rating Criteria. New York, New York, Fitch Ratings.

19 National Federation of Municipal Analysts Disclosure Guidance recommends average monthly bill for residential customers based on 7,500 gallons of usage.

20 Ceres, April 2013. Disclosure Framework for Water & Sewer Enterprises. Boston, Massachusetts.

Table 2: Sample Metrics for Assessing Drinking Water Provider Pricing Structure			
Issue of Concern	**Commonly Used Metric**	**Alternative or Additional Metrics**	**Rationale**
Competitiveness. Comparison of household expenditures for water service between systems. How much does a utility charge versus another utility?	Residential customer water bill at consumption level of 7,500 gallons per month.	Residential customer water bill at consumption level of 5,000 gallons per month.	Average household use for utilities has declined significantly in recent years, and in many places is now much lower than 7,500 gal/mo. Many utilities see the vast majority of their customers using 5,000 gallons or less per month.
Affordability. Might households have trouble making payments and governing boards be under political pressure to limit price adjustments?	Typical household monthly water bill divided by Median Household Income (MHI) for community	Typical household monthly water bill divided by the poverty income for a family of four at time of analysis. Percentage of households in service area that are at or below poverty line.	As income distributions have dispersed and water service bills have increased in real and nominal terms, understanding affordability stresses requires additional metrics beyond simply the percentage of expenditure over MHI. By looking at the percentage of expenditure for an at-risk family and assessing the relative number of those types of families in a service area, an analyst would learn more about challenges facing a particular area.
Revenue Sufficiency. Does the pricing in place provide investors with confidence that it generates sufficient revenues to meet debt requirements?	Debt Service Coverage (DSC)—typically expect range of 1.2 to 2	Modified annual DSC that incorporates annual operating revenues plus annual drawdowns from a sufficiently funded rate stabilization fund (e.g. withdrawals in a given year never exceed more than 25% of rate stabilization fund). Alternatively, if a utility maintains a rate stabilization fund, DSC could be analyzed as a rolling three-year average to allow for natural revenue variation.	Under current pricing structures, the inherent revenue swings due to normal usage changes make maintaining high DSC year in and year out much more challenging. Utilities that take steps to cushion this variation with a rate stabilization fund are arguably reducing investor risk, while at the same time minimizing pressure to over charge to compensate for revenue variability.
Revenue Vulnerability. Does the utility's pricing structure expose it to excessive revenue reduction from adoption of basic water efficiency measures, such as fixture and appliance replacements?	Rate structure defined by the change in commodity price over different consumption blocks. (e.g. decreasing vs. uniform vs. increasing block)	Percent of household charge at 5,000 gallons per month attributed to fixed fee. Percent of operational revenue attributed to fixed charges.	Some simplified characterizations of pricing focus primarily on block structure. But rate structure may have less significance on pricing signals and revenue variability than does the size of the base charge or fixed fee.
Revenue Vulnerability. Does the utility's demand profile expose the utility to excessive revenue variability from changes in customer composition or use patterns?	Revenue from top 10 customers.	Average amount of revenue attributed to irrigation as a percentage of total revenue.	Investors should remain aware of dependence on a small number of customers and should continue to document the percent of revenue attributed to top customers. But heavy dependence on outdoor irrigation for revenue can also be a risk driver, since drought-induced watering restrictions or even pricing responsiveness in inclining block rate structure may cause significant reductions in revenue as customers reduce outdoor usage.
Revenue Vulnerability. Does the utility's pricing structure expose the utility to excessive revenue variability in the event of outdoor watering reductions?	Rate structure defined by the change in commodity price over different consumption blocks.	Percent of household bill at 10,000 gallons per month that is attributed to fixed fee.	Similar to above, but provides insight into vulnerability of revenues to usage changes by water users in higher tiers.
Conservation Pricing Signals. How strong an incentive does pricing structure create for reduced usage?	Presence of inclining block rate structure.	Percentage of household charge at a given consumption point that is attributed to variable charge. Percentage change in bill for a set change in consumption. Absolute change in charge for a set change in consumption.	Some dialogue around conservation pricing signals focuses on the general block structure of the pricing. The block structure can influence pricing signal, but these other factors can have a more significant role in influencing the price incentive for reducing usage.

Conclusion

This paper demonstrates the complexity and variation of water utility pricing, and the relevance of pricing structure to credit health. What should be clear from our analysis is that there is tremendous variability in the pricing of water services in the United States, and a range of recent experience in the ability of water systems to increase revenue through rate adjustments. We invite bond analysts to incorporate these types of analyses and supplemental metrics into their own credit assessment frameworks. While the lack of reliable data on pricing structures and demand profiles provided to analysts in utilities' financial documents may limit integration into credit analyses, over time, persistent demand by analysts for this sort of data will help the market to undertake more consistent analysis of pricing structures and demand profiles. We also encourage water systems to use these metrics to educate their boards and elected officials on how to safeguard the financial stability of their communities' most critical infrastructure, for present and future generations.

There is no one-size-fits-all solution to pricing for drinking water services—flexibility in designing pricing structures will allow utilities to address their specific financial objectives in the ways that best suits their communities.

It is also clear that there is no one-size-fits-all solution to pricing for drinking water services. In some ways this is for the best, as flexibility in designing pricing structures will allow utilities to address their specific financial objectives in the ways that best suits their communities. But even amidst this range of practice, the metrics and analyses described in this paper should help analysts and utilities better assess the resilience of water systems to demand changes, while also providing a clearer view of how well a utility is meeting their own stated goals.

The next paper in this series will look at emerging pricing models that can jointly optimize the protection of revenue and the use of pricing to manage demand.

Ceres is a nonprofit organization mobilizing business leadership on sustainability challenges such as climate change and water scarcity. It directs the Investor Network on Climate Risk (INCR), a network of more than 100 investors with collective assets totaling more than $11 trillion.

Ceres provides tools and resources to advance corporate water stewardship including the *Ceres Aqua Gauge*, a roadmap that helps companies assess, improve and communicate their water risk management approach and that allows investors to evaluate how well companies are managing water-related risks and opportunities. For more details, see: www.ceres.org/aquagauge

ACKNOWLEDGEMENTS

This report was written by Jeff Hughes of the Environmental Finance Center (EFC) at the University of North Carolina at Chapel Hill and Sharlene Leurig of Ceres. The authors wish to acknowledge the generous financial support of the Walton Family Foundation and the California Water Foundation. Essential research support for the report was provided by members of the water finance team at the EFC including Mary Tiger, Shadi Eskaf, Sarah Royster, and Caroline Simpson. The authors also wish to acknowledge the Water Research Foundation for funding #4366 – *Defining a Resilient Business Model for Water Utilities*.

Report design by Patricia Robinson Design.

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