



# Pricing Water to Achieve Full Cost Recovery

Shadi Eskaf

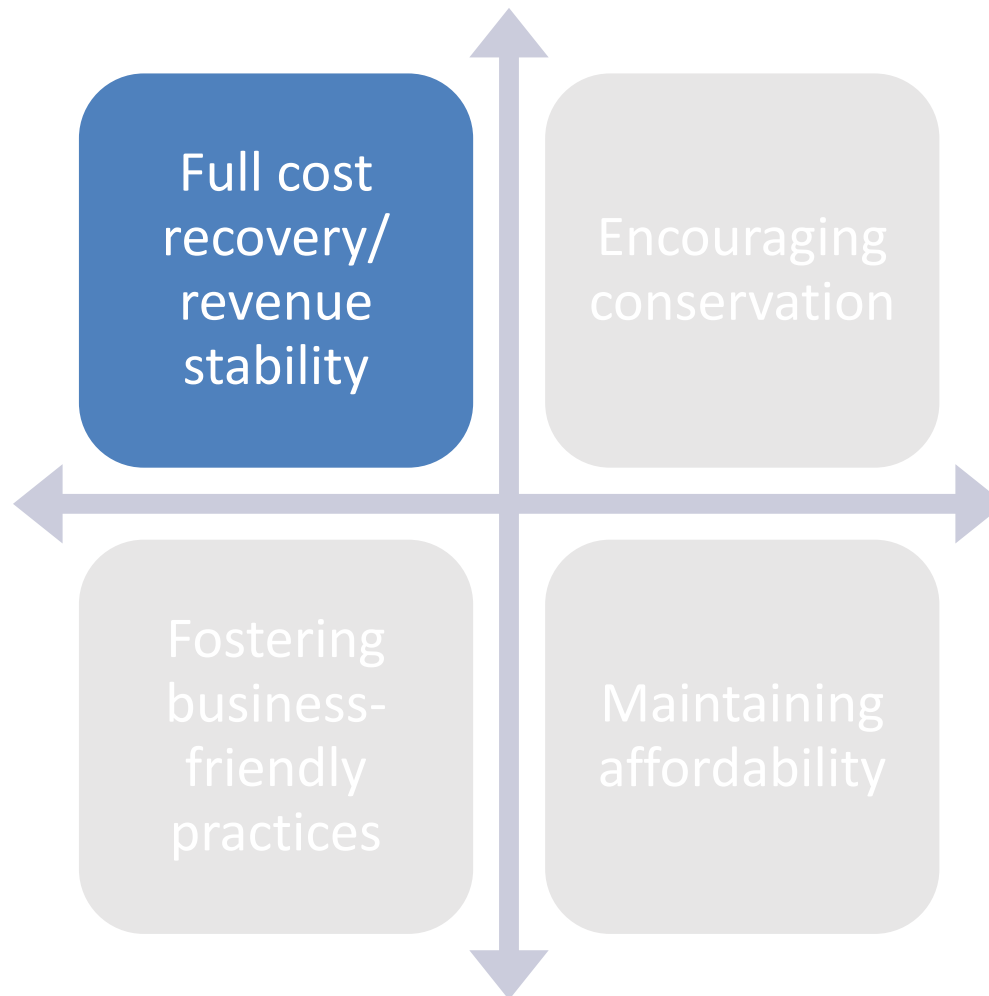
Environmental Finance Center

The University of North Carolina at Chapel Hill

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# Rate Setting Objectives





UNC  
ENVIRONMENTAL  
FINANCE CENTER

## NC Water and Wastewater Rates Dashboard

Rates as of January 1, 2017

Last updated: October 4, 2017



Graham

Rates Comparison

Financial Benchmarks

Characteristics

Links

Edit Data or Add Utility

Select residential bill and monthly consumption amount

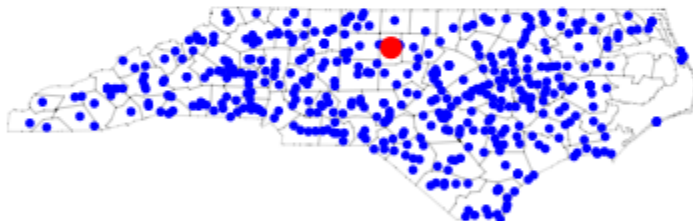
☒ Water Bill ☐ Sewer Bill ☐ Water + Sewer Bill



Monthly Water Bill: \$24.05

Select comparison group: All Utilities

Comparing to all utilities in survey

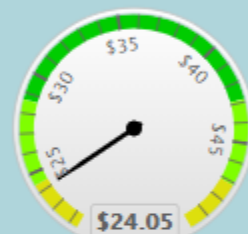


448 rate structures compared

Effects of raising rates by: 0%

Bill Comparison

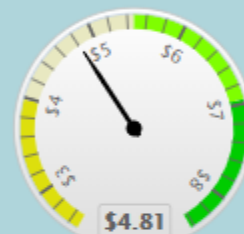
Water Bill at  
5,000 gallons  
Median: \$32.50



