



Pricing Water to Achieve Full Cost Recovery

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Environmental Finance Center

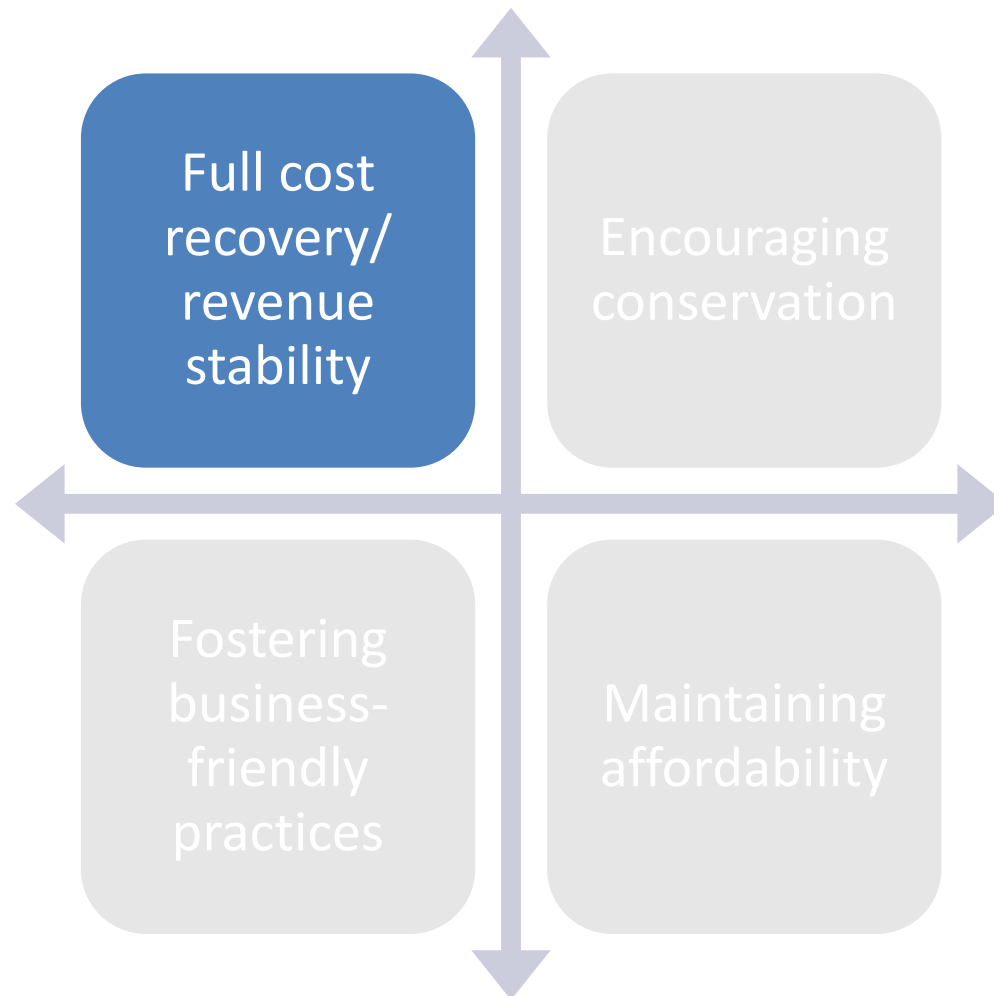
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Water System Objectives



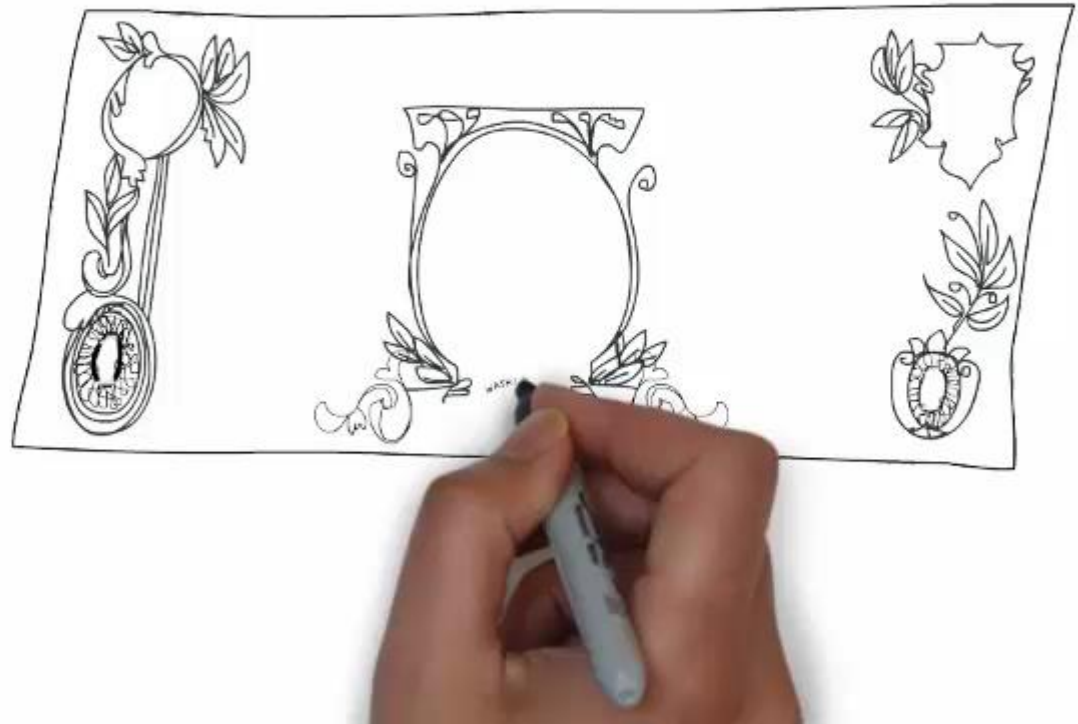


Session Objectives

- Understand how to calculate the base charges and volumetric charges to cover the full cost of providing water service
- Demonstrate the impact of different pricing structures on different customers
- Discuss what factors can impact your pricing assumptions

Understanding Water Revenues

**How
Utilities
Generate
Revenue**



<https://www.youtube.com/watch?v=0jf83mE0Lyk>



Full Cost Pricing

- The goal of full cost pricing is to have the charges for water cover the entire cost of running the water system today and into the future
- Of course, there are many ways in which you can get to the right dollar figure. Some of it comes down to your rate setting philosophy



Rate Setting Philosophies

- Payment for access vs. payment for volume of product received
- Fixed charges for fixed costs and variable charges for variable costs
- Some mix of the above ideas



Rate Setting Philosophies

Jeff Hughes

The Science of Setting Water and Sewer Rates

- *An increase in mergers and acquisitions*
- *Almost \$8 billion in assets and more than \$1 billion in annual revenues¹*
- *Changing regulations, affecting the bottom line*
- *A backlog in capital investment needs*
- *Interruptions in supplies that hurt revenues*
- *Loss of major customers*
- *Innovative pricing and customer-relations strategies*
- *Sagging revenues*

typically fall on governing boards that were chosen not as business or technical experts but as representatives of their constituents on a broad range of matters.

