



Report to the Public Staff of the North Carolina Utilities Commission
and Aqua North Carolina, Inc.

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**Studies of Volumetric Wastewater Rate Structures and a Consumption Adjustment
Mechanism for Water Rates of Aqua North Carolina, Inc.**

Background and Timeline of Activities

On May 2, 2014 the North Carolina Utilities Commission (Commission) issued its Order *Granting Partial Rate Increase, Approving Rate Adjustment Mechanism, and Requiring Customer Notice* in Docket No. W-218, Sub 363. As part of this Order, the Commission required that Aqua North Carolina, Inc. (Aqua) fund two studies: one study on the replacement of flat-rate wastewater billing with rates tied to volumetric consumption, and one study on mechanisms that address the rate impact to customers and the revenue impact to Aqua from significant changes in customer water consumption patterns (a consumption adjustment mechanism). This report presents the results of both studies.

The main goal of these studies is to assess the effect on customer bills and Aqua revenues by implementing a volumetric wastewater rate structure or implementing a consumption adjustment mechanism water rate structures, relative to the status quo. This assessment is carried out in this report by simulating the alternative rate structures on existing, historic customer bills for Aqua's customers and answering the following questions:

- a) If Aqua had implemented (revenue-neutral) volumetric wastewater rates for metered water and wastewater customers in the recent past, how many customers would have had their wastewater bills increase or decrease and by how much?
- b) If Aqua had implemented volumetric wastewater rates for metered water and wastewater customers in the recent past, how would have Aqua's modeled wastewater revenues compared to their actual revenues from the status quo rates?
- c) If Aqua had implemented a consumption adjustment mechanism for its water rates in the recent past, what would have the water rates surcharge and/or credit been in the recent past, given actual changes to average water use levels?
- d) If Aqua had implemented a consumption adjustment mechanism for its water rates in the recent past, how many customers would have had their water bills increase or decrease after the application of surcharges and/or credit surcharges and by how much?
- e) If Aqua had implemented a consumption adjustment mechanism for its water rates in the recent past, how would have Aqua's modeled water revenues compared to their actual revenues from the status quo rates and to the revenues projected in the rate case that set the utility's water rates *a priori* to water consumption changes?

On June 3, 2014, the Public Staff of the North Carolina Utilities Commission (Public Staff) and Aqua met with Shadi Eskaf, Senior Project Director at the Environmental Finance Center at the UNC School of Government (EFC). At and after this meeting, the Public Staff listed a few

questions for the EFC to answer related to policy, tradeoffs, and the operations of local government water and wastewater utilities in North Carolina (see Section 1).

Since this meeting, Aqua has requested, and been granted, two extensions for this study. In the summer of 2015, the EFC and Aqua staff met and discussed data requirements for the EFC to complete the study. In July and October 2015, Aqua provided the EFC billing transaction data for all of its North Carolina water and wastewater customers. The billing data included a record for every charge and billing adjustment transaction that occurred in the past seven years. During the Fall of 2015, the EFC focused its efforts on cleaning the data. These efforts included verifying that all months of the data were included, dropping unnecessary information, and aggregating all transaction records for each customer (premise) to one record per month, accounting for all adjustments and charges.

In October and November, 2015, the EFC met with Aqua staff to ask questions about the general design of the water rate consumption adjustment mechanism in order to begin modeling the rate structure using billing data, and general questions about current wastewater rates and charges.

On December 7, 2015, the EFC met with the Public Staff and Aqua to discuss responses to some of the Public Staff's questions (see Section 1), as well as discuss the methodologies for both the study on the water rate consumption adjustment mechanism and the study of volumetric wastewater rates.

After incorporating Aqua's and the Public Staff's feedback into the analysis, the EFC met with Aqua by phone on December 16, 2015 and on January 11, 2016 to present preliminary findings on the studies of alternative water and wastewater rates, and to ask questions to fine-tune the methodology given more detailed context about Aqua's billing practices and rate structures.

On January 19, 2016, the EFC met with the Public Staff and Aqua to present preliminary findings from the wastewater volumetric rate structure study and the water rate consumption adjustment mechanism study. The methodologies and data used for each study were explained and the results of the modeling analysis shared in a presentation.

Based on feedback from the Public Staff at that meeting, the EFC revisited each study. For the study on the water rate consumption adjustment mechanism, a hypothetical scenario that would demonstrate the effects of having both surcharges and credit surcharges was asked to be included. For the study on volumetric wastewater rates, Public Staff requested that commercial customers be removed from the analysis and a cap be imposed on the volumes in the billing

data. After incorporating these requests into the analyses and updating the reports, on February 22, 2016, the EFC emailed the updated analyses to the Public Staff and Aqua.

At the January 19th meeting, both Aqua and Public Staff requested that billing data from the fourth quarter of 2015 also be included in the analyses since water consumption follows a seasonal pattern. Aqua provided the billing transaction data for those months in January 2016. In March 2016 (after the email submitted on February 22), the EFC was able to clean and include this dataset in the analysis. The report below shows the updated, final analysis that includes billing data through the end of December 2015, per Public Staff's and Aqua's request. Thus, the analysis in the report below is the same as those submitted in the February 22nd email, with the exception that both studies now include data from the October-December, 2015 period (note: the "high volume/credit surcharge analysis," however, does not use these last three months of data).

Section 1 of this report provides responses to questions posed to the EFC by the Public Staff. Section 2 describes the analysis and results of simulating the use of a water rate consumption adjustment mechanism on water billing data across the Brookwood, Fairways, and ANC rate divisions of Aqua. Section 3 of this report describes the analysis and results of simulating the use of a volumetric wastewater rate structure on wastewater billing data across the Fairways and ANC rate divisions of Aqua. Both Section 2 and Section 3 explore the modeled impact on the revenues of Aqua and on the customers' bills. At the beginning of both Section 2 and Section 3, the data, methodology, and assumptions for each analysis are described.

Section 1 - Responses to Questions from the Public Staff

Wastewater

1. *What percentage of North Carolina wastewater utilities surveyed by the UNC EFC bill volumetric wastewater, excluding those regulated by the North Carolina Utilities Commission?*

The EFC has data on the January 2015 wastewater rates charged by 392 local government utilities and 1 not-for-profit utility not regulated by the North Carolina Utilities Commission. These rates were collected from the (by then) latest annual rates survey conducted by the North Carolina League of Municipalities (NCLM) and the EFC. Of the 393 utilities with wastewater rates, 391 (99%) charged volumetric wastewater rates in January 2015.

2. *What percentage of North Carolina government systems bill volumetric wastewater based on water meter usage?*

While this information is not specifically collected in the EFC's rates survey, from the EFC's reading of the rate sheets, it seems that almost all (if not all) of the utilities with volumetric wastewater rates base the charges on the water meter usage. The EFC does not recall any utility that uses sewer meters as the primary source of information for calculating wastewater rates for residential customers. Sewer meters may be more prevalent for large/industrial customers than for residential/commercial customers, but water meter usage is the most common method of calculating wastewater volumetric rates. Many, or most, wastewater utilities specify a flat monthly wastewater charge for wastewater customers that do not have a water meter (e.g. on individual wells or purchasing water from a different utility).

3. Which North Carolina government systems bill flat-rate wastewater? What are the size of those systems? If known, what are the justifications for such rates?

The EFC provided the Public Staff and Aqua a spreadsheet file that listed all utilities' rates and rate structures and utility characteristics from the 2015 rates survey. The most up-to-date tables can be accessed and downloaded from <http://www.efc.sog.unc.edu/project/north-carolina-water-and-wastewater-rates-and-rate-structures>

Of the 393 wastewater residential rate structures studied in January 2015:

- 282 were uniform rates without a cap
- 6 were uniform rates with a cap
- 75 were increasing block rates
- 22 were decreasing block rates
- 5 were block rates that increased and decreased
- 2 were non-volumetric flat charges
- 1 had a unique tiered uniform rate structure

Note: these breakdowns may be different for non-residential rate structures, which are not included in the above counts.

Justifications for the rate structure choices are not known. The EFC & NCLM rates survey does not include questions about why utilities opted for certain types of rate structures.

4. Of the government systems that bill wastewater volumetrically:

- a) How many have caps for residential customers?

Only 6 local governments included in the 2015 rates study used caps. These utilities all have separate non-residential wastewater rates, and the caps apply *only* to their residential wastewater rates (the non-residential rates are uniform rates, without a cap).

- b) What are those caps?

Utility	Residential Sewer Cap (Monthly)
Greenville Utilities Commission	25,000 gallons
Harrisburg	12,000 gallons
Cape Fear Public Utility Authority	15,000 gallons
Charlotte Water	1,600 cubic feet (11,968 gallons)
OWASA	15,000 gallons
Union County	12,000 gallons

5. *What percentage of Aqua’s uniform rate wastewater operating systems is fixed?*

Expenses can be defined as short-term fixed costs or short-term variable costs. Short-term variable expenses are those that vary significantly from month-to-month based on the volume of wastewater collected and treated by the wastewater system during the month. Short-term fixed expenses are all other expenses, which do not vary significantly from month-to-month based on wastewater volume.

For wastewater, short-term variable expenses include at least a portion of each of the plant O&M expenses listed below, shown with the “pro forma as adjusted” total expenses in test year ending March 31, 2013 (filed in the Aqua NC General Rate Case W-218 Sub 363).

Variable Expense	Pro Forma As Adjusted Total in Test Year 2013
Purchased sewer treatment	\$195,376
Sludge removal	\$412,186
Purchased power	\$955,796
Fuel for power production	\$11,134
Chemicals	\$470,662
TOTAL	\$2,045,154

Note: a (small) portion of these expenses might actually be short-term fixed, depending on the nature of the expenses.

Total pro-forma wastewater O&M expenses + depreciation + taxes + interest in that test year = \$11,712,556

Short-term variable expenses = $\$2,045,154 / \$11,712,556 = 17\%$

Therefore, short-term fixed expenses for wastewater = 83%

Note: the percentage of fixed expenses might be slightly higher, depending on the nature of the expenses listed in the table above.

6. Which of the twelve government water utility providers for service areas in which Aqua provides wastewater service would:
- Provide Aqua monthly water readings electronically and at what cost?
 - Perform wastewater billings and collections for Aqua and at what cost?
 - What limitations would these entities have, if any, in providing the above services?

As explained in the December 2015 meeting, the EFC is unable to answer these questions with any specificity. Aqua might be in a better position to answer these questions than the EFC, given their understanding of their relationship with the local governments in question. *Generally speaking*, limitations may include:

- Entering into a contract specifying the terms and conditions of the service
- Setting and receiving compensation from Aqua for services provided by the local government
- Staffing and training required for the local government staff to be able to extract the required billing data in a format that is usable by Aqua to compute wastewater bills (the level of difficulty depends on the billing software used and expertise of the billing analysts)
- Coordination and constant (at least monthly) communication between the local government and Aqua staff
- Technological limitations and will to sharing data securely (billing data are not public records)
- Coordinating and matching premises/locations from the local government billing data with Aqua's billing data, and keeping these records updated between both parties
- Updating Aqua whenever an individual customer's water meter reading/water volume record is adjusted by the local government (e.g. for a meter reading error or due to a leak adjustment) so that Aqua could/would also adjust the corresponding wastewater bill if necessary
- Notifying Aqua if a customer's water meter set-up changes. E.g. if an irrigation meter is installed, Aqua would need to know that wastewater bills should not be charged to a specific meter but charged to the other meter(s)

7. *Is the EFC aware of any government wastewater systems in North Carolina that bill customers with private wells volumetric wastewater rates, based on measurements accomplished by water meters on the private wells?*

The EFC is not aware of any such metering arrangements. It is possible that this practice might exist and is simply not reflected in the rate sheets that are collected by the EFC as part of the rates survey. However, the EFC is not aware of any examples. Many wastewater utilities, though, specify on their rate sheet a flat non-volumetric monthly wastewater charge for wastewater customers that do not have a water meter (e.g. on individual wells).

8. *What are the respective benefits of metered and of flat-rate billing?*

Metered billing encourages customers to conserve or be more efficient in their water use by pricing their wastewater bill based on their water demand. Volumetric rates provide customers with more control over their bill by allowing them to lower their bill as they lower consumption. In a revenue-neutral pricing scenario, metered billing could lower charges for low-water using customers while raising charges for high-water using customers compared to flat-rate billing. Volumetric pricing allows the utility to charge according to changes in their short-term (variable) costs that are demand-driven; thus, during high demand months in which the utility faces higher variable costs of treatment, the utility would also be generating greater revenues from volumetric wastewater bills.

Flat-rate (flat-charge) billing is simpler to administer for the utility, and easier to budget for as a customer in terms of knowing with certainty what the wastewater charge will be every single month. Customers that have high water use (or even have a leak) will not be charged an excessively high volumetric wastewater bill. Flat-rate billing avoids the difficulty of pricing a volumetric rate, which could create problems if a portion of the customer base relies on high water use for basic needs and will therefore face high volumetric wastewater rates. Flat-rate billing provides a more predictable and stable revenue stream to the utility.

9. For North Carolina governmental utilities, what are the following charges (note: all results are from the January 2015 North Carolina rate study):

a) *Average water base charge?*

The average for all “inside” residential water rate structures (including the secondary service areas): \$15.74 per month. For “outside” residential water rate structures, the average is \$22.10 per month.

Note: The EFC usually reports only in terms of medians and percentiles since averages are often skewed by a few outliers.

b) *Median water base charge?*

The median for all “inside” residential water rate structures (including the secondary service areas): \$15.00 per month. For “outside” residential water rate structures, the median is \$21.00. Base charges are higher for smaller systems.

c) *Average wastewater base charge?*

The average for all “inside” residential wastewater structures (including the secondary service areas): \$17.78 per month. For “outside” residential wastewater rate structures, the average is \$25.70 per month.

Note: The EFC usually reports only in terms of medians and percentiles since averages are often skewed by a few outliers.

d) *Median wastewater base charge?*

The median for all “inside” residential wastewater structures (including the secondary service areas): \$16.00 per month. For “outside” residential wastewater rate structures, the median is \$24.00. Base charges are higher for smaller systems.

Many of the responses above were derived from the EFC’s 2015 rates survey. As of the time of this report, the 2016 rates survey has not been finalized. The results of the 2016 rates survey will be posted by the beginning of April at <http://www.efc.sog.unc.edu/project/north-carolina-water-and-wastewater-rates-and-rate-structures>

10. *How does customer growth on existing wastewater systems affect revenue stability?
E.g. an increase of 50 customers since the general rate case, assuming that Aqua does not pay for any system capacity expansions.*

Assuming the 50 new customers produce the same average amount of wastewater per month, contribute $50 \times 12 = 600$ new wastewater bills per year, and are all charged the \$65.07/month non-volumetric wastewater charges, Aqua would be making \$39,000 additional wastewater revenue each year, above the general rate case revenue requirement, holding all else constant.

Expenses would also rise. In the example described in the question, only short-term variable expenses would rise, plus a small portion of the fixed expenses (e.g. administrative costs for billing and collections). In Test Year 2013, according to the general rate case application, ANC Main had $2,800 + 142,377 + 12 + 3,378 + 36 + 12 + 2,028 = 150,643$ total wastewater bills throughout the year, 95% of which did not include any volumetric wastewater charges. During those 12 months, short-term variable wastewater operating expenses (pro forma estimates) = \$2,045,154. Thus, the average variable expense per bill = \$13.58. Adding a small amount for billing and collections, short-term expenses might rise by about \$16/bill, or \$9,600 per year for those 50 new customers.

However, customer growth will eventually affect all short-term costs (fixed and variable) as well as some of the long-term costs. In Test Year 2013, total short-term O&M wastewater expenses (fixed and variable) averaged \$44.61/customer bill, or \$26,750 per year for those 50 new customers.

If depreciation, taxes and interest are also factored in (longer-term costs), the Test Year 2013 total wastewater expenses averaged \$65.20/bill, canceling out the additional revenues generated from the new customers.

This analysis, however, does not consider the fact that operating expenses in the future will likely not be the same as they were in Test Year 2013. If unit costs for O&M increase (e.g. cost of chemicals and power increase, salaries increase, etc.), the future costs would be higher than the averages calculated above.

In sum: under the current rate case pricing scenario, customer growth would, in the short-term, generate net positive wastewater revenues for Aqua, although part of the increase will likely be reduced by rising O&M unit costs in the future. In the long-term, there will be no net effect on revenues and expenses, since customer growth between rate cases are accounted for in the latest rate case and the costs and revenues contributed by those 50 new customers will be

calculated and used to adjust rates in the future to compensate for their effects between rate cases.

Water

11. What percentage of Aqua’s uniform rates water system operating expenses is fixed?

Expenses can be defined as short-term fixed costs or short-term variable costs. Short-term variable expenses are those that vary significantly from month-to-month based on the volume of volume treated and delivered by the water system during the month. Short-term fixed expenses are all other expenses, which do not vary significantly from month-to-month based on water volume.

For water, short-term variable expenses include at least a portion of each of the plant O&M expenses listed below, shown with the “pro forma as adjusted” total expenses in test year ending March 31, 2013 (filed in the Aqua NC General Rate Case W-218 Sub 363).

Variable Expense	Pro Forma As Adjusted Total in Test Year 2013
Purchased water	\$1,065,987
Purchased power	\$1,861,281
Fuel for power production	\$762
Chemicals	\$324,384
TOTAL	\$3,252,414

Note: a (small) portion of these expenses might actually be short-term fixed, depending on the nature of the expenses.