Min \$10.69 Max \$101.64

Conservation Signal

Water Price/1,000 gallons, after  
10,000 gallons  
Median: \$4.83



Min \$0.50 Max \$20.00

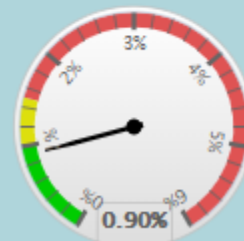
Cost Recovery

Operating  
Ratio Incl. Deprec. 2016



Affordability

Water Bills as % MHI



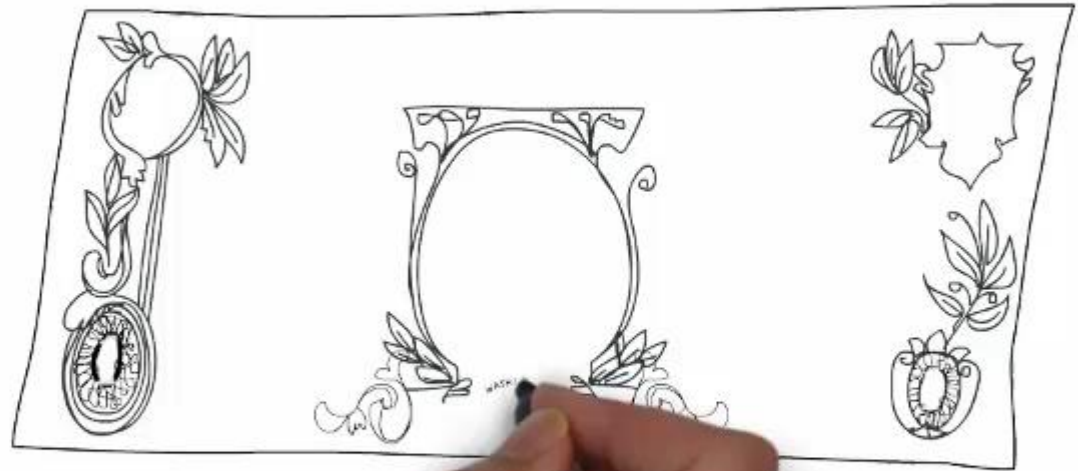


# Session Objectives

- Understand how to calculate the base charges and volumetric charges to cover the full cost of providing water service
- 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 revenues<sup>1</sup>*
- *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.<sup>2</sup>

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 Irwindale 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

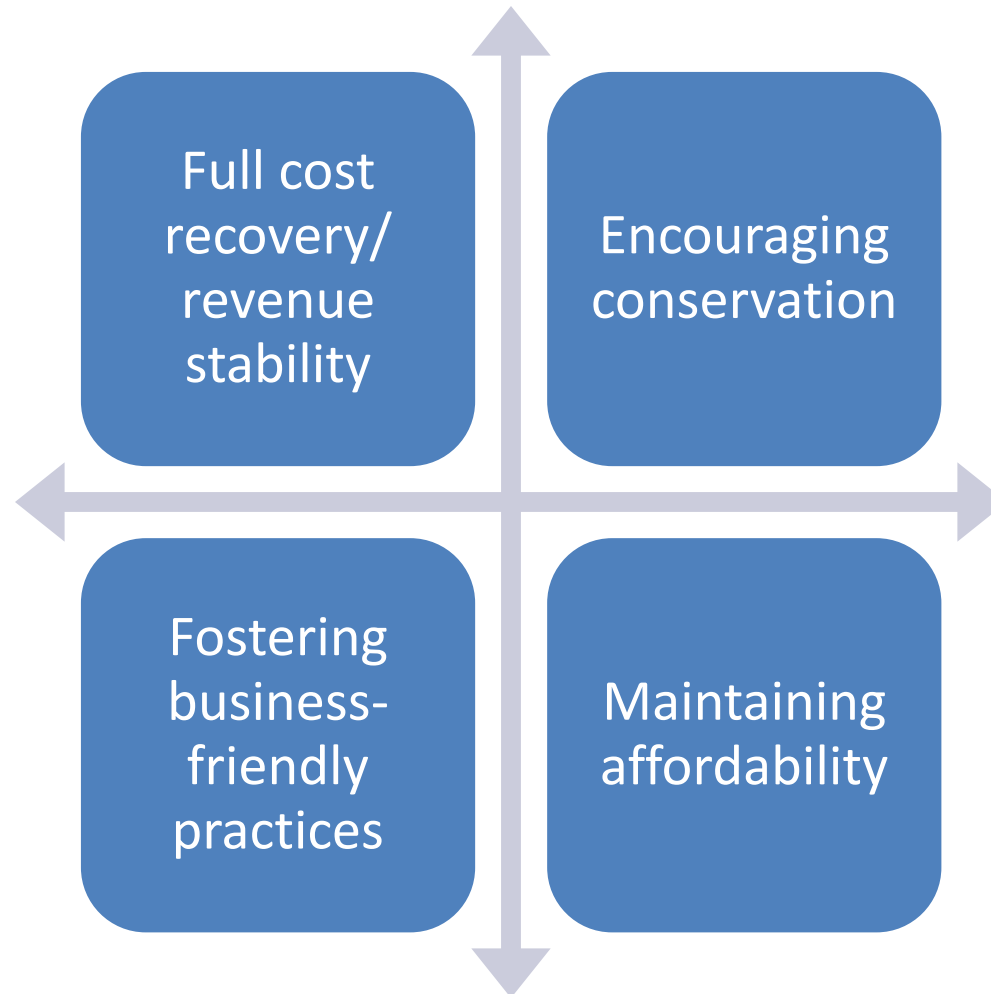
- What information do we need to make this calculation?
- Total revenue needed from rates
- Total number of accounts