The drought of 2002 brought two types of water stories to the headlines: (1) the struggles of many communities to maintain their water supplies and (2) the financial difficulties of many communities due to decreased sales. The response to the first type of circumstance was immediate and significant: an executive order requiring conservation, and statewide initiatives to examine current supplies. The response to the second type of circumstance has been less obvious and less pronounced.

Table 1). These numbers are impressive. However, the projected numbers are staggering. According to a study by the North Carolina Rural Economic Development Center, the state will need more than \$11 billion in investments to meet its capital needs for water and sewer infrastructure over the next twenty years.²

In North Carolina, as throughout the country, numerous water and sewer enterprises owned by local governments benefited from the federal government's ambitious construction grants program of the 1970s (for the patterns of federal wastewater funding from 1970 to 2000, see Figure 1). Many local government officials fondly remember those days of



Exercise

Let's figure out some rates for Irvindale that cover the full cost of providing water service



Non-Rate Revenues

	Account	Budget
1	30-329-00 W/S INTEREST EARNED DEPOS	\$0.00
2	30-334-00 CONTRIBUTIONS/DONATIONS	\$0.00
3	30-335-00 W/S MISC. REVENUE	\$700.00
4	30-336-00 FUND BALANCE APPROPRIATED	\$9,187.87
7	30-345-01 SALES TAX REFUND	\$0.00
9	30-371-01 W/S CHARGES	\$344,445.00
10	30-371-02 W/S ADJUSTMENTS	\$0.00
11	30-373-00 TAP CONNECTIONS	\$1,500.00
13	30-373-02 SERVICE CHARGES/CUT OFFS	\$12,500.00
14	30-373-04 IMPACT FEES	\$1,000.00
15	30-373-05 CAPITAL CONTRIBUTIONS	\$0.00
16	30-374-00 Online W/S Payment Fee	\$1,600.00
17	30-375-80 Contributed Capital - G.R.S.P.	\$0.00
18	30-375-81 Contributed Capital Fund	\$0.00
19	30-377-00 RBEG - Pump Station	\$0.00
20	30-378-00 I&I Study Grant - Commerce	\$12,000.00
22	30-385-00 SALE OF ASSETS	\$0.00
23	30-386-00 TRANSFER FROM OTHER FUND	\$0.00
		\$382,932.87



For the Exercise

Total Revenues:
\$382,932.87

Revenues from Rates:
\$344,445.00



Payment for Access

- In its pure form, everyone in the water system pays the same amount for access to the system, regardless of how much water they use



Payment for Access

We charge a flat rate of \$15.00 monthly

P.O. - Box 133
Jacksonville

We ARE a small town we do NOT have sewage

Jacksonville, GA



Payment for Access

- What information do we need to make this calculation?
- Total revenue needed from rates
- Total number of accounts

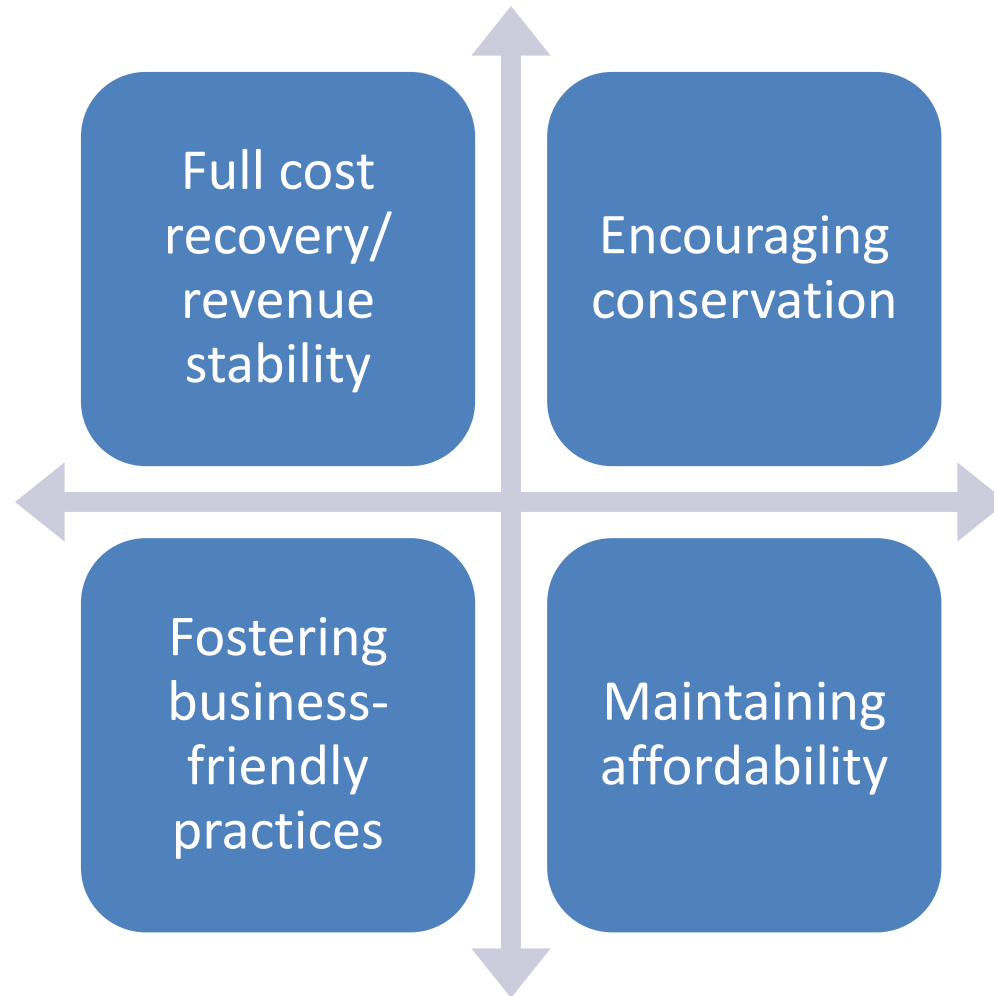
Payment for Access

$$\frac{\boxed{\$344,445}}{\text{Total Needed Revenue}} \div \frac{\boxed{\$765.43}}{\text{Total Annual Bill}} = \frac{\boxed{\$63.79}}{\text{Monthly Bill}}$$

$\frac{\boxed{450}}{\text{Total Accounts}} = 12$



Which Water System Objectives?