Total pro-forma water O&M expenses + depreciation + taxes + interest in that test year = \$28,592,790

Short-term variable expenses = \$3,252,414 / \$28,592,790 = 11%

Therefore, short-term fixed expenses for water = 89%

Note: the percentage of fixed expenses might be slightly higher, depending on the nature of the expenses listed in the table above.

12. *What is the average change-out period for residential water meters (i.e. 10 years, 15 years, 1 million gallons, etc.) for the more professionally-operated North Carolina government water utilities, such as Raleigh, Durham, OWASA, CMUD, Fayetteville PWC, Greensboro, and Winston-Salem?*

Most of the utilities use around 15 years, although two use more than 15 years and one uses less than 15. Below are the responses provided by some of the local government utilities:

Raleigh: Our expected replacement rate is every 15 years. We are currently experiencing a failure rate of 0.6% each month, which would yield 14 years. However, we are now getting a 20 year warranty from our meter supplier and expect the replacement rate to improve over time.

Greensboro: We typically change out residential water meters every 15 years. With the new technology, if a transmitter fails we may change out sooner, but as a rule we are looking for 15 years.

Durham: Our schedule in the past has been 15 to 10 years. For larger meters, change out would be based on performance/accuracy. We conduct annual testing of 3" and greater to track accuracy; results could lead to a replacement rather than a set usage rate.

Cary: We are counting on a 17 year life for the meters we installed for AMI. Based on average use for a residential customer, that ought to be around 1,000,000 gallons (4900x12x17).

Winston-Salem/Forsyth County Utilities: Our best practice for residential meter change out is 20 years or 5 million gallons. We have a meter replacement warranty for 15 years/5 million gallons at 98.5% accurate. We choose to extend residential meter life to 20 years, which is not expected to drop below 96% accurate (0.5% per additional year).

OWASA: OWASA has temporarily suspended its meter change-out program since 2014. Prior to this (since the late 1990's), the utility was averaging a 20-year replacement cycle and "testing of removed meters indicated this interval was acceptable, meter accuracy was still excellent." In the mid 1990's, OWASA was using a 15-year cycle, and a 10-year cycle in the early 1990's.

13. How does customer growth on existing water systems affect the consumption adjustment mechanism? E.g. an increase of 50 customers since the general rate case, assuming that Aqua does not pay for any system capacity expansions.

In the current rate case pricing scenario, prices are set assuming a set number of customers (bills) and a set average water use level. If 50 new customers are added to the water system, revenues will increase in the short-term beyond what the revenue requirement of the rate case is determined to be. However, the expenses associated with these new customers will not be factored into the rates until the subsequent rate case. This is explained in more detail in question 10.

In the consumption adjustment mechanism scenario, the effect of new customers on whether or not a surcharge / credit surcharge is triggered, and how much, is dependent on the average water use of those new customers. If the 50 customers average the same water use level as the rest of Aqua's existing customer base, the trigger for activating a surcharge/credit surcharge will not be affected. If the 50 customers' average water use is closer to the test year average water use than the existing customers' average water use, the new customers will reduce the likelihood of activating a surcharge/credit surcharge next year. If, however, their average water use is farther from the test year average water use than the existing customers' average water use, the new customers will increase the likelihood of activating a surcharge/credit surcharge next year.

Because the 50 new customers will increase the total water use in a given rate year, they will effectively reduce the surcharge or credit surcharge that might be applied in the following year, compared to the scenario in which there is no customer growth. Thus, customer growth in the consumption adjustment mechanism essentially would lower the surcharge/credit surcharge amounts. Customer growth is not used in the consumption adjustment mechanism described in Section 2 of this report to calculate or change the "shortfall/surplus in rate year's volumetric revenue from revenue requirement."

Section 2 - Modeling of Consumption Adjustment Mechanism for Water Rates

Updated Analysis: March 4, 2016

Notes:

- Analysis includes only metered water customers of Aqua North Carolina.
- Analysis is on water billing data from October 2011 – December 2015.
- Residential and non-residential customers are included.
- All WISC charges are excluded from the billing data and analysis. Analysis only includes charges to customers set by the rates of Aqua, not the WISC pass-through charges.
- The volumetric rates applied to purchase systems are blended with the standard volumetric rates to produce a single volume-weighted average “blended” rate for analysis (see table below)
- Methodology applies for each rate division separately: ANC, Fairways, Brookwood.
- Calendar Year (CY) is January through December.
- Rate Year (RY) is October through September. E.g. RY2013 is October 2012 – September 2013.
- The methodology assumes no price elasticity.
- The methodology does not adjust revenue requirements, revenues, or triggers based on growth. Trigger is based on average water use, not total revenues.

The following revenue requirements and test year average water use were determined from Aqua's previous two rate cases, and used in our models:

Rate Division	Period	Test Year Blended Volumetric Rate (\$/1000 gallons)	Revenue Requirement from Metered Accounts	Test Year Average Water Use (gallons/month)	Test Year # of Metered Accounts
Aqua North Carolina (ANC)	Sept 2011-April 2014	\$4.95	\$28,658,383	5,639	53,146
Brookwood	Sept 2011-April 2014	\$2.26	\$4,604,742	6,104	13,869
Fairways	Sept 2011-April 2014	\$1.68	\$924,229	7,994	3,431

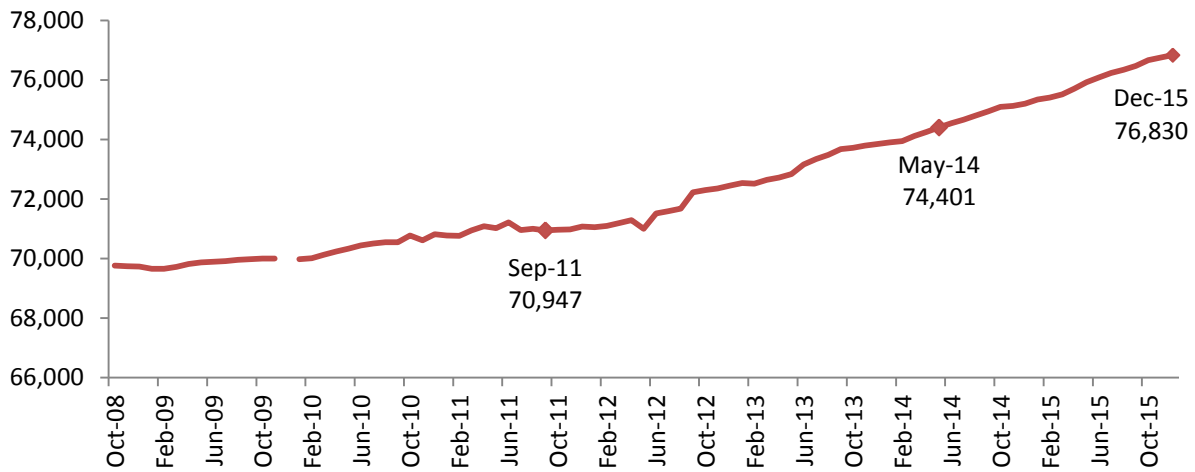
Rate Division	Period	Test Year Blended Volumetric Rate (\$/1000 gallons)	Revenue Requirement from Metered Accounts	Test Year Average Water Use (gallons/month)	Test Year # of Metered Accounts
Aqua North Carolina (ANC)	May 2014 onwards	\$5.32	\$31,003,181	5,170	56,670
Brookwood	May 2014 onwards	\$2.89	\$4,981,361	5,817	13,651
Fairways	May 2014 onwards	\$1.43	\$874,312	7,655	3,684

For rate year 2014, we use the weighted average of test year volumetric rate, revenue requirement, test year water use, and test year number of metered accounts to account for 7 months of the older rate case values and 5 months of the newer rate case values. We use the following values in rate year 2014:

- ANC: \$5.10/1000 gallons; \$29,635,382; 5,444 gallons/month; 54,614 accounts
- Brookwood: \$2.52/1000 gallons; \$ 4,761,667; 5,984 gallons/month; 13,778 accounts
- Fairways: \$1.58/1000 gallons; \$ 903,430; 7,853 gallons/month; 3,536 accounts

Basic Statistics on Number of Metered Water Accounts

Number of metered water accounts, across all systems



Customer Class	Number of metered water accounts in August 2015	Percent
COMMERCIAL/WATER	1,743	2%
RESIDENTIAL/WATER	74,601	98%
Total	76,344	100%

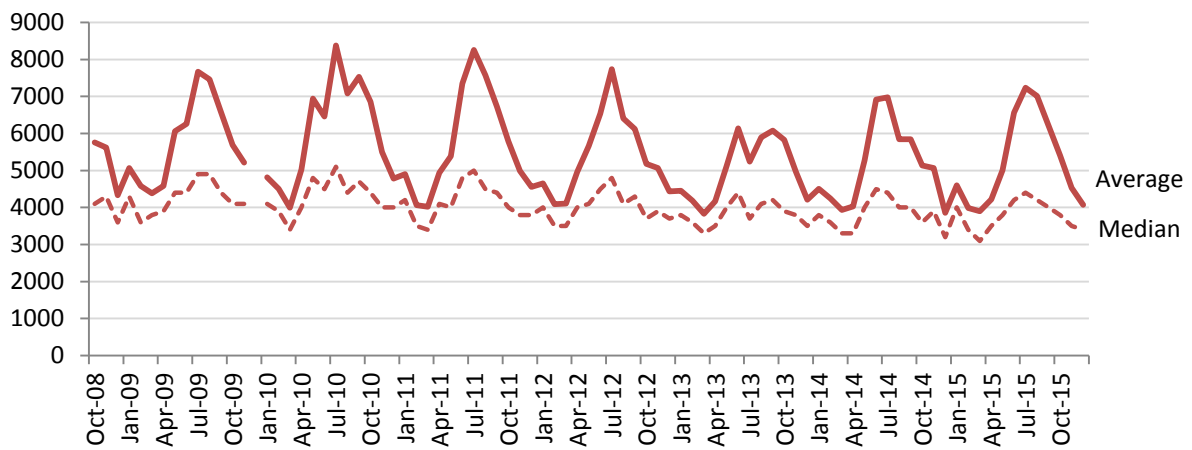
Meter Size	Number of metered water accounts in August 2015	Percent
0.625	12,383	16%
0.75	63,405	83%
1	420	0.55%
1.5	30	0.04%
2	90	0.12%
3	8	0.01%
4	7	0.01%
6	1	<0.01%

There were an additional 290 unmetered accounts, but these are excluded from the analysis

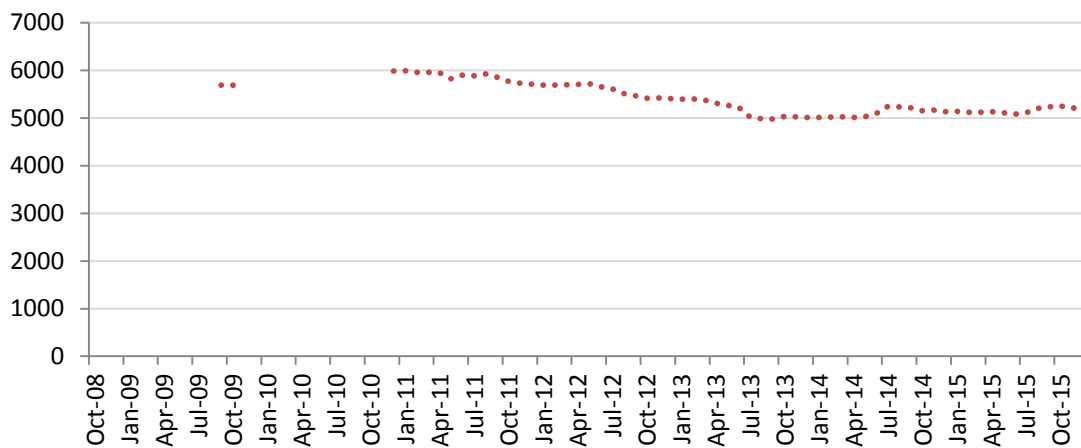
Rate Division	Number of metered water accounts in August 2015	Percent
ANC	58,715	77%
Brookwood	13,684	18%
Fairways	3,945	5%
Total	76,344	100%

Basic Statistics on Customer Water Use

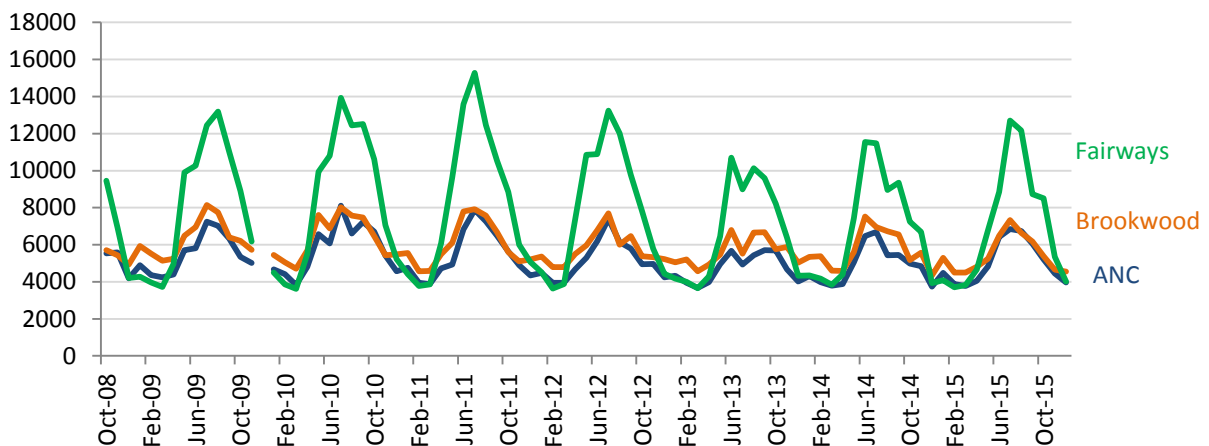
Per account water use, across all systems (gallons/month)



12-month rolling average of per account water use, across all systems



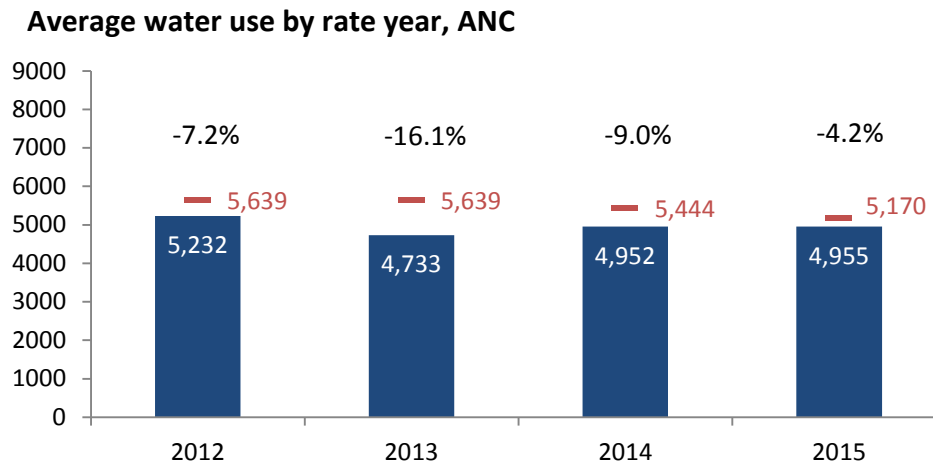
Average water use, by rate division (gallons/month)



METHOD: How the surcharge/credit surcharge is modeled:

- 1) At the end of a rate year (end of September), calculate the average water use in the rate year.
- 2) Compare the rate year average use to the test year average use.
 - a. If the difference is within $\pm 1\%$, no surcharge or credit surcharge is applied in the next year. Return to Step 1 in the next rate year.
 - b. If the difference is $>+1\%$, a credit surcharge may apply in the following calendar year (Jan-Dec).
 - c. If the difference is $<-1\%$, a surcharge may apply in the following calendar year (Jan-Dec).
- 3) If a surcharge or credit surcharge is triggered in step 2, it is calculated as follows (see ANC, Fairways and Brookwood results for examples):
 - a. The difference between the test year average use and actual rate year average use is calculated in 1,000s of gallons. This is called “delta average use”.
 - b. The delta average use is multiplied by 12 months and by the test year number of metered accounts. This calculates the “delta total yearly use from test year”.
 - c. The delta total yearly use from the test year is multiplied by the blended volumetric rate set in the rate case. This calculates the “shortfall/surplus in rate year’s volumetric revenue from revenue requirement.” This is how much the utility will try to generate or give back in surcharges or credit surcharges.
 - i. Note: if a surcharge was applied in this rate year, then the shortfall/surplus in rate year’s volumetric revenue from revenue requirement is decreased by the “surplus” (or increased by the “consequential shortfall”) that is calculated in ‘f’ below. This prevents the utility from generating excessive surpluses or not making up their shortfalls if water use increases or decreases from a prior rate year, respectively.
 - d. The surcharge or credit surcharge is calculated by dividing the net shortfall/surplus in rate year’s volumetric revenue from revenue requirement by the total water use in the rate year.
 - e. The surcharge or credit surcharge applies in the next calendar year (Jan-Dec). In that calendar year, all existing surcharges and credit surcharges are nullified and replaced by the new surcharge or credit surcharge calculated in the previous step.
 - f. The revenues generated/returned from the surcharge/credit surcharge in the next rate year is calculated by multiplying the surcharge/credit surcharge (\$/1000 gallons) by the total water use in the next rate year. If this value is greater than the net shortfall that it was compensating for, the difference is called a “surplus” and deducted from next rate year’s shortfall amount (if applicable) as shown in c.
- 4) Repeat Step 1, using the next rate year. This methodology allows for a multi-year surcharge/credit surcharge modeling to occur.