# Payment for Access

$$\frac{\boxed{\$344,445}}{\text{Total Needed Revenue}} \div \frac{\boxed{\$765.43}}{\text{Total Annual Bill}} = \frac{\boxed{\$63.79}}{\text{Monthly Bill}}$$
$$\frac{\boxed{450}}{\text{Total Accounts}} = \frac{\mathbf{12}}{\text{Monthly Bill}}$$

# Which Rate Setting 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*

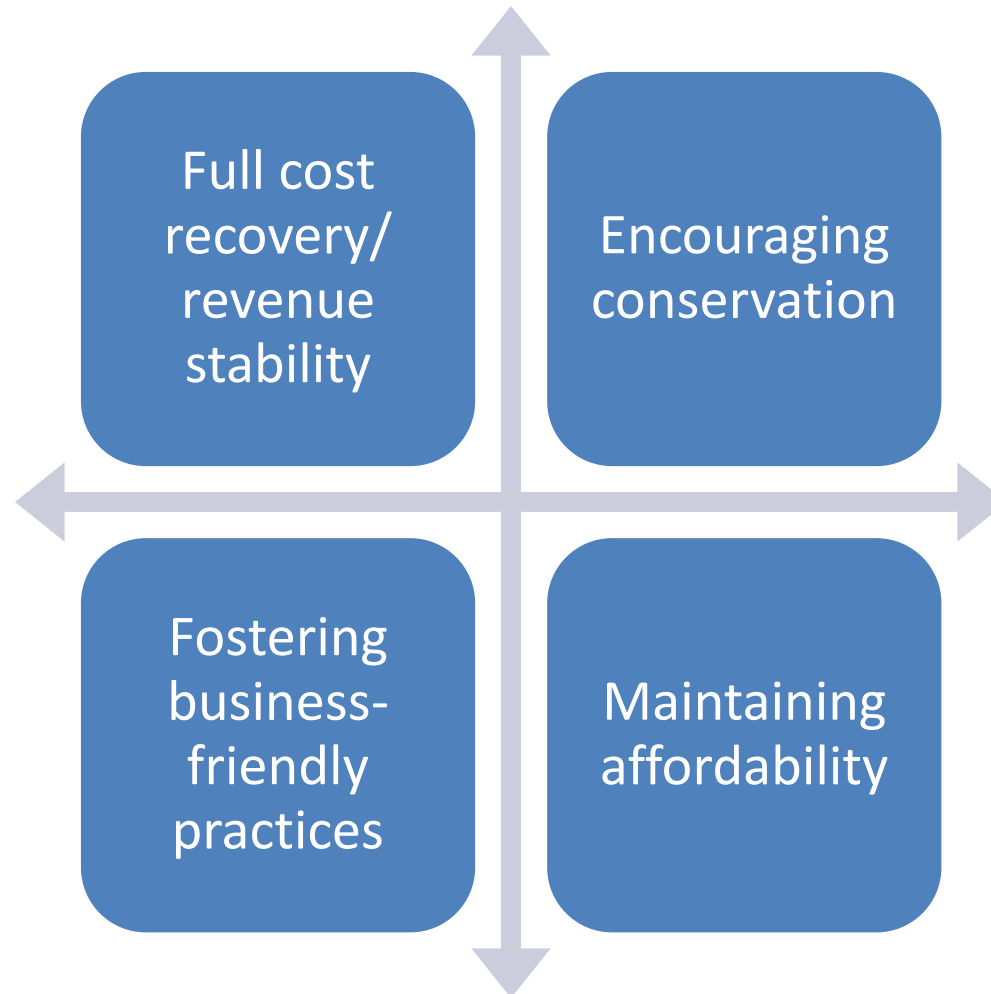
**x 1,000 =**

\$10.48

*Price per 1,000 Gallons*



# Which Rate Setting 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, featuring large pipes and valves, serving as a background for 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

