BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

Application of California-American Water Company (U210W) for Authorization to Increase its Revenues for Water Service by \$55,771,300 or 18.71% in the year 2024, by \$19,565,300 or 5.50% in the year 2025, and by \$19,892,400 or 5.30% in the year 2026.	A.22-07-001 (Filed July 1, 2022)

SUPPLEMENTAL DIRECT TESTIMONY OF DAVID MITCHELL

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SUPPLEMENTAL DIRECT TESTIMONY OF DAVID MITCHELL

I. INTRODUCTION

Q1. Please state your name, business address, and telephone number.

A1. My name is David Mitchell. My business address is 5358 Miles Avenue, Oakland, California, 94618. My telephone number is 510-593-6913

Q2. By whom are you employed and in what capacity?

A2. I am a General Partner in M.Cubed, an economic consulting firm.

Q3. Are there any changes to your qualifications?

A3. No.

II. PURPOSE OF MY TESTIMONY

Q4. What is the purpose of your testimony?

A4. The purpose of my testimony is to discuss my analysis of the difference between the Water Resources Sustainability Plan ("WRSP") and the Monterey WRAM ("M-WRAM") with respect to conservation, low-income customers, and utility incentives. I will also address California American Water's WRSP specifically and how it complies with legislative requirements and addresses concerns raised by the Commission D.20-08-

047. Last, I provide an updated sales forecast incorporating the revised rate design that is part of the WRSP and which includes more recent data.

III. WRSP AND THE M-WRAM

Q5. What is the difference between the WRSP and the M-WRAM?

A5. In public utility regulation, revenue decoupling is a ratemaking mechanism that is designed to eliminate or reduce the dependence of a utility's revenues on the level of sales, thereby removing the "throughput" incentive to sell as much commodity as possible in order to maximize revenues and profits. By severing the relationship between sales volume and revenue, decoupling removes the financial disincentives to promote customer efficiency programs.[1]

Revenue decoupling has been used in the energy utility sector for many decades.[2] All of the energy utilities regulated by the Commission are decoupled. Its introduction to the water utility sector is more recent. The Commission first implemented revenue decoupling for water utilities in 2008 as part of a pilot program to transition Class A

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[1] Jenya Kahn-Lang, "Effects of Electric Utility Decoupling on Energy Efficiency," *The Energy Journal*, https://www.jstor.org/stable/44075504, Vol. 37, No. 4 (October 2016), pp. 297-314; Victor von Loessl and Heike Wetzel, "Revenue decoupling, energy demand, and energy efficiency: Empirical evidence from the U.S. electricity sector," *Utilities Policy,* Vol. 79, https://doi.org/10.1016/j.jup.2022.101416, December 2022.

[2] And it continues to be an important policy lever. See, for example, this post from the American Council for an Energy Efficient Economy on the importance of decoupling for carbon reduction: https://www.aceee.org/blog-post/2020/08/shift-toward-electrification-decoupling-remains-key-driving-decarbonization. Additionally, " NRDC tracks and regularly updates progress on 'revenue decoupling,' a crucial utility regulatory reform that breaks the link between the financial health of investor-owned and publicly owned utilities and their sales of electricity and natural gas." Ralph Cavanagh, "Clean Energy Progress in America's Electric Sector in 2018," *NRDC Expert Blog*, https://www.nrdc.org/experts/ralph-cavanagh/clean-energy-progress-americas-electric-sector-2018-0December 6, 2018.

water utilities to conservation rate designs and encourage greater investment in customer conservation programs and assistance.[3]

Since 2008, half the Class A water utilities regulated by the Commission have operated under a fully decoupled Water Revenue Adjustment Mechanism (hereafter, WRAM). The other half have operated under a so-called Monterey-Style Water Revenue Adjustment Mechanism (hereafter, M-WRAM).

In a General Rate Case, rates are established to recover the authorized revenue requirement:

$$Revenue\ Requirement = \sum_i R_i \cdot Q_i^*$$

In the above equation, Q_i^* is the forecasted level of sales and R_i is the commodity rate in each block (indexed by i). The values for the *Revenue Requirement*, R_i, and Q_i^* are determined in the General Rate Case.

Realized revenue is based on actual sales:

$$Realized\ Revenue = \sum_i R_i \cdot Q_i$$

In this equation, Q_i is the realized level of sales in each block which may differ from the forecasted level, Q_i^*.

[3] *See,* D.08-06-022, D.08-08-030, D.08-09-026, D.08-11-023, D09-05-005, D.09-07-021 and D.10-06-038.

With full decoupling, realized revenue is compared to the revenue requirement determined in the GRC.[4]

$$Realized\ Revenue - Revenue\ Requirement = \sum_i R_i \cdot (Q_i - Q_i^*)$$

Under the WRAM or California American Water's proposed WRSP, revenue is fully decoupled from sales. The utility's revenue requirement is established in a General Rate Case. If realized revenue exceeds the established revenue requirement, the excess is credited back to customers on future bills via surcredits. Conversely, if realized revenue falls short of the established revenue requirement, the shortfall is recovered from customers on future bills via surcharges. The utility gains nothing by encouraging additional water consumption because any excess revenue earned thereby will simply be credited back to customers. Similarly, it loses nothing by promoting conservation and investing in water use efficiency programs because any shortfall in revenue caused by these actions will be recovered by the utility through future surcharges.

Unlike the WRAM or the proposed WRSP, the M-WRAM does not decouple sales from revenue. Instead, it is designed to reduce the variance in revenue caused by the use of increasing-block rates. Relative to a uniform rate, an increasing-block rate design will increase revenue variability because marginal changes in water use are more likely to occur in the upper blocks of the rate design – in fact, increasing customer responsiveness to the price signal in order to incentivize conservation is the primary goal of increasing-block rates. If all consumption were charged the Single-Quantity-Rate (SQR)[5], the

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[4] Additionally, differences between forecasted and actual variable production cost are tracked in a Modified Cost Balancing Account (MCBA) and differences between projected and realized variable production cost are factored into the calculation of surcharges and surcredits. For the sake of parsimony, the accounting of variable production cost is not shown in the above equations.

[5] The SQR is the uniform volumetric rate that would fully recover the revenue requirement given the forecasted level of water sales.

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change in revenue from a one unit change in consumption is the SQR. Now instead suppose the utility has a four-tier increasing-block rate design where the rate in each block is a multiple of the SQR. The SQR multiplier will be less than 1 in the lower blocks and greater than 1 in the higher blocks. Suppose the multiplier is 1.25 in the third block and 1.5 in the fourth block. In this case, the change in revenue from a one unit change in consumption would be 25% greater in the third block and 50% greater in the fourth block than if the utility had been charging the SQR for all units of consumption. Hence, with block rates, revenue variability increases since most of the change in consumption occurs in the upper blocks of the rate design.

The M-WRAM adjusts the utility's revenue for the difference between the revenue it earns from block rates and the revenue it would have earned if it had instead been charging the SQR on all units of consumption. When rates are set in the General Rate Case, the block rates are calibrated to generate the same revenue as would be generated by the SQR:

$$Revenue\ Requirement = \sum_i R_i \cdot Q_i^* = \sum_i SQR \cdot Q_i^*$$

In the above equation, Q_i^* is again the forecasted level of sales and R_i is the commodity rate in each block. The values for the *Revenue Requirement*, R_i, SQR, and Q_i^* are determined in the General Rate Case.

As before, realized revenue is based on actual sales:

$$Realized\ Revenue = \sum_i R_i \cdot Q_i$$

In this equation, Q_i is the realized level of sales in each block which may differ from the forecasted level, Q_i^*. The M-WRAM compares the realized revenue under the block rates

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to the revenue that would have been realized if all units of consumption had been sold at the SQR:

$$\sum_i R_i \cdot Q_i - \sum_i SQR \cdot Q_i$$

Positive differences are credited back to customers via surcredits on future bills and negative differences are recovered from customers via surcharges on future bills. This has the effect of pegging the utility's revenue to the SQR rather than to the increasing-block rates and thus revenue variability is reduced, and the rate design's conservation signal is enhanced.

The key point to note is that unlike the WRAM or proposed WRSP, the M-WRAM does not eliminate the throughput incentive. It is not a true revenue decoupling mechanism. Whereas the WRAM or proposed WRSP use forecasted sales Q* as the basis for adjusting revenues, the M-WRAM lets revenues float with realized sales Q. For each additional unit sold, the utility gains SQR in revenue. Conversely, for each additional unit NOT sold, the utility forgoes SQR in revenue. Thus, the utility has a financial incentive to encourage sales and discourage conservation under the M-WRAM because it will increase its revenue when sales increase and it will decrease its revenue when sales decrease. With the WRAM or proposed WRSP, this relationship between sales and revenue is severed. If sales are in excess of the level needed to recover its revenue requirement, the surplus is credited back to customers, and if sales are deficient, the deficit is recovered in subsequent periods from customers.

Q6. Do the WRSP and the M-WRAM create different incentives for water utilities?

A6. Yes. As I just illustrated, under the WRAM or proposed WRSP the utility neither gains nor loses when sales are above or below their forecasted level. As a consequence, they do not have a financial incentive to promote sales or discourage conservation. Under the M-

WRAM, on the other hand, the utility gains SQR in revenue for each unit of sales above the forecast and loses SQR for each unit below the forecast. As a consequence, the utility *does* have a financial incentive to promote sales and discourage conservation.

One way to promote sales is to propose rate designs that dilute the financial incentive to conserve water. This can be done by shifting revenue recovery into fixed service charges and widening and flattening the commodity blocks. As I discuss below, both of these strategies have been pursued by Class A utilities with the M-WRAM.

Additionally, the two mechanisms create different incentives to accurately forecast sales. In D.20-08-047, the Commission stated:[6]

> As discussed elsewhere in this decision, both utilities and their customers rely on forecasts that are as accurate as possible. Without a WRAM/MCBA mechanism, the forecast determines how all rates, both service charge and quantity rates, are established for the future. It will be incumbent upon the parties in each GRC to determine that the recommended forecasts are as accurate as possible. The consequences of inaccuracy can be significant to both the water utility and the customer. The WRAM/MCBA mechanism removes most of those consequences from the water utility and removes most of the risk from customers, by adding a means to adjust future rates to meet the approved revenue requirement.

In the case of the M-WRAM, the consequences of a forecast that errs on the high-side is under-recovery of revenue and one that errs on the low-side is over-recovery of revenue. In California, in particular, the sales distribution is not symmetrical, like a bell curve, but instead has a long left tail (as shown in Figure Cal Am – 2, below). As a consequence, it

[6] D.20-08-047, page 73.

is more likely for a utility to over than to under forecast sales. Thus, utilities with an M-WRAM have a strong incentive to adopt very conservative sales forecasts because this will help mitigate the risk of revenue under-recovery.[7]

The WRAM or proposed WRSP changes these incentives because the utility can only earn what is authorized in the General Rate Case. The risk to the utility of under-recovery and the risk to customers of over-recovery is removed. As stated by the Commission, the WRAM/MCBA mechanism “removes most of those consequences from the water utility and removes most of the risk from customers.”

D.20-08-047 asserts that the WRAM/MCBA “eliminates the incentive to accurately forecast sales in the GRC.”[8] The evidence I have reviewed does not support this assertion. For example, we compared the accuracy of 2020 sales forecasts prepared by California American Water and California Water Service, each of which have operated with a WRAM since 2008, to the average sales forecast accuracy of all California urban water suppliers, which projected 2020 sales in their 2015 Urban Water Management Plans (UWMPs) and reported actual sales in their 2020 UWMPs.[9] To guard against biasing the forecast performance metrics due to outlier forecast errors, we removed the

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[7] It will also boost revenue. As noted by the Commission, the sales forecast determines the rates and charges that are adopted. A conservative forecast will produce a higher SQR and this will result in higher revenue for the utility because water demand is inelastic and therefore the change in sales due to the higher rate will be less than proportionate to the increase in the rate itself and so revenue will increase.

[8] D.20-08-047, page 53.

[9] For the assessment of California Water Service sales forecasts, see Mitchell, David. (2022). Rebuttal to Public Advocates Office Report on California Water Service Company’s Sales Forecast: California Water Service Company General Rate Case Application 12-07-002. Prepared by M.Cubed, March 2022.

largest 5% of the forecast errors in the UWMP dataset before calculating the forecast mean absolute percentage error (MAPE).[10]

- For single-family residential water use, the UWMP average forecast error across 318 suppliers was 20%. The mean absolute error for California American was 2% across its 10 districts and for California Water Service it was less than 4% across its 24 districts.[11]

- For commercial water use, the UWMP average forecast error across 281 suppliers was 34%. The mean absolute error for both California American and California Water Service was less than 10%.

Cal Am's overall 2020 sales forecast error across its 10 districts was 3.3%, which is hugely better than average forecast performance by California's urban water utilities as a whole. Based on these results, I see no evidence that utilities with a WRAM are more likely to produce inaccurate sales forecast.

Q7. Have you reviewed Commission decision D.20-08-047?

A7. Yes, I have.

Q8. Do you agree with the conclusions in that decision regarding the conservation and decoupling?

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[10] 2015 and 2020 UWMP data were downloaded from the DWR website (https://wuedata.water.ca.gov/). The reported count of suppliers in each use category is the number of suppliers that projected 2020 water use in that category in their 2015 UWMP and reported actual 2020 water use in that category in their 2020 UWMP. The tally for each category excludes the top 5% of suppliers in terms of forecast error.

[11] Cal Am districts include in this assessment are: Baldwin Hills, Duarte, San Marino, San Diego, Ventura, Larkfield, Sacramento, Monterey, Central Satellite, and Chualar.

A8. No, I do not. As laid out in an August 2020 report prepared with co-authors Tom Chesnutt and Gary Fiske,[12] we conclude that D.20-08-047 made several factual errors regarding the conservation performance of utilities with a WRAM relative to those with a Monterey-Style WRAM. I will summarize our main findings here with page references to both our report (hereafter Report, which is Attachment 1 to this testimony) and D.20-08-047 (hereafter Decision).

For starters, the Decision (p. 103) incorrectly states as a finding of fact that block rate designs are "a reasonable means to stabilizing revenues." As explained above and noted in our Report (p.4), the opposite is the case. Block rate designs result in less stable, not more stable, revenue. This has long been noted in the ratemaking literature and was a primary reason for adopting the WRAM to begin with.[13] D.20-08-047 directly contradicts D.08-08-030, which implemented full decoupling for Class A utilities. D.08-08-030 states on page 14: "Increasing block rates also **increase** volatility in sales, sales forecasts, and earnings. The proposed WRAM eliminates that volatility." (Emphasis added.) D.20-08-047 does not explain why the Commission has chosen to reverse this finding and does not provide supporting evidence for this change.

In the absence of a decoupling mechanism, there are different ways to mitigate revenue volatility. The two most common strategies are to recover more revenue through fixed service charges and to widen and flatten the steps between rate blocks. The first approach is a de facto partial revenue decoupling mechanism that adversely impacts conservation and affordability. Conservation is negatively affected because commodity charges

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[12] Mitchell, David, Tom Chesnutt, and Gary Fiske, "Impacts on Customer Bills and Water Use of Recoupling Water Utility Revenue and Sales: Analysis of CPUC Proposed Decision to Transition all Class A Utilities to a Monterey-Style Water Revenue Adjustment Mechanism. August 2020.