Modeling surcharges/credit surcharges for ANC



The Consumption Adjustment Mechanism would have been triggered every year because average water use was more than 1% lower than the test year water use in each rate year.

Rate Year 2012 (October 2011 – September 2012):

- Test year average water use: 5,639 gallons/month.
- Rate year average water use: 5,232 gallons/month.
- Delta average use: 407 gallons/month, or -7.2%. Therefore, a surcharge is triggered for CY2013.
- Delta total yearly water use from test year = 407 gallons/month * 12 months * 53,146 test year accounts = 259,883 thousand gallons
- Blended volumetric rate set by the rate case: \$4.95/1000 gallons
- Shortfall in rate year's volumetric revenue from revenue requirement = 259,883 * \$4.95 = \$1,286,419
- Rate year total water use = 3,393,356 thousand gallons
- Revenues generated by the surcharge in rate year 2012: \$0 (no surcharge in this first year)
- The surplus/shortfall from surcharges = \$0 (no surcharge in this first year)
- Net shortfall used to determine next surcharge = \$1,286,419 – \$0 = \$1,286,419
- Computed volumetric surcharge for CY2013 = \$1,286,419 / 3,393,356 thousand gallons = \$0.37/1000 gallons
- Blended volumetric water rate in CY2013 = \$4.95 + \$0.37 = \$5.32/1,000 gallons. Base charges are not affected.

Practically, the surcharge would be applied January-December 2013. What are the effects in CY2013?

- Average bill goes up from \$40.81 to \$42.57: a \$1.76/month increase or 4.3% increase from original rates.
- Calendar Year 2013 revenue without surcharge: \$27,353,826
- Calendar Year 2013 revenue with surcharge: \$28,531,848 (all 12 months surcharged)
- Calendar Year 2013 revenue requirement: \$28,658,383 plus growth

Rate Year 2013 (October 2012 – September 2013):

- Test year average water use: 5,639 gallons/month.
- Rate year average water use: 4,733 gallons/month.
- Delta average use: 906 gallons/month, or -16.1%. Therefore, a surcharge is triggered for CY2014.
- Delta total yearly water use from test year = 906 gallons/month * 12 months * 53,146 test year accounts = 577,703 thousand gallons
- Blended volumetric rate set by the rate case: \$4.95/1000 gallons
- Shortfall in rate year's volumetric revenue from revenue requirement = 577,703 * 4.95 = \$2,859,631
- Rate year total water use = 3,152,916 thousand gallons
- Revenues generated by the surcharge in rate year 2013 (assuming the surcharge applied to all volume from Oct 2012 through Sept 2013, even though surcharge only starts in the beginning of the calendar year) = \$0.37/1000 gallons * 3,152,916 thousand gallons = \$1,166,579
- Because the revenues generated by the surcharge were less than the shortfall it was making up in rate year 2012, the consequential shortfall from surcharges = \$1,286,419 - \$1,166,579 = \$119,840
- Net shortfall used to determine next surcharge = \$2,859,631 + \$119,840 = \$2,979,471
- Computed volumetric surcharge for CY2014 = \$2,979,471 / 3,152,916 thousand gallons = \$0.94/1000 gallons
- Blended volumetric water rate in CY2014 = \$5.20 (weighted average rate) + \$0.94 = \$6.14/1,000 gallons (weighted average rate). Base charges are not affected.

Practically, the surcharge would be applied January-December 2014. What are the effects in CY2014?

- Average bill goes up from \$43.26 to \$47.85: a \$4.59/month increase or 10.6% increase from original rates.
- Calendar Year 2014 revenue without surcharge: \$29,682,294
- Calendar Year 2014 revenue with surcharge: \$32,832,436 (all 12 months surcharged)
- Calendar Year 2014 revenue requirement: \$30,221,582 (weighted average) plus growth

Rate Year 2014 (October 2013 – September 2014):

- Test year average water use: 5,444 gallons/month (7 months @ 5,639 and 5 months @ 5,170)
- Rate year average water use: 4,952 gallons/month.
- Delta average use: 492 gallons/month, or -9.0%. Therefore, a surcharge is triggered for CY2015.
- Delta total yearly water use from test year = 492 gallons/month * 12 months * 54,614 weighted average test year accounts = 322,422 thousand gallons
- Blended volumetric rate set by the rate case: \$5.10/1000 gallons (7 months @ \$4.95 and 5 months @ \$5.32)

- Shortfall in rate year's volumetric revenue from revenue requirement = $322,422 * 5.10 = \$1,645,694$
- Rate year total water use = 3,378,084 thousand gallons
- Revenues generated by the surcharge in rate year 2014 (assuming the surcharge applied to all volume from Oct 2013 through Sept 2014, even though surcharge only starts in the beginning of the calendar year) = $\$0.94/1000 \text{ gallons} * 3,378,084 \text{ thousand gallons} = \$3,175,399$
- Because the revenues generated by the surcharge EXCEEDED the shortfall it was making up in rate year 2013, a portion of it will be deducted from the shortfall this year. The surplus from surcharges = $\$3,175,399 - 2,979,471 = \$195,928$
- Net shortfall used to determine next surcharge = $\$1,645,694 - \$195,928 = \$1,449,766$
- Computed volumetric surcharge for CY2015 = $\$1,449,766 / 3,378,084 \text{ thousand gallons} = \$0.42/1000 \text{ gallons}$
- Blended volumetric water rate in CY2015 = $\$5.32 + \$0.42 = \$5.74/1,000 \text{ gallons}$. Base charges are not affected.

Practically, the surcharge would be applied January-December 2015. What are the effects in CY2015?

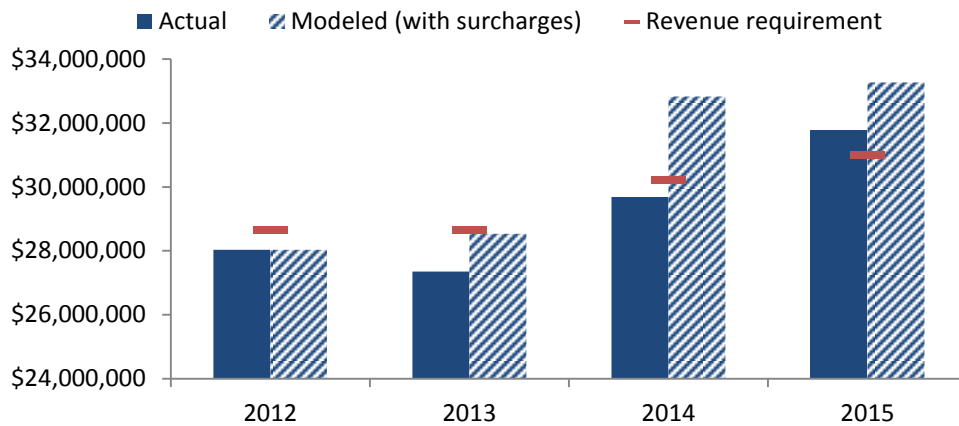
- Average bill goes up from \$45.24 to \$47.36: a \$2.12/month increase or 4.7% increase from original rates.
- Calendar Year 2015 revenue without surcharge: \$31,773,146
- Calendar Year 2015 revenue with surcharge: \$33,266,340
- Calendar Year 2015 revenue requirement: \$31,003,181 plus growth.

Rate Year 2015 (October 2014 – September 2015):

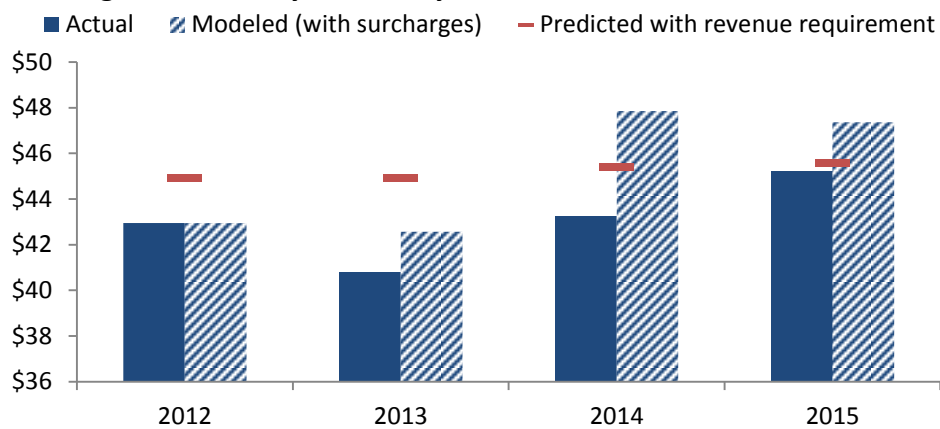
- Test year average water use: 5,170 gallons/month
- Rate year average water use: 4,955 gallons/month.
- Delta average use: 215 gallons/month, or -4.2%. Therefore, a surcharge is triggered for CY2016.
- Delta total yearly water use from test year = $215 \text{ gallons/month} * 12 \text{ months} * 56,670 \text{ test year accounts} = 146,209 \text{ thousand gallons}$
- Blended volumetric rate set by the rate case: $\$5.32/1000 \text{ gallons}$
- Shortfall in rate year's volumetric revenue from revenue requirement = $146,209 * 5.32 = \$777,830$
- Rate year total water use = 4,338,163 thousand gallons
- Revenues generated by the surcharge in rate year 2015 (assuming the surcharge applied to all volume from Oct 2014 through Sept 2015, even though surcharge only starts in the beginning of the calendar year) = $\$0.42/1000 \text{ gallons} * 4,338,163 \text{ thousand gallons} = \$1,822,029$
- Because the revenues generated by the surcharge EXCEEDED the shortfall it was making up in rate year 2014, a portion of it will be deducted from the shortfall this year. The surplus from surcharges = $\$1,822,029 - \$1,449,766 = \$372,263$
- Net shortfall used to determine next surcharge = $\$777,830 - 372,263 = \$405,567$

- Computed volumetric surcharge for CY2016 = $\$405,567 / 4,338,163$ thousand gallons = $\$0.09/1000$ gallons
- Blended volumetric water rate in CY2016 = $\$5.32 + \$0.09 = \$5.41/1,000$ gallons. Base charges are not affected.

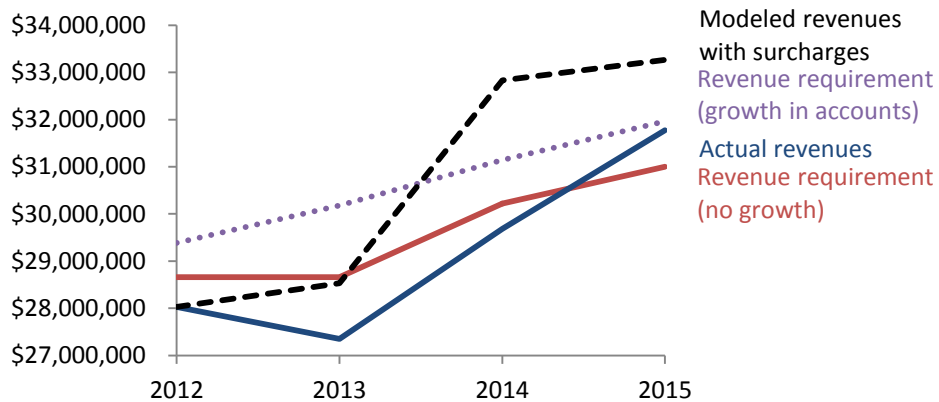
Metered water revenues by calendar year, ANC



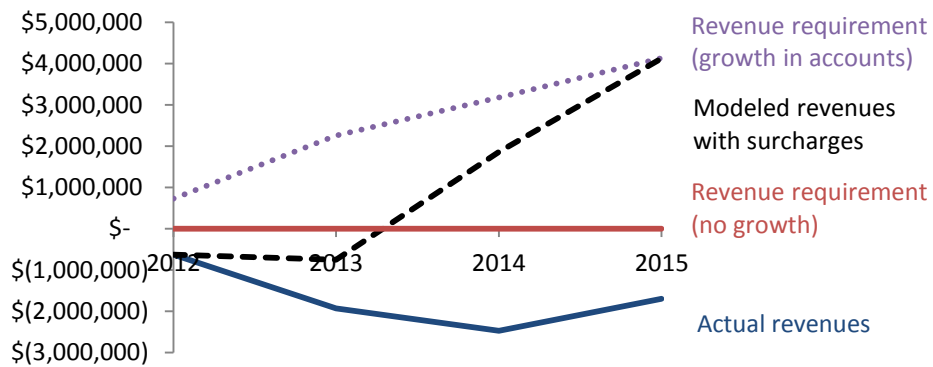
Average water bill by calendar year, ANC



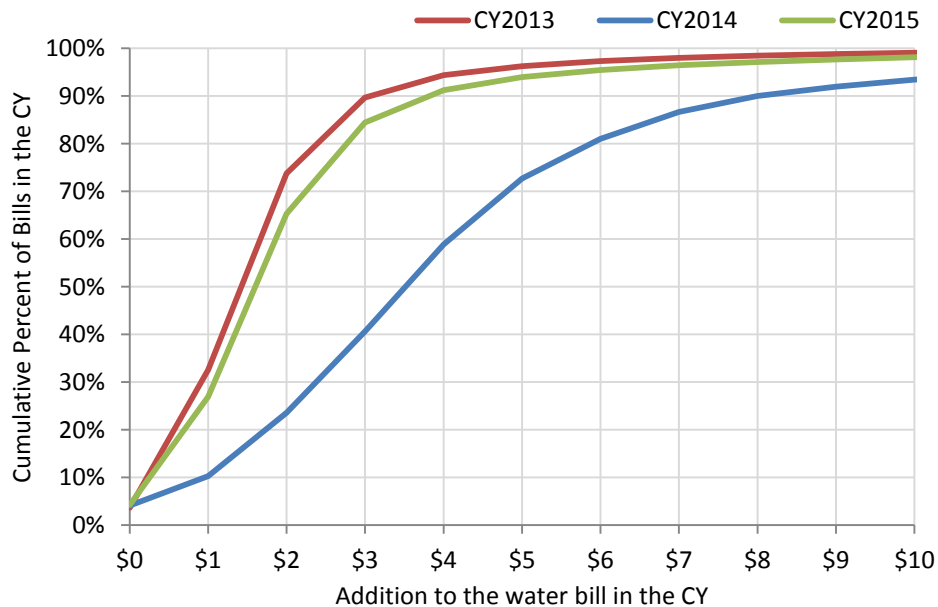
Revenues and expectations by calendar year, ANC



Cumulative difference from revenue requirement (no growth), ANC

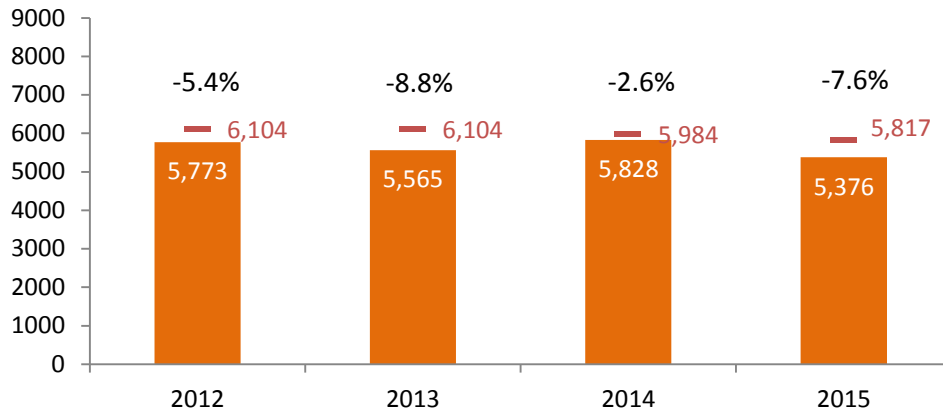


Changes to water bills with surcharges, ANC - Method 1



Modeling surcharges/credit surcharges for Brookwood

Average water use by rate year, Brookwood



The Consumption Adjustment Mechanism would have been triggered every year because average water use was more than 1% lower than the test year water use in each rate year.

Rate Year 2012 (October 2011 – September 2012):

- Test year average water use: 6,104 gallons/month.
- Rate year average water use: 5,773 gallons/month.
- Delta average use: 331 gallons/month, or -5.4%. Therefore, a surcharge is triggered for CY2013.
- Delta total yearly water use from test year = 331 gallons/month * 12 months * 13,869 test year accounts = 55,087 thousand gallons
- Blended volumetric rate set by the rate case: \$2.26/1000 gallons
- Shortfall in rate year's volumetric revenue from revenue requirement = 55,087 * 2.26 = \$124,495
- Rate year total water use = 953,764 thousand gallons
- Revenues generated by the surcharge in rate year 2012: \$0 (no surcharge in this first year)
- The surplus from surcharges = \$0 (no surcharge in this first year)
- Net shortfall used to determine next surcharge = \$124,495 – \$0 = \$124,495
- Computed volumetric surcharge for CY2013 = \$124,495 / 953,764 thousand gallons = \$0.13/1000 gallons
- Blended volumetric water rate in CY2013 = \$2.26 + \$0.13 = \$2.39/1,000 gallons. Base charges are not affected.

Practically, the surcharge would be applied January-December 2013. What are the effects in CY2013?