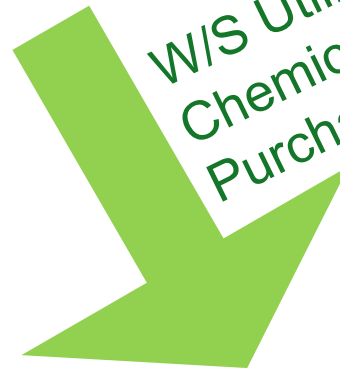
Everything else



\$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 =**

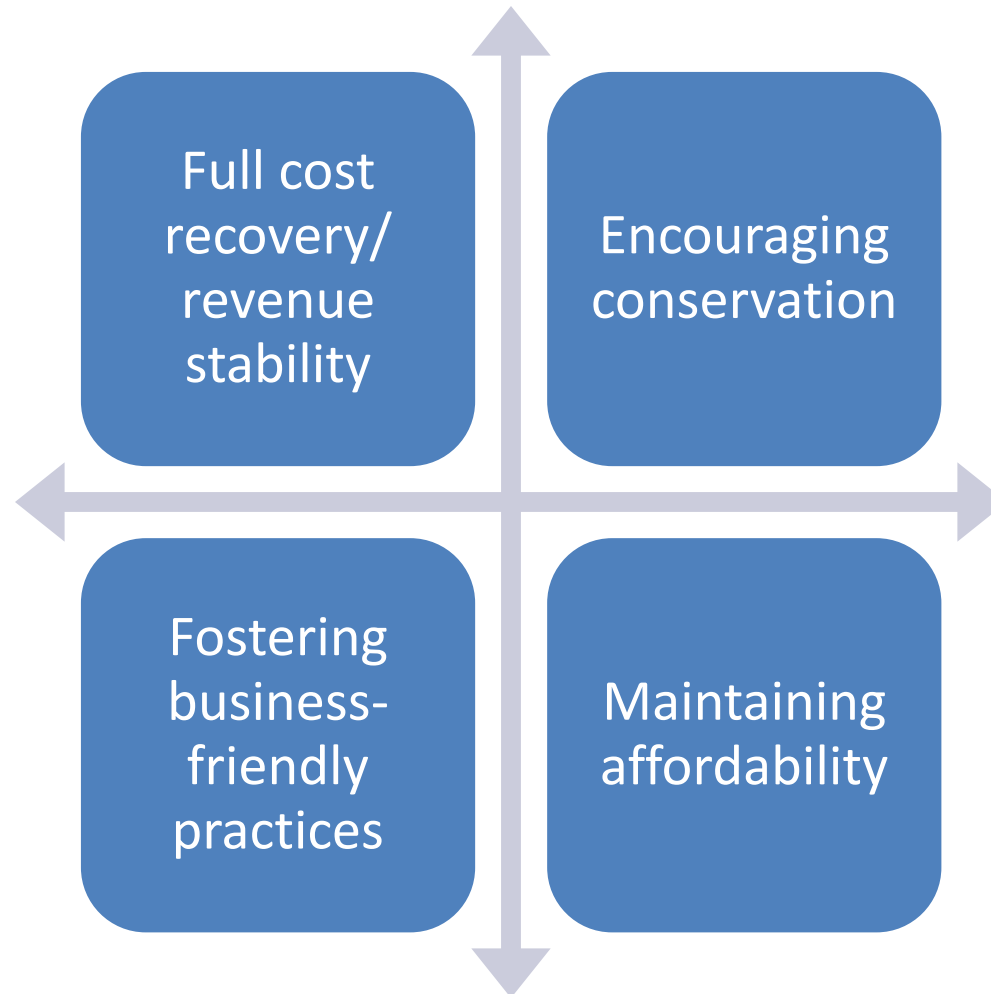
\$1.59

*Price per 1,000 Gallons*

32,877,590

*Total Gallons Sold*

# Which Rate Setting 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

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

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

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