Payment for volume of product received

- In its pure form, everyone in the water system pays for the volume of water received and only for the volume of water received



Payment for volume of product
received

WATER & SEWER RATES

In Town

Water	\$ 7.72 per 1000 gallons
Sewer	\$ 10.73 per 1000 gallons

Out of Town

Water	\$ 15.44 per 1000 gallons
Sewer	\$ 21.46 per 1000 gallons

Troutman, NC



Payment for volume of product received

- What information do we need to make this calculation?
- Total revenue needed from rates
- Total gallons sold



Payment for volume of product received

\$344,445

Total Needed Revenue

32,877,590

Total Gallons Sold

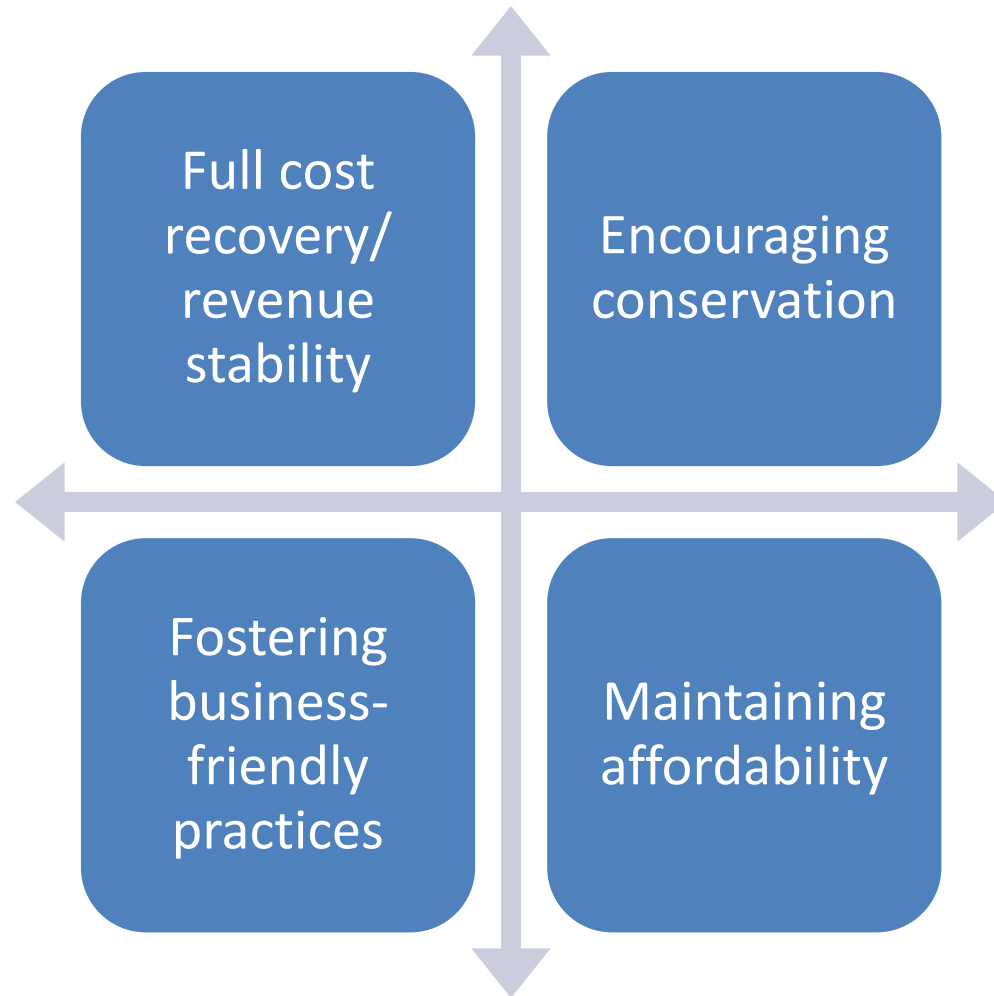
x 1,000 =

\$10.48

Price per 1,000 Gallons



Which Water System Objectives?





Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

- In its pure form, all of the fixed costs of the water system would be covered by the base charge, and all of the variable costs would be covered by the volumetric rate



Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

Base Chrg Lower Bound

Rate

38.00

0

0.000000

4

9.500000

Readsboro, VT



Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

Revenue

76%

24%

Expenses

91%

9%

Readsboro, VT

A blue-tinted photograph of industrial machinery, specifically large pipes and valves, located at the top of the slide.

Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

- What information do we need to make this calculation?
- Total revenue needed to cover fixed costs
- Total Accounts
- Total revenue needed to cover variable costs
- Total gallons sold

For the Exercise

Revenues from Rates:

\$344,445

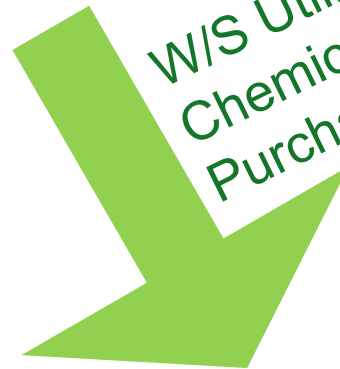
Everything else



\$292,045

Fixed Cost

W/S Utilities
Chemicals & Salt
Purchase Water Bill



\$52,400

Variable
Cost



Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

\$292,045

Fixed Annual Costs

\$648.99

Total Annual Bill

\$54.08

Monthly Base Bill

450

Total Accounts

12

\$52,400

Variable Annual Costs

x 1,000 =

\$1.59

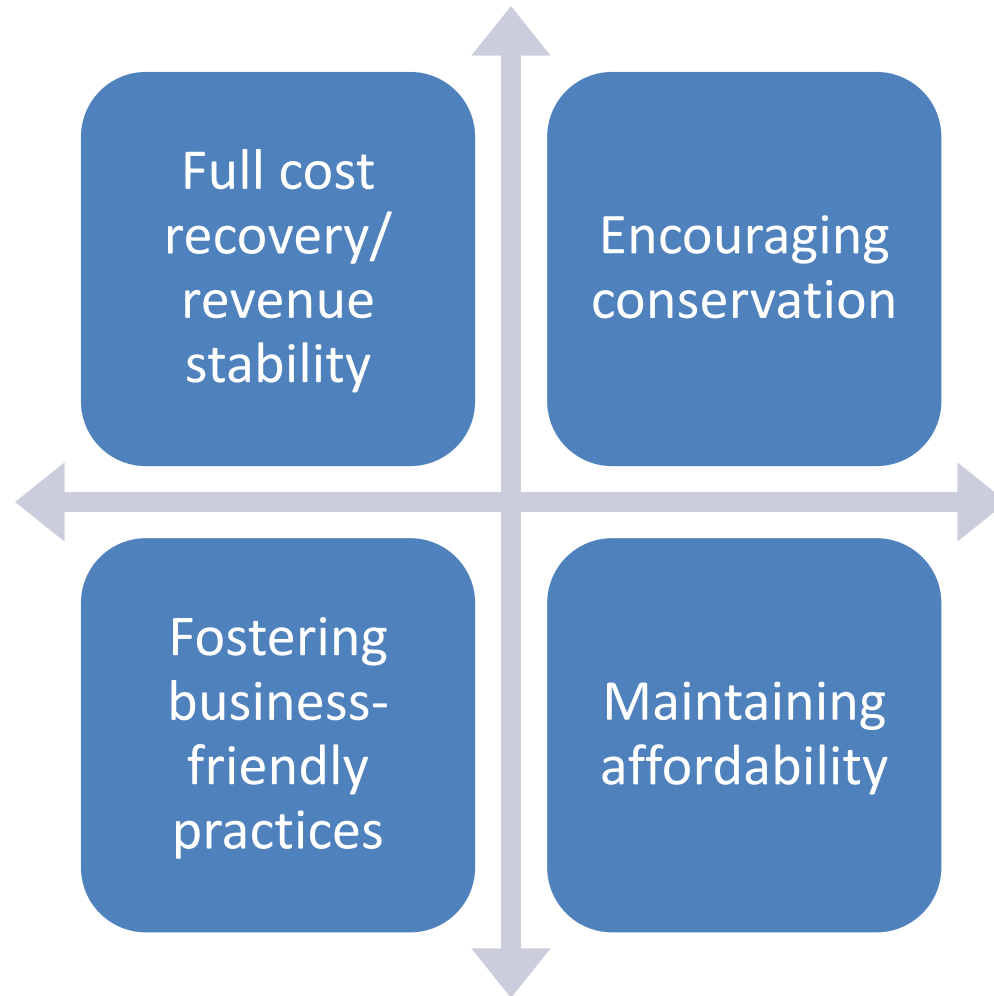
Price per 1,000 Gallons

32,877,590

Total Gallons Sold



Which Water System Objectives?





\$25 Base Charge; Rest from Volumetric Rates

- Pick a base charge and see what the volumetric charge would need to be



\$25 Base Charge; Rest from Volumetric Rates

WATER & SEWER RATES AND FEE SCHEDULE EFFECTIVE

IN TOWN

WATER MINIMUM (1000 GALLONS)	\$25.00
SEWER MINIMUM (1000 GALLONS)	\$25.00
DISPOSAL FEE	\$ 5.00
ADDITIONAL WATER PER 1000 GALLONS	\$ 6.15

Denton, NC



\$25 Base Charge; Rest from Volumetric Rates

- What information do we need to make this calculation?
- Total Accounts
- Total Revenue Needed
- Total Gallons

\$25 Base Charge; Rest from Volumetric Rates

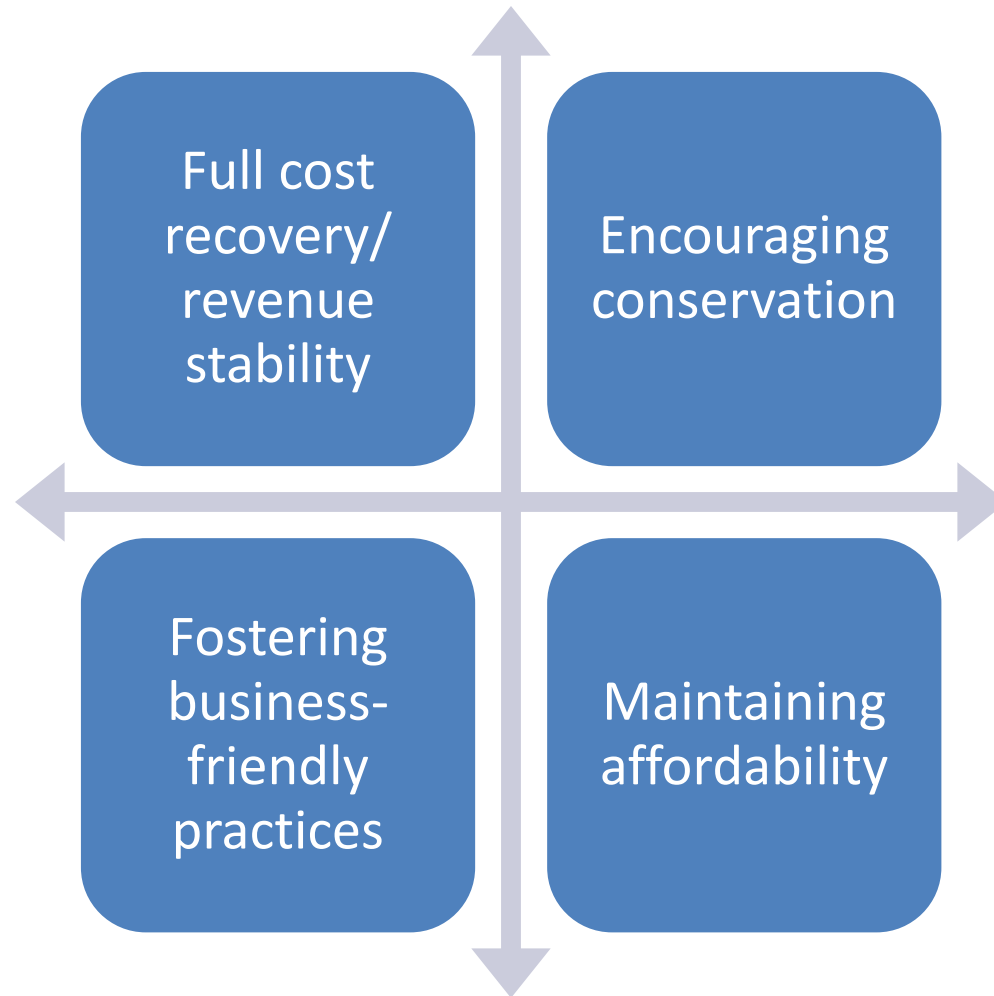
$$\begin{array}{rcccl} \boxed{12} & \times & \boxed{\$25} & \times & \boxed{450} = \boxed{\$135,000} \\ \text{Months} & & \text{Monthly Base} & & \text{Total Accounts} & & \text{Total from Base Bill} \\ & & \text{Bill} & & & & \end{array}$$

$$\begin{array}{r} \boxed{\$344,445} \\ \text{Total Revenue Needed} \\ - \boxed{\$135,000} \\ \text{Total from Base Bill} \\ \hline \boxed{\$209,445} \\ \text{Total Needed from Volumetric} \end{array}$$

$$\begin{array}{r} \boxed{\$209,445} \\ \text{Total Needed from Volumetric} \\ \hline \boxed{32,877,590} \\ \text{Total Gallons Sold} \end{array} \times 1,000 = \boxed{\$6.37} \text{ Price per 1,000 Gallons}$$



Which Water System Objectives?