[13] For a general discussion of block rates and revenue instability, see: Chesnutt, T.W., C.N. McSpadden, and J. Christianson (1996), "Revenue Instability Induced by Conservation Rate Structures," Journal of the American Water Works Association, January 1996.

necessarily fall as fixed charges rise and customers' financial incentives to reduce water use are thereby lessened. As I noted above, this also works to the utility's advantage by encouraging more water use by customers. Affordability is adversely impacted because customers that use small amounts of water end up paying more overall for water service due to the higher fixed charges. Customers enrolled in low-income assistance programs use less water, on average, than other customers, and thus are disproportionately impacted by higher fixed service charges. In the bill impact simulations I describe later in my testimony, we found this to be the case even after accounting for the CAP (formerly called LIRA) subsidies received by low-income households.

Widening and flattening the steps between rate blocks can also help reduce revenue volatility but it does so by weakening the price incentive to conserve water, particularly for customers in the upper blocks of consumption.

The Decision (p.53) also wrongly asserts that rate design and rate impacts "are independent of whether a utility has a WRAM or Monterey-Style WRAM." In our Report (pp. 5-7), we point out that the Commission has, in effect, been running a natural experiment in rate design incentives for the past ten or so years by fully decoupling some of the Class A utilities and keeping the others on the M- WRAM. We do not need to conjecture on whether the two mechanisms provide different incentives for rate design; we can simply look at the evidence:

- A comparative analysis of rate designs used by the fully decoupled utilities and those with the M-WRAM showed that the rate designs employed by the latter group of utilities, on average, recover more revenue from the service charge – about 35% more – and have fewer and flatter tiers. In other words, the rate designs employed by the utilities with the M-WRAM were less conservation oriented than those employed by the utilities with full revenue decoupling.

- The comparative analysis also showed that, on average, the utilities operating under the M-WRAM recover about 66 percent more of their fixed costs from fixed service charges than do the fully decoupled utilities. We also see that the Class A utilities being transitioned from full decoupling to the M-WRAM are proposing to significantly increase revenue recovery from fixed service charges. In the absence of full decoupling, this is the most straightforward way to stabilize sales revenue, but it comes at the cost of reduced financial incentive for customers to conserve water.

- We also found that the utilities operating with the M-WRAM have substantially less authorized expenditure for conservation than do the fully decoupled utilities – about 47 to 56 percent less expenditure per residential customer.

- Thus, we concluded, just as theory would predict, that the utilities operating with the M-WRAM recover significantly more of their fixed costs through fixed service charges, have block rate designs that provide less incentive to conserve water, and have significantly lower authorized conservation program expenditure.

Q9. Have you analyzed the differences in conservation between the companies with a decoupling WRAM and companies with a M-WRAM?

A9. Yes, the Report (p. 13 and Table 3) examined this question in detail. It found that authorized annual conservation program expenditures for the fully decoupled Class A utilities were more than double the level for M-WRAM utilities -- $18 per residential customer compared to $8 per residential customer.

The Report (p. 22) also found that between 2008 and 2018, fully decoupled utilities saw larger reductions in water use per customer than M-WRAM utilities. The difference is enough to meet the needs of 84,000 households.

The Decision (p. 69) incorrectly uses the fact that fully decoupled and M- WRAM utilities achieved similar water use reductions during the 2013-2016 drought as evidence that the two revenue mechanisms perform similarly in terms of water conservation. However, this is a false equivalency for two reasons:

- First, conservation was not discretionary during the drought emergency. Utilities and their customers were complying with the state's regulatory conservation mandate. Fully decoupled and M-WRAM utilities had similar state mandated reduction requirements and therefore achieved similar drought savings (Report, p. 20).

- Second, all but one of the M-WRAM utilities were fully decoupled during the drought via a Lost Revenue Memorandum Account (LRMA). The one M-WRAM utility that did not avail itself of the LRMA was the only Class A utility that failed to comply with the state conservation mandate (Report, p. 21).

Prior to the drought, between 2008 and 2014, a period of discretionary water conservation expenditure, fully decoupled utilities achieved a 29% larger reduction in water use per customer than M-WRAM utilities (Report, p. 21). Similar efficiency gains from decoupling have been reported for energy utilities. For example, studies conducted by NRDC found that "utilities more than doubled their energy savings in 2008 compared to a decade earlier when regulators had eliminated decoupling for several years."[14]

Q10. If encouraging conservation is a priority for the Commission, which mechanism provides greater incentives?

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[14] Dylan Sullivan, et al, "Removing Disincentives to Utility Energy Efficiency Efforts," https://www.nrdc.org/sites/default/files/decoupling-utility-energy.pdf, May 2012.

A10. The evidence garnered from 2008 to present clearly indicates that the Class A utilities with full decoupling:

- Adopted more aggressive conservation rate designs
- Recovered a lower percentage of fixed costs through fixed service charges
- Invested more in customer conservation programs
- And achieved greater reductions in customer water use

Based on the preponderance of the evidence, I conclude that full decoupling provided greater incentives to promote and achieve conservation than did the M- WRAM.

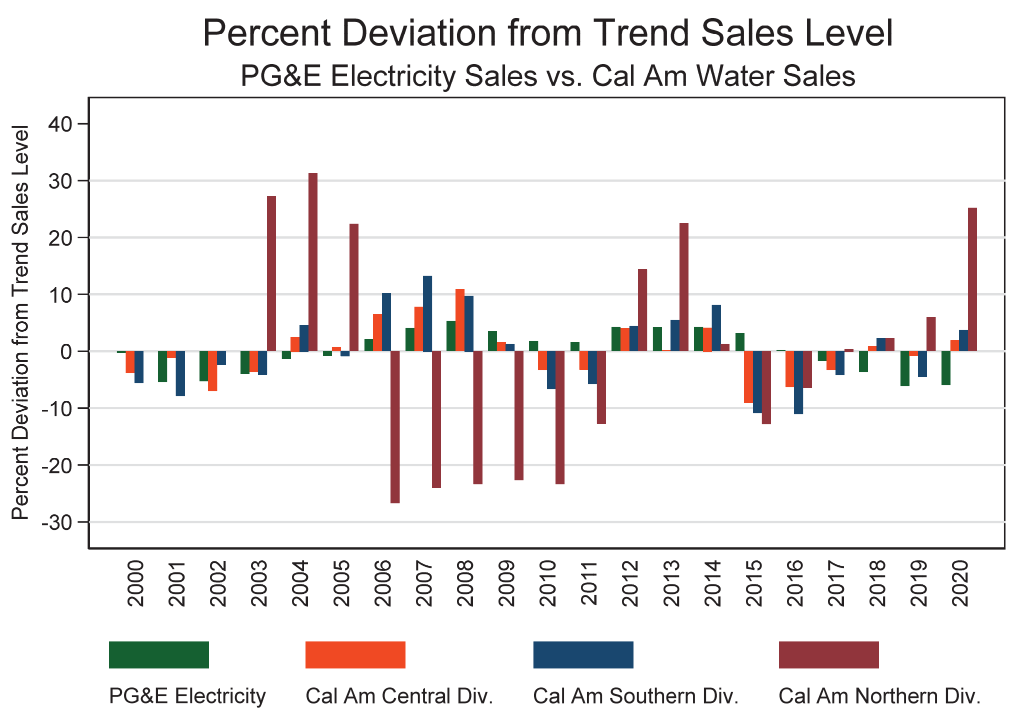
IV. NEED FOR DECOUPLING MECHANISM

Q11. Are there factors specific to the water industry that heighten the need for a decoupling mechanism?

A11. Yes, there are. In California, water sales are highly variable due to the state's extreme climate and constraints on surface and groundwater supply which necessitates periodic rationing of water use. In years when water use is rationed, sales may decrease by 10 to 30 percent. After rationing is lifted, sales tend to remain depressed and typically do not fully rebound to their pre-rationing level because water users have made long-lived investments to conserve water. Gauging the rate and extent to which sales will recover following the lifting of rationing is inherently difficult and makes accurate sales forecasts challenging. For the period 1989-2021, the annual coefficient of variation in Cal Am water sales has been approximately 14%.[15] This constitutes significant annual sales variability.

In the energy sectors, by comparison, annual sales typically vary by only a few percent. Comparing Pacific Gas & Electric Company's (PG&E) electricity sales for 2000-2020, the coefficient of variation is only 3.8%.[16] For the same period, the coefficient of variation for Cal Am divisional sales was 13-14%, or more than three times as large. For PG&E, the largest deviation from the trend sales level in any one year was 6.1%; for Cal Am it was 31.3%. The relative magnitude of deviations from trend sales level is illustrated in Figure Cal Am - 1.

Figure Cal Am - 1

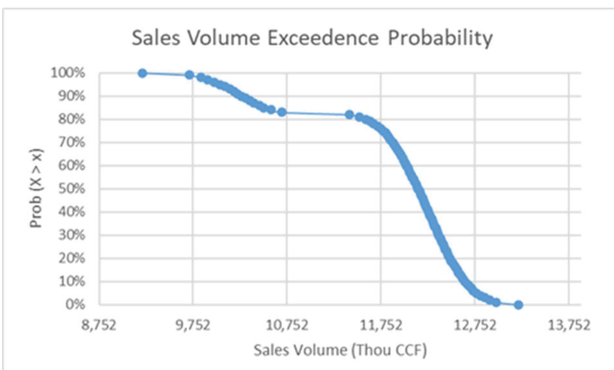


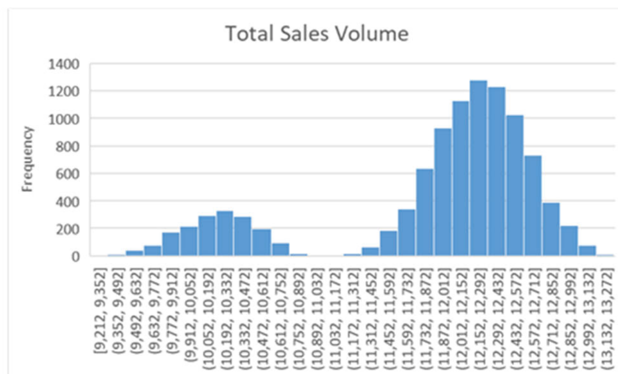
[15] The coefficient of variation is the standard deviation in annual sales divided by mean annual sales. It is a unitless measure of the typical variability in a data series.

[16] PG&E 2023 ERRA Forecast Workpapers, A.22-05-029, 02.ERRA 2023-Forecast_WP_PGE_20221017_Ch02_2-3_Sales_REV1_PUB.xlsx.

Moreover, there is not much upside for sales because years when sales would be higher than expected are precisely the years when rationing is most likely – namely, years when rainfall is sparse, and/or temperature is higher than normal. The sales and revenue distributions are not symmetrical – i.e., like a bell curve – but rather are left-skewed and bimodal. We've used Monte Carlo simulation to characterize the sales and revenue distributions for Cal Am districts. The simulation considers uncertainty in the primary factors that drive annual water sales -- weather, hydrology, and employment. An example using Sacramento is shown in Figure Cal Am - 2. The distribution is strongly left-skewed and bi-modal.

Figure Cal Am - 2





The asymmetry in sales generates financial risk for two reasons. First, the potential decrease in sales is large, both in magnitude and duration. Sales reductions in excess of 20% and lasting more than a year are not uncommon.[17] Second, urban water systems are capital intensive, with fixed capital costs comprising 50-80% of total cost in most cases.[18] More than half of fixed costs are typically recovered from volume charges. When sales decrease, fixed cost recovery is put in jeopardy. This is not a new issue. In

[17] Mitchell, David L., et al. (2017). *Building Drought Resilience in California's Cities and Suburbs*. Public Policy Institute of California. Accessible from: https://www.ppic.org/content/pubs/report/R_0617DMR.pdf

[18] CPUC D. 16-12-026.

1994, UC Berkeley Professor Michael Hanemann and I noted in a report for the California Urban Water Conservation Council that:

> Class A utilities, however, are in a difficult situation. Because their ability to adjust rates, use surplus funds, or use balancing accounts to stabilize revenue during rationing periods is very restricted, and because at least 50 percent of fixed costs must be recovered through volume charges, they frequently are unable to cover their fixed costs when demand drops off during a shortage.[19]

The adoption of the WRAM/MCBA in 2008 largely addressed the issue by providing a mechanism for tracking and recovering fixed costs when realized sales were below expected. The Commission's decision to prohibit the companies with WRAM/MCBAs from proposing that these mechanisms should continue in their next General Rate Cases has brought fixed cost recovery risk back to the fore.

Q12. As compared to energy utilities, do water utilities experience more or less variability with respect to annual usage?

A12. Water utilities experience more sales variability than energy utilities. As discussed above, Cal Am's annual sales, for example, are at least three times more variable than PG&E's, and PG&E's sales tend to be more variable than the other major energy utilities because it serves more agricultural load than do the other energy providers. In fact, agricultural sales are a major source of sales variation for PG&E.[20] It is worth noting that the variability in agricultural energy use is primarily related to agricultural water use and thus

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[19] Mitchell, David L., and W. Michael Hanemann (1994). *Setting Urban Water Rates for Efficiency and Conservation: A Discussion of Issues*. A Report Sponsored by the California Urban Water Conservation Council. October 1994.

[20] Testimony of Richard McCann and Laura Norin on Behalf of the Agricultural Parties in Pacific Gas & Electric's (PG&E's) 2017 General Rate Case Phase 2 Application Addressing PG&E's Agricultural Class Balancing Account Study, as Revised on February 9, 2018, A.16-06-013, March 15, 2017, p. 13, Table 2.

the same hydrologic factors that result in large variations in water utility sales also are at play with respect to agricultural energy use. The difference, however, is that agricultural energy use comprises only a small share of total energy sales and thus the impact is diluted.[21] This is not the case for water utilities. Virtually all water sales are affected by swings in hydrology and the availability of water supply. Consequently, water utilities in California experience greater sales variability than energy utilities.

Q13. Please compare the ability to forecast energy usage to the ability to forecast water usage.

A13. Excluding agriculture, energy sales forecasting is driven by four factors, all of which are also common to water sales forecasting:

- Population and household growth;

- Changes in economic activity, sector specific for commercial, industrial and agricultural;

- Changes in use efficiency;

- Price responsiveness by customers.

Each of these generally follow long term trends or are relatively predictable. Population rarely falls and no longer grows faster than 2%. Economic activity rarely changes by more than 5% in a year in either direction. Energy efficiency is a gradual process. And price responsiveness can be projected based on changes in utility revenue requirements.

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[21] Agriculture accounted for just under 8% of PG&E's sales for 2016-2020. PG&E 2023 ERRA Forecast Workpapers, A.22-05-029, 02.ERRA 2023-Forecast_WP_PGE_20221017_Ch02_2-3_Sales_REV1_PUB.xlsx.

But water sales have a fifth factor—water availability. For electricity utilities, agricultural customers often self-supply through wells which means that loads go up when surface water supplies are curtailed. However, agricultural sales are less than 8% of total sales for PG&E, and substantially less for Southern California Edison and San Diego Gas and Electric, so the influence on overall sales variation is muted. (For gas utilities, water sales are largely a non-factor. Heated indoor water use is largely invariant with water conditions.)