# 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

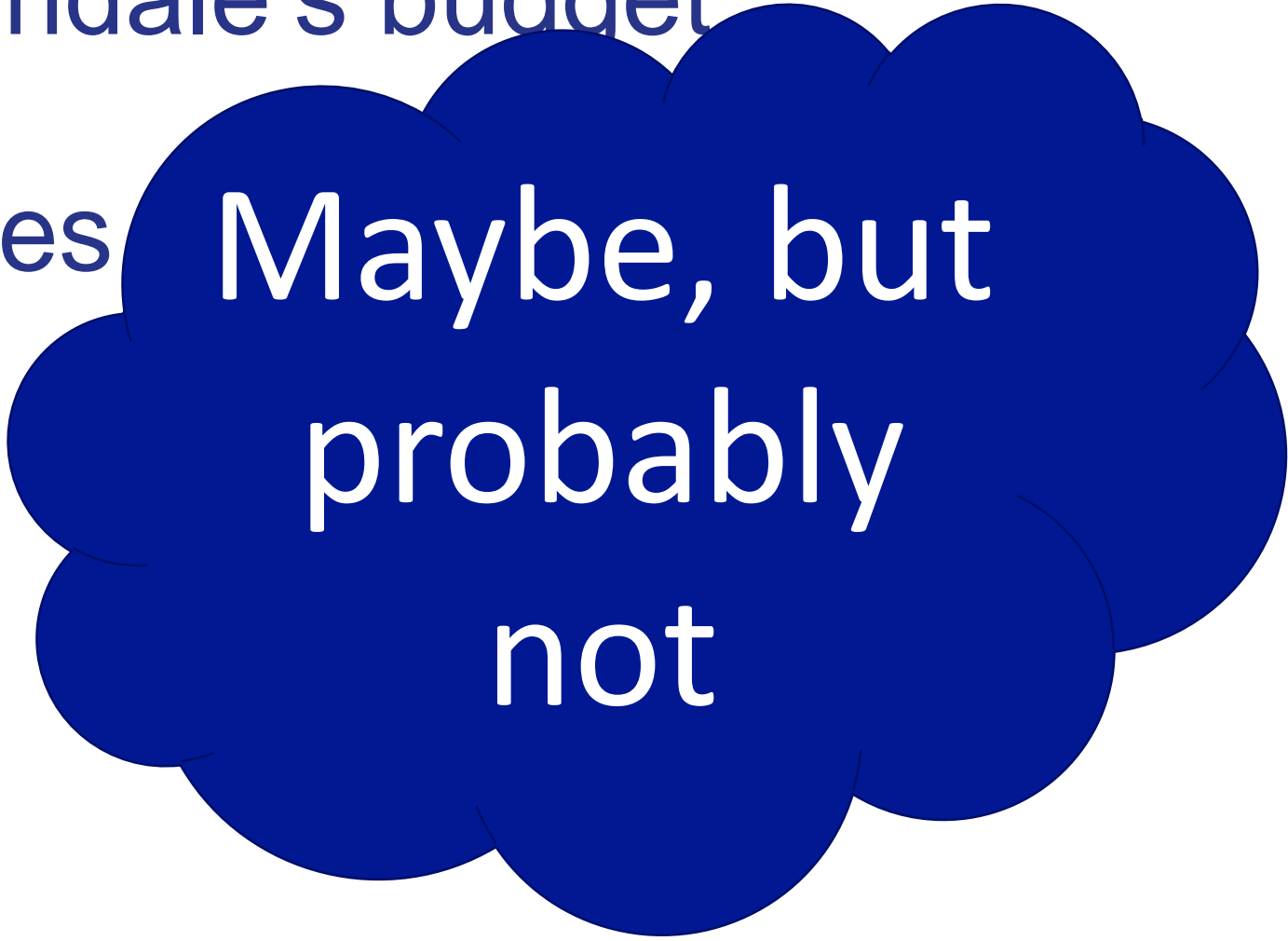


	 1,000 gallons/month	 4,000 gallons/month	 12,000 gallons/month	 34,000 gallons/month
Payment for Access (Fixed Monthly Bill)	\$63.79	\$63.79	\$63.79	\$63.79
Payment for Volume of Product Received	\$10.48	\$41.92	\$125.76	\$356.32
Base Charge for Fixed Costs; Volumetric Charge for Variable Costs	\$55.67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