- Average bill goes up from \$26.35 to \$27.08: a \$0.73/month increase or 2.8% increase from original rates.
- Calendar Year 2013 revenue without surcharge: \$4,329,877
- Calendar Year 2013 revenue with surcharge: \$ 4,450,118 (all 12 months surcharged)
- Calendar Year 2013 revenue requirement: \$4,604,742 plus growth

Rate Year 2013 (October 2012 – September 2013):

- Test year average water use: 6,104 gallons/month.
- Rate year average water use: 5,565 gallons/month.
- Delta average use: 539 gallons/month, or -8.8%. Therefore, a surcharge is triggered for CY2014.
- Delta total yearly water use from test year = 539 gallons/month * 12 months * 13,869 test year accounts = 89,771 thousand gallons
- Blended volumetric rate set by the rate case: \$2.26/1000 gallons
- Shortfall in rate year's volumetric revenue from revenue requirement = 89,771 * 2.26 = \$202,882
- Rate year total water use = 916,140 thousand gallons
- Revenues generated by the surcharge in rate year 2013 (assuming the surcharge applied to all volume from Oct 2012 through Sept 2013, even though surcharge only starts in the beginning of the calendar year) = \$0.13/1000 gallons * 916,140 thousand gallons = \$119,098
- Because the revenues generated by the surcharge were less than the shortfall it was making up in rate year 2012, the consequential shortfall is to be made up = \$124,495 - \$119,098 = \$5,397
- Net shortfall used to determine next surcharge = \$202,882 + \$5,397 = \$208,279
- Computed volumetric surcharge for CY2014 = \$208,279 / 916,140 thousand gallons = \$0.22/1000 gallons
- Blended volumetric water rate in CY2014 = \$2.68 (weighted average rate) + \$0.22 = \$2.90/1,000 gallons (weighted average rate). Base charges are not affected.

Practically, the surcharge would be applied January-December 2014. What are the effects in CY2014?

- Average bill goes up from \$28.78 to \$30.03: a \$1.25/month increase or 4.4% increase from original rates.
- Calendar Year 2014 revenue without surcharge: \$4,699,158
- Calendar Year 2014 revenue with surcharge: \$4,903,718 (all 12 months surcharged)
- Calendar Year 2014 revenue requirement: \$4,855,821 (weighted average) plus growth

Rate Year 2014 (October 2013 – September 2014):

- Test year average water use: 5,984 gallons/month (7 months @ 6,104 and 5 months @ 5,817)
- Rate year average water use: 5,828 gallons/month.
- Delta average use: 157 gallons/month, or -2.6%. Therefore, a surcharge is triggered for CY2015.
- Delta total yearly water use from test year = 157 gallons/month * 12 months * 13,778 weighted average test year accounts = 25,911 thousand gallons
- Blended volumetric rate set by the rate case: \$2.52/1000 gallons (7 months @ \$2.26 and 5 months @ \$2.89)
- Shortfall in rate year's volumetric revenue from revenue requirement = 25,911 * 2.52 = \$65,361
- Rate year total water use = 953,159 thousand gallons

- Revenues generated by the surcharge in rate year 2014 (assuming the surcharge applied to all volume from Oct 2013 through Sept 2014, even though surcharge only starts in the beginning of the calendar year) = $\$0.22/1000 \text{ gallons} * 953,159 \text{ thousand gallons} = \$209,695$
- Because the revenues generated by the surcharge EXCEEDED the shortfall it was making up in rate year 2013, a portion of it will be deducted from the shortfall this year. The surplus from surcharges = $\$209,695 - \$208,279 = \$1,416$
- Net shortfall used to determine next surcharge = $\$65,361 - \$1,416 = \$63,945$
- Computed volumetric surcharge for CY2015 = $\$63,945 / 953,159 \text{ thousand gallons} = \$0.06/1000 \text{ gallons}$
- Blended volumetric water rate in CY2015 = $\$2.89 + \$0.06 = \$2.95/1,000 \text{ gallons}$. Base charges are not affected.

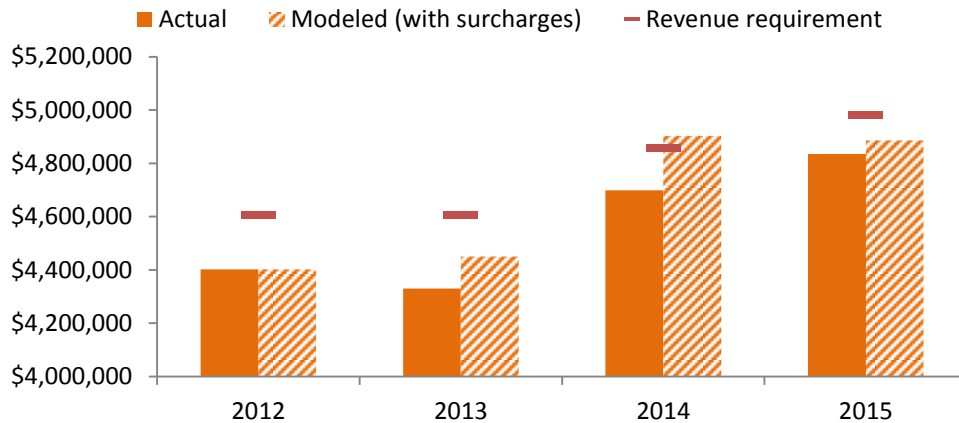
Practically, the surcharge would be applied January-December 2015. What are the effects in CY2015?

- Average bill goes up from \$29.51 to \$29.84: a \$0.33/month increase or 1.1% increase from original rates.
- Calendar Year 2015 revenue without surcharge: \$4,833,117
- Calendar Year 2015 revenue with surcharge: \$4,886,800
- Calendar Year 2015 revenue requirement: \$4,981,361 plus growth

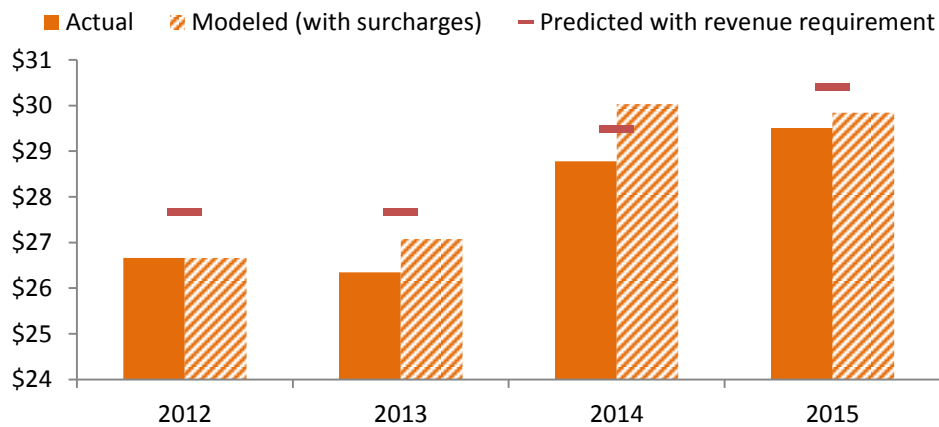
Rate Year 2015 (October 2014 – September 2015):

- Test year average water use: 5,817 gallons/month
- Rate year average water use: 5,376 gallons/month.
- Delta average use: 441 gallons/month, or -7.6%. Therefore, a surcharge is triggered for CY2016.
- Delta total yearly water use from test year = $441 \text{ gallons/month} * 12 \text{ months} * 13,651 \text{ test year accounts} = 72,241 \text{ thousand gallons}$
- Blended volumetric rate set by the rate case: $\$2.89/1000 \text{ gallons}$
- Shortfall in rate year's volumetric revenue from revenue requirement = $72,241 * 2.89 = \$208,777$
- Rate year total water use = 1,099,360 thousand gallons
- Revenues generated by the surcharge in rate year 2015 (assuming the surcharge applied to all volume from Oct 2014 through Sept 2015, even though surcharge only starts in the beginning of the calendar year) = $\$0.06/1000 \text{ gallons} * 1,099,360 \text{ thousand gallons} = \$65,962$
- Because the revenues generated by the surcharge were more than the shortfall it was making up in rate year 2014, the consequential surplus to refund is= $\$65,962 - 63,944 = \$2,017$
- Net shortfall used to determine next surcharge = $\$208,777 - 2,017 = \$206,760$
- Computed volumetric surcharge for CY2016 = $\$206,760 / 1,099,360 \text{ thousand gallons} = \$0.18/1000 \text{ gallons}$
- Blended volumetric water rate in CY2016 = $\$2.89 + \$0.18 = \$3.07/1,000 \text{ gallons}$. Base charges are not affected.

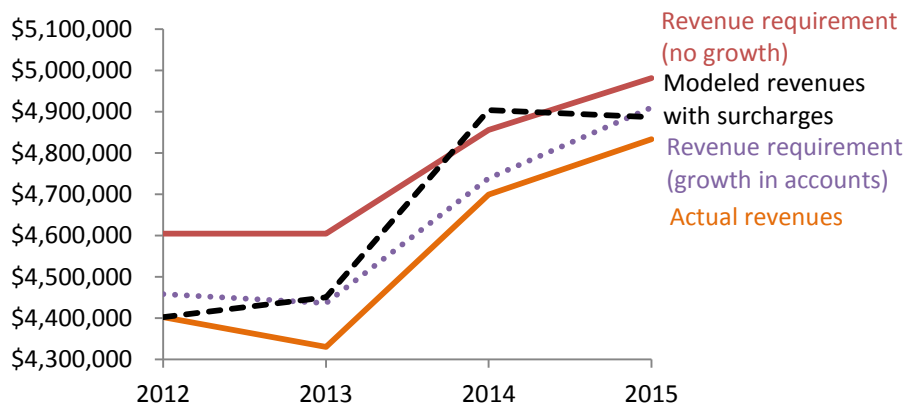
Metered water revenues by calendar year, Brookwood



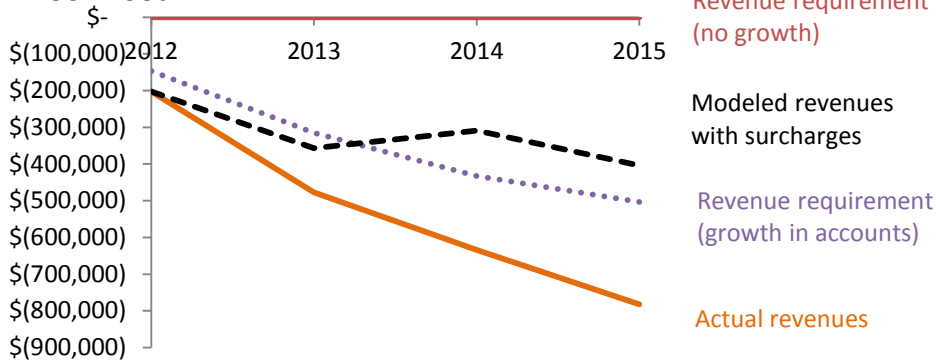
Average water bill by calendar year, Brookwood



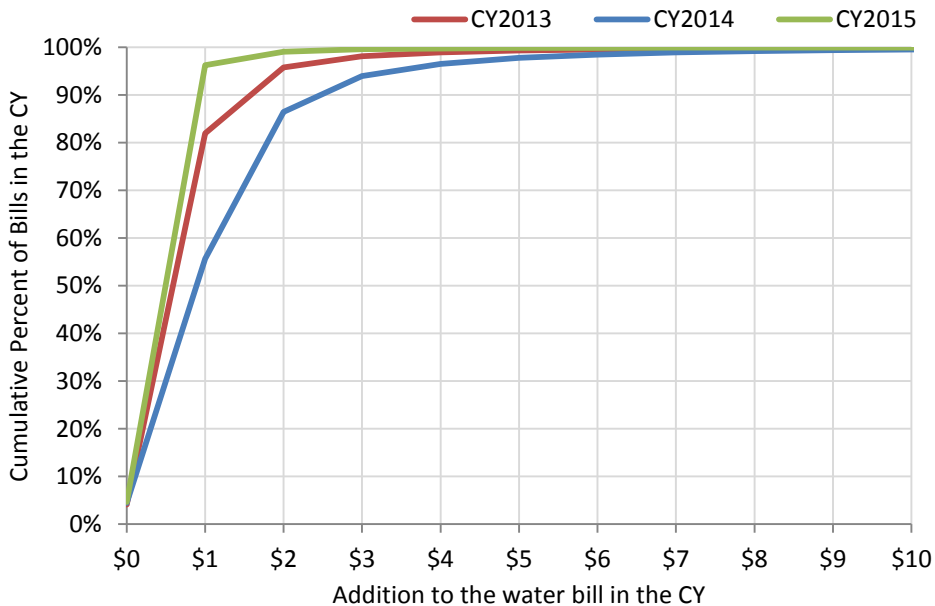
Revenues and expectations by calendar year, Brookwood



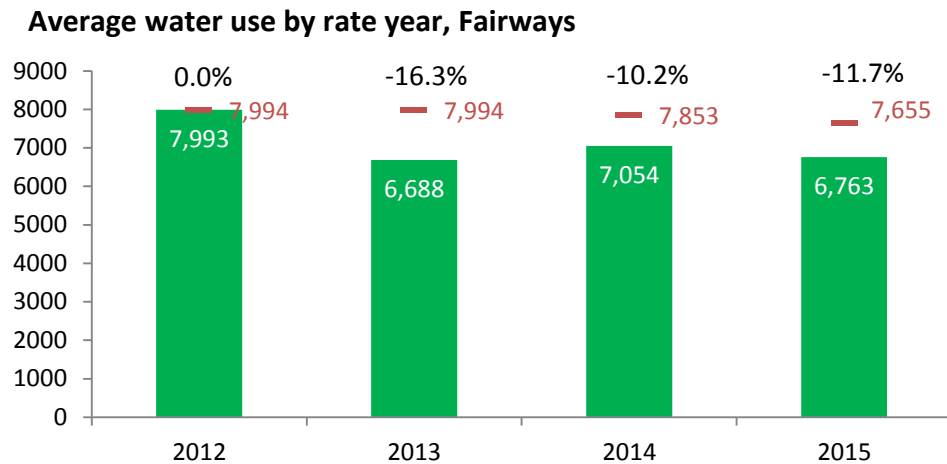
Cumulative difference from revenue requirement (no growth), Brookwood



Changes to water bills with surcharges, Brookwood - Method 1



Modeling surcharges/credit surcharges for Fairways



The Consumption Adjustment Mechanism would have been triggered every year except after rate year 2012.

Rate Year 2012 (October 2011 – September 2012):

- Test year average water use: 7,994 gallons/month.
- Rate year average water use: 7,993 gallons/month.
- Delta average use: 1 gallon/month, or <-0.01%. Therefore, NO SURCHARGE is triggered for CY2013.

No surcharge would be applied January-December 2013. Thus, no changes to charges or revenues.

Rate Year 2013 (October 2012 – September 2013):

- Test year average water use: 7,994 gallons/month.
- Rate year average water use: 6,688 gallons/month.
- Delta average use: 1,306 gallons/month, or -16.3%. Therefore, a surcharge is triggered for CY2014.
- Delta total yearly water use from test year = 1,306 gallons/month * 12 months * 3,431 test year accounts = 53,760 thousand gallons
- Blended volumetric rate set by the rate case: \$1.68/1000 gallons
- Shortfall in rate year's volumetric revenue from revenue requirement = 53,760 * 1.68 = \$90,316
- Rate year total water use = 289,153 thousand gallons
- Revenues generated by the surcharge in rate year 2013 = \$0 (no surcharge)
- Net shortfall used to determine next surcharge = \$90,316 – \$0 = \$90,316
- Computed volumetric surcharge for CY2014 = \$90,316 / 289,153 thousand gallons = \$0.31/1000 gallons

- Blended volumetric water rate in CY2014 = $\$1.51$ (weighted average rate) + $\$0.31$ = $\$1.82/1,000$ gallons (weighted average rate). Base charges are not affected.

Practically, the surcharge would be applied January-December 2014. What are the effects in CY2014?

- Average bill goes up from $\$19.23$ to $\$21.39$: a $\$2.16$ /month increase or 11.2% increase from original rates.
- Calendar Year 2014 revenue without surcharge: $\$876,858$
- Calendar Year 2014 revenue with surcharge: $\$975,211$ (all 12 months surcharged)
- Calendar Year 2014 revenue requirement: $\$890,951$ (weighted average) plus growth

Rate Year 2014 (October 2013 – September 2014):

- Test year average water use: 7,853 gallons/month (7 months @ 7,994 and 5 months @ 7,655)
- Rate year average water use: 7,054 gallons/month.
- Delta average use: 799 gallons/month, or -10.2%. Therefore, a surcharge is triggered for CY2015.
- Delta total yearly water use from test year = 799 gallons/month * 12 months * 3,536 weighted average test year accounts = 33,897 thousand gallons
- Blended volumetric rate set by the rate case: $\$1.58/1000$ gallons (7 months @ $\$1.68$ and 5 months @ $\$1.43$)
- Shortfall in rate year's volumetric revenue from revenue requirement = $33,897 * 1.58 = \$53,415$
- Rate year total water use = 318,558 thousand gallons
- Revenues generated by the surcharge in rate year 2014 (assuming the surcharge applied to all volume from Oct 2013 through Sept 2014, even though surcharge only starts in the beginning of the calendar year) = $\$0.31/1000$ gallons * 318,558 thousand gallons = $\$98,753$
- Because the revenues generated by the surcharge EXCEEDED the shortfall it was making up in rate year 2013 ($\$90,316$), a portion of it will be deducted from the shortfall this year. The surplus from surcharges = $\$98,753 - \$90,316 = \$8,436$
- Net shortfall used to determine next surcharge = $\$53,415 - \$8,436 = \$44,979$
- Computed volumetric surcharge for CY2015 = $\$44,979 / 318,558$ thousand gallons = $\$0.14/1000$ gallons
- Blended volumetric water rate in CY2015 = $\$1.43 + \$0.14 = \$1.57/1,000$ gallons. Base charges are not affected.