How This Impacts Customers

- All four rate structures get us to the same total revenue
- But how does each approach impact different types of customers?



How This Impacts Customers



1,000 gallons/month



4,000 gallons/month



12,000 gallons/month



34,000 gallons/month



Exercise

How much will water service cost per month for different customers under each rate structure?

Payment for Access



\$63.79

\$63.79

\$63.79

\$63.79

Payment for Volume of Product Received



\$10.48

\$41.92

\$125.76

\$356.32

Base Charge for Fixed Costs; Volumetric Charge for Variable Costs



\$55.67

\$60.44

\$73.16

\$108.14



\$25 Base Charge; Volumetric Charge for Rest



\$31.37

\$50.48

\$101.44

\$241.58



	 1,000 gallons/month	 4,000 gallons/month	 12,000 gallons/month	 34,000 gallons/month
Payment for Access (Fixed Monthly Bill)	\$63.79	\$63.79	\$63.79	\$63.79
Payment for Volume of Product Received	\$10.48	\$41.92	\$125.76	\$356.32
Base Charge for Fixed Costs; Volumetric Charge for Variable Costs	\$55.67	\$60.44	\$73.16	\$108.14
\$25 Base Charge; Volumetric Charge for Rest	\$31.37	\$50.48	\$101.44	\$241.58



So where do you think the \$25
per month base charge came
from?



These numbers are based on
Irvindale's budget

Does

Maybe, but
probably
not



What causes variation?

Rate Changes



As rates go up, usage goes down

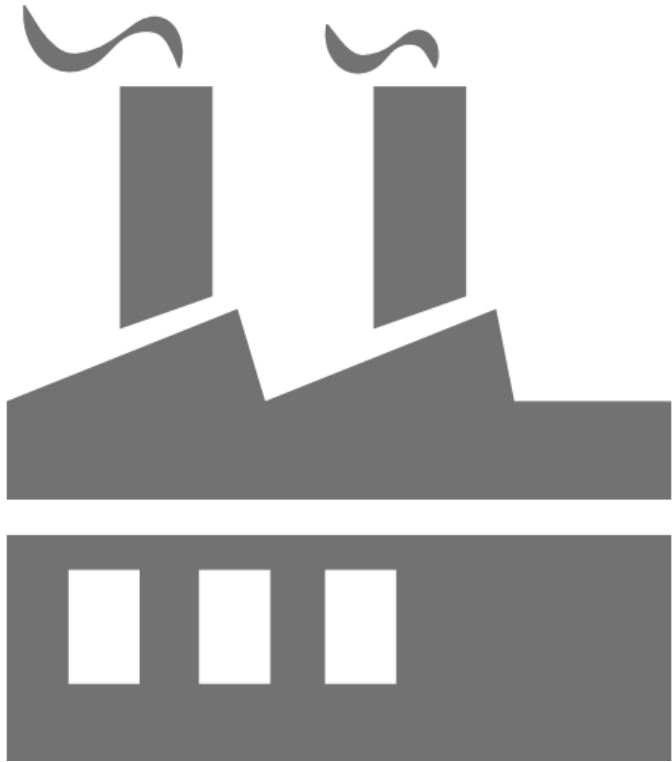
As a rule of thumb, typically usage goes down 3-4% for every 10% increase in rates

Population Change



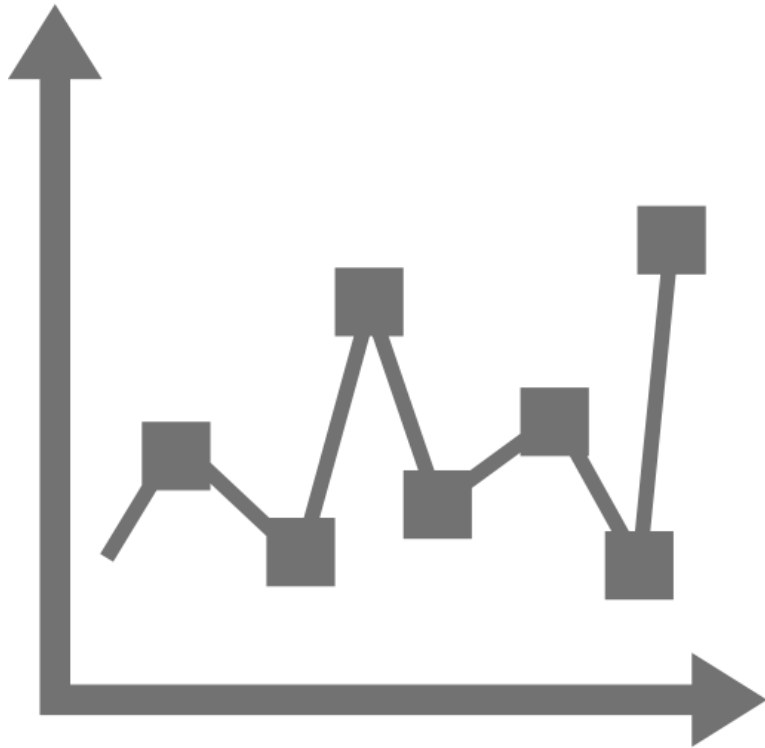
Customers could be coming into your system or leaving your system

Loss of a Big Customer



Some customers use significantly more water than others. Losing a single big user can have a disproportionate impact on revenues

Economic Conditions



Economic downturns can cause customers to cut back on water use. Conversely, periods of economic growth can lead to higher water consumption