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

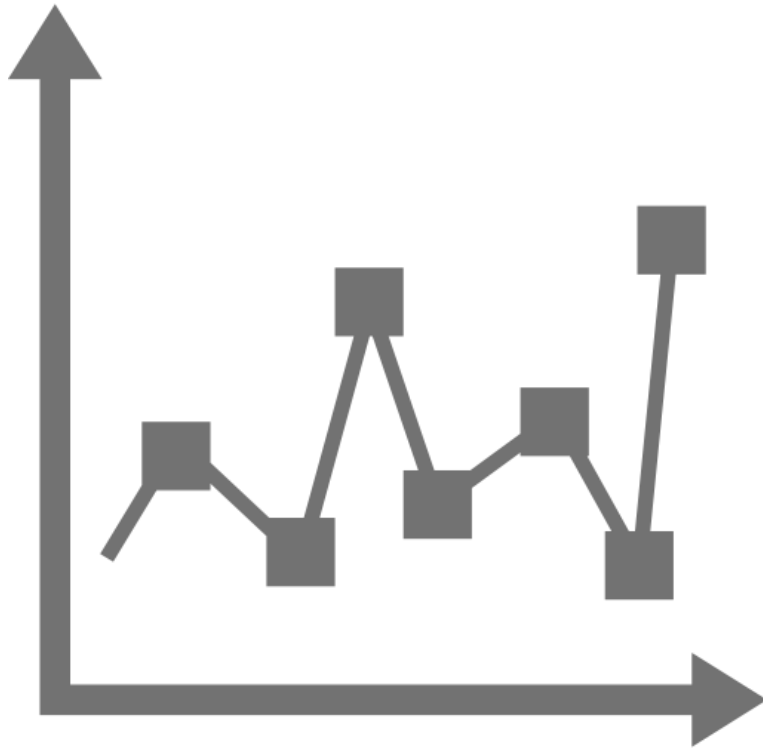


# Loss of a Big Customer



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

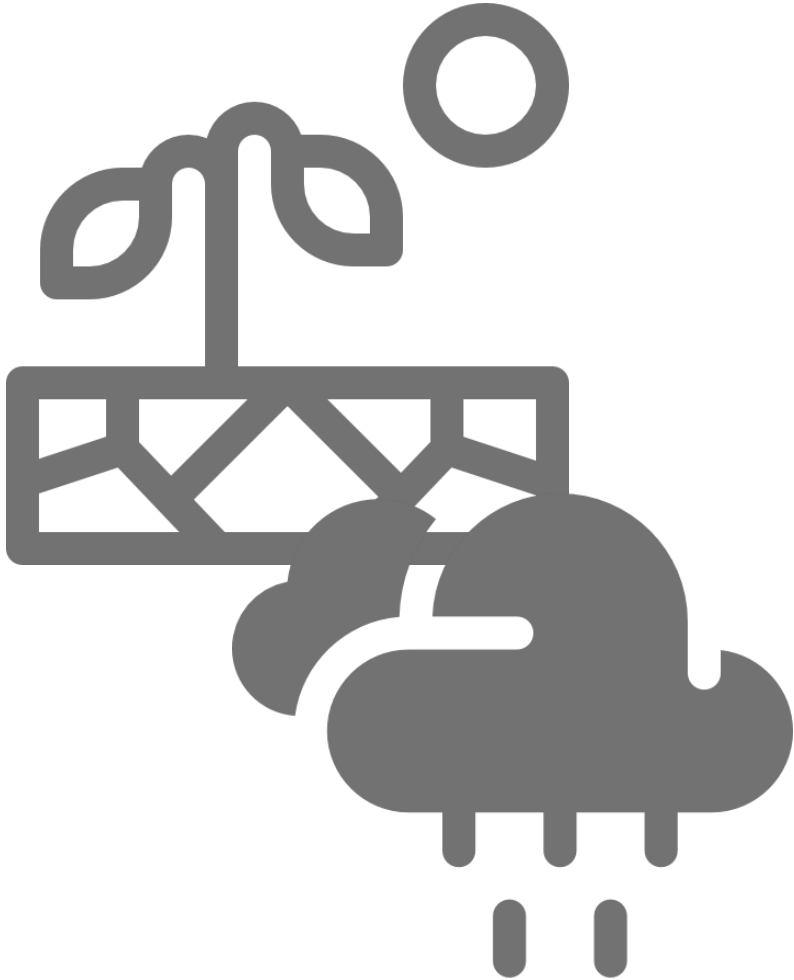


# Changes in Collection Rates



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

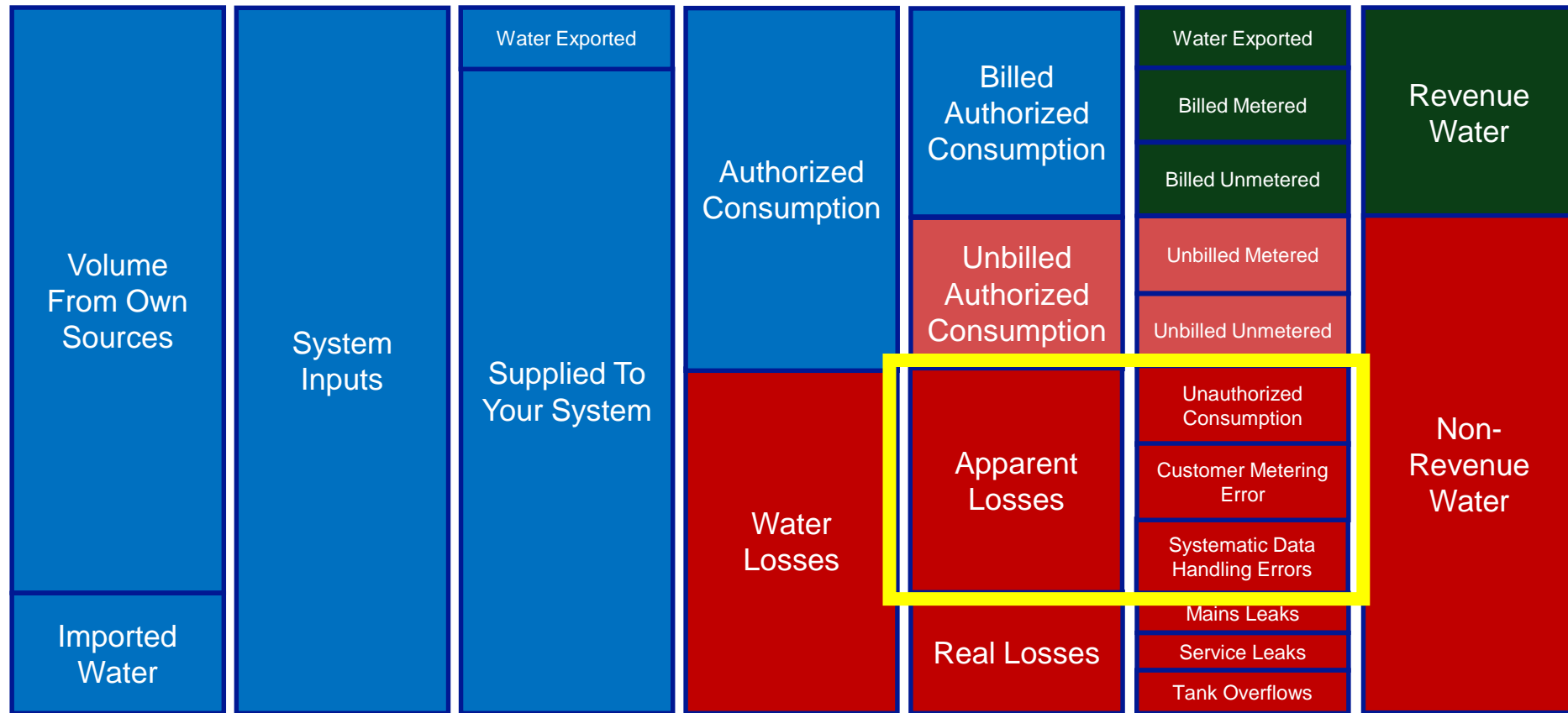
# Technology



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 large pipe or valve, serves as the background for the top portion of the slide.

# 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>



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



Division of  
WATER  
RESOURCES  
Public Water  
Supply Section

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	\$11.50	\$13.00	\$14.00	\$17.00	\$20.00	\$21.00