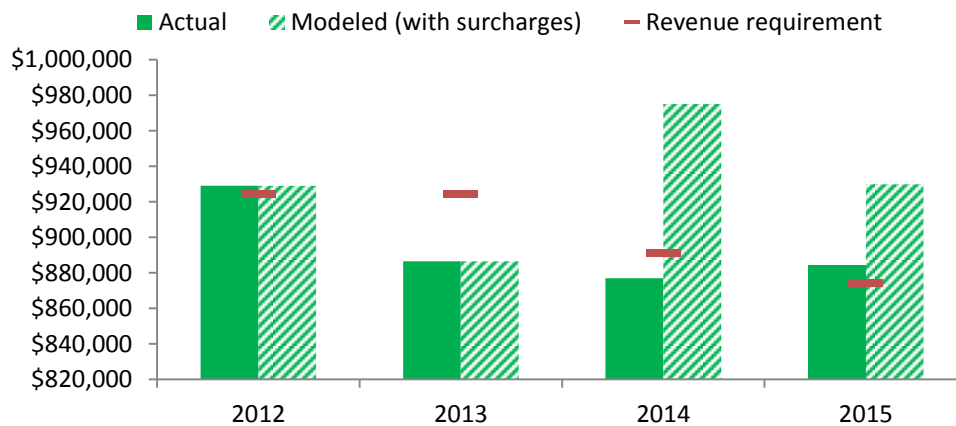
Practically, the surcharge would be applied January-December 2015. What are the effects in CY2015?

- Average bill goes up from $\$18.78$ to $\$19.75$: a $\$0.97$ /month increase or 5.2% increase from original rates.
- Calendar Year 2015 revenue without surcharge: $\$884,101$
- Calendar Year 2015 revenue with surcharge: $\$929,987$
- Calendar Year 2015 revenue requirement: $\$874,312$ plus growth

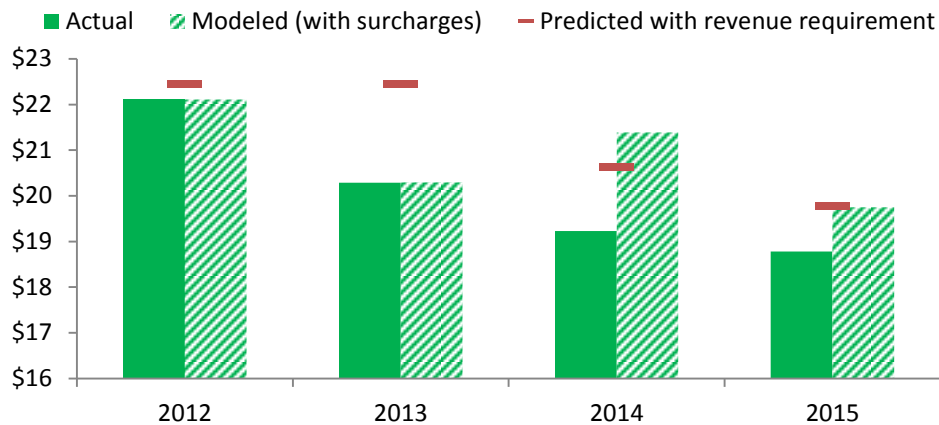
Rate Year 2015 (October 2014 – September 2015):

- Test year average water use: 7,655 gallons/month
- Rate year average water use: 6,763 gallons/month.
- Delta average use: 892 gallons/month, or -11.7%. Therefore, a surcharge is triggered for CY2016.
- Delta total yearly water use from test year = 892 gallons/month * 12 months * 3,684 test year accounts = 39,434 thousand gallons
- Blended volumetric rate set by the rate case: \$1.43/1000 gallons
- Shortfall in rate year’s volumetric revenue from revenue requirement = 39,434 * 1.43 = \$56,390
- Rate year total water use = 396,498 thousand gallons
- Revenues generated by the surcharge in rate year 2015 (assuming the surcharge applied to all volume from Oct 2014 through Sept 2015, even though surcharge only starts in the beginning of the calendar year) = \$0.14/1000 gallons * 396,498 thousand gallons = \$55,510
- Because the revenues generated by the surcharge EXCEEDED the shortfall it was making up in rate year 2014 (\$44,979), a portion of it will be deducted from the shortfall this year. The surplus from surcharges = \$55,510 - \$44,979 = \$10,531
- Net shortfall used to determine next surcharge = \$56,390 – \$10,531 = \$45,859
- Computed volumetric surcharge for CY2016 = \$45,859 / 396,498 thousand gallons = \$0.11/1000 gallons
- Blended volumetric water rate in CY2016 = \$1.43 + \$0.11 = \$1.54/1,000 gallons. Base charges are not affected.

Metered water revenues by calendar year, Fairways



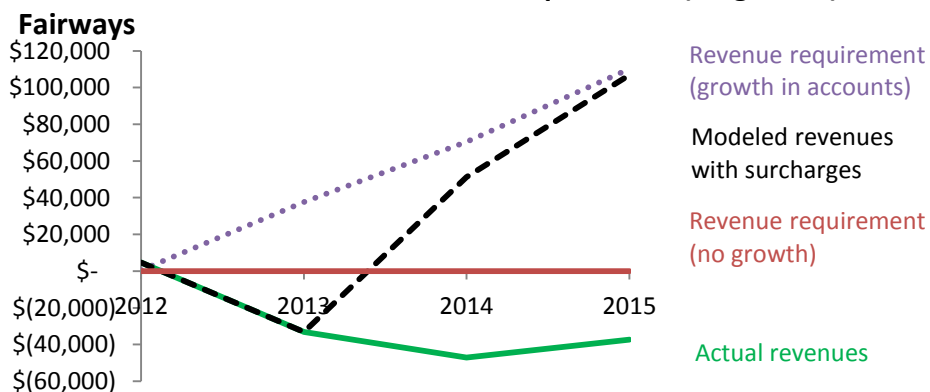
Average water bill by calendar year, Fairways



Revenues and expectations by calendar year, Fairways



Cumulative difference from revenue requirement (no growth), Fairways

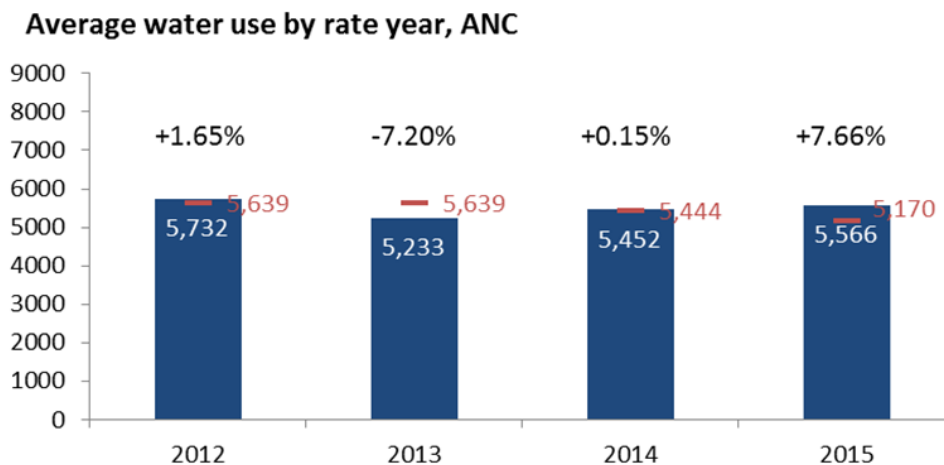


Simulating a “High Use” Scenario to Demonstrate Use of Credit Surcharges

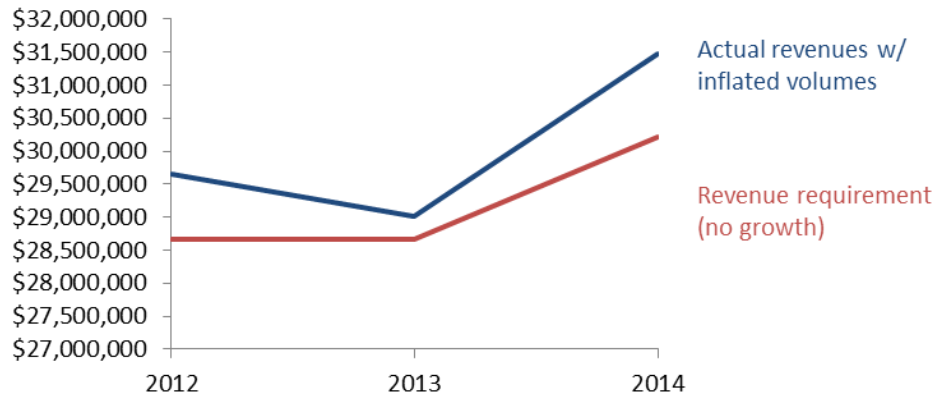
In almost all of the rate years, in all rate divisions, the average water volume was below the average volume defined in the rate case. Therefore, in almost all of the rate years above, a surcharge would have been applied to a customer’s water bill. Public Staff expressed interest in seeing what a hypothetical situation that would trigger credit surcharges would look like.

As described above, if average water use increases above the test year threshold, credit surcharges would apply. The following simulates a scenario in which average water use is above the test year average, creating a credit surcharge situation. This analysis focuses only on ANC bills. The analysis for ANC below attempts to show such a scenario and its effect on base charges, volumetric charges, and total revenue.

1. Only the billing data from January 2012-September 2015 were used for this part of the analysis.
2. The same method described in the analyses above was used for this as well.
3. This analysis only describes the effects on ANC customers.
4. In order to achieve an average water volume that would trigger the 1 percent collar in at least one year, 500 gallons were added to each bill’s water consumption in every year of ANC billing data. In other words, every customer is simulated to have used an extra 500 gallons/month than they actually did.
5. The new baseline against which total revenues after a surcharge credit or surcharge is compared is the “Actual Revenues with Inflated Volumes.” Although “Actual Revenues with Inflated Volumes” did not happen in reality, it is what would have happened if average use was 500 gallons higher per month per customer AND if a collar were not used.



Revenues and expectations by calendar year, ANC



Modeling surcharges/credit surcharges for ANC

Rate Year 2012 (October 2011- September 2012):

- Test year average water use: 5,639 gallons/month
- Rate year average water use: 5,732 gallons/month
- Delta average use: 93 gallons/month, or +1.65%. Therefore, a credit surcharge is triggered for CY2013.
- Delta total yearly water use from test year=93 gallons/month*12 months*53,146 test year accounts= 59,311 thousand gallons
- Blended volumetric rate set by the rate case: \$4.95/1000 gallons
- Surplus in rate year's volumetric revenue from revenue requirement=59,311*\$4.95=\$293,589
- Rate year total water use: 3,717,676 thousand gallons
- Revenues generated by the surcharge in rate year 2012: \$0 (no surcharge in the first year)
- Shortfall/surplus from surcharges=\$0 (no surcharge in the first year)
- Net surplus used to determine next surcharge=\$293,589-\$0= \$293,589
- Computed volumetric credit surcharge for CY2013=\$293,589/3,717,676 thousand gallons=\$0.07/gallons
- Blended volumetric water rate for CY2013=\$4.95-\$0.07=\$4.88/1000 gallons. Base charges are not affected.

Practically, the credit surcharge would be applied January-December 2013. What are the effects in CY2013?

-Average bill would drop from \$43.29 to \$42.96: a \$0.33/month decrease, or 0.76%, from original rates.

-Calendar Year 2013 revenue without surcharge credit: \$29,016,393

-Calendar Year 2013 revenue with surcharge credit: \$28,793,524

-Calendar Year 2013 revenue requirement: \$28,658,383 plus growth

Rate Year 2013 (October 2012-September 2013):

-Test year average water use: 5,639 gallons/month

-Rate year average water use: 5,233 gallons/month

-Delta average use: 406 gallons/month, or -7.20%. Therefore, a surcharge is triggered for CY2014.

-Delta total yearly water use from test year=406 gallons/month*12 months*53,146 test year accounts=258,927 thousand gallons

-Blended volumetric rate set by the rate case: \$4.95/1000 gallons

-Shortfall in rate year's volumetric revenue from revenue requirement:
 $258,927 * \$4.95 = \$1,281,690$

-Rate year total water use=3,485,984 thousand gallons

-Revenues generated by the credit surcharge in rate year 2013 (assuming the credit surcharge applied to all volume from Oct. 2012-Sept. 2013, even though the credit surcharge only starts at the beginning of the calendar year) = $(\$0.07/1000 \text{ gallons}) * 3,485,984 \text{ thousand gallons} = \$244,019$

-Because the revenues refunded by the credit surcharge did not fully refund the surplus from Rate Year 2012, the consequential surplus is $\$293,589 - \$244,019 = \$49,570$

-Net shortfall used to determine next surcharge: $-\$1,281,690 + \$49,570 = -\$1,232,120$

-Computed volumetric surcharge for CY2014= $\$1,232,120 / 3,485,984 \text{ gallons} = \$0.35/1000 \text{ gallons}$

-Blended volumetric rate in CY2014= $\$5.20 \text{ (weighted average rate)} + \$0.35 = \$5.55/1000 \text{ gallons}$ (weighted average rate). Base charges are not affected.

Practically, the surcharge would be applied in January-December 2014. What are the effects in CY2014?

-Average bill goes up from \$45.86 to \$47.57: a \$1.71/month increase or 3.73% increase from original rates.

-Calendar Year 2014 revenue without a surcharge: \$31,466,677

-Calendar Year 2014 revenue with surcharge: \$32,639,602 (all 12 months surcharged)

-Calendar Year 2014 revenue requirement: \$30,221,582 (weighted average) plus growth

Rate Year 2014 (October 2013-September 2014):

-Test year average water use: 5,444 gallons/month (7 months @ 5,639 and 5 months @ 5,170)

-Rate year average water use: 5,452 gallons/month

-Delta average use: 8 gallons/month, or +0.15%. Therefore, the collar is not triggered.

-Rate year total water use: 3,719,202 thousand gallons

-Revenues generated by the surcharge in rate year 2014 (assuming the surcharge applied to all volume from Oct. 2013-Sept. 2014, even though surcharge only starts in the beginning of the calendar year)= $\$0.35/\text{thousand gallons} \times 3,719,202 \text{ thousand gallons} = \$1,301,721$

-The revenue shortfall aimed to be made up in Rate Year 2014= \$1,232,120, therefore Aqua recovered a surplus of \$69,601. Since the collar is not triggered, we will aim to return only \$69,601 to customers. Therefore the net shortfall used to determine the next surcharge=\$69,601.

-Computed volumetric surcharge for CY2015= $\$69,601/3,719,202 \text{ thousand gallons} = \$0.01/\text{thousand gallons}$

-Blended volumetric water rate in CY2015= $\$5.32 - \$0.01 = \$5.31/1000 \text{ gallons}$. Base charges are not affected.

Practically, the surcharge would be applied January-December 2015. What are the effect in CY2015?

-Average bill drops from \$48.87 to \$48.82: a \$0.05/month decrease, or 0.10% from original rates.