Changes in Collection Rates

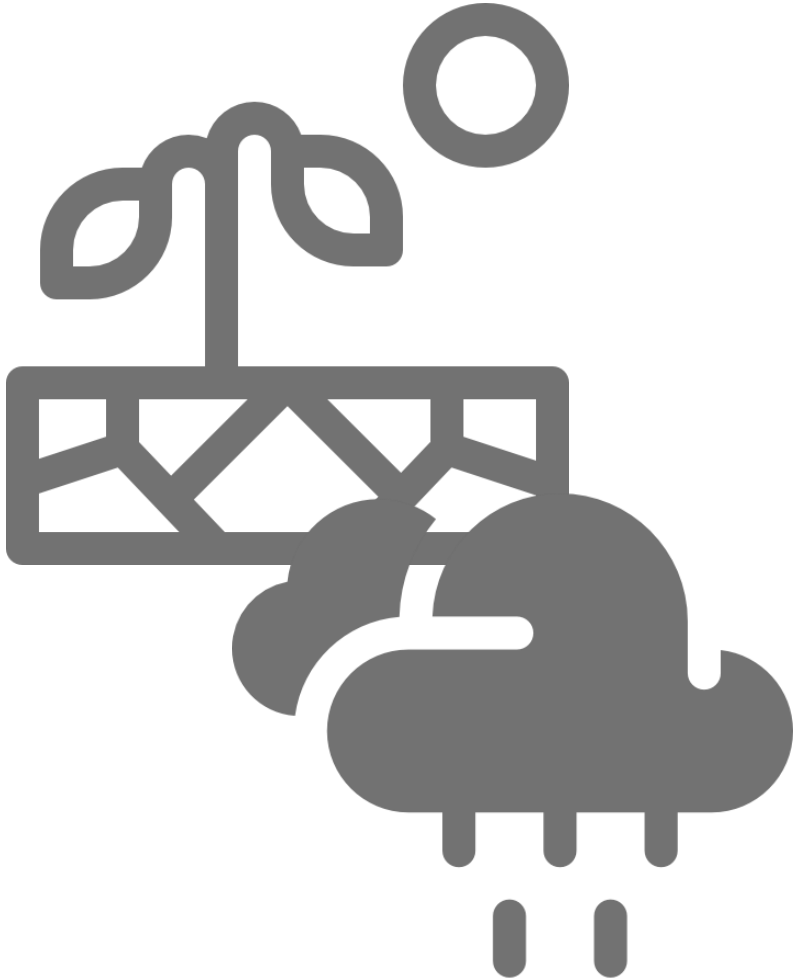


Even if the number of customers doesn't change, how often they are paying you may be changing





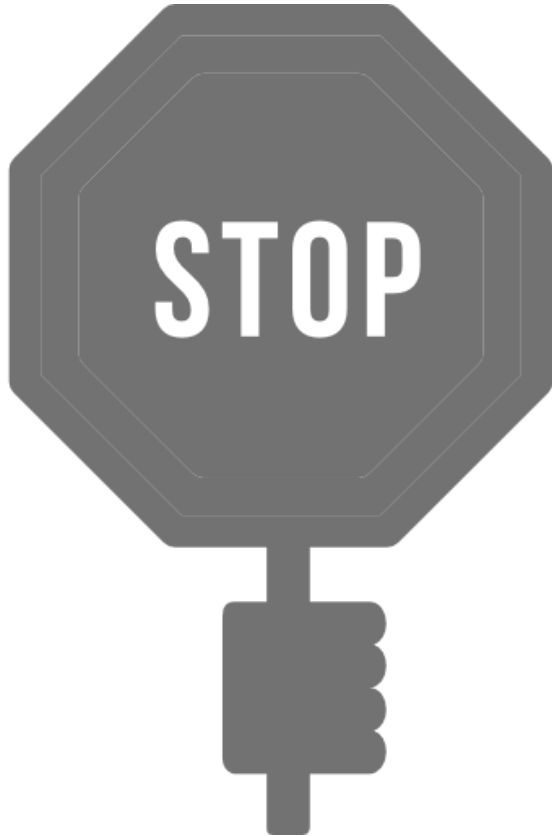
Weather



Rainy conditions or dry/drought conditions can impact how much water customers use for outside irrigation



Water Use Restrictions



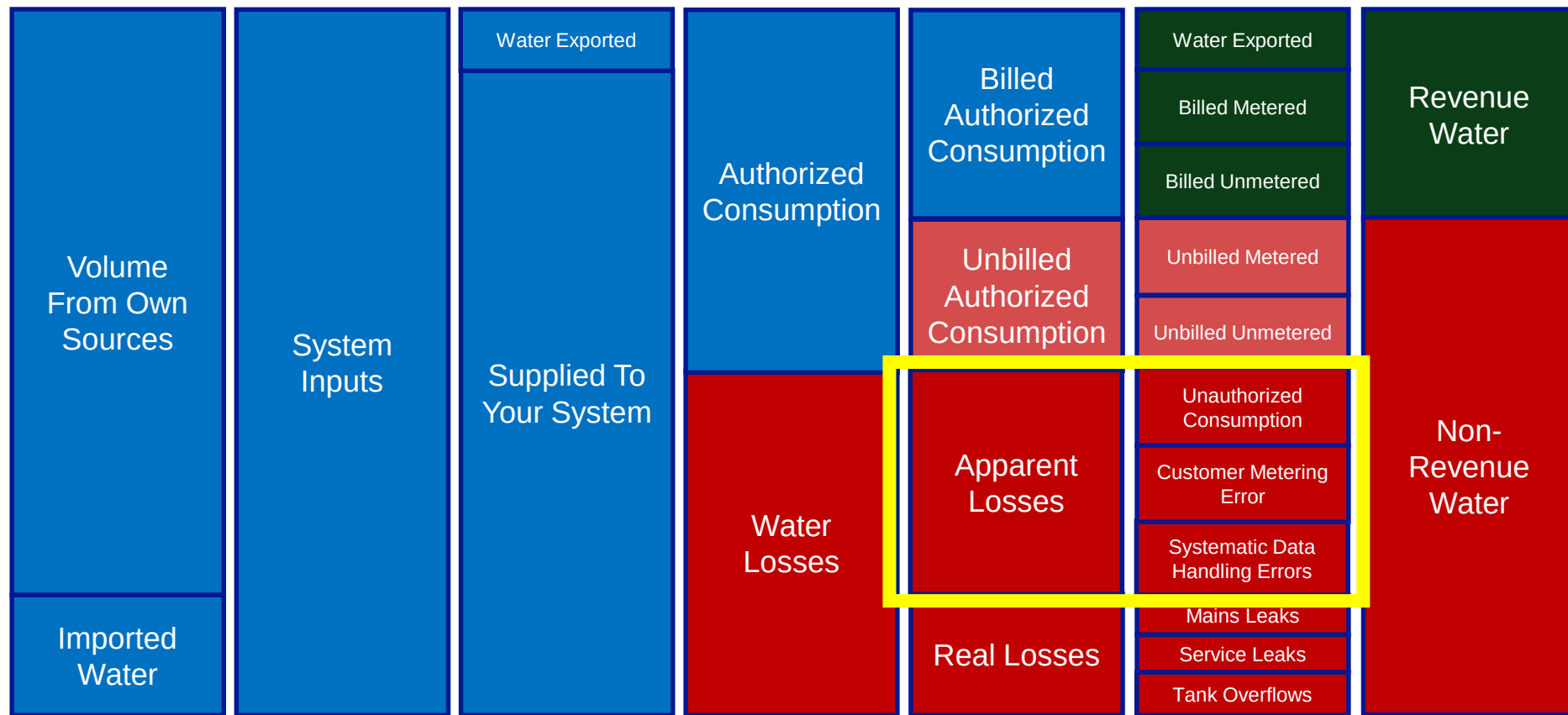
Whether due to water supply shortages or drought conditions, restricting water use will obviously impact revenues