New	2,000	2,000	2,000	2,000	2,000	2,000

Block End:

4,000 gal/mo	\$2.78	\$2.78	\$2.78	\$3.00	\$3.50	\$4.00
7,000 gal/mo	\$4.00	\$4.50	\$5.00	\$5.50	\$6.00	\$6.50
10,000 gal/mo	\$5.00	\$5.50	\$6.00	\$6.50	\$7.00	\$7.50

Back to top

Error: missing block rates  
Error: missing block size

Debt Service and Other Known Annual Expenses for Next 20 Years

Year	2015	2016	2017	2018	2019	2020
Debt Service	\$ 2,000,000	\$ 2,000,000	\$ 2,000,000	\$ 2,000,000	\$ 2,000,000	\$ 2,000,000
Other Known Annual Expenses	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000	\$ 1,500,000
Total	\$ 3,500,000	\$ 3,500,000	\$ 3,500,000	\$ 3,500,000	\$ 3,500,000	\$ 3,500,000

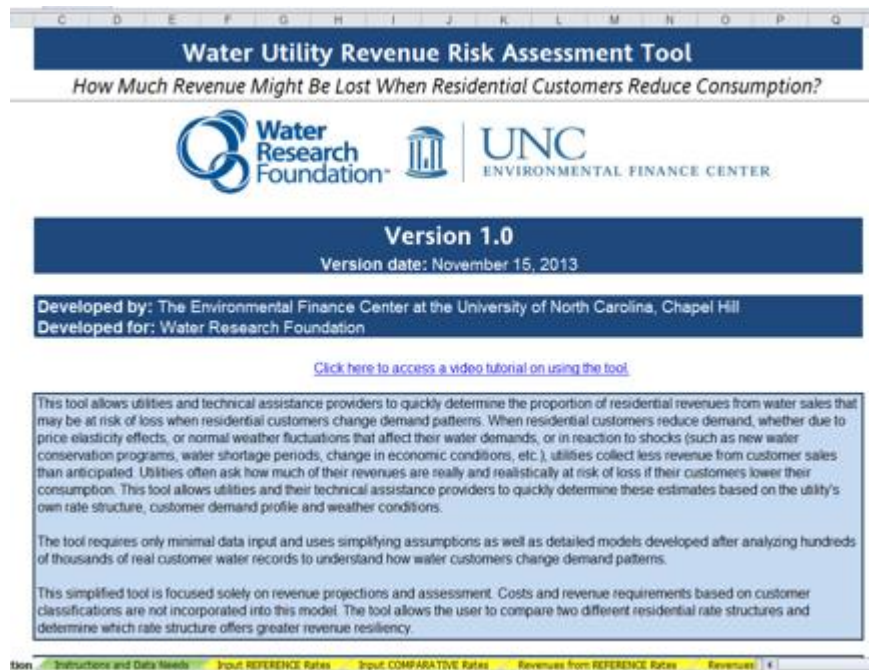
Functional Utility Expenses that Grow Every Year