-Calendar Year 2015 revenue without surcharge: \$25,658,993 (just 9 months of data)

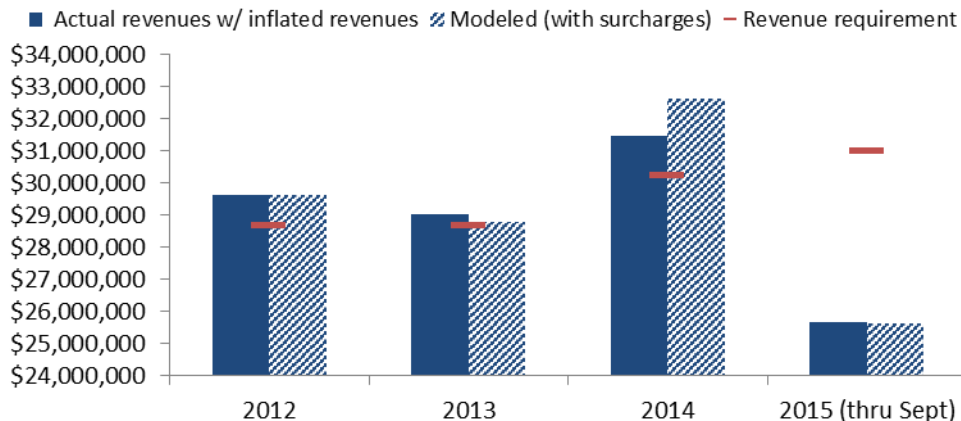
-Calendar Year 2015 revenue with surcharge credit: \$25,631,452 (all 9 months surcharged)

-Calendar Year 2015 revenue requirement: \$31,003,181 (plus growth)

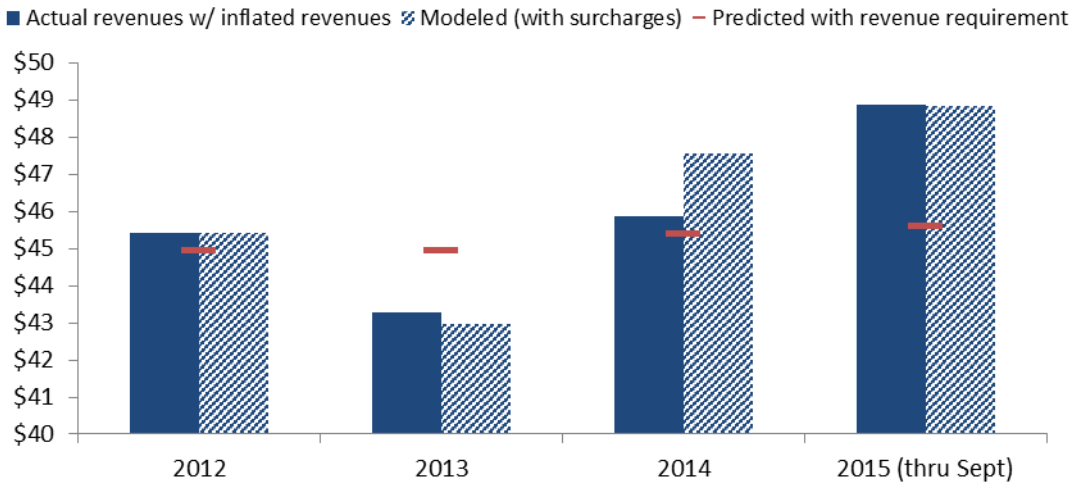
Rate Year 2015 (October 2014-Sept. 2015):

- Test year average water use: 5,170 gallons/month
- Rate year average water use: 5,566 gallons/month
- Delta average use: 396 gallons/month, or +7.66%. Therefore, a surcharge credit is triggered for CY 2016.
- Delta total yearly water use from test year= 396 gallons/month*12 months*56,670 test year accounts= 269,296 thousand gallons
- Blended volumetric rate set by the rate case: \$5.32/1000 gallons
- Surplus in rate year's volumetric revenue from revenue requirement: $\$5.32 * 269,296 = \$1,432,654$
- Rate year total water use: 3,886,070 thousand gallons
- Revenues generated by the surcharge in rate year 2015 (assuming the surcharge applied to all volume from Oct. 2014-Sept. 2015, even though the surcharge only starts in the beginning of the calendar year)= $\$0.01 * 3,886,070$ thousand gallons= $\$38,861$
- Because the revenues returned to the customer fell short of what was intended to be returned to them (\$69,601) by \$30,740, it will be added to the amount to be returned in CY2016.
- Net shortfall used to determine next surcharge credit: $\$1,432,654 + \$38,861 = \$1,463,394$
- Computed volumetric surcharge credit for CY2016= $\$1,463,394 / 3,886,070$ thousand gallons= $\$0.38$ /thousand gallons

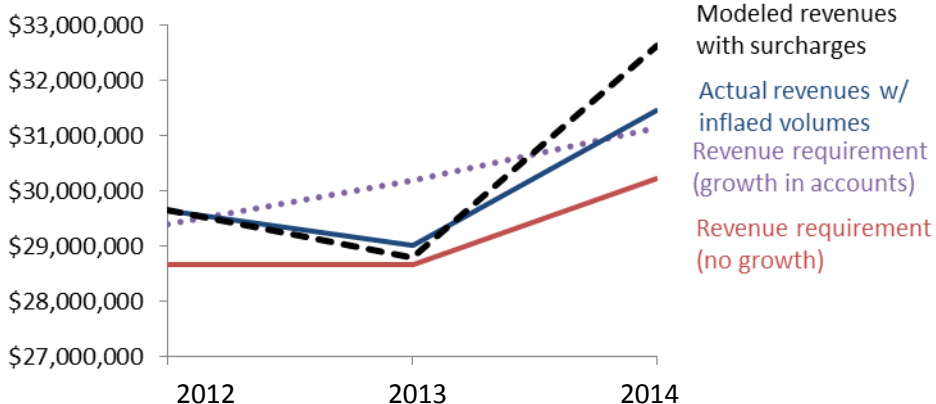
Metered water revenues by calendar year, ANC



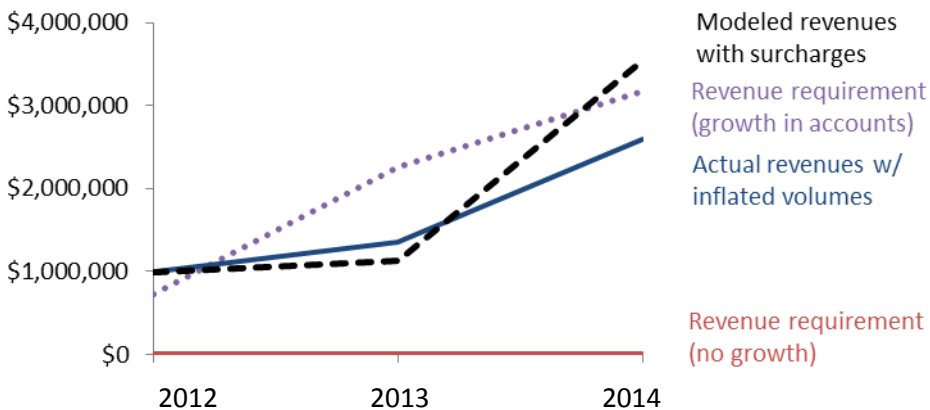
Average water bill by calendar year, ANC



Revenues and expectations by calendar year, ANC



Cumulative difference from revenue requirement (no growth), ANC



Section 3 - Modeling Volumetric Wastewater Rates for ANC and Fairways Residential Customers with Aqua Water Meters

Updated Analysis: March 4, 2016

Notes:

- Analysis includes only residential customers who are metered water customers. Residential customers without volumes and non-residential customers are excluded from the analysis.
 - Analysis relies on billing data from January, 2012-December, 2015
 - Methodology applies for each rate division separately: ANC and Fairways
 - Calendar Year (CY) is January through December
 - This methodology assumes no price elasticity
 - Without a test year to establish a baseline, we use Calendar Year 2012 as the test year. Based on rates and revenues in Calendar Year 2012, we set volumetric and base charges for January 2013-April 2014.
 - Using a methodology described in more detail below, we use a new test year (May 2013-April 2014) and calculate a new rate case that sets new volumetric and base charges for May 2014 onwards.
 - The following rates are set with a goal of achieving 60% of the annual revenue requirement from fixed (base) charges and 40% coming from variable (volumetric) rates.
 - This analysis uses a cap of 12,000 gallons.
-

Existing Residential Wastewater Charges

Sept 2011 – April 2014:

- \$65.07/month fixed charge for ANC customers
- \$35.16/month fixed charge for Fairways customers

May 2014 – onwards:

- \$65.21/month fixed charge for ANC customers
- \$36.60/month fixed charge for Fairways customers

Basic Statistics on Number of Residential Wastewater Customers and their Water (i.e. Sewer) Use

All of Aqua’s wastewater customers between January 2012-December 2015 were comprised of the following:

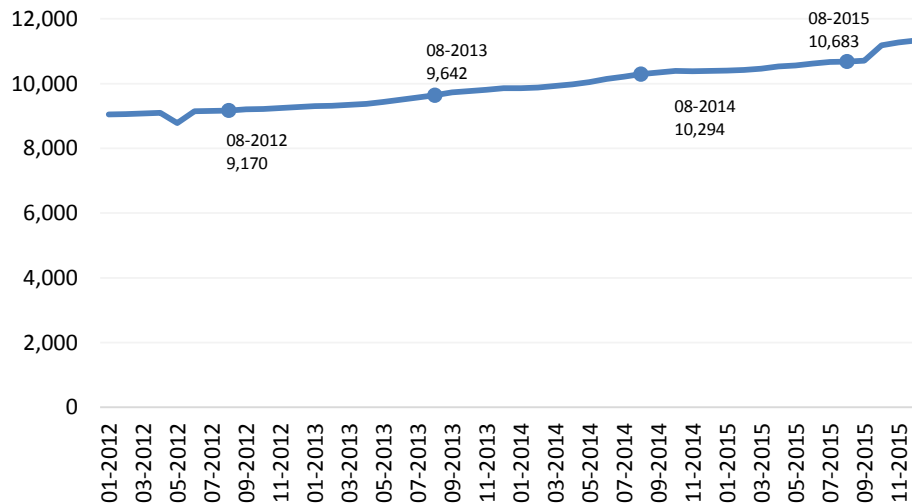
Customers with:	Number of unique customers (accounts)
Wastewater volumes (commercial)	292 (2%)
Water volumes (water + wastewater customers)	11,861 (65%)
No volume data (wastewater-only customers)	6,055 (33%)

We excluded all non-residential customers and all residential customers without volume data from the analysis.

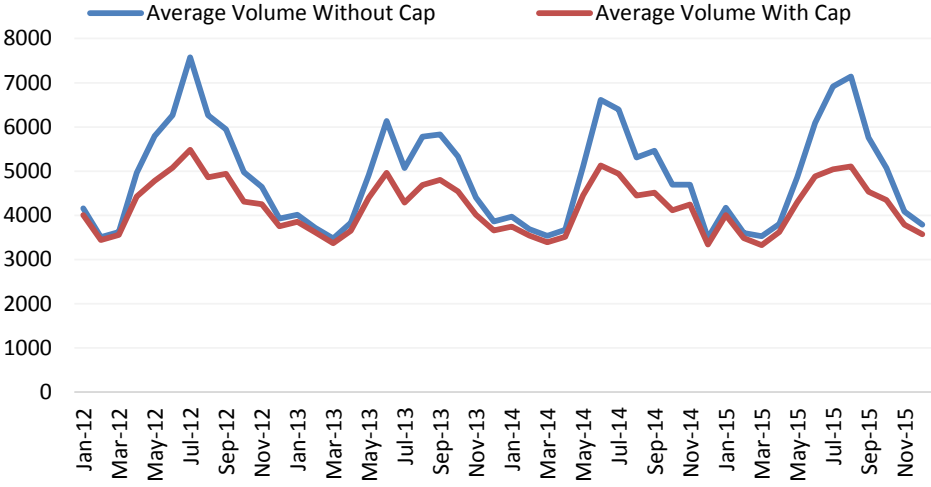
As of August 2015, there were 10,683 residential wastewater customers with volume data:

Rate Division	Number of volumetric residential wastewater customers in August 2015
ANC	9,032
Fairways	1,651

Number of residential sewer customers, across all systems

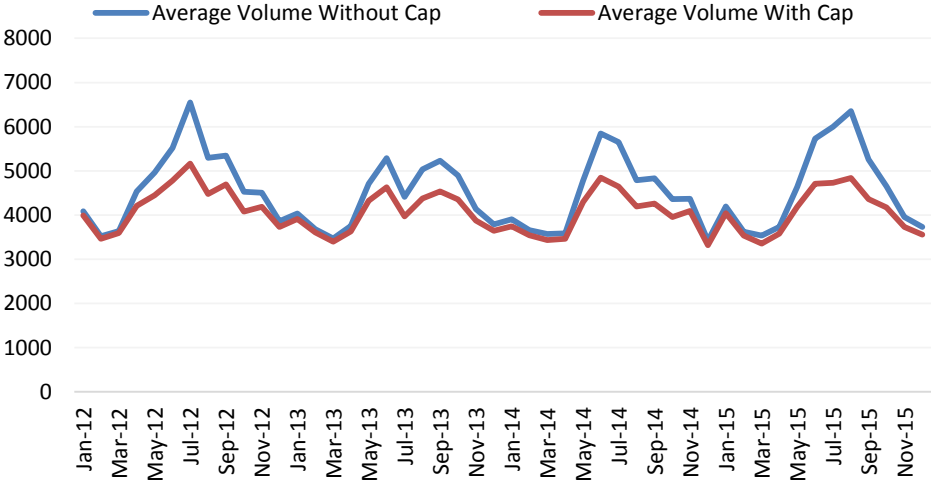


Per account water use, across all systems (gallons/month)

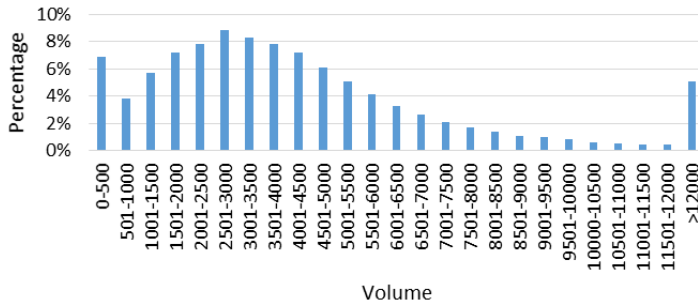


Wastewater Use among Volumetric Residential Customers in ANC

Per account water use, across ANC (gallons/month)



ANC 2012 (91,007 bills)

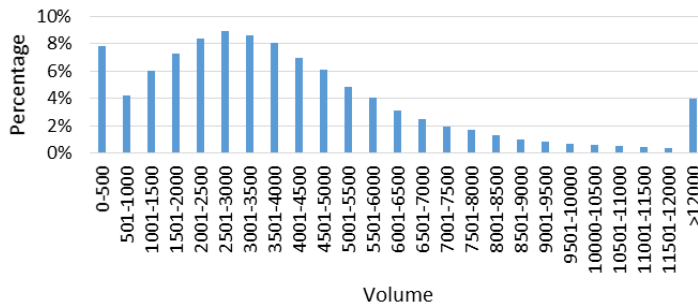


Average without cap:
4,696 gallons/month

Average with cap:
4,235 gallons/month

Median:
3,600 gallons/month

ANC 2013 (95,761 bills)

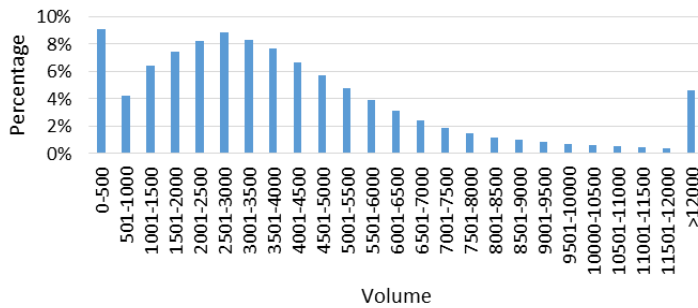


Average without cap:
4,376 gallons/month

Average with cap:
4,023 gallons/month

Median:
3,450 gallons/month

ANC 2014 (102,359 bills)

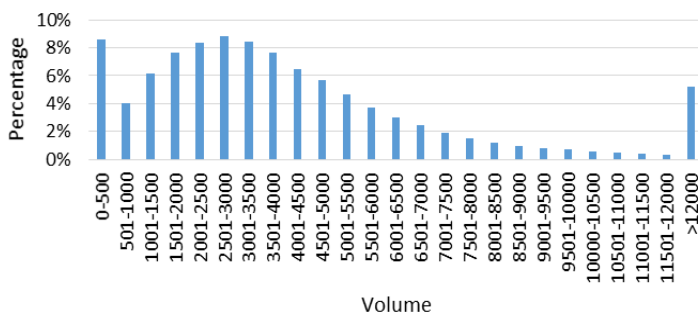


Average without cap:
4,401 gallons/month

Average with cap:
3,987 gallons/month

Median:
3,400 gallons/month

ANC 2015 (109,066 bills)



Average without cap:
4,614 gallons/month

Average with cap:
4,065 gallons/month

Median:
3,400 gallons/month

Modeling Wastewater Volumetric Rates for ANC

Calculating a “Volumetric Wastewater Revenue Requirement” using CY 2012 as a Test Year for ANC:

Number of residential volumetric wastewater customers in CY2012: 7,830

Number of residential volumetric wastewater bills in CY2012: 91,007

Wastewater revenues generated from the residential wastewater volumes in CY2012: \$5,579,410. This is used as the annual “revenue requirement” for through April 2014 (when the next rate case became effective).

Total residential wastewater volume (within the cap only): 385,377,000 gallons

Average wastewater volume: 4,235 gallons/month (average without cap: 4,696 gallons/month)

To determine the volumetric rates to generate the revenue requirement, splitting it between 60% from fixed (base) charges and 40% from variable (volumetric) rates:

Monthly Base Charge = $(\$5,579,410 * 60\%) / 91,007 \text{ bills} = \$3,347,646 / 91,007 = \$36.78 / \text{bill}$

Volumetric Rate = $(\$5,579,410 * 40\%) / 385,377,000 \text{ gallons within the cap} = \$2,231,764 / 385,377,000 = \$0.00579 / \text{gallon} = \$5.79 / 1000 \text{ gallons}$

Based on our calculations using CY2012 as a “test year”, we determine that Aqua would have set a \$36.78/month base charge plus \$5.79/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons) starting in January 2013.

Volumetric wastewater rates would decrease bills for consumptions 0 – 4,000 gallons, and increase for 5,000 gallons and above.

Gallons	Existing Rates	Volumetric Rates	Change in Bill
0	\$65.07	\$36.78	-\$28.29
1000	\$65.07	\$42.57	-\$22.50
2000	\$65.07	\$48.36	-\$16.71
3000	\$65.07	\$54.15	-\$10.92
4000	\$65.07	\$59.94	-\$5.13
5000	\$65.07	\$65.73	\$0.66
6000	\$65.07	\$71.52	\$6.45
7000	\$65.07	\$77.31	\$12.24
8000	\$65.07	\$83.10	\$18.03
9000	\$65.07	\$88.89	\$23.82
10000	\$65.07	\$94.68	\$29.61
11000	\$65.07	\$100.47	\$35.40
12000	\$65.07	\$106.26	\$41.19
13000+	\$65.07	\$106.26	\$41.19

Calendar Year 2013:

2013 actual wastewater revenue from existing rates: \$5,846,738

2013 estimated revenue from modeled volumetric rates: \$5,752,849

New Base Revenue: \$3,522,089 (61%)

New Volumetric Revenue: \$2,230,760 (39%).

Number of bills: 95,671

Number of customers: 8,362

Average volume: 4,023 gallons/month (average without cap: 4,376 gallons/month)

The average volume consumed in CY 2013 (4,023 gallons/month) is lower than the average volume consumed in CY 2012 (4,235 gallons/month). Therefore, the volumetric revenue is lower than what would have been expected given CY 2012 consumption. This means that volumetric revenue only accounted for 39 percent of total revenue.