Technology



Fixtures use less water today than in the past, and overall per capita water demand is decreasing across the country

Bill Correctly



A blue-tinted photograph of industrial machinery, possibly a pump or engine, with various pipes and mechanical components visible.

What to do?

- Multiple forecasts based on different assumptions
- Ideally, be conservative
- Don't forget price elasticity
- Use tools to stress test projections
- Give board options

Water and Wastewater Rates Analysis Model
<http://efc.sog.unc.edu> or <http://efcnetwork.org>

or

Find the most up-to-date version in [Resources / Tools](#)

Water & Wastewater Rates Analysis Model

Version 2.8.2 (last updated August 4, 2015)

UNC
ENVIRONMENTAL FINANCE CENTER

Developed by the Environmental Finance Center at the University of North Carolina, Chapel Hill
<http://efc.sog.unc.edu>

Funded by the U.S. Environmental Protection Agency and the Public Water Supply Section
of the North Carolina Department of Environment and Natural Resources

Get Started

Download a copy of the
model populated with data
from an example utility

DESCRIPTION

A do-it-yourself, simplified financial model to assist utility managers and private system owners in setting water and wastewater rates.

FEATURES

- Comparisons of annual fund balance projections (for up to 20 years) under proposed new rates vs. staying with existing rates
- Adjust rates for the next 1-5 years
- Up to 12 rate structures
- Uniform or block rates (up to 10 blocks)
- Model changes to accounts and water use
- Customizable list of operating and capital expenses
- Building up reserves through rates
- Compare monthly bills under new rates vs. existing rates
- Assess revenue sufficiency and fund balance
- Error notifications

INSTRUCTIONS

1) Navigate using worksheet tabs at bottom of screen or following arrows and clicking on buttons

2) In the green "Data Input" worksheets, input data in the dark green cells

View Results

Financial forecast of the next few years under
"Existing" rates versus "New" rates (graphs of
cost recovery and end-of-year fund balance)

How new rates compare to existing rates
(graphs of monthly bills)

Year:	2015	2016	2017	2018	2019	2020
Existing						
New						
Charge (gallons/month)	\$11.50	\$13.00	\$14.00	\$17.00	\$20.00	\$25.00
Block End						
1,000 gal/mo	\$2.78	\$2.78	\$2.78	\$3.00	\$3.50	\$4.00
2,000 gal/mo	\$4.00	\$4.50	\$5.00	\$5.50		
3,000 gal/mo	\$6.00	\$6.50	\$7.00	\$8.00	\$9.00	\$9.50
4,000 gal/mo						

Back to top

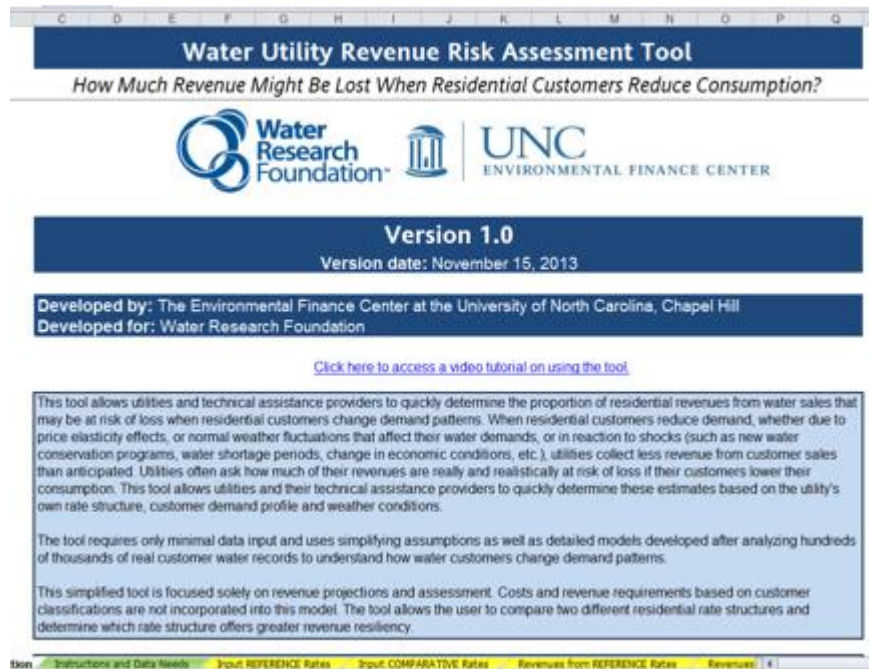
Error: missing block rates
Error: missing block size

Watch out for red "Error"
messages describing
where data entry errors

Debt Service and Other Known Annual Expenses for Next 20 Years		Additional Utility Expenses that Grow Every Year	
Year	Amount	Year	Amount
2015	\$1,000,000	2015	\$1,000,000
2016	\$1,000,000	2016	\$1,000,000
2017	\$1,000,000	2017	\$1,000,000
2018	\$1,000,000	2018	\$1,000,000
2019	\$1,000,000	2019	\$1,000,000
2020	\$1,000,000	2020	\$1,000,000
2021	\$1,000,000	2021	\$1,000,000
2022	\$1,000,000	2022	\$1,000,000
2023	\$1,000,000	2023	\$1,000,000
2024	\$1,000,000	2024	\$1,000,000
2025	\$1,000,000	2025	\$1,000,000
2026	\$1,000,000	2026	\$1,000,000
2027	\$1,000,000	2027	\$1,000,000
2028	\$1,000,000	2028	\$1,000,000
2029	\$1,000,000	2029	\$1,000,000
2030	\$1,000,000	2030	\$1,000,000

Created by the Environmental Finance Center at the University of North Carolina, Chapel Hill
Funded by the U.S. E.P.A. and the N.C. Department of Environment and Natural Resources