For urban water utilities, variations in water availability have two important influences. First, during drought conditions, customers are frequently asked to make extraordinary conservation efforts, often reinforced with mandatory restrictions on particular activities such as landscape irrigation. In the 2013-2016 drought, for example, the state mandated that urban water utilities reduce sales by 8% to 36%, with a goal of reducing overall urban water use by 25%.[22] Second, excessively wet years also suppress sales – typically by 5-10% – by reducing the need for landscape irrigation. The highest water sales typically occur in average water years rather than in years that are unusually wet or dry. These two factors are what cause the asymmetric sales distribution shown in Figure Cal Am – 2 above.

With regard to forecasting sales, it is almost impossible to predict the water conditions for the coming year. There is no strong long-term trend and the deviations up or down from the average can be more than 50% downward and over 100% upward.[23] Time-series of annual precipitation and runoff are largely consistent with a random walk process, and thus we go into each year not knowing if it will be wet, dry, or average. We

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[22] For discussion of the state conservation mandate, see Mitchell, D., et al. 2017. Building Drought Resilience in California's Cities and Suburbs. Public Policy Institute of California. https://www.ppic.org/publication/building-drought-resilience-californias-cities-suburbs/

[23] For annual variation in California hydrology, see https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST

see this playing out now in the winter of 2022/23. NOAA's long-range forecasts predicted a drier than normal winter due to persistent La Nina conditions in the Pacific Ocean. Yet currently California is experiencing record precipitation and appears to be on-track to have one of its wettest winters on record. We also know, however, that conditions can change unexpectedly, as they did in 2020/2021 when California's water year started out wet and then abruptly changed to extremely dry. This fifth factor is beyond our current ability to effectively forecast.

In contrast, with regard to the other four factors, the most volatile of which is changes in economic activity, vast resources are devoted to forecasting possible changes such as a surge in growth or a pending recession, and the variations are much less in magnitude than for water availability. As a result, energy utility sales do not vary nearly as much, and the variations can be better anticipated than those of water utility sales.

Q14. Do the differences in usage variability and issues related to forecasting make a decoupling mechanism more necessary for water utilities?

A14. I would say it does. Even with their forecasting advantage, energy utilities are afforded effective revenue adjustment mechanisms through various balancing accounts. A review of the Preliminary Statements for the four large energy utilities shows at least 17 different balancing accounts that establish forward annual revenue requirements and then credit or debit projected utility revenue requirements based on realized revenue collections.[24] One such account, the Portfolio Allocation Balancing Account (PABA), goes so far as to

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[24] PGAE-2022-ELEC_PRELIM_CZ-DRAM, PGAE-2022-ELEC_PRELIM_DI-PEEBA, PGAE-2022-ELEC_PRELIM_HS-PABA, PGAE-2022-GAS_PRELIM_FC (Prelim)-RBAMA, PGAE-2022-GAS_PRELIM_F-CFCA, PGAE-2022-GAS_PRELIM_J-NCCCA, SCE-ELECTRIC_PRELIM_WW-PABA, SCE-ELECTRIC_PRELIM_YY-BRRBA, SCG-2019-PBR_PS-XI, SCG-2022-GAS_G-PRELIM_PS-V, SCG-DIMPBA-2022, SCG-GAS_G-PRELIM_CFCA-2022, SCG-GAS_G-PRELIM_NFCA-2022, SDGE-2022-ELEC_ELEC-PRELIM_EDFCA, SDGE-2022-ELEC_ELEC-PRELIM_PABA, SDGE-2022-GAS_GAS-PRELIM_CFCA, SDGE-2022-GAS_GAS-PRELIM_NFCA, SDGE-Prelim-CFCA_2022.

require transfers from one set of load-serving entities (LSEs) who either provide direct access (DA) service or are community choice aggregators (CCAs) to the large utilities to ensure that they are made whole on recovering their generation asset and power purchase costs. The Commission has multiple objectives for establishing these balancing accounts, but the underlying principle is to address volatility created by changes in sales and to ensure they can recover their fixed costs.

As I have discussed extensively above, water utilities have much more volatile sales and associated revenues. Additionally, a greater proportion of their revenue requirement is comprised of fixed costs. These considerations provide an even stronger rationale for addressing revenue volatility. Unless the Commission on principle simply believes that water utilities deserve less consideration as a separate class of utilities — a rationale that to my knowledge it has never previously expressed — then the Commission should provide at least similar revenue stability mechanisms to water utilities as to those supplying energy.

V. LOW-INCOME CUSTOMERS

Q15. Did you analyze usage data with respect to low-income customers?

A15. Yes. As part of our 2020 Report (pp. 14-19), we conducted bill impact simulations to evaluate the impacts of transitioning the Class A utilities from full decoupling to a M-WRAM. We used 2018 monthly customer billing data for Cal Water and Cal Am, the two largest fully decoupled utilities, to run the simulations. Cal Water has 24 service areas and Cal Am has 10 service areas. We simulated bills based on their rate designs under full decoupling and then compared these bills to the bills that would have resulted if they had used the rate designs employed by the four utilities operating under the M-WRAM. In all of the simulations, we enforce strict revenue neutrality, meaning each rate design is calibrated to generate the same amount of revenue, so that the simulations isolate the impact of the rate design on affordability and water use.

Q16. How would transitioning away from decoupling mechanism affect low-income customers?

A16. The simulations clearly show that transitioning to the rate designs used by the utilities with a M-WRAM would harm low income and low water use customers. For customers in the bottom 25% of the water use distribution, the simulations indicate that bills would **increase**, on average, by 14%. For high water use customers, those in the top 25% of the water use distribution, on the other hand, the simulations indicates that bills would **decrease**, on average, by 8%. Thus, transitioning to the M-WRAM was found to harm low water use customers and benefit high water use customers.

Similar results are seen for low-income customers enrolled in Customer Assistance Programs (CAP). For low water use CAP customers, even with rate assistance, bills increase, on average, by 9%. For high water use CAP customers, however, they decrease, on average, by 6%. It is important to note that the water use distribution of CAP customers skews toward lower usage volumes and thus proportionately more CAP customers would be expected to be harmed by recoupling Class A utility revenue.

Customers in the middle of the water use distribution would also see bill increases, though not to the same degree as those in the bottom 25%. In fact, the only group that clearly gains from transitioning to a M-WRAM are the high water use customers, which is at odds with the State's and Commission's directives and policies on urban water use efficiency.

The Decision (p. 68) asserts that "there is no evidence that eliminating the WRAM will raise rates on low-income and low-use customers." Yet, our bill impact simulations based on the rate designs adopted by utilities with a M-WRAM provide clear and convincing evidence that eliminating decoupling will in fact raise rates on low-income and low-use customers, and it is not hard to understand why. Utilities operating with the M-WRAM have an incentive to increase sales and to mitigate revenue risk. Both encourage the utility to want to recover more revenue through service charges and flatten the tiers in their rate design. The consequence of this is to lower the marginal cost of water faced by the highest-volume water users and to raise it for those customers already using the least amount of water. Low-volume customers can expect to pay more for water service while high-volume customers can expect to pay less. The bill impact simulations indicate this is how it has in fact played out between the fully decoupled utilities and those operating under the M-WRAM.

Q17. Does decoupling or the M-WRAM provide a greater benefit for low-income customers?

A17. In the bill impact simulations we performed, low-income customers fared better under full decoupling. The rate designs employed by utilities with a M-WRAM resulted in higher bills for low-volume and low-income customers.

VI. RATE DESIGN

Q18. Did California American Water modify its proposed rate design as part of the proposed WRSP?

A18. Yes. In the Southern Division, it reduced the percentage of fixed cost recovery in the service charge and added a fifth tier to target excessive water use by residential customers. In the Northern Division, it made a similar adjustment to fixed cost recovery and added a fourth tier to target excessive water use by residential customers.

Q19. Does the modified proposed rate design that is part of the proposed WRSP provide greater conservation incentives?

A19. It does. We performed a sales simulation using 2021 billing data and empirically derived price response parameters. The simulation model indicated that district level sales would decrease by up to a couple percent, depending on district, under the proposed rate design relative to what one would expect under the rate design in Cal Am’s original filing.

Q20. How would the modified rate design affect low income customers?

A20. Low-income customers using average to below-average amounts of water would see lower bills under the proposed rate design compared to bills based on the rate design in Cal Am's original filing. This is primarily due to lower fixed service charges under the proposed rate design.

VII. SALES ADJUSTMENT MECHANISM

Q21. Are there benefits to updating sales forecasts more frequently?

A21. Yes. It allows the utility to incorporate new information and account for changed circumstances that can reasonably be expected to impact future sales. Changing economic conditions, new legislative or regulatory requirements, and changing availability or cost of supplies are examples of factors that could reasonably be expected to have an impact on future sales. Certainly, if the utility expects with a reasonable degree of certainty that it will need to ask customers to curtail their water use in response to a supply shortfall or state regulatory mandate (as occurred in 2015-16), then it should adjust its sales forecast and water rates accordingly. Failing to do so can result in financial distress for the utility, as was documented in a 2017 report on urban drought response and policy that I coauthored for the Public Policy Institute of California.[25]

There will be better alignment between projected and realized sales if the forecasts are updated at least annually. For example, for the thirteen-year period 2009-2021, we found that Cal Am's GRC forecast errors for its Ventura District were, on average, twice as large as the forecast errors that would have obtained had it deployed its ACAM, which updates the forecast annually. The three-year GRC forecasts had an average forecast error of 13.5% compared to an average error of 6.7% for the ACAM forecasts. If rates had

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[25] Mitchell, D., et al. 2017. Building Drought Resilience in California's Cities and Suburbs. Public Policy Institute of California. https://www.ppic.org/publication/building-drought-resilience-californias-cities-suburbs/

been pegged to the ACAM rather than the GRC forecasts over this period, WRAM balances would have been significantly smaller.

Q22. Does the state now require annual updating of supply and demand forecasts by urban water suppliers?

A22. Yes, it does. In 2018, the California Legislature enacted into law new requirements for urban water suppliers to increase drought resilience and to improve communication of water shortage response actions. These requirements are codified in California Water Code Section 10632. As part of these new requirements, urban suppliers must now complete and submit to the state an annual water supply and demand assessment by July 1 of each year, and include in this assessment information on anticipated shortage, triggered shortage response actions, compliance and enforcement actions, and communication actions consistent with the supplier's water shortage contingency plan. In reporting their expected demands for the coming year, suppliers are to list and describe all factors considered, such as growth in population and service connections, changes in business climate, differences in weather/hydrology, changes in regulatory requirements and policies, availability of supply, and any other factors reasonably expected to impact next year's sales.

Q23. Are there parallels between these state requirements and Cal Am's ACAM?

A23. There are. Both are intended to forecast water sales/production 12 months ahead using data on sales/production from the previous 12 months as well as reasonably foreseeable factors that may result in differences between current and subsequent year supplies and demands. Both are intended to improve upon and update longer-range forecasts prepared as part of urban water management plans or general rate cases by incorporating contemporaneous and reasonably foreseeable factors into the projection of demands and supplies for the coming year.

The explicit purpose of the ACAM is to course-correct the GRC forecast so that rates and charges align better over-time with realized sales. In similar fashion, the state-mandated annual supply and demand assessment is intended to identify potential supply and demand imbalances and trigger responses by the utility to address these imbalances, including adjustments to rates and charges.[26] I think it is fair to say that Cal Am's proposed ACAM aligns closely with state water policy concerning the forecasting of following year supply and demand.

VIII. UPDATED SALES FORECAST

Q24. Did you update the sales forecast for California American Water's updated application?

A24. Yes. We made two changes to the forecasts provided in our June 2022 sales forecast report.[27] First, we updated the forecasts to incorporate drought response information from 2022. This is consistent with D.20-98-047 which ordered that sales forecasts in future rate cases address, among other things, incorporate local and statewide trends in consumption, demographics, climate, population density, and historic trends by ratemaking area, as well as D.16-12-026, which required IOUs to incorporate drought information into their sales forecasts.[28] These updates are documented in a Technical Memorandum, dated January 23, 2023, which is attached to my testimony as Attachment 2.[29]

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[26] Specifically, Water Code Section 10632(a)(8) requires suppliers to document the financial consequences of supply/demand imbalances, including (1) potential revenue reductions and expense increases and (2) mitigation actions needed to address revenue reductions and expense increases, which includes adjusting rates and charges.

[27] Mitchell, David. (2022). California American Water Sales Forecast: 2022 General Rate Case. Report prepared by M.Cubed, June 2022.

[28] D.20-08-047, pages 50-51. D.16-12-026, pages 24, 30-31.

[29] Technical Memorandum to Jeffrey Linam, California American Water, from David Mitchell, M.Cubed, regarding Revised GRC Sales Forecast, dated January 23, 2023.

Second, we reduced the sales forecasts for the Northern and Southern Division districts by slightly more than 1% to reflect changes to the rate design that are part of Cal Am's decoupling proposal. The results of the sales and bill impact simulations we ran using the proposed rate designs and the rate designs in Cal Am's original filing provided the basis for the second adjustment.

IX. CONCLUSION

Q25. Why should the Commission adopt the WRSP instead of the M-WRAM?

A25. As I noted previously, the evidence garnered from 2008 to present clearly indicates that the Class A utilities with full decoupling:

- Adopted more aggressive conservation rate designs
- Recovered a lower percentage of fixed costs through fixed service charges
- Invested more in customer conservation programs
- And achieved greater reductions in customer water use.

Similar results from decoupling electricity and gas utility sales have also been extensively documented in the literature.

Contrary to assertions made in D.20-08-047, bill impact simulations and the comparative analysis of fully decoupled utilities to those with a M-WRAM provide strong evidence that low-income and low water use customers would be harmed by recoupling revenue and shifting to M-WRAM. Utilities operating with an M-WRAM have an incentive to increase sales and to mitigate revenue risk caused by sales volatility. Both encourage the utility to want to recover more revenue through service charges and flatten the tiers in their rate design. The consequence of this is to lower the marginal cost of water faced by the highest-volume water users and to raise it for those customers already using the least amount of water.

Q26. Does this conclude your testimony?

A26. Yes, it does.

ATTACHMENT 1

Impacts on Customer Bills and Water Use of Recoupling Water Utility Revenue and Sales

Analysis of CPUC Proposed Decision to Transition all Class A Utilities to a Monterey-Style Water Revenue Adjustment Mechanism

POLICY ANALYSIS FOR THE PUBLIC AND PRIVATE SECTORS

M.CUBED

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August 2020

Contents

About the Authors

David Mitchell has 30 years of professional experience using statistical and economic methods to help guide water resources management and investment decisions. He has been deeply involved in urban water conservation planning and evaluation since he became the California Urban Water Conservation Council's first Project Manager and Director of Research back in 1993. Serving for 15 years in this capacity, he has had a direct hand in shaping many of the policies and technical resources guiding urban conservation in California. At the state level, he has provided technical and policy support to the California Department of Water Resources, State Water Board, California Water Fix, Bay Delta Conservation Plan, Delta Risk Management Strategy, and the CALFED Bay-Delta Program. Throughout his career he has worked with numerous retail and wholesale water suppliers on resource plans, financial analyses, sales forecasts, and rate designs. Mr. Mitchell is a co-author with Dr. Chesnutt of Building Better Water Rates for an Uncertain World and the primary architect of the Alliance for Water Efficiency's companion Sales Forecasting and Rates Model. In addition to his regular consulting practice, Mr. Mitchell is an Adjunct Fellow with the Public Policy Institute of California.