Calendar Year 2014:

- In order to simulate a rate case in May 2014 so that we could have a new test year revenue requirement, we did the following:
 1. Divided the 2011 ANC Wastewater Rate Case Revenue Requirement (\$9,880,520) by the number of test year customers established in the 2011 rate case (12,004). This calculates what the 2011 rate case established as an annual revenue requirement per wastewater customer.
 2. Divided the 2014 ANC Wastewater Rate Case Revenue Requirement (\$10,887,547) by the number of test year customers established in the 2014 rate case (13,306). This calculates what the 2014 rate case established as an annual revenue requirement per wastewater customer.
 3. Divided the result of Step 2 by the result of Step 1, which equals 0.9941. This ratio shows that the Utilities Commission in 2014 approved ANC to earn 99.41% of the annual wastewater revenue per customer that it had been granted in the 2011 rate case.
 4. Divided the number of analyzed bills in Calendar Year 2012 (91,007) by 12, which equals 7,584. This is the approximate number of residential wastewater customers that had water meter volume data from Aqua NC at the start of the simulated 2011 rate case period in this analysis.
 5. Divided the number of analyzed bills from May 2013-April 2014 (97,834) by 12, which equals 8,153. This is the approximate number of residential wastewater customers that had water meter volume data from Aqua NC at the start of the simulated 2014 rate case period in this analysis. The number of customers went up since the previous rate case.

6. Divided the result of Step 6 by the result of Step 5, which equals 1.075. This step takes into account the growth in the number of customers ANC had.
7. Multiplied the revenue requirement calculated for ANC in CY2012 test year by the ratio of the approved revenues/customer from 2011 to 2014 (Step 3) and by the ratio of number of customers from 2011 to 2014 (Step 6).

$$\begin{aligned} \text{Annual residential wastewater revenue requirement in May 2014 onwards} = & \\ & \text{Revenue requirement from previous rate case } (\$5,579,410) \\ & \times \text{ Approved WW revenues per customer in 2014 / Approved WW} \\ & \text{revenues per customer in 2011 } (0.9941) \\ & \times \text{ Number of customers in 2014 rate case / number of customers in} \\ & \text{previous rate case } (1.075) \end{aligned}$$

This gives us the new annual revenue requirement of **\$5,962,625** going forwards from May 2014.

Number of residential volumetric wastewater bills from May 2013 through April 2014: 97,834

Total residential wastewater volume (within the cap only) from May 2013 through April 2014: 389,869,400 gallons

Average wastewater volume from May 2013 through April 2014: 3,985 gallons/month (average without cap: 4,343 gallons/month)

To determine the volumetric rates to generate the newly-calculated revenue requirement, splitting it between 60% from fixed (base) charges and 40% from variable (volumetric) rates:

$$\text{Monthly Base Charge} = (\$5,962,625 * 60\%) / 97,834 = \$3,577,575 / 97,834 = \$36.57/\text{bill}$$

$$\text{Volumetric Charge: } (\$5,962,625 * 40\%) / 389,869,400 \text{ gallons within the cap} = \$2,385,050 / 389,869,400 = \$0.00612/1000 \text{ gallons} = \$6.12/1000 \text{ gallons}$$

Based on our calculations using May 2013 through April 2014 as a “test year” to set rates in May 2014 onwards, we determine that Aqua would have set a \$36.57/month base charge plus \$6.12/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons) starting in May 2014.

Volumetric wastewater rates would decrease bills for consumptions 0 – 4,000 gallons, and increase for 5,000 gallons and above.

Gallons	Existing Rates	Volumetric Rates	Change in Bill
0	\$65.21	\$36.57	-\$28.64
1000	\$65.21	\$42.69	-\$22.52
2000	\$65.21	\$48.81	-\$16.40
3000	\$65.21	\$54.93	-\$10.28
4000	\$65.21	\$61.05	-\$4.16

5000	\$65.21	\$67.17	\$1.96
6000	\$65.21	\$73.29	\$8.08
7000	\$65.21	\$79.41	\$14.20
8000	\$65.21	\$85.53	\$20.32
9000	\$65.21	\$91.65	\$26.44
10000	\$65.21	\$97.77	\$32.56
11000	\$65.21	\$103.89	\$38.68
12000	\$65.21	\$110.01	\$44.80
13000+	\$65.21	\$110.01	\$44.80

2014 actual wastewater revenue from existing rates: \$6,237,596

2014 estimated revenue from modeled volumetric rates (Jan-Apr using first rate case modeled rates and May-Dec using second rate case modeled rates): \$6,208,970

New Base Revenue: \$3,750,238 (60%)

New Volumetric Revenue: \$2,458,732 (40%)

Number of bills in CY2014: 102,359

Number of customers in CY2014: 8,862

Average volume in CY2014: 3,987 gallons/month (average without cap: 4,401 gallons/month)

Calendar Year 2015:

2015 actual wastewater revenue from existing rates: \$6,683,607

2015 estimated revenue from modeled volumetric rates: \$6,701,551

New Base Revenue: \$3,988,544 (60%)

New Volumetric Revenue: \$2,713,008 (40%)

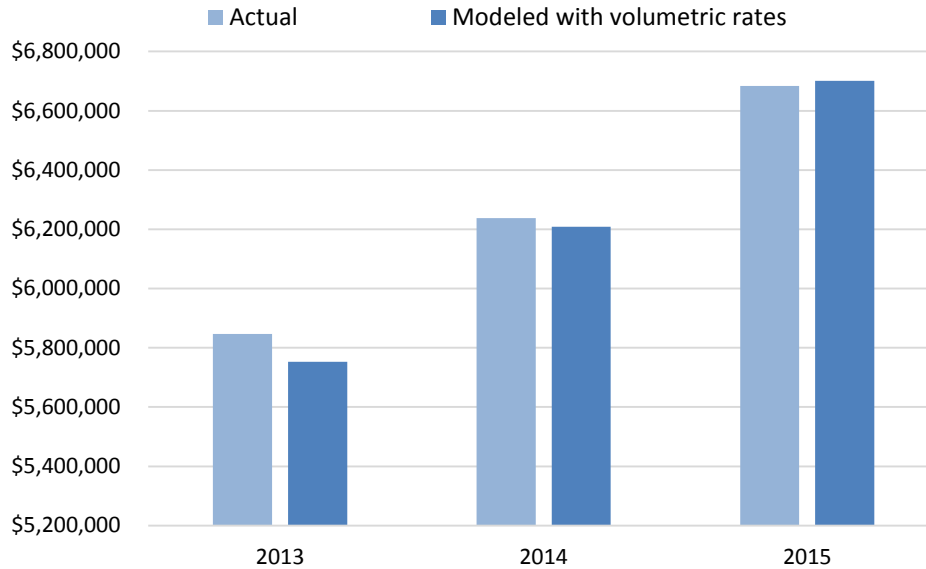
Number of bills: 109,066

Number of customers: 9,851

Average volume: 4,065 gallons/month (average without cap: 4,614 gallons/month)

Comparison of wastewater rates, bills and revenues in ANC

Revenue from Volumetric Residential Customers in ANC



	2013	2014	2015	Total
Actual	\$5,846,738	\$6,237,596	\$6,683,607	\$18,767,941
Modeled with volumetric rates	\$5,752,849	\$6,208,970	\$6,701,551	\$18,663,370
Difference	(\$93,889) -1.6%	(\$28,626) -0.5%	\$17,944 0.3%	(\$104,571) -0.56%

January 2013 – April 2014:

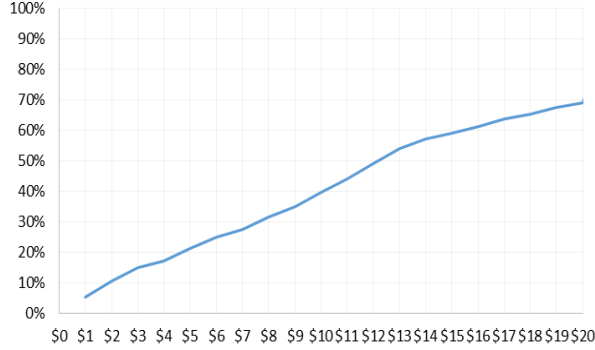
- Existing flat charge: \$65.07/month fixed charge
- Modeled rates: \$36.78/month base charge plus \$5.79/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons).
- Thus, bills for volumes less than 4,886 would be lower under the volumetric rates than under the existing flat charge. Bills with greater volumes would be higher than under the existing flat charge.

May 2014 – September 2015:

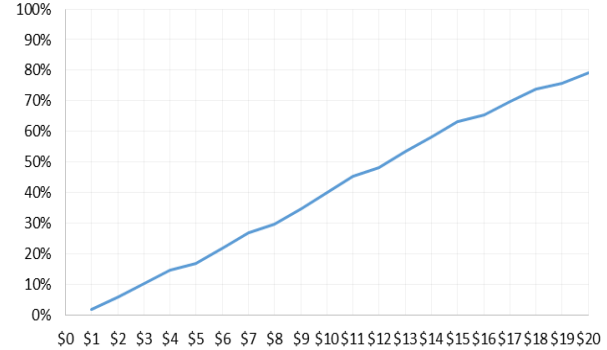
- Existing flat charge: \$65.21/month fixed charge
- Modeled rates: \$36.57/month base charge plus \$6.12/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons).
- Thus, bills for volumes less than 4,680 would be lower under the volumetric rates than under the existing flat charge. Bills with greater volumes would be higher than under the existing flat charge.

CY	% of bills that would increase	% of bills that would decrease
2013	44%	56%
2014	46%	54%
2015	47%	53%

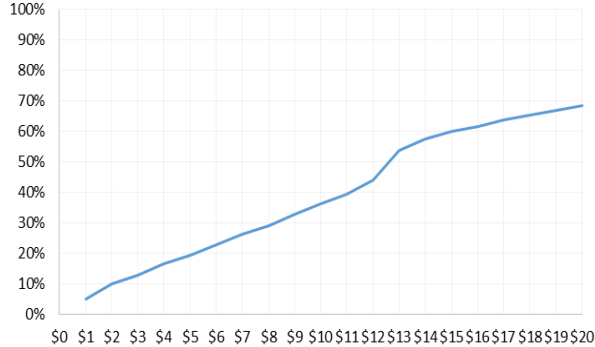
Cumulative distribution function of the 41,963 bills paying more, ANC 2013



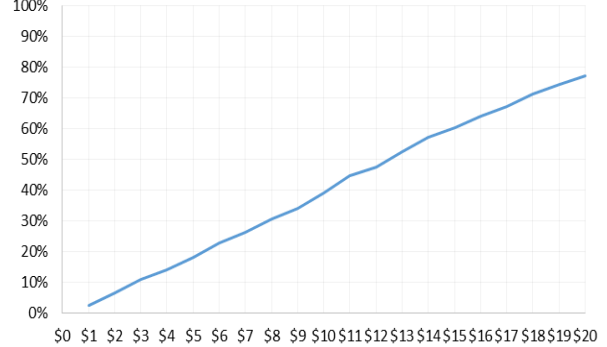
Cumulative distribution function of the 53,798 bills paying less, ANC 2013



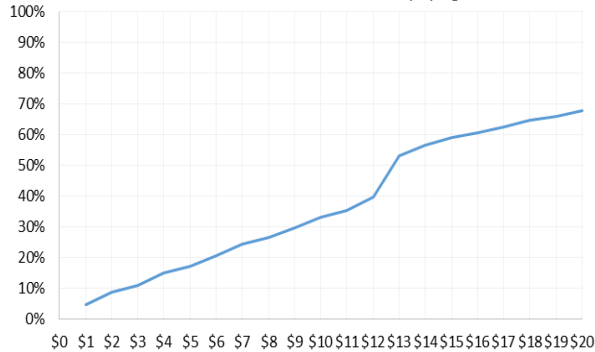
Cumulative distribution function of the 46,653 bills paying more, ANC 2014



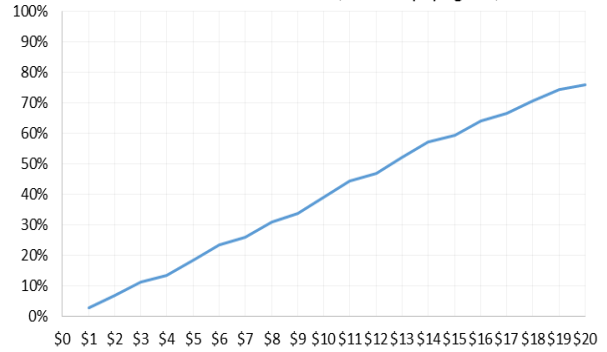
Cumulative distribution function of the 55,706 bills paying less, ANC 2014



Cumulative distribution function of the 51,793 bills paying more, ANC 2015

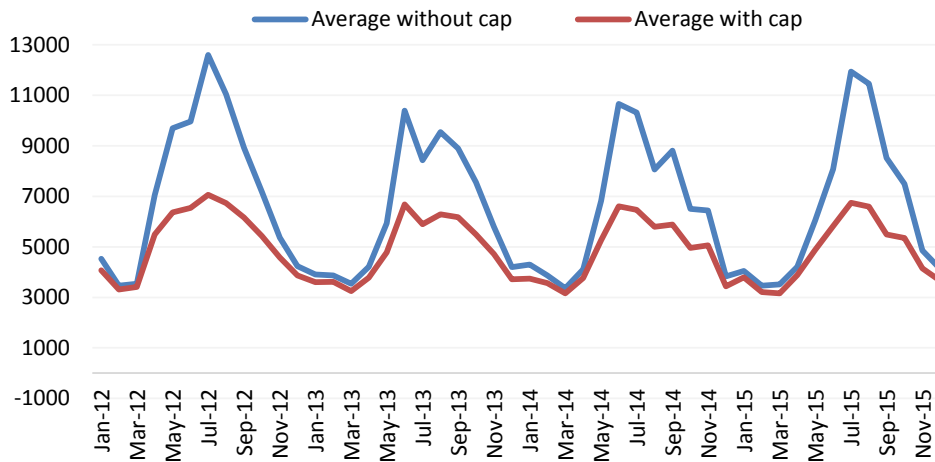


Cumulative distribution function of the 57,273 bills paying less, ANC 2015

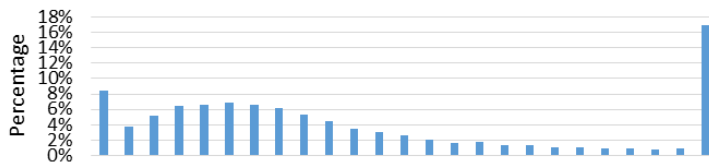


Wastewater Use among Volumetric Residential Customers in Fairways

Per account water use, across Fairways (gallons/month)

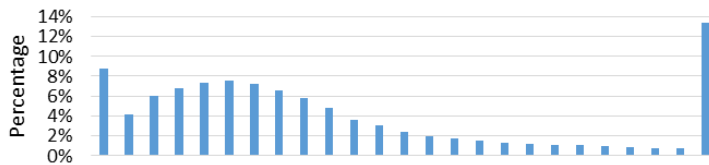


Fairways 2012 (18,477 bills)



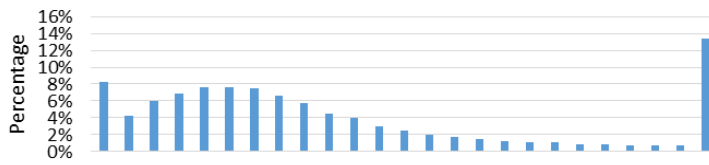
Average without cap: 7,306 gallons/month
Average with cap: 5,255 gallons/month
Median: 4,000 gallons/month

Fairways 2013 (18,884 bills)



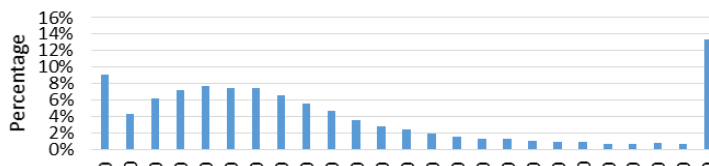
Average without cap: 6,365 gallons/month
Average with cap: 4,838 gallons/month
Median: 3,700 gallons/month

Fairways 2014 (19,486 bills)



Average without cap: 6,434 gallons/month
Average with cap: 4,815 gallons/month
Median: 3,700 gallons/month

Fairways 2015 (19,776 bills)



Average without cap: 6,487 gallons/month
Average with cap: 4,729 gallons/month
Median: 3,600 gallons/month

Modeling wastewater volumetric rates for Fairways

Calculating a “Volumetric Wastewater Revenue Requirement” using CY 2012 as a Test Year for Fairways:

Number of residential volumetric wastewater customers in CY2012: 1,565

Number of residential volumetric wastewater bills in CY2012: 18,477

Wastewater revenues generated from the residential wastewater volumes in CY2012: \$650,228. This is used as the annual “revenue requirement” for through April 2014 (when the next rate case became effective).

Total residential wastewater volume (within the cap only): 97,094,100 gallons

Average wastewater volume: 5,255 gallons/month (average without cap: 7,306 gallons/month)

To determine the volumetric rates to generate the revenue requirement, splitting it between 60% from fixed (base) charges and 40% from variable (volumetric) rates:

Monthly Base Charge = $(\$650,228 * 60\%) = \$390,137 / 18,477 \text{ bills} = \$21.11/\text{bill}$

Volumetric Rate = $(\$650,228 * 40\%) = \$260,091 / 97,094,100 \text{ gallons within the cap} = \$2.68/1000 \text{ gallons}$

Based on our calculations using CY2012 as a “test year”, we determine that Aqua would have set for Fairways a \$21.11/month base charge plus \$2.68/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons) starting in January 2013.