Water Utility Revenue Risk Assessment Tool



- Excel tool (simplified)
- Focus on residential revenues
- Utility inputs own:
 - Rate structure details
 - Residential customer water use profile
 - Weather patterns
 - Assumptions on price elasticity
- Tool estimates the proportion of revenues that may be lost due to changes in water use patterns due to:
 - Rate increase, alone or plus:
 - Normal weather pattern changes, or
 - One-time, significant and sudden conservation effort

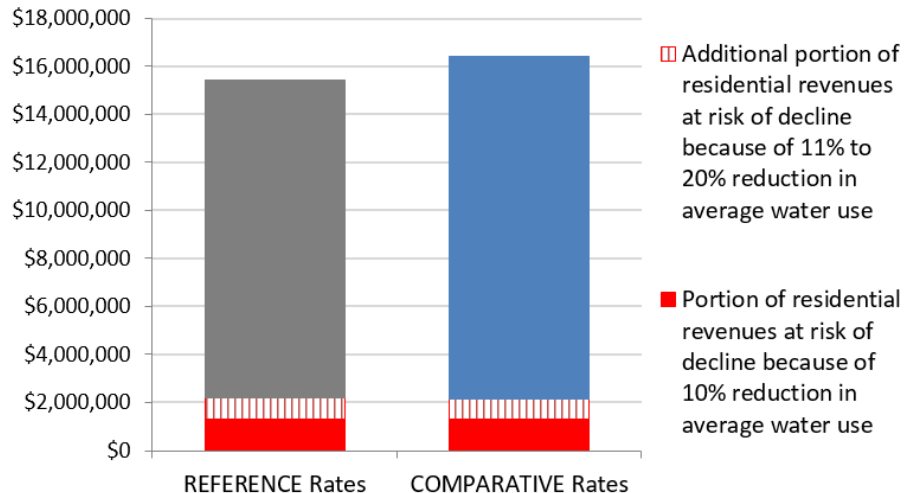
Free to download and use at
www.waterrf.org
www.efc.sog.unc.edu

Water Utility Revenue Risk Assessment Tool

Comparing Revenues After a Significant Decline in Water Use

How do the total revenues compare under both rate structures if there is a reduction of 10% - 20% in average water use and subsequent demand distribution shifts?

Portions of Annual Revenues under REFERENCE and COMPARATIVE Rate Structures that are at Risk of Loss Due to Significant Reductions in Average Water Use



Decline in Total Annual Revenues for a:	REFERENCE Rates	COMPARATIVE Rates
10% reduction in avg use	\$1,311,000	\$1,319,000
20% reduction in avg use	\$2,181,000	\$2,167,000
10% reduction in avg use	8.5%	8.0%
20% reduction in avg use	14.2%	13.2%

The comparative rate structure generates revenues that are MORE resilient to sudden and significant declines in residential water use than the revenues generated by the reference rate structure. Revenues under the comparative rate structure are projected to drop 8% - 13.2% for a 10% - 20% reduction in average water use, and their related shifts in demand distribution. These declines occur after including the effect of price elasticity when adjusting rates from the reference rate structure to the comparative rate structure. By comparison, revenues under the reference rate structure are projected to drop 8.5% - 14.2% for the same declines in residential water use.

AWE Sales Forecasting and Rate Model



The screenshot shows the website for FINANCING SUSTAINABLE WATER, with the tagline "Rates. Revenue. Resources." and social media icons for Facebook, Twitter, YouTube, and LinkedIn. The navigation bar includes links to HOME, WATER EFFICIENCY, BUILDING RATES, IMPLEMENTATION, FISCAL SUSTAINABILITY, TOOLS, and RESOURCE SEARCH. The "TOOLS" section is highlighted, and the "AWE Sales Forecasting and Rate Model" is featured. The page includes a sidebar with links to "Building Better Water Rates for an Uncertain World", "AWE Sales Forecasting and Rate Model", "Rate Model Video Tutorials", "Request Tools", "Rate Model User Guide", "Appendices: Costing Methods, Demand Forecasting and Revenue Modeling", and "Communications Tools". The main content area is titled "AWE Sales Forecasting and Rate Model" and describes the tool's purpose and features.

FINANCING SUSTAINABLE WATER
Rates. Revenue. Resources.

A project of the
Alliance for Water Efficiency

HOME WATER EFFICIENCY BUILDING RATES IMPLEMENTATION FISCAL SUSTAINABILITY **TOOLS** RESOURCE SEARCH

Home • Tools • **AWE Sales Forecasting and Rate Model**

Building Better Water Rates for an Uncertain World

AWE Sales Forecasting and Rate Model

Rate Model Video Tutorials

Request Tools

Rate Model User Guide

Appendices: Costing Methods, Demand Forecasting and Revenue Modeling

Communications Tools

RATES HANDBOOK
Building Better

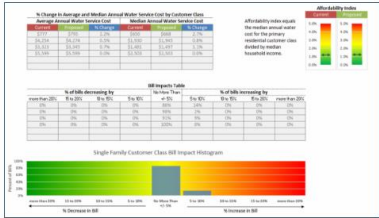
AWE Sales Forecasting and Rate Model

The AWE Sales Forecasting and Rate Model is a new analytical tool that can explicitly model the effects of rate structures. Typical water rate models assume that future sales are known with certainty, and do not respond to price, weather, the economy, or supply shortages — that is to say, not the world we live in. The AWE Sales Forecasting and Rate Model addresses this deficiency and enables analysis of the following:

- Customer Consumption Variability – weather, drought/shortage, or external shock
- Demand Response – Predicting future block sales (volume and revenue) with empirical price elasticities
- Drought Pricing – Contingency planning for revenue neutrality
- Probability Management – Risk theoretic simulation of revenue risks
- Fiscal Sustainability – Sales forecasting over a 5 Year Time Horizon

The Rate Design Module can answer these questions:

- What effect would increasing the top tier rate by 15% have on water demand?
- Will shifting to seasonal rates cause water use to increase or decrease?
- What block rate design could allow us to preserve our current level of revenue while reducing demand?
- How should we adjust rates to support our water demand management objectives during water shortages?
- What proportion of customer bills will



The charts show the impact of rate changes on water demand and revenue. The top chart, "No Change in Demand and Weather Demand Water Revenue Loss for Customer Class", shows a significant revenue loss for the Single Family Customer Class. The bottom chart, "Single Family Customer Class Bill Impact Histogram", shows the distribution of bill impacts, with a large portion of bills increasing by 10% or more.

Available for
Alliance for
Water Efficiency
members:

<http://www.financingsustainablewater.org/>



Pricing Water to Achieve Full Cost Recovery

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