Category	2015
Administrative	\$ 100,000
Capital Expenses	\$ 200,000
Construction	\$ 100,000
Engineering	\$ 100,000
General Services	\$ 100,000
Information Systems	\$ 100,000
Legal Services	\$ 100,000
Professional Services	\$ 100,000
Public Water Supply Section	\$ 100,000
Regional Sewer Authority operations & maintenance	\$ 100,000
Regional Sewer Authority capital expenses	\$ 100,000
Regional Sewer Authority debt service	\$ 100,000
Regional Sewer Authority other known annual expenses	\$ 100,000
Regional Sewer Authority total	\$ 1,000,000
Regional Sewer Authority debt service	\$ 100,000
Regional Sewer Authority other known annual expenses	\$ 100,000
Regional Sewer Authority total	\$ 1,000,000
Regional Sewer Authority debt service	\$ 100,000
Regional Sewer Authority other known annual expenses	\$ 100,000
Regional Sewer Authority total	\$ 1,000,000

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

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

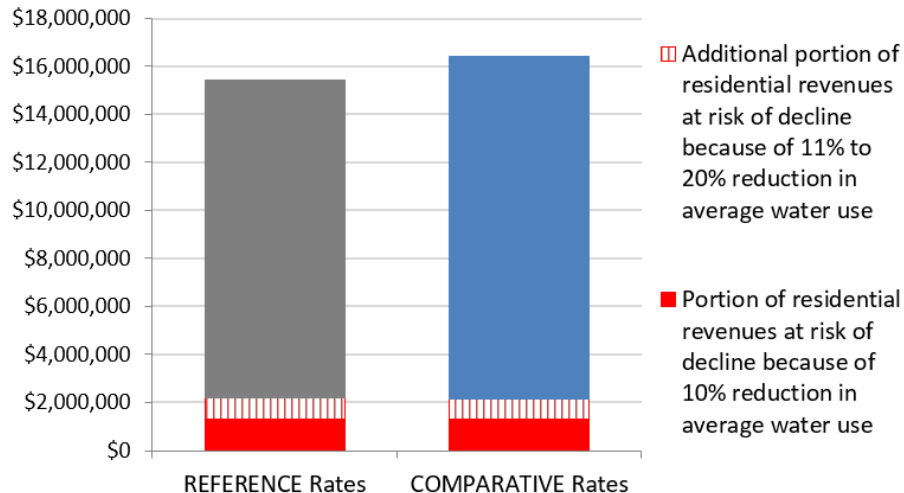
Free to download and use at  
[www.waterrf.org](http://www.waterrf.org)  
[www.efc.sog.unc.edu](http://www.efc.sog.unc.edu)

# 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.



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

**Figure 1** illustrates the effect of the COVID-19 pandemic on the relationship between customer and firm social responsibility. The figure is divided into four main sections:

- Top Left: Conceptual Model**
  - COVID-19** (represented by a virus icon) has a positive effect on **Customer Social Responsibility** (indicated by a red arrow).
  - Customer Social Responsibility** has a positive effect on **Customer Satisfaction** (indicated by a red arrow).
  - Firm Social Responsibility** has a positive effect on **Customer Satisfaction** (indicated by a red arrow).
  - Customer Social Responsibility** and **Firm Social Responsibility** have a positive interaction effect on **Customer Satisfaction** (indicated by a red arrow).
- Top Right: Regression Coefficients**

**% Change in Average and Standard Average Scores Due to Customer Size**

Customer Size	Customer Social Responsibility	Customer Satisfaction	Firm Social Responsibility
Small	0.012	0.015	0.010
Medium	0.015	0.020	0.012
Large	0.020	0.025	0.015

**affiliability index weight**

used for the primary regression analysis

divided by median

Standardized values

Legend: 0.00 (blue), 0.25 (green), 0.50 (yellow), 0.75 (orange), 1.00 (red)
- Bottom Left: Interaction Effects Heatmap**

**Interaction Effects**

Legend: 0.00 (blue), 0.25 (green), 0.50 (yellow), 0.75 (orange), 1.00 (red)
- Bottom Right: Bar Chart**

**Single-Family Customer: Net BSE Impact Weights**

Legend: 0.00 (blue), 0.25 (green), 0.50 (yellow), 0.75 (orange), 1.00 (red)



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