Gary Fiske has more than 35 years of professional experience with water resource and facility planning, conservation planning and program design, strategy development and evaluation, economic and financial analysis, utility cost allocation and pricing, demand forecasting, and project management. He is a pioneer in the development and application of integrated resource planning to water supply industry. He has prepared IRP guidelines published by American Water Works Association, directed and participated in major planning and forecasting projects for many water purveyors in the U.S., and is a frequent speaker and moderator on issues of water resource planning, water supply reliability, and the integration of non-traditional resources in water supply plans. Mr. Fiske, developed the Confluence water resource planning model, a state-of-the-art tool to evaluate alternative water resource and infrastructure strategies against a variety of user-specified criteria.

Tom Chesnutt has provided state-of-the-art empirical policy analysis and statistics applied to water resources and water efficiency programs for more than 35 years. Dr. Chesnutt has broad experience in applications such as water reuse and recycling, and water supply and demand estimation and simulation. He has worked with organizations such as the American Water Works Association Research Foundation, RAND, the U.S. Bureau of Reclamation, the United States Environmental Protection Agency, California Urban Water Agencies, the California Urban Water Conservation Council, the California State Legislature, the California Public Utilities Commission, law firms, and numerous water agencies in the Western United States. He is the lead author of the seminal guidebook on designing, evaluating, and implementing conservation rate structures and has served on AWWA's Rates and Charges Committee for many years.

Introduction

In public utility regulation, revenue decoupling is a ratemaking mechanism that is designed to eliminate or reduce the dependence of a utility's revenues on the level of sales, thereby removing the "throughput" incentive to sell as much commodity as possible in order to maximize revenues. Additionally, by severing the relationship between sales volume and revenue, decoupling removes the financial disincentives to promote customer efficiency programs.

Revenue decoupling has been used in the energy utility sector for many decades.[1] Its introduction to the water utility sector is more recent. The California Public Utilities Commission (CPUC) first implemented revenue decoupling for water utilities in 2008 as part of a pilot program to transition Class A water utilities to conservation rate designs and encourage greater investment in customer conservation programs and assistance.[2] Now the CPUC is reconsidering this policy. In a Proposed Decision it released in the beginning of July, the CPUC would recouple water utility revenues and sales.[3]

Currently, half the Class A water utilities regulated by the CPUC operate under a fully decoupled Water Revenue Adjustment Mechanism (hereafter, WRAM). The other half operate under a so-called Monterey-Style Water Revenue Adjustment Mechanism (hereafter, Monterey-Style WRAM). The distinction between the WRAM and the Monterey-Style WRAM can be confusing, so we provide a simple example to illustrate how they differ in Appendix A. The bottom line, however, is this: whereas the WRAM fully decouples revenue from sales volume, thereby removing the throughput incentive, the Monterey-Style WRAM does not. When you have a Monterey-Style WRAM the more sales the better.

Revenue risk also is different. All else equal, utilities operating with the Monterey-Style WRAM face greater revenue risk. There are different ways in which this risk can be mitigated, but two obvious ones are to recover more of your revenue requirement through fixed service charges and to flatten the tiers in your block rate design. Why does this help with revenue risk? Service charges provide guaranteed revenue regardless of sales level. Of course, the downside to this is the impact it has on water use and

[1] And it continues to be an important policy lever. See, for example, this post from the American Council for an Energy Efficient Economy on the importance of decoupling for carbon reduction.

[2] *See,* D.08-06-022, D.08-08-030, D.08-09-026, D.08-11-023, D09-05-005, D.09-07-021 and D.10-06-038.

[3] Proposed Decision for the OIR Evaluating the Commission's 2010 Water Action Plan Objective of Achieving Consistency between Class A Water Utilities' Low-Income Rate Assistance Programs, Providing Rate Assistance to All Low-Income Customers of Investor-Owned Water Utilities, and Affordability (hereafter, PD or Proposed Decision)

affordability. As more revenue is recovered from service charges, commodity charges will fall and water use will increase. The Law of Demand applies to water service as it does to any other good or service.[4]

In addition to recovering more revenue from the fixed charge, flattening tiers in a block rate design can also attenuate revenue risk.[5] Consider a simple two-tier rate design where half your sales are expected to fall in the first tier and half in the second. Suppose the price in the second tier is twice the price in the first. Then every sale you lose in the second tier has twice the impact on your revenue as a sale lost in the first tier. Now, where is a reduction in sales most likely to manifest itself? In the second tier, which captures a disproportionate share of discretionary water uses. Flattening the tiers means raising the price in the first block and lowering the price in the second block to attenuate this revenue risk – widening the first block also helps accomplish this. Again, this change in the rate design will encourage more water use by reducing the marginal price faced by the highest volume water.

Now think about what these changes in rate design do to customer bills and affordability. If you are a low-volume water customer, such as a customer on a fixed income or one that has already made extensive changes to their home and yard to be as efficient as possible, your bill will increase because you will pay a higher service charge and the rate in the first one or two tiers also will increase. Because you don't use very much water, you are not going to benefit from the lower rates for water use in the higher tiers. On the other hand, if you are a high-volume water customer, your bill will decrease. Because you use a lot of water, the price break you get in the upper tiers of water use will more than compensate for the higher service charge. Because your marginal cost has decreased, you have an incentive to use more water.

Economists like to say incentives matter. If you want to understand the impacts of a policy, such as the CPUC's Proposed Decision to switch fully decoupled utilities to the Monterey-Style WRAM, trace out the consequences of the incentives the policy will generate. We've just considered the incentives the Monterey-Style WRAM creates for utilities, the price incentives that water customers face, and how the two can be expected to interact. Utilities with the Monterey-Style WRAM have an incentive to increase sales and to mitigate revenue risk through their rate design.[6] Both encourage the utility to want to recover more revenue through service charges and flatten the tiers in their rate design. The consequence of this

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[4] The Law of Demand simply states that as the price of something goes up, consumers will choose to use less of it.

[5] The Proposed Decision gets this precisely wrong, incorrectly stating on page 84 as a Finding of Fact that a tiered rate design "is a reasonable means to stabilizing revenues." In actual fact, tiered rate designs decrease revenue stability. *See*, Chesnutt, T.W., C.N. McSpadden, and J. Christianson (1996), "Revenue Instability Induced by Conservation Rate Structures," Journal of the American Water Works Association, January 1996.

[6] As demonstrated in Appendix A, they also face a moral hazard to understate their Test Year sales forecast upon which their rates are based.

is to lower the marginal cost of water faced by the highest-volume water users and to raise it for those customers already using the least amount of water. Low-volume customers can expect to pay more for water service, high-volume customers can expect to pay less, and overall water use can be expected to increase.

The Proposed Decision is quick to note that the utilities currently operating with the Monterey-Style WRAM employ increasing block rates and the utilities that will be transitioned to it will be required to continue using them. The thing about increasing block rate designs, however, is that the details matter – a lot. These rate designs are highly non-linear and the rate analyst has many degrees of freedom with which to impact their performance. Tweaking the number, width, and height of the blocks can quickly transform a conservation-oriented rate design into something else entirely.

The Proposed Decision even seems to encourage tier flattening, stating: "we expect utilities in proposing an adopted water rate design will minimize the number of households requiring greater water usage by setting breakpoints between tiers above Tier 1 that minimize the percentage of households in these higher tiers."[7] Of course, taken at face value, this means adopting a single quantity rate, since this is the rate design that minimizes the number of households in higher tiers. But short of this, reducing the number of households in the higher tiers implies increasing the size of the first tier, which would have many potential consequences, including necessitating an increase in that tier's rate. This is just as theory would predict.

We are fortunate in this case not to have to rely only on theory. The CPUC has, in effect, been running a natural experiment in rate design incentives for the past ten or so years by fully decoupling some of the Class A utilities and keeping the others on the Monterey-Style WRAM. We can actually look at the rate designs of the two groups of utilities to see how they differ. More than this, we can simulate customer bills and water use under the different designs used by the fully decoupled utilities and those with the Monterey-Style WRAM and compare them in terms of affordability and conservation performance. We do both these things in the remaining sections of this report.

In case you would like to cut to the chase, here is a brief summary of our findings:

- A comparative analysis of rate designs used by the fully decoupled utilities and those with the Monterey-Style WRAM shows that the rate designs employed by the latter group of utilities, on

[7] PD, page 60.

average, recover more revenue from the service charge – about 35% more – and have fewer and flatter tiers, as theory would predict.

- This comparative analysis also shows that, on average, the utilities operating under the Monterey-Style WRAM recover about 66 percent more of their fixed costs from fixed service charges than do the fully decoupled utilities.
- We also find that the utilities operating with the Monterey-Style WRAM have substantially less authorized expenditure for conservation than do the fully decoupled utilities – about 47 to 56 percent less expenditure per residential customer.
- Thus, we find just as theory would predict, that the utilities operating with the Monterey-Style WRAM recover significantly more of their fixed costs through fixed service charges, have block rate designs that provide less incentive to conserve water, and have significantly lower authorized conservation program expenditure.
- On top of this, bill impact simulations indicate that the rate designs used by the utilities operating with the Monterey-Style WRAM would increase bills for most customers, including most customers receiving low income rate assistance. Moreover, the policy would shift more of the revenue recovery burden onto the backs of customers already using the least amount of water. We estimate that bills for the bottom 25 percent of customers in terms of water use would *increase* by an average of 14 percent while bills for those in the middle 50 percent of the water use distribution would *increase* by an average of 6%. Meanwhile, the top 25 percent of customers in terms of water use would see their bills *decrease* by an average of 8 percent.
- Our bill impact simulations also indicate that adopting rate designs used by the utilities operating with the Monterey-Style WRAM would increase water use by more than 10 percent in some areas. The overall effect on water use in our bill simulations is smaller, only 3 percent. However, there is a great deal of variation across the individual service areas we model. For example, simulated water use increases by 13 percent in Cal Am's San Diego service area and 11 percent in its Ventura service areas, two areas with limited water supplies. Similarly, the simulated water use increase for Cal Water's Bay Area ratemaking area, a region with some of the highest cost water in the state, is 5 percent, more than double the increase for Cal Water overall.
- Lastly, we examined the evidence presented in the Proposed Decision that is purported to show an equivalency of water savings between the fully decoupled utilities and those operating with the Monterey-Style WRAM. We are unpersuaded by this evidence. Comparing changes in water use between 2015 and 2019 does not provide a meaningful performance test because both

groups of utilities were complying with the state's conservation mandate and both groups were ordered to reduce water use by the same percentage. Moreover, all but one of the utilities operating with the Monterey-Style WRAM were effectively fully decoupled during the drought via the Lost Revenue Memorandum Accounts authorized by the CPUC. Only one utility did not avail itself of this revenue mechanism and it happens to be the only one that did not fully comply with the state conservation mandate. Further, we note that prior to the drought and the state mandate, the percentage reduction in water use was greater for the fully decoupled utilities than for those operating with the Monterey-Style WRAM.

None of these findings suggest that recoupling revenue and sales will help advance the CPUC's affordability and water conservation objectives. To the contrary, our findings indicate the policy will make water service less rather than more affordable for low-volume and low-income customers and will, on balance, increase residential water use.

Rate Design and Conservation Expenditure Differences between Fully Decoupled Utilities and Utilities Operating with the Monterey-Style WRAM

The essence of this section of the report is to compare several quantitative and qualitative measures of conservation incentives associated with rate design and conservation programming between the fully decoupled utilities and those with the Monterey-Style WRAM.

The fully decoupled utilities are:

- California Water Service (Cal Water)
- Golden State Water
- Liberty Utilities
- California American Water (Cal Am)

The Monterey-Style WRAM utilities are:

- Suburban Water Systems
- San Jose Water
- Great Oaks Water
- San Gabriel Valley Water

Following are discussions of the results. The primary information source is decisions and advice letters that are publicly available on the CPUC website, as well as information presented on each utility's own website. To the degree possible, the results presented are comparable across utilities, although this was not always completely achievable due to differences in the form, content, timing, and completeness of each utility's documents. Cal Water provided some additional information from the Settlement Agreement in its current GRC, which has not yet been adopted by the CPUC.

In general, the rate design and conservation expenditure data for Cal Am's Monterey district is anomalous. Therefore, in most cases two sets of results are shown, one excluding that district and a second including it.

Residential Rate Designs

The residential rate structures of most or all districts of the utilities listed above consist of increasing-block commodity charges and a fixed monthly service charge. The following discussion begins with a comparison of the tiered commodity rate structures and then moves on to discuss the relationship between the revenues collected through commodity and fixed charges.

The analysis is made more difficult by the fact that, for those utilities with multiple districts, each one has its own rates. For such utilities, the results presented below are based on weighted averages of the relevant rate design parameters across districts, based on the numbers of residential connections. In addition, the tables and charts below show the averages for each utility group that are weighted by the total number of each utility's residential connections.

The overall purpose of these comparisons is to determine whether there are systematic differences between the water conservation incentives provided by the rates of the fully decoupled utilities and those operating with the Monterey-Style WRAM.

Commodity Rate Structures

First, we consider the number and size of blocks in each utility's rate structure. These are summarized in Appendix B. Generally speaking, the district-specific residential commodity rate structures for all of the utilities have 2 or 3 blocks, with the exception of Cal Am, for which all the district rate structures have between 3 and 5 blocks. Cal Am Monterey not only is the only district with 5 blocks, it is also an outlier in the block sizes, with blocks being significantly smaller than those of the other utilities.

The magnitude of the actual rates in, say, $/ccf are dependent on each utility's cost of service, which vary widely. Thus, for our purposes, the dollar value of the rates is not relevant. But the patterns of rate step-ups between rate blocks are important. Larger step-ups provide more price incentive to use water efficiently. Appendix B also provides a summary of these rate step-ups for each utility.

The potential conservation incentive is, of course, a function of both the block structure and the magnitude of the rate step-ups. Researchers have investigated the factors that drive customers to conserve water. Economic theory says that consumers respond to the marginal rate that they are facing, that is, the rate charged for their last unit of consumption. The higher that marginal rate, the more incentive there is to reduce usage. Other research concludes that customers respond more to the total bill. Higher bills discourage future consumption.[8] Therefore, we consider both rate multipliers and bill multipliers as indicators of the relative strength of the rate design's conservation incentive. Larger multipliers may provide a more robust conservation incentive. Results for the two utility groups are summarized in Figures 1 and 2.

The marginal rate multipliers shown in Figure 1 are based on the rate in the first tier. Thus, a multiplier of 2 at a particular monthly usage level means the marginal rate at that usage level is twice the rate in the first tier. When we include Cal Am Monterey in the comparison, the trend is for the fully decoupled utilities to have, on average, higher rate multipliers. When Cal Am Monterey is excluded from the comparison, the rate multipliers between the two utility groups are more similar, though still somewhat higher for the fully decoupled utility group.

Turning now to the bill multipliers, Figure 2 shows that with or without Cal Am Monterey, the bill multipliers for the fully decoupled utility group are decidedly more conservation-oriented.

[8] Of course, there are many other factors that might affect water usage. A short list of these includes bill frequency, the effectiveness of a utility's explanation of how customers are being charged, whether or not water bills are combined with other utility bills (e.g. sewer), the depth and breadth of conservation programming and messaging, and weather conditions.