Volumetric wastewater rates would decrease bills for consumptions 0 – 5,000 gallons, and increase for 6,000 gallons and above.

Gallons	Existing Rates	Volumetric Rates	Change in Bill
0	\$35.16	\$21.11	-\$14.05
1000	\$35.16	\$23.79	-\$11.37
2000	\$35.16	\$26.47	-\$8.69
3000	\$35.16	\$29.15	-\$6.01
4000	\$35.16	\$31.83	-\$3.33
5000	\$35.16	\$34.51	-\$0.65
6000	\$35.16	\$37.19	\$2.03
7000	\$35.16	\$39.87	\$4.71
8000	\$35.16	\$42.55	\$7.39
9000	\$35.16	\$45.23	\$10.07
10000	\$35.16	\$47.91	\$12.75
11000	\$35.16	\$50.59	\$15.43
12000	\$35.16	\$53.27	\$18.11
13000+	\$35.16	\$53.27	\$18.11

Calendar Year 2013:

2013 actual wastewater revenue from existing rates: \$662,695

2013 estimated revenue from modeled volumetric rates: \$643,492

New Base Revenue: \$398,641 (62%)

New Volumetric Revenue: \$244,851 (38%).

Number of bills: 18,884

Number of customers: 1,615

Average volume: 4,838 gallons/month (average without cap: 6,365 gallons/month)

The average volume consumed in CY 2013 (4,838 gallons/month) is lower than the average volume consumed in CY 2012 (5,255 gallons/month). Therefore, the volumetric revenue is lower than what would have been expected given CY 2012 consumption. This means that volumetric revenue only accounted for 38 percent of total revenue.

Calendar Year 2014:

- In order to simulate a rate case in May 2014 so that we could have new test year revenue requirement, we did the following:
 1. Divided the 2011 Fairways Wastewater Rate Case Revenue Requirement (\$1,046,195) by the number of test year customers established in the 2011 rate case (2,466). This calculates what the 2011 rate case established as an annual revenue requirement per wastewater customer.
 2. Divided the 2014 Fairways Wastewater Rate Case Revenue Requirement (\$1,135,832) by the number of test year customers established in the 2014 rate case (2,537). This calculates what the 2014 rate case established as an annual revenue requirement per wastewater customer.
 3. Divided the result of Step 2 by the result of Step 1, which equals 1.055. This ratio shows that the Utilities Commission in 2014 approved Fairways to earn 105.5% of the annual wastewater revenue per customer that it had been granted in the 2011 rate case.
 4. Divided the number of analyzed bills in Calendar Year 2012 (18,477) by 12, which equals 1,540. This is the approximate number of Fairways residential wastewater customers that had water meter volume data from Aqua NC at the start of the simulated 2011 rate case period in this analysis.
 5. Divided the number of analyzed bills from May 2013-April 2014 (19,114) by 12, which equals 1,593. This is the approximate number of Fairways residential wastewater customers that had water meter volume data from Aqua NC at the start of the simulated 2014 rate case period in this analysis. The number of customers went up since the previous rate case.
 6. Divided the result of Step 6 by the result of Step 5, which equals 1.0344. This step takes into account the growth in the number of customers Fairways had.

7. Multiplied the revenue requirement calculated for Fairways in CY2012 test year by the ratio of the approved revenues/customer from 2011 to 2014 (Step 3) and by the ratio of number of customers from 2011 to 2014 (Step 6).

$$\begin{aligned} \text{Annual residential wastewater revenue requirement in May 2014 onwards} = & \\ & \text{Revenue requirement from previous rate case } (\$650,228) \\ & \times \text{ Approved WW revenues per customer in 2014 / Approved WW} \\ & \text{revenues per customer in 2011 } (1.055) \\ & \times \text{ Number of customers in 2014 rate case / number of customers in} \\ & \text{previous rate case } (1.0344) \end{aligned}$$

This gives us the new annual revenue requirement of **\$709,600** going forwards from May 2014.

Number of residential volumetric wastewater bills from May 2013 through April 2014: 19,114

Total residential wastewater volume (within the cap only) from May 2013 through April 2014: 92,172,100 gallons

Average wastewater volume from May 2013 through April 2014: 4,822 gallons/month (average without cap: 6,346 gallons/month)

To determine the volumetric rates to generate the newly-calculated revenue requirement, splitting it between 60% from fixed (base) charges and 40% from variable (volumetric) rates:

$$\text{Monthly Base Charge} = (\$709,600 * 60\%) = \$425,760 / 19,114 \text{ bills} = \$22.27/\text{bill}$$

$$\text{Volumetric Charge: } (\$709,600 * 40\%) = \$283,840 / 92,172,100 \text{ gallons within the cap} = \$3.08/1000 \text{ gallons}$$

Based on our calculations using May 2013 through April 2014 as a “test year” to set rates in May 2014 onwards, we determine that Aqua would have set for Fairways a \$22.27/month base charge plus \$3.08/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons) starting in May 2014.

Volumetric wastewater rates would decrease bills for consumptions 0 – 4,000 gallons, and increase for 5,000 gallons and above.

Gallons	Existing Rates	Volumetric Rates	Change in Bill
0	\$36.60	\$22.27	-\$14.33
1000	\$36.60	\$25.35	-\$11.25
2000	\$36.60	\$28.43	-\$8.17
3000	\$36.60	\$31.51	-\$5.09
4000	\$36.60	\$34.59	-\$2.01
5000	\$36.60	\$37.67	\$1.07
6000	\$36.60	\$40.75	\$4.15

7000	\$36.60	\$43.83	\$7.23
8000	\$36.60	\$46.91	\$10.31
9000	\$36.60	\$49.99	\$13.39
10000	\$36.60	\$53.07	\$16.47
11000	\$36.60	\$56.15	\$19.55
12000	\$36.60	\$59.23	\$22.63
13000+	\$36.60	\$59.23	\$22.63

2014 actual wastewater revenue from existing rates: \$702,340

2014 estimated revenue from modeled volumetric rates (Jan-Apr using first rate case modeled rates and May-Dec using second rate case modeled rates): \$706,266

New Base Revenue: \$426,477 (60%)

New Volumetric Revenue: \$279,789 (40%)

Number of bills in CY2014: 19,486

Number of customers in CY2014: 1,650

Average volume in CY2014: 4,815 gallons/month (average without cap: 6,434 gallons/month)

Calendar Year 2015:

2015 actual wastewater revenue from existing rates: \$723,776

2015 estimated revenue from modeled volumetric rates: \$728,451

New Base Revenue: \$440,412 (60%)

New Volumetric Revenue: \$288,039 (40%)

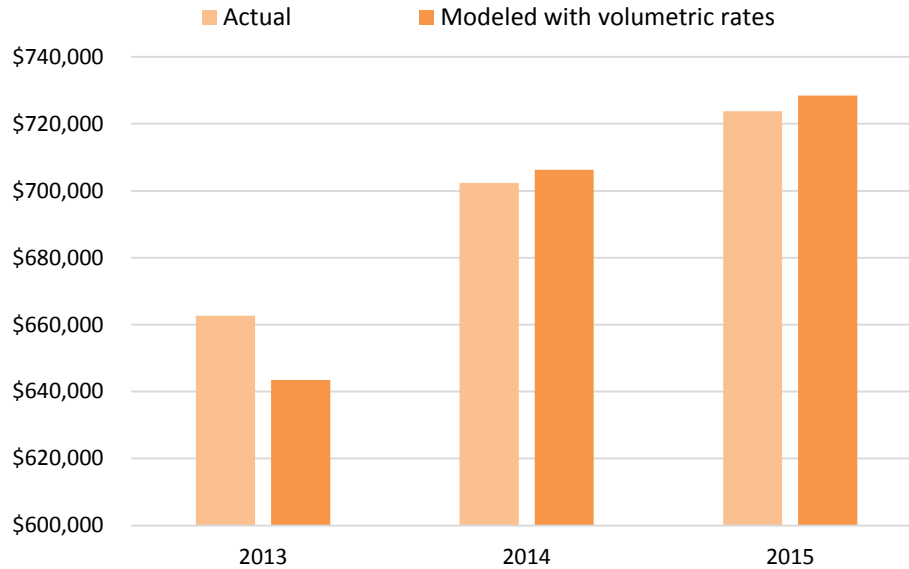
Number of bills: 19,776

Number of customers: 1,680

Average volume: 4,729 gallons/month (average without cap: 6,487 gallons/month)

Comparison of wastewater rates, bills and revenues in Fairways

Revenue from Volumetric Residential Customers in Fairways



	2013	2014	2015	Total
Actual	\$662,695	\$702,340	\$723,776	\$2,088,811
Modeled with volumetric rates	\$643,492	\$706,266	\$728,451	\$2,078,209
Difference	(\$19,203) -2.90%	\$3,926 0.56%	\$4,675 0.65%	(\$10,602) -0.51%

January 2013 – April 2014:

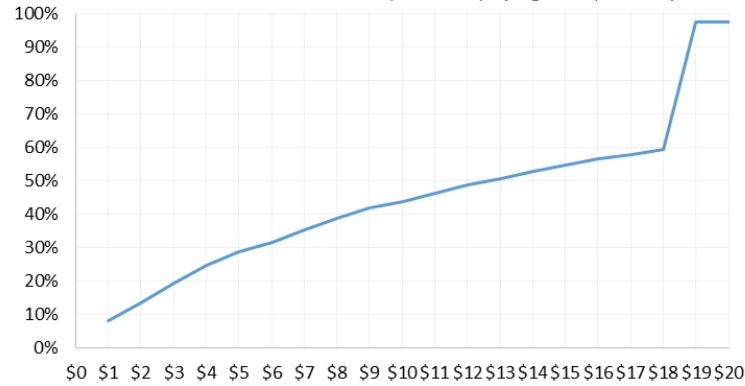
- Existing flat charge: \$35.16/month fixed charge
- Modeled rates: \$21.11/month base charge plus \$2.68/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons).
- Thus, bills for volumes less than 5,243 would be lower under the volumetric rates than under the existing flat charge. Bills with greater volumes would be higher than under the existing flat charge.

May 2014 – September 2015:

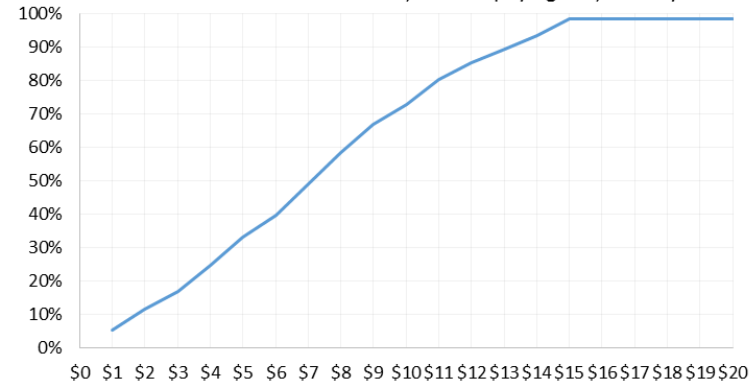
- Existing flat charge: \$36.60/month fixed charge
- Modeled rates: \$22.27/month base charge plus \$3.08/1000 gallon uniform rate on residential wastewater volumes (capped at 12,000 gallons).
- Thus, bills for volumes less than 4,653 would be lower under the volumetric rates than under the existing flat charge. Bills with greater volumes would be higher than under the existing flat charge.

CY	% of bills that would increase	% of bills that would decrease
2013	35%	65%
2014	38%	62%
2015	39%	61%

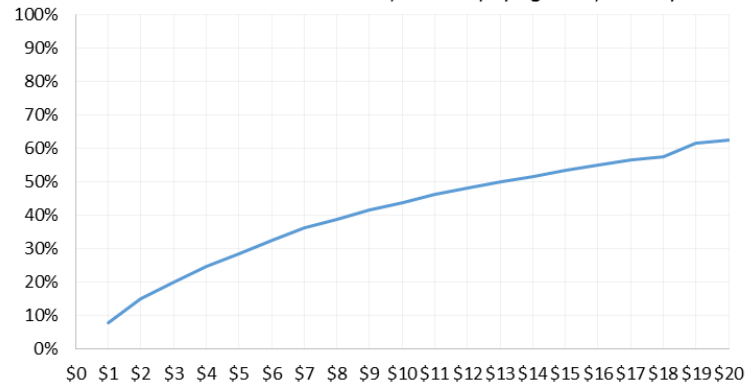
Cumulative distribution function of the 6,633 bills paying more, Fairways 2013



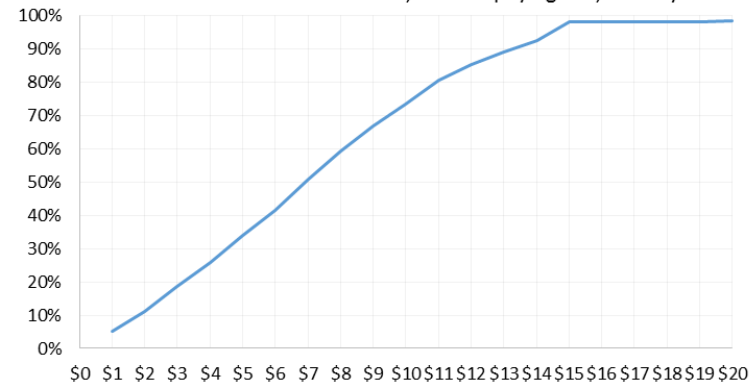
Cumulative distribution function of the 12,251 bills paying less, Fairways 2013

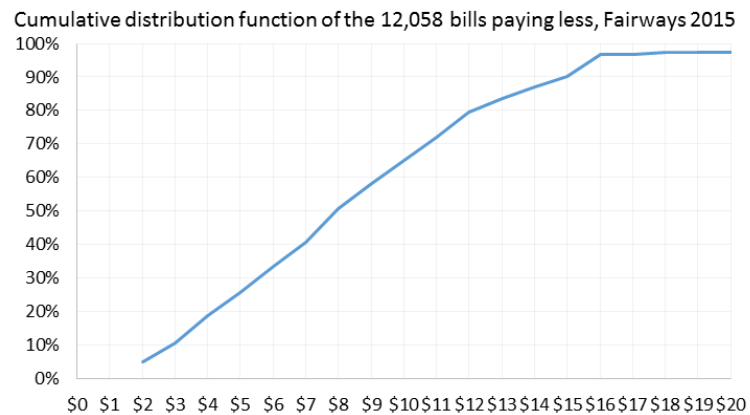
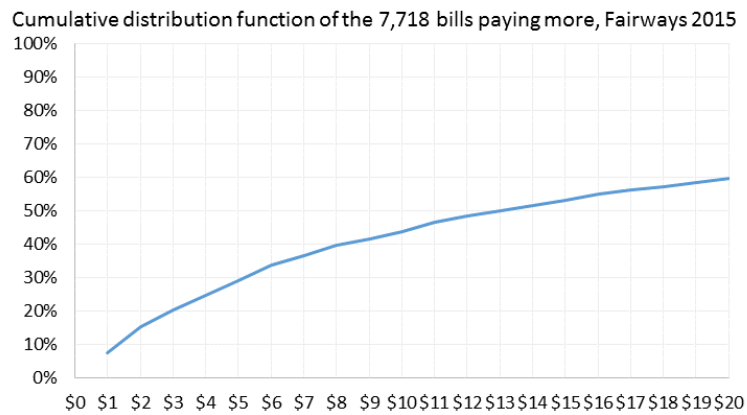


Cumulative distribution function of the 7,413 bills paying more, Fairways 2014



Cumulative distribution function of the 12,073 bills paying less, Fairways 2014





Conclusion

This report:

- a) provides answers to inquiries from the Public Staff about pricing and billing practices in North Carolina,
- b) demonstrates the effects of a water rate consumption adjustment mechanism on Aqua's revenues and Aqua's customers' bills by simulating its use in the past four years using actual customer water use data (and simulated increase to all water use levels), and
- c) demonstrates the effects of volumetric wastewater rates on Aqua's revenues and Aqua's customers' bills by simulating its use in place of flat-rate billing for the residential customers that also receive water service from Aqua.

The analysis demonstrates that average water use has declined significantly among Aqua water customers, relative to test year average water use, although has recently stabilized close to 5,000 gallons/month average for ANC customers. The drop in average consumption reduced the water revenues generated below the rate case revenue requirements for most years (despite a growth in customers). In the simulation of the consumption adjustment mechanism, a surcharge would have been applied nearly every year for the water customers for the past three years to compensate Aqua for this reduction. In the simulation of a "high use" scenario in which water use increases over the test year average, credit surcharges would have applied.

The analysis also demonstrates that revenue-neutral volumetric wastewater rates can lower wastewater charges to the residential customers with Aqua water meters that use, generally, below 5,000 gallons/month. For customers that use more than 5,000 gallons/month, volumetric wastewater rates would increase their monthly wastewater bills significantly relative to the current flat-rate charge.

This report maintains a narrow scope of assessing the potential impacts of a consumption adjustment mechanism on customer water bills and Aqua water revenues and the potential impacts of volumetric pricing on customer wastewater bills and Aqua wastewater revenues. In submitting this report, the EFC does not offer a recommendation on whether or not to implement either option. Authorizing a change to the water or wastewater rate structure requires additional policy and values tradeoffs that are ultimately the domain of the Commission, and are beyond the scope of this study. The simulated effects of these two rate mechanisms on actual, historic Aqua customer bills and Aqua revenues reported in this study could help inform the decisions of the Commission and Aqua.