Figure 1. Average Rate Multipliers by Utility Group

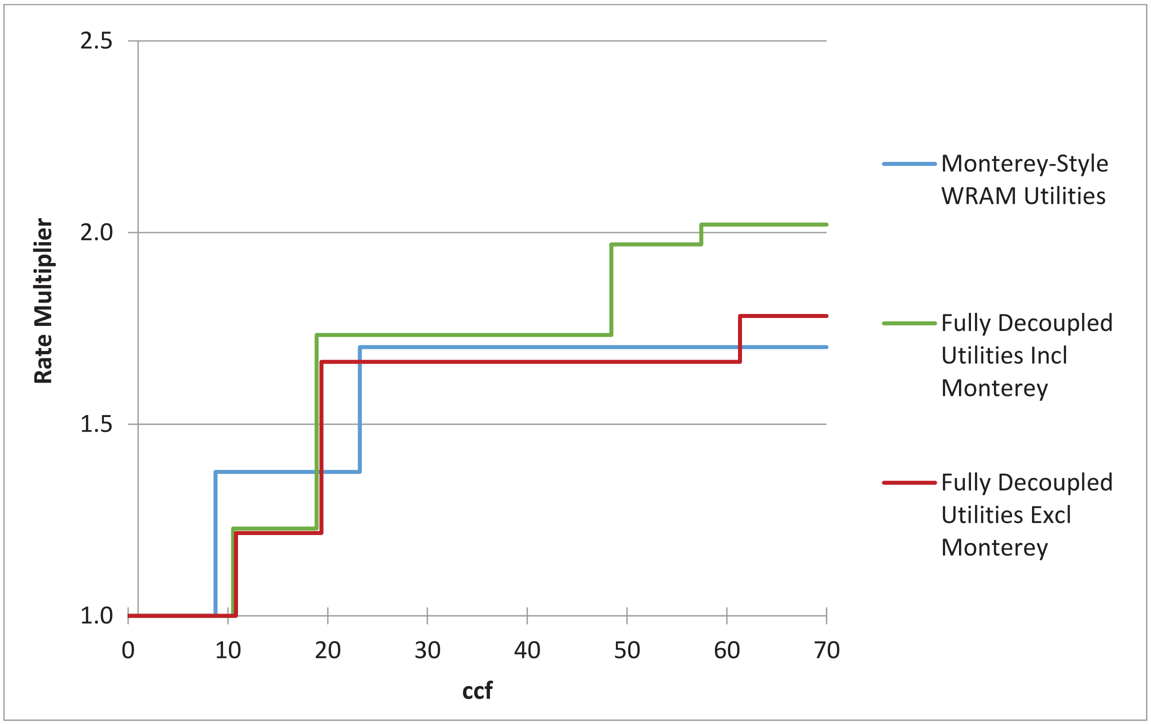
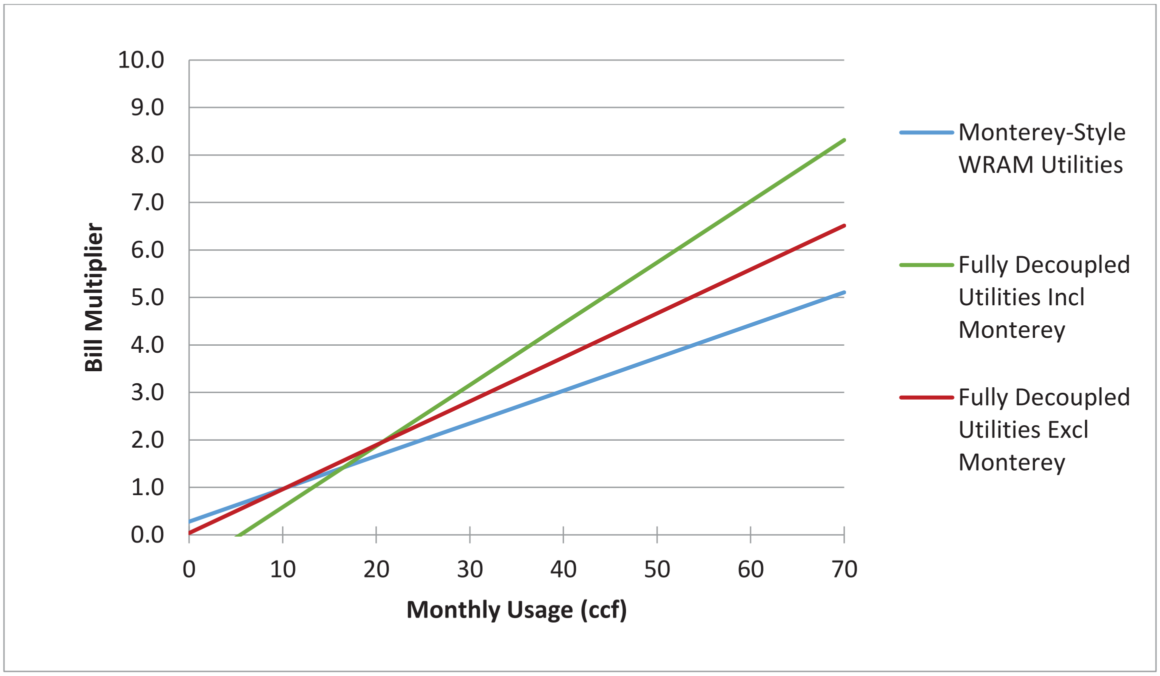


Figure 2. Average Bill Impact Multipliers by Utility Group



Commodity Rate vs. Service Charge Revenue

Another measure of the degree to which a utility's rate structure provides a conservation incentive is the split between revenue recovered through commodity rates and from fixed monthly service charges. Recovering revenue through the commodity charge raises the marginal price for water and hence increases the incentive to conserve water. Conversely, recovering revenue through the service charge lowers the marginal price for water and hence decreases the incentive to conserve water. Unmetered water service, which used to be fairly common in California, is an extreme form of this, where all the revenue is recovered through the service charge. Numerous studies have shown that shifting to volumetric pricing through metering decreases water use by 10-30 percent, in part because marginal water cost goes from zero to something much greater than zero.[9]

We argued above that the Monterey-Style WRAM creates an incentive to recover more revenue through the service charge in order to mitigate revenue risk. Do we see a significant difference between the two utility groups in this respect? In Table 1 we show the revenue splits for the two groups. We indeed see that the utilities with the Monterey-Style WRAM, on average, collect more of their revenue through service charges, about 35 percent more, in fact.[10] On average, the fully decoupled utilities recover more of their revenues through commodity rates, thereby providing a larger conservation incentive to their residential customers.

Table 1. Residential Commodity and Service Charge Revenue Splits by Utility Group

	Commodity Charge	Service Charge
Fully Decoupled Utilities		
Cal Water	73%	27%
Golden State	70%	30%
Liberty	73%	27%
Cal Am	82%	18%
Weighted Average	**74%**	**26%**
Monterey-Style WRAM Utilities		
Suburban	N/A	
San Jose	60%	40%
Great Oaks	67%	33%
San Gabriel Valley	74%	26%
Weighted Average	**65%**	**35%**

[9] For example, see, Tanverakul, S., and Lee, J., "Impacts of Metering on Residential Water Use in California," Journal AWWA, February 2015.

[10] The results for the fully decoupled utilities are the same with or without Cal Am Monterey, so it is included in the analysis.

Moreover, if we look at the share of fixed costs that the two groups of utilities recover through their service charges, the differences are even more striking. Table 2 shows data on operating revenue, fixed costs, and percent of fixed costs recovered through service charges for the fully decoupled utilities and those with the Monterey-Style WRAM. What we see is as a group the Monterey-Style WRAM utilities recovered 68 percent of their fixed costs from their service charges while the fully decoupled utilities recovered just 41 percent. In other words, the proportion of fixed costs recovered through the service charge is 66 percent greater for the utilities with the Monterey-Style WRAM.

Again, if you trace out the incentives created by the Monterey-Style WRAM, this is precisely what you would expect. Operating costs are mostly fixed. In the absence of full revenue decoupling, utilities face significant risk of revenue shortfall when sales unexpectedly decrease. Appendix A provides a simple example of this. An obvious way to limit this risk is to recover more of your fixed costs through fixed service charges. But as noted above, doing so dilutes the incentives customers face to conserve water and shifts more of the revenue recovery burden onto the backs of low-volume water users.

Table 2. Share of Fixed Costs Recovered from Service Charge by Utility Group

	Operating Revenue	Fixed Costs	% of Fixed Costs in Service Charge
Fully Decoupled Utilities			
Liberty (Park)	34,856,300	23,794,200	37%
Liberty (Apple Valley)	22,370,000	19,006,700	35%
Cal Water	672,403,600	426,249,567	42%
Cal Am	254,825,149	164,404,091	32%
Golden State Water	305,531,600	202,120,800	45%
Weighted Average*			**41%**
Monterey-Style WRAM Utilities			
San Jose	377,059,000	202,506,000	67%
Great Oaks	20,836,321	8,687,071	75%
San Gabriel - LA	71,064,500	41,469,900	74%
San Gabriel - Fontana	71,107,600	41,251,200	65%
Weighted Average*			**68%**

* Weighted by operating revenue.
Data compiled from General Rate Case Decisions and directly from utilities listed in the table. We were unable to compile cost data for Suburban for this report. Note that the data in this table are for total operations whereas the data used for Table 1 are only for residential and therefore not directly comparable.

Fully decoupled utilities and those with Monterey-style WRAMs both employ increasing block rates, but if you lift up the hood and look at the details of these designs you see that the ones used by the fully decoupled utilities provide stronger incentives for customers to use water efficiently. We don't think this is merely coincidence. It is a consequence of the incentives created by fully decoupling versus partially decoupling sales from revenue.

Water Conservation Expenditure

We also argued previously that utilities operating with the Monterey-Style WRAM would be less inclined to promote water conservation in their service areas. One of the objectives of full decoupling is to remove this disincentive to invest in conservation programs. How does the theory play out in practice? Table 2 compares authorized conservation expenditure per customer for the fully decoupled and Monterey-Style WRAM utility groups. We make the comparison with and without Cal Am Monterey. In either case, authorized expenditure by the utilities operating with the Monterey-Style WRAM is significantly less than authorized expenditure for the fully decoupled utilities – about 56 percent less if Cal Am Monterey is included in the comparison, and 47 percent less if it is excluded.

Table 3. Total Authorized Conservation Expense per Residential Customer by Utility Group

Fully Decoupled Utilities	**$/Residential Customer**	**$/Residential Customer**
	Cal Am Monterey Included	*Cal Am Monterey Excluded*
Cal Water	$20	$20
Golden State	$5	$5
Liberty*	N/A	N/A
Cal Am	$28	$17
Weighted Average	**$18**	**$15**
Monterey-Style WRAM Utilities		
Suburban	$5	
San Jose	$7	
Great Oaks*	N/A	
San Gabriel Valley	$12	
Weighted Average	**$8**	
* Conservation expense data were not available for Liberty and Great Oaks.		

Section Summary

In summary, subject to the inherent difficulties with the data upon which we are relying, the fully decoupled utilities are arguably providing greater conservation incentives to their residential customers than the utilities operating with the Monterey-Style WRAM. All of the differences between the two groups that we observe in the measures that this analysis has examined are in favor of the fully decoupled utilities. As we stated in the introduction, incentives matter. If you want to understand the impact of a proposed policy, trace out the consequences of the incentives it creates. In the case of revenue recoupling, the incentives suggest utilities will flatten their tiers, recover more fixed cost through their service charges, and spend less on conservation programming. The results of the CPUC's 10 year natural experiment with full and partial water utility revenue decoupling conform to these expectations.

Bill Impact Simulations

Which customers can expect to win and which can expect to lose by replacing full revenue decoupling with the Monterey-Style WRAM? In other words, whose bills are likely to increase and whose are likely to decrease as a consequence of this policy? Bill impact simulations can help answer this question.

A bill impact simulation applies alternative rate designs to historical metered water usage and calculates the bills and water use that would result under each alternative. We can then see whose bills go up or down and how water use would change. The key to this type of analysis is to hold revenue constant across all the rate designs being considered. Revenue neutrality isolates the effect of the rate design on bills and water use. The only thing that is changing is how a given amount of revenue gets recovered from customers. The size of the pie is always the same, but the sizes of the slices change with each rate design.

Methodology

Our goal is to consider how bills of customers of fully decoupled utilities would likely change if those utilities were to transition to Monterey-Style WRAM. We use 2018 monthly customer billing data for Cal Water and Cal Am, the two largest fully decoupled utilities, to run the simulations. Cal Water has 24 service areas and Cal Am has 10. For both utilities, some of these service areas have been consolidated into ratemaking areas. Therefore, for each Cal Water and Cal Am ratemaking area, we simulate bills based on their currently proposed rate design and then using the rate designs employed by the four utilities operating under the Monterey-Style WRAM. We then calculate the change in bills under each of these rate designs relative to the baseline rate design. We average the four results to get the average impact of the rate designs used by the Monterey-Style WRAM utilities on customer bills and water use.

The simulations strictly enforce revenue neutrality. This is done as follows. First, we calculate bills using the current Cal Water and Cal Am rate designs. This gives us the baseline revenue for each district. Next we calibrate the rates from the utilities with Monterey-Style WRAMs so they generate the same amount of revenue. This calibration preserves the share of revenue coming from the service charge versus the commodity charge, as well as the width and relative heights of the tiers. In other words, calibration changes the levels of the rates and service charges but not their relationships to one another.

The simulations assume that water use is subject to the Law of Demand, which simply means that consumers want less water when its price goes up, and want more water when its price goes down. The relationship between price and water use is captured by the elasticity of demand, which measures the percentage change in water use given a one percent change in price. Thus, if the elasticity of demand is -0.3, a one percent increase in price would be expected to decrease demand by 0.3 percent. We have empirical estimates of price elasticity for Cal Water and Cal Am districts that were derived from econometric models of their water sales. For the simulations, we use a price elasticity of -0.1 for winter water use (Nov-Apr) and -0.3 for Cal Water and -0.32 for Cal Am for summer water use (May-Oct). Note that price responsiveness is greater in the summer, which is dominated by more discretionary outdoor water use, than in the winter, which is dominated by less discretionary indoor water use.

In each simulation, we apply the same rules for calculating the low income rate assistance (LIRA) discounts as are currently being used by Cal Water and Cal Am. In the case of Cal Water, the LIRA discount is equal to 50 percent of the service charge or $48, whichever is less. In the case of Cal Am, the LIRA discount for ratemaking areas other than Monterey, is equal to 20 percent of the service charge and 20 percent of the commodity charge in the first two tiers of usage. For Monterey, the LIRA discount is equal to 20 percent of the service charge and 30 percent of the commodity charge in the first four tiers of usage.

We divide customers in each ratemaking area into three groups, according to the level of their 2018 water use. The first group includes customers in the bottom 25 percent of the water use distribution. These are low-volume customers. The second group includes customers in the middle 50 percent of the water use distribution. These are customers using typical amounts of water for the ratemaking area. The third group includes customers in the top 25 percent of the water use distribution. These are high-volume customers.

Bill impact results are presented in terms of the percentage change in the average bill for each customer group. Thus, if the average bill in the first customer group under the baseline rate design is $50 and the average bill under the Monterey-Style WRAM rate design is $60, the reported impact is a 20 percent bill increase.

Water use impact results are presented in terms of the percentage change in total residential water use predicted by the simulation. Thus, if total residential water use is 200,000 CCF under the baseline rate design and 210,000 CCF under the Monterey-Style WRAM rate design, the reported impact is a 5 percent water use increase.

Because our goal is to examine the general trend in bill and water use impacts, we average the results across all the ratemaking areas included in the simulations. In the case of the bill impacts, we weight these averages by the number of bills represented in each ratemaking area. In the case of the water use impacts, we weight these averages by the baseline volume of water use in each ratemaking area.

Simulation Results

Bill Impacts

The bill impact results are summarized in Figures 3 and 4. Figure 3 shows the average impact for all customers by water use category. Figure 4 shows the same thing just for LIRA customers. In both cases, it is clear who would win and who would lose if the fully decoupled utilities were to conform their rate designs to something akin to what the Monterey-Style WRAM utilities currently employ. Low-volume customers would lose and high volume customers would win. The increase in the average bill for low-volume customers is 14 percent while the average decrease for high-volume customers is 8 percent. The results for LIRA customers are similar. The average bill for low-volume LIRA customers increases by 9 percent while the average bill for high-volume LIRA customers decreases by 6 percent. One thing to note with the LIRA impacts is that somewhat more than 25 percent of LIRA customers are in the Bottom 25% Use Category in Figure 4 and somewhat less than 25 percent are in the Top 25% Use Category because water use by LIRA customers is distributed somewhat differently than for all customers.

Customers in the middle of the water use distribution also see their bill go up, though not to the same degree as those in the bottom 25 percent. In fact, the only group that clearly gains are the high-volume water users. This is shown in Figure 5, which compares the average bill impact for customers in the bottom 75 percent of the water use distribution to those in the top 25 percent.

These results are what theory would predict. As we discussed earlier, utilities operating with the Monterey-Style WRAM have an incentive to increase sales and to mitigate revenue risk. Both encourage the utility to want to recover more revenue through service charges and flatten the tiers in their rate design. The consequence of this is to lower the marginal cost of water faced by the highest-volume water users and to raise it for those customers already using the least amount of water. Low-volume customers can expect to pay more for water service while high-volume customers can expect to pay less. The bill impact simulations indicate this is pretty much how it has played out between the fully decoupled utilities and those operating under the Monterey-Style WRAM.

Water Use Impacts

What about water use? Theory predicts water use can be expected to increase if the fully decoupled utilities adopt rate designs akin to those used by the Monterey-Style WRAM utilities. The simulations confirm this, as shown in Figure 6. Water use across the Cal Am ratemaking areas increases by 7 percent while use across the Cal Water ratemaking areas increases by 2 percent. The overall effect is a 3 percent increase in simulated water use. However, there is a great deal of variation across the individual service areas. For example, simulated water use increases by 13 percent in Cal Am's San Diego service area and 11 percent in its Ventura service areas, two areas with limited water supplies. Similarly, the simulated water use increase for Cal Water's Bay Area ratemaking area is 5 percent, more than double the increase for Cal Water overall.

Figure 3. Bill Impact of Rate Designs used by Monterey-Style WRAM Utilities, All Customers

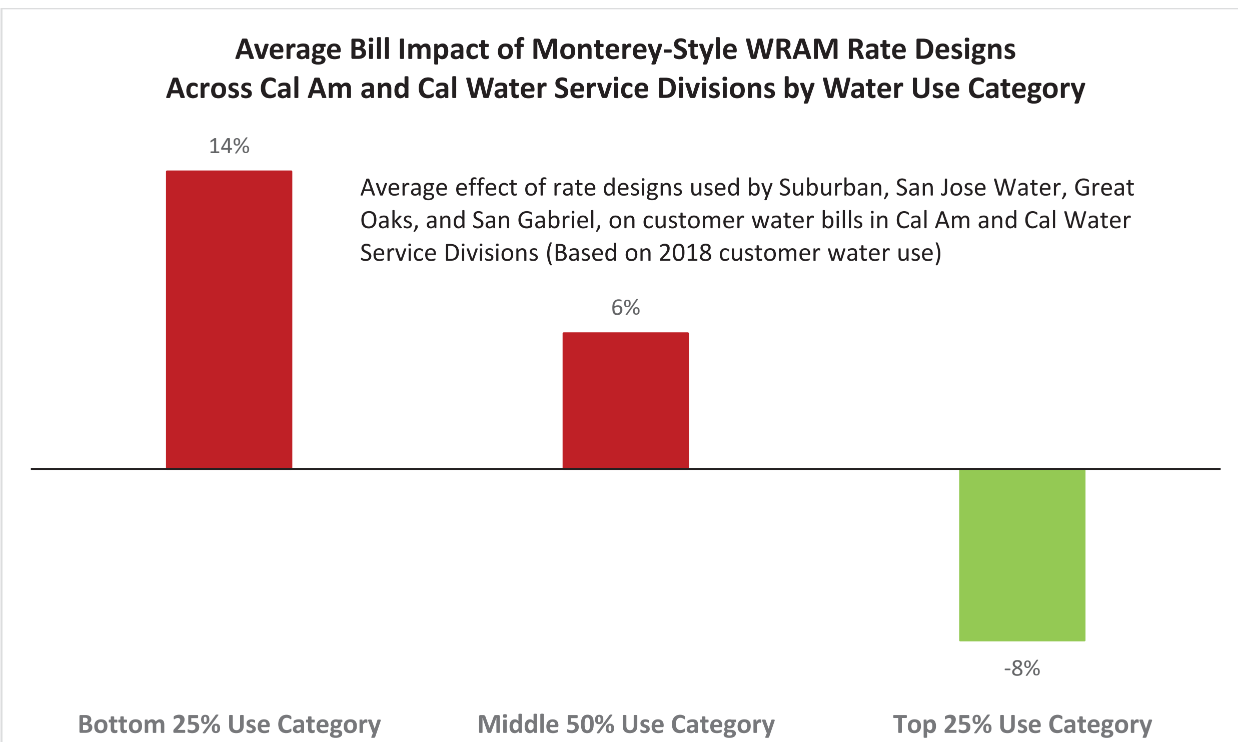


Figure 4. Bill Impact of Rate Designs used by Monterey-Style WRAM Utilities, LIRA Customers

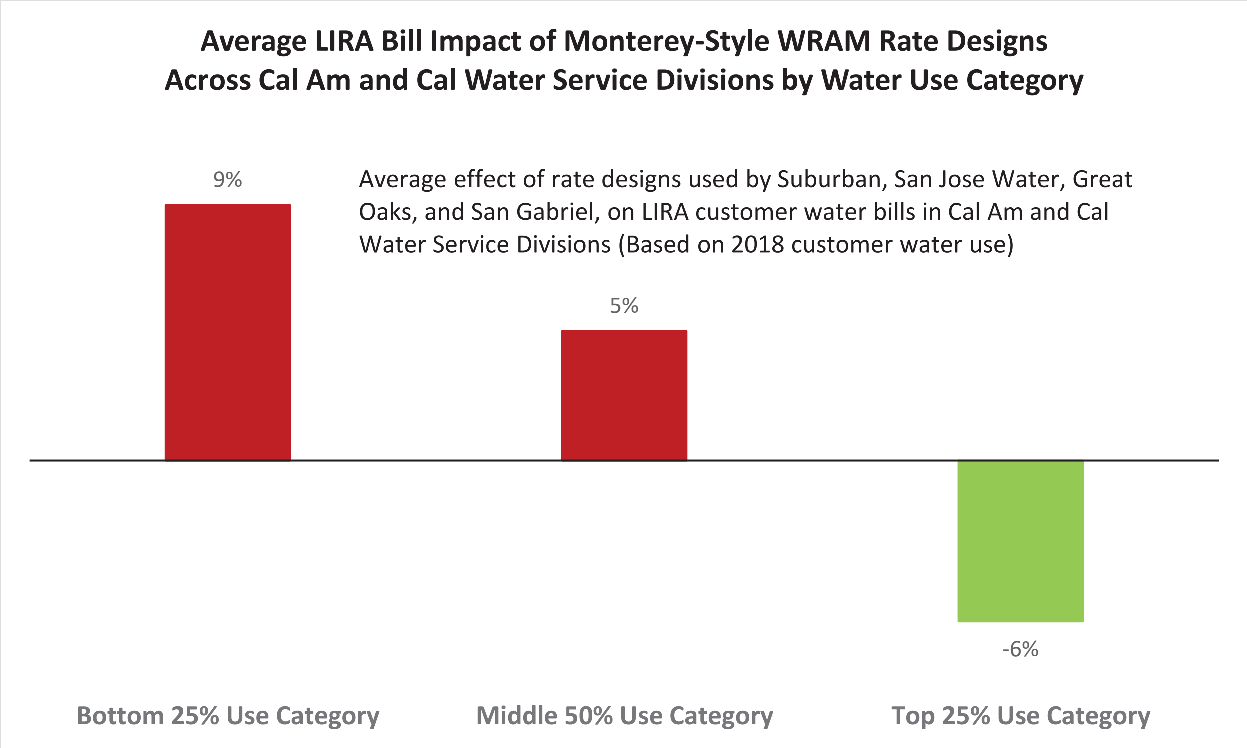


Figure 5. Bill Impact of Rate Designs Used by Monterey-Style WRAM Utilities on Bottom 75% versus Top 25% Water Users

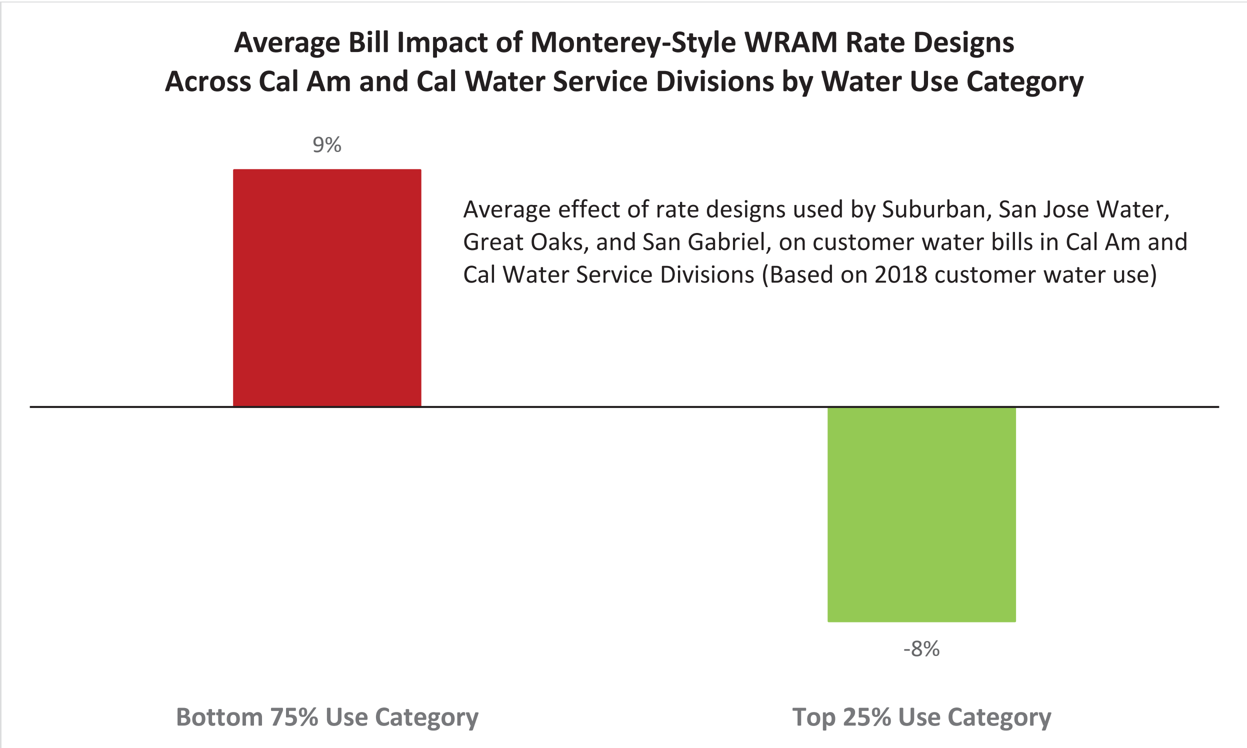
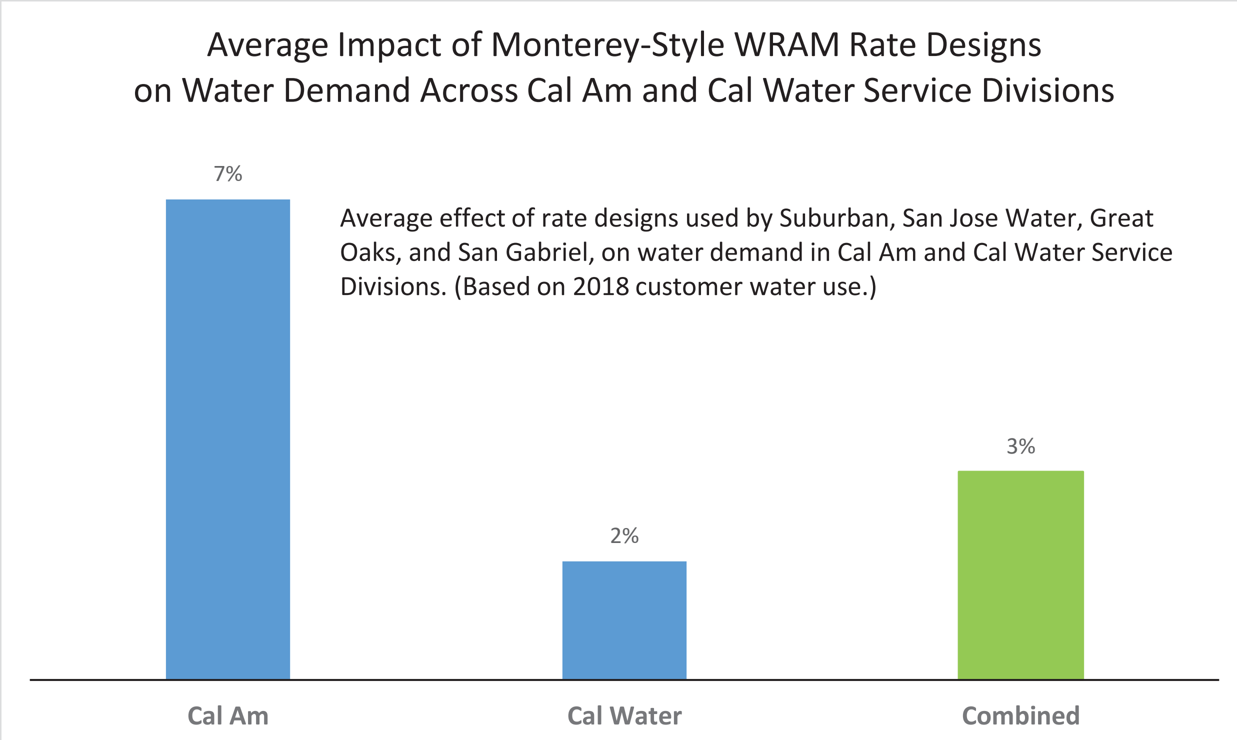


Figure 6. Impact on Water Use of Rate Designs Used by Monterey-Style WRAM Utilities



Section Summary

In this section we used bill impact simulations to see what effect switching to rate designs used by the utilities operating with the Monterey-Style WRAM would have on Cal Water and Cal Am customer bills and water use. It is important to emphasize that there is nothing hypothetical about the rate designs we are simulating. These *are* the rate designs currently employed by Cal Am, Cal Water, and the utilities operating with the Monterey-Style WRAM. The simulated bill and water use impacts are in-line with what theory predicts. Low-volume customers pay more, high-volume customers pay less, and water use goes up. Moreover, these effects are a consequence of the rate designs themselves, not differences in the level of revenue being collected. In all the simulations, the exact same amount of revenue is generated. As said before, the size of the pie always stays the same in the simulations, only the size of the slices change.

Another important thing to note is that while one can say that utilities operating with the Monterey-Style WRAM have "conservation" rate designs in the sense that they use tiered pricing, as stated before the devil is in the details. These simulations demonstrate that the "conservation" rate designs used by the Monterey-Style WRAM utilities are not as conserving as the ones used by the fully decoupled utilities. They also shift more of the revenue recovery burden onto the backs of customers already using the least amount of water. Additionally, they increase rather than decrease bills for the majority of LIRA customers. None of this would seem to advance CPUC's affordability and water conservation objectives.

Observed Changes in Water Use for Fully Decoupled and Monterey-Style WRAM Utilities

In this section we consider some of the Proposed Decision's statements and analysis of changes in historical water use by fully decoupled utilities and those operating with the Monterey-Style WRAM.

Changes in Water Use during the Drought

The Proposed Decision asserts that full revenue decoupling is not needed to achieve conservation.[11] It concludes that "it appears customer conservation is accomplished independently of whether a utility does or does not maintain a WRAM/MCBA mechanism."[12] This conclusion appears to be based on a naïve comparison of changes in the water use by the two groups of utilities between 2015 and 2019. However, a careful analysis of the data upon which this claim is based, as well as an understanding of the circumstances under which the changes occurred, do not support the Proposed Decision's conclusions:

- First, water savings during this period were not discretionary, but rather were mandated by the state. Consequently, they do not provide a meaningful test of conservation performance between full decoupling and the Monterey-Style WRAM. The utilities were complying with a state mandate. In many cases, the conservation savings realized during this period were in excess of what was needed based on available water supply and risk of water shortage.[13]
- Second, the Proposed Decision wrongly claims that the utilities with the Monterey-Style WRAM had water savings that exceeded those by the fully decoupled utilities.[14] Proper statistical analysis of the data do not support this claim.[15] There isn't a statistically significant difference in the rates of savings during the drought between the two utility groups. This shouldn't be surprising because both groups were responding to the state conservation mandate, and both in the aggregate had identical mandated reductions.[16] Additionally, by focusing on changes in demand after 2014, the Proposed

[11] PD, pages 54-55.
[12] PD, page 55.
[13] See Public Policy Institute of California, Building Drought Resilience in California's Cities and Suburbs.
[14] PD, page 55.
[15] See Appendix C.
[16] The sales-weighted average state mandate level for both groups was 21% when rounded to the nearest whole percent.

Decision effectively differences away any savings realized before the start of the drought, the precise period when one might expect to see significant differences in water savings between fully decoupled utilities and those operating with the Monterey-Style WRAM.

- Third, and this point cannot be stressed enough, the Lost Revenue Memorandum Accounts authorized by the CPUC effectively converted the utilities with Monterey-Style WRAMs to full decoupling for the duration of the drought. The Proposed Decision states: *All non-WRAM utilities availed themselves of the opportunity to establish such accounts and thus were able to recover lost revenues caused as a result of the declared drought emergencies"* (emphasis added).[17] This isn't quite true. One chose not to implement a Lost Revenue Memorandum Account and it is the only one that failed to comply with the state conservation mandate.[18] The other utilities with Monterey-Style WRAMs, which were fully decoupled during this period, exceeded their state mandated reductions, as did all of the original fully decoupled utilities. We do not believe it is a coincidence that the only utility that did not avail itself of the Lost Revenue Memorandum Account also is the only one that failed to comply with the state mandate.

The Commission established full decoupling in order to remove disincentives for utilities to invest in cost-effective long-term conservation, which is not the same as drought-induced voluntary or mandatory rationing. The Proposed Decision considers the latter and not the former. Whereas rationing harms consumer welfare, cost-effective conservation programming does not. It empowers customers to do more with less. Conflating the two, unfortunately, is a common mistake which can lead to poor policy choices.

Changes in Water Use Prior to the Drought

While the Proposed Decision makes much of the reductions in water use from 2015 to 2019, as noted above, these were driven by the drought and the state conservation mandate. Between 2008 and 2014, the fully decoupled utilities saw a larger decrease in average customer water use than did those operating with the Monterey-Style WRAM – 18% versus 14%.[19] Had the fully decoupled utilities experienced the

[17] PD, pages 58-59.
[18] See Appendix C.
[19] The WRAM for Cal Am was phased in at different times for their service areas. WRAMs were adopted for its Southern California service areas and Larkfield in Sonoma County in the 2008-09 timeframe. Its Monterey district initially had a Monterey-Style WRAM and transitioned to full decoupling February 1, 2010. Full decoupling was instituted in its Sacramento service area in 2015, following the large-scale conversion of flat rate residential customers to metered water service.

same smaller decrease as the Monterey-Style WRAM utilities, their customers would have used 7.9 billion gallons of additional water in 2014 – enough to meet the needs of 90,000 households.[20]

In their reply to CWA comments, the Public Advocates Office provided a chart which the Proposed Decision references showing the trend in water sales for fully decoupled and Monterey-Style WRAM utilities covering this period. They assert an equivalency in conservation performance because the trends appeared to be visually similar. But it doesn't look like they got their "eyeball" statistics right. Their chart shows a divergence in water use between 2008 and 2014, which is consistent with our finding that the fully decoupled utilities saw a larger reduction in average water use than did the Monterey-Style WRAM utilities during these years.

Over the longer period, 2008 to 2018, the fully decoupled utilities also saw a larger reduction in usage per customer than did the Monterey-Style WRAM utilities – 27% versus 24%.

Of course, there was much else going on in these years, simple comparisons of water use of this sort are not conclusive by any stretch of the imagination. Careful statistical analysis that controls for confounding factors affecting water use is needed to really figure out what was going on during this period. But the results are at least suggestive that the fully decoupled utilities may have been achieving greater conservation savings than the Monterey-Style WRAM utilities during this period. This would certainly be consistent with the other analytical findings presented in the previous sections of this report.

Section Summary

In this section we considered the evidence presented in the Proposed Decision that utilities operating with the Monterey-Style WRAM have achieved similar conservation savings as the fully decoupled utilities. First we pointed out that comparing changes in water use during the drought does not provide a meaningful performance test because both groups of utilities were complying with the state's conservation mandate and both groups were ordered to reduce water use by the same percentage. Moreover, during this period, all but one of the Monterey-Style WRAM utilities were fully decoupled via the Lost Revenue Memorandum Accounts authorized by the CPUC. The one utility that did not avail itself

[20] Average use per meter in 2014 was 267.6 CCF/customer. Under the counterfactual savings assumption it would have been 279.4 CCF/customer, or 11.8 CCF/customer greater. In 2014, the full WRAM utilities served 903,639 customers, so total water use would have been 10.6 million CCF greater, or equivalently, 21.8 MGD greater. The typical residential home uses 241 gallons/day, according to the Water Research Foundation. Thus, 21.8 MGD could serve approximately 90,000 households.

of this revenue mechanism also happens to be the only one that did not fully comply with the state conservation mandate.

If we consider changes in water use prior to the drought, we see that the fully decoupled utilities saw larger percentage decreases in water use than did those operating with the Monterey-Style WRAM. This is at least consistent with the other findings presented in this report. We will not go so far as to say it provides strong evidence that the fully decoupled utilities outperformed the Monterey-Style WRAM utilities during this period. To reach such a conclusion would require careful statistical analysis that controlled for myriad confounding factors also impacting water use during this period. This is a question that merits further study. “Eyeball” statistics are often misleading and should not be used as the basis for consequential policy decisions.

Report Conclusions

This report has considered what impact transitioning the fully decoupled water utilities to the Monterey-Style WRAM would likely have on customer bills and water use. We considered these impacts from both a theoretical and empirical point of view.

First, we considered the rate design and conservation programming incentives the policy change would generate and traced out their logical consequences. We noted that utilities operating with the Monterey-Style WRAM have an incentive to increase sales and to mitigate revenue risk. Both encourage a utility to want to recover more revenue through service charges and flatten the tiers in their rate design.

Next, we looked at the actual rate designs of the fully decoupled utilities and those operating with the Monterey-Style WRAM. We found, as theory predicts, that the rate designs used by the utilities operating with the Monterey-Style WRAM do in fact recover more revenue from the service charge, about 35% more, and have, on average, fewer and flatter tiers. This comparative analysis also shows that, on average, the utilities operating under the Monterey-Style WRAM recover about 66 percent more of their fixed costs from fixed service charges than do the fully decoupled utilities. Theory also predicts that Monterey-Style WRAM utilities would have less incentive to invest in conservation. When we look at authorized conservation expenditures, we find they are 47 to 56 percent less per residential customers for the utilities operating under the Monterey-Style WRAM.

We then used bill impact simulations to examine whose bills are likely to increase and whose are likely to decrease if the fully decoupled utilities are switched to the Monterey-Style WRAM. We again find that the results are consistent with what theory predicts. Low-volume customers pay more, high-volume customers pay less, and water use goes up. The bill impact simulations demonstrate that the "conservation" rate designs used by the utilities operating under the Monterey-Style WRAM are not as conserving as the ones used by the fully decoupled utilities. They also shift more of the revenue recovery burden onto the backs of customers already using the least amount of water. Additionally, they increase rather than decrease bills for the majority of LIRA customers. None of these changes advance the CPUC's affordability and water conservation objectives.

Lastly, we examined the evidence presented in the Proposed Decision about the equivalency of water savings between the fully decoupled and Monterey-Style WRAM utilities. We are unpersuaded by this evidence, such as it is. Comparing changes in water use between 2015 and 2019 does not provide a meaningful performance test because both groups of utilities were complying with the state's conservation mandate and both groups were ordered to reduce water use by the same percentage. Moreover, during this period, all but one of the Monterey-Style WRAM utilities were effectively fully decoupled via the Lost Revenue Memorandum Accounts authorized by the CPUC. The one utility that did not avail itself of this revenue mechanism also happens to be the only one that did not fully comply with the state conservation mandate. Further, we noted that prior to the drought the percentage reduction in water use was greater for the fully decoupled utilities. While we do not consider such a comparison conclusive evidence that the fully decoupled utilities had better conservation performance during this period, at least it is in the direction theory would predict and is consistent with the other evidence we present in this report, which taken together leads us to conclude that fully decoupled utilities are more likely to encourage and promote conservation through their rate designs and conservation expenditures than are utilities operating under the Monterey-Style WRAM.

Appendix A – Water Revenue Adjustment Mechanism Example

This appendix provides a simple example to illustrate the key differences between full revenue decoupling and partial decoupling via the Monterey-Style WRAM.

First, let's suppose we operate a utility that sells water. To keep things really simple, let's say we have just one customer. In most years we expect to sell 100 units of water to this customer. In some years, our customer purchases more than this and in other years less, but on average, our best estimate of what our customer will purchases is 100 units.

Our costs are mostly fixed and are primarily associated with labor and capital – e.g. pipes, pumps, treatment works, etc., plus the labor needed to run and maintain the system. These fixed costs are $75 per year. It also costs us $0.25 for each unit of water we deliver. This covers costs for energy, chemicals, etc., that vary with how much water we sell.

If we sell 100 units of water our total cost will be $75 + (100 x $0.25) = $100

If we sell 120 units of water our total cost will be $75 + (120 x $0.25) = $105

If we sell 80 units of water our total cost will be $75 + (80 x $0.25) = $95

Notice that our costs don't change very much with how much water we sell. A 20% uptick or downtick in sales only changes our costs by 5%. This is because most of our costs are fixed.

Now let's consider our revenues. The costs we are authorized to recover, the amount of revenue we can recover from a service charge, and the rates we can charge for each unit of water we sell are overseen by a Public Utility Commission (PUC) that regulates our enterprise. Note that it is the PUC's task to review and authorize only costs of service that are necessary for the safe and reliable operation of our system in a reasonable and prudent manner. We are not an unfettered monopoly. All of our expenditures are subject to review and approval by the PUC that regulates us.

Let's say the PUC determines that we should recover two-thirds of our fixed costs and all of our variable costs from our commodity rates. The remaining one-third of our fixed costs, $25, is recovered through a service charge. If we charge $0.75 for each unit of water we sell, then in normal times we will fully recover our costs ($25 + 100 x $0.75 = $100).

The PUC, however, requires that we use Block Rates rather than a Single Quantity Rate. The Block Rates they have authorized are as follows:

Units Sold	Rate ($/Unit)
0-50	$0.40
51-75	$1.00
76 or more	$1.20

If we sell 100 units of water our revenue under this design would be:

$25 + (50 x $0.40) + (25 x $1.00) + (25 x $1.20) = $100

So we still fully recover our revenue requirement during normal times.

Now let's consider how our revenue changes if our sales are 20% higher or lower than expected.

If we sell 120 units of water, our revenue is

$25 + (50 x $0.40) + (25 x $1.00) + (45 x $1.20) = $124

Recall from above that our cost of producing 120 units of water is $105, so we gain $19 in excess revenue.

If we sell 80 units of water, our revenue is

$25 + (50 x $0.40) + (25 x $1.00) + (5 x $1.20) = $76

Recall from above that our cost of producing 80 units of water is $95, so our costs would exceed our revenue for a loss of $19.

Full revenue decoupling is designed to balance out these revenue fluctuations so that over the long run revenues match costs. Selling only 80 units increases the WRAM balance by $19. Selling 120 units decreases it by $19. If we have a positive WRAM balance, it means we under collected our revenue requirement and we can recover this under collection on future bills. If we have a negative WRAM balance, it means we over collected our revenue requirement and we must credit this back to customers on future bills. These are the basic mechanics of fully decoupling revenue from sales.

Notice that we don't gain if we sell more water than expected because any excess revenue gets returned to the customer on future bills. Also, we don't lose if we sell less water than expected because any shortfall gets recovered from the customer on future bills. Over the long-run, we recover our fixed and variable costs of production. Nothing more and nothing less.

Now let's see how the Monterey-Style WRAM works. The difference between the Monterey-Style WRAM and full decoupling is how revenue shortfalls and surpluses are calculated. With the Monterey-Style

WRAM if we sell more water than expected, we credit back to customers only the difference between what we would have earned with a Single Quantity Rate versus what we actually earned with our block rate. Similarly, if we sell less water than expected, we recover from customers what we would have earned with a Single Quantity Rate versus what we actually earned with our block rate.

Thus, if we sell 120 units of water the revenue we earn from our block rate is

$25 + (50 x $0.40) + (25 x $1.00) + (45 x $1.20) = $124

And the revenue we would have earned from a Single Quantity Rate is

$25 + (120 x $0.75) = $115

The difference is $9, which is how much we credit back to customers. Recall from above that our cost to produce 120 units is $105, so we earn an additional $10 above our cost when we sell 20% more than expected ($124 - $9 - $105 = $10).

Now suppose we sell 80 units of water. The revenue we earn is:

$25 + (50 x $0.40) + (25 x $1.00) + (5 x $1.20) = $76

And the revenue we would have earned from a Single Quantity Rate is

$25 + 80 x $0.75 = $85

The difference is -$9, which is how much additional revenue we can recover from our customers. Recall from above that our cost to produce 80 units is $95, so we lose $10 when we sell 20% less than expected ($76 + $9 - $95 = -$10).

This illustrates the main difference between full decoupling and the Monterey-Style WRAM. With the Monterey-Style WRAM our revenue is partially, rather than fully, decoupled from our sales volume. We still have a financial incentive to sell as much water as possible because we will profit from any sales that are in excess of what we expected to sell. We also have little incentive to promote conservation, because we will lose money if our sales come out lower than expected.

Notice also that with the Monterey-Style WRAM there is a moral hazard. Low balling our sales forecast can earn us more than forecasting it accurately. Suppose we think sales next period will be 120 but we low ball our forecast and say we expect sales will be 100. How will this work out for us? If we base our rates on selling 100 units and then actually sell 120 units (which is what we really were expecting all along), we will gain an additional $10 in profit.[21] If our revenues are fully decoupled from our sales, this potential moral hazard goes away. If we base our rates on selling 100 units and then sell 120 units, we will gain nothing. Any excess revenue will be credited back to our customer.

[21] Actually, since we have artificially inflated our rates by lowballing our sales forecast, our sales will be somewhat less than 120 units as our customer adjusts their consumption to the higher price. But since water demand is inelastic – meaning that the decrease in demand is less than proportionate to the increase in price -- our revenue will nonetheless be higher than if we had forecast our sales accurately.

Appendix B – Rate Design Data

This appendix provides the data upon which Figures 1 and 2 are based. As noted in the main report, the primary information source is decisions and advice letters that are publicly available on the CPUC website, as well as information presented on each utility's own website. To the degree possible, the results presented are comparable across utilities, although this was not always completely achievable due to differences in the form, content, timing, and completeness of each utility's documents. Cal Water provided some additional information from the Settlement Agreement in its current GRC, which has not yet been adopted by the CPUC.

In general, the rate design and conservation expenditure data for Cal Am's Monterey district is anomalous. Therefore, in most cases two sets of results are shown, one excluding that district and a second including it.

Table B1. Number and Size of Rate Blocks, Cal Am Monterey Included

		BLOCK SIZES (ccf)*			
Utility	**Number of Blocks**	**Block 1**	**Block 2**	**Block 3**	**Block 4**
Fully Decoupled Utilities					
Cal Water [a]	2.9	10.3	8.6		
Golden State	2.8	12.2	7.0		
Liberty	2.5	10.4	12.0		
Cal Am (incl. Monterey	3.8	8.9	8.6	29.5	9.0
Weighted Mean	**3.1**	**10.5**	**8.4**	**29.5**	**9.0**
Monterey-Style WRAM Utilities					
Suburban	2.0	20.0			
San Jose	3.0	3.0	15.0		
Great Oaks [b]	3.0	3.0	9.0		
San Gabriel	2.0	14.5			
Weighted Mean	**2.2**	**8.8**	**14.5**		

* The average block sizes are across those districts that have at least one block beyond the one in question. For example, the Block 2 average sizes account only for districts that have at least 3 blocks.
a. In these tables and all following tables and charts, Cal Water's rate structure is based on the Proposed Settlement Rates. There are currently high and low versions of these rates. For purposes of this analysis, the low version was used.
b. Great Oaks monthly block sizes are half the bi-monthly blocks included in tariff sheet 878-W.

Table B2. Number and Size of Rate Blocks, Cal Am Monterey Excluded

		BLOCK SIZES (ccf)*			
Utility	**Number of Blocks**	**Block 1**	**Block 2**	**Block 3**	**Block 4**
Fully Decoupled Utilities					
Cal Water [a]	2.9	10.3	8.6		
Golden State	2.8	12.2	7.0		
Liberty	2.5	10.4	12.0		
Cal Am (excl. Monterey	3.5	10.2	9.9	42.0	
Weighted Mean	**3.0**	**10.8**	**8.6**	**42.0**	
Monterey-Style WRAM Utilities					
Suburban	2.0	20.0			
San Jose	3.0	3.0	15.0		
Great Oaks [b]	3.0	3.0	9.0		
San Gabriel	2.0	14.5			
Weighted Mean	**2.2**	**5.4**	**15.3**		

* The average block sizes are across those districts that have at least one block beyond the one in question. For example, the Block 2 average sizes account only for districts that have at least 3 blocks.
a. In these tables and all following tables and charts, Cal Water's rate structure is based on the Proposed Settlement Rates. There are currently high and low versions of these rates. For purposes of this analysis, the low version was used.
b. Great Oaks monthly block sizes are half the bi-monthly blocks included in tariff sheet 878-W.

Table B3. Rate Step-Ups between Blocks, Cal Am Monterey Included

	Block 1-2	**Block 2-3**	***Compound 1-3***	**Block 3-4**	***Compound 1-4***	**Block 4-5**	***Compound 1-5***
Fully Decoupled Utilities							
Cal Water	23.6%	47.0%	*81.7%*	0.0%	*81.7%*	*0.0%*	*81.7%*
Golden State	15.0%	15.0%	*32.2%*	0.0%	*32.2%*	*0.0%*	*32.2%*
Liberty	15.8%	13.6%	*34.1%*	0.0%	*34.1%*	*0.0%*	*34.1%*
Cal Am	33.1%	64.9%	*119.5%*	56.5%	*243.4%*	*8.0%*	*270.8%*
Weighted Mean	***22.7%***	***40.3%***	***73.4%***	***10.7%***	***97.0%***	***1.5%***	***102.2%***
Monterey-Style WRAM Utilities							
Suburban [a]	11.5%		11.5%				
San Jose	50.0%	33.3%	100.0%				
Great Oaks	100.0%	52.5%	205.0%				
San Gabriel [a]	14.1%		14.1%				
Weighted Mean	**37.6%**	**35.1%**	**70.1%**				

* Results only include districts that have at least the requisite number of rate blocks.
a. Since Suburban and San Gabriel Valley rate structures have only two blocks, the compound rate step-up shown reflects the step-up between blocks 1 and 2.

Table B4. Rate Step-Ups between Blocks, Cal Am Monterey Excluded

	Block 1-2	**Block 2-3**	***Compound 1-3***	**Block 3-4**	***Compound 1-4***
Fully Decoupled Utilities					
Cal Water	23.6%	47.0%	81.7%	0.0%	81.7%
Golden State	15.0%	15.0%	32.2%	0.0%	32.2%
Liberty	15.8%	13.6%	31.6%	0.0%	31.6%
Cal Am	28.4%	45.9%	87.3%	41.0%	164.2%
Weighted Mean	**21.6%**	**36.2%**	**66.3%**	**6.4%**	**78.2%**
Monterey-Style WRAM Utilities					
Suburban [a]	11.5%		11.5%		
San Jose	50.0%	33.3%	100.0%		
Great Oaks	100.0%	52.5%	205.0%		
San Gabriel [a]	14.1%		14.1%		
Weighted Mean	**37.6%**	**35.1%**	**70.1%**		

* Results only include districts that have at least the requisite number of rate blocks.
a. Since Suburban and San Gabriel Valley rate structures have only two blocks, the compound rate step-up shown reflects the step-up between blocks 1 and 2.

Appendix C – Analysis of State Water Board Data

The Proposed Decision uses monthly water utility production data collected by the State Water Board to make a naïve comparison of water savings achieved by fully decoupled utilities and those operating under the Monterey-Style WRAM between 2015 and 2019 and wrongly claims that the latter group of utilities had water savings that exceeded those by the fully decoupled utilities. The data are publicly available and can be downloaded here.

In this appendix, we demonstrate that there is no statistically distinguishable difference in savings between the two groups of utilities during the drought. As noted in the main report, this is not surprising because the two groups had, in aggregate, virtually identical conservation mandates.

Table C-1 shows the mean percentage difference in 2019 demand relative to 2013, which was the reference year the state used to assess compliance with the conservation mandate. While the point estimate for the Monterey-Style WRAM (M-WRAM) utilities does indeed exceed the estimate for the fully decoupled utilities (F-WRAM), the difference is not statistically significant as evinced by the overlapping 95% confidence intervals.

Table C-1. Percentage Reduction in 2019 Demand Relative to 2013 Demand

```
-> wram_type = F-WRAM
(analytic weights assumed)

    Variable |        Obs        Mean    Std. Err.       [95% Conf. Interval]
-------------+---------------------------------------------------------------
      savpct |        576    19.06291     .384683        18.30735    19.81847

-------------------------------------------------------------------------------------
---------------------------------------------------------------------------------
-> wram_type = M-WRAM
(analytic weights assumed)

    Variable |        Obs        Mean    Std. Err.       [95% Conf. Interval]
-------------+---------------------------------------------------------------
      savpct |         72      21.549    .9551031        19.64458    23.45342
```

Table C-2 presents the results of a more comprehensive panel model that tests for differences in rates of savings between the M-WRAM and full WRAM utilities while controlling for each utilities assigned mandate level, the different drought restriction periods, and seasonality of water savings. The model parameter of interest is M-WRAM. If M-WRAM utilities saved more, on average, than full WRAM utilities, the parameter will be positive and statistically significant. While the parameter is positive, it is not significantly different from zero, meaning no difference.

Table C-2. Panel Model of Water Savings Relative to 2013

```
Random-effects GLS regression                   Number of obs     =      3,833
Group variable: supplier                        Number of groups  =         54

R-sq:                                           Obs per group:
     within  = 0.3557                                         min =         70
     between = 0.3619                                         avg =       71.0
     overall = 0.3570                                         max =         71

                                                Wald chi2(16)     =     656.34
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

                              (Std. Err. adjusted for 54 clusters in supplier)
------------------------------------------------------------------------------
             |               Robust
      savpct |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 mandate_pct |   .3635421   .0632768     5.75   0.000     .2395219    .4875622
             |
     drought |
     Mandate |   13.82848   .8652664    15.98   0.000     12.13259    15.52437
   Self-Cert |   12.36282   .7981664    15.49   0.000     10.79844    13.92719
Post-drought |   5.557073   .6894984     8.06   0.000     4.205681    6.908465
             |
       month |
          2  |  -1.295761    .718686    -1.80   0.071     -2.70436    .1128373
          3  |   9.092156    1.08205     8.40   0.000     6.971377    11.21293
          4  |   12.01587   1.196212    10.04   0.000     9.671334     14.3604
          5  |    14.3162    1.16572    12.28   0.000     12.03143    16.60097
          6  |   7.093549   1.068525     6.64   0.000     4.999278     9.18782
          7  |   6.659314   1.074677     6.20   0.000     4.552987    8.765642
          8  |   4.981064   1.074199     4.64   0.000     2.875673    7.086456
          9  |   5.211254   .9608383     5.42   0.000     3.328046    7.094463
         10  |   2.797917   .9358287     2.99   0.003     .9637262    4.632107
         11  |   1.841979   1.207281     1.53   0.127    -.5242487    4.208206
         12  |   6.145526   1.112272     5.53   0.000     3.965514    8.325539
             |
   wram_type |
      M-WRAM |   .0054523   1.646259     0.00   0.997    -3.221155     3.23206
       _cons |  -2.414597   1.767638    -1.37   0.172    -5.879104     1.04991
-------------+----------------------------------------------------------------
     sigma_u |  4.2807315
     sigma_e |  8.3195554
         rho |  .20932982   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Table C-3 shows the mean difference between savings and assigned conservation mandate during the period of the conservation mandate, June 2015 through May 2016. Of the four M-WRAM utilities, only one failed to comply with the state conservation mandate. It is also the only one that did not avail itself of the Lost Revenue Memorandum Account.

Table C-3. Mean Difference between Realized Savings and Assigned Conservation Mandate

WRAM and Utility	Mean Difference in Savings and Mandate
Full WRAM Utilities	
Apple Valley	1.1
Cal Water	2.2
Cal American	8.4
Golden State	2.1
Park	13.1
M-WRAM Utilities	
Great Oaks	12.9
San Gabriel	4.2
San Jose Water Company	12.0
Suburban	-2.3

ATTACHMENT 2

M.CUBED
POLICY ANALYSIS FOR THE PUBLIC AND PRIVATE SECTORS

5358 MILES AVENUE
OAKLAND, CA 94618
(510) 593-6913
MITCHELL@MCUBED-ECON.COM

Date: **January 23, 2023**
To: **Jeffrey Linam**
Fr: **David Mitchell**
Re: **Revised GRC Sales Forecast**

In light of the 2020-2022 drought and reductions in water use which were particularly impactful in the Southern Division in 2022, Cal Am requested M.Cubed to review the GRC sales forecast model and to revise the sales forecast to incorporate this new information. This memorandum summarizes the review we undertook and the revisions to the sales forecast we made.[1]

Sales Forecast Performance Review

We conducted a sales forecast performance review, comparing actual to forecast services and water sales for 2022.

The service forecast model produced accurate forecasts, as shown in Table 1. The only significant error is in Larkfield. There are two potential causes. First, the forecast was augmented with the Gregory Group's forecasts of residential construction associated with recovery from the 2017 Tubbs Fire and it appears some of the housing units were not completed within the timeframe they anticipated. Second, it is possible the reported actual number of services for 2022 is too low. It indicates that residential services decreased between 2021 and 2022, which would be surprising given that recovery from the Tubbs Fire is ongoing.

Overall, however, forecasted services are in line with actual services in each division and we see no strong justification for changing our GRC service forecast.

[1] Our original GRC sales forecast is presented in the report “California American Water Sales Forecast: 2022 General Rate Case,” prepared by M.Cubed, June 2022.

Table 1. 2022 Forecast vs. Actual Services

Division	District	GRC Forecast	Actual	Error	% Error
Central	Monterey	39,735	39,817	-82	-0.2%
Central	Central Satellite Systems	899	899	0	0.0%
Central	Chualar	193	195	-2	-1.2%
Southern	Baldwin Hills	6,254	6,221	33	0.5%
Southern	Duarte	7,516	7,481	35	0.5%
Southern	San Marino	14,492	14,453	39	0.3%
Southern	San Diego	21,903	21,690	213	1.0%
Southern	Ventura	21,201	21,141	60	0.3%
Northern	Sacramento	60,724	60,126	598	1.0%
Northern	Larkfield	2,477	2,337	140	6.0%
Northern	Meadowbrook	1,731	1,724	7	0.4%
	Total	**177,126**	**176,084**	**1,042**	**0.6%**
Central		**40,827**	**40,911**	**-84**	**-0.2%**
Southern		**71,366**	**70,986**	**380**	**0.5%**
Northern		**64,933**	**64,187**	**746**	**1.2%**

Next, we compared forecasted to actual sales volumes for 2022, as shown in Table 2. The Baseline Sales Forecast is based on average weather and unrestricted water use -- i.e., no drought water use restrictions. For the Central Division, forecasted sales are in line with actual sales. For the Northern and Southern Divisions, forecasted sales are approximately 5 and 12 percent too high, respectively.

Table 2. 2022 Baseline Sales Forecast vs. Actual Sales

Division	District	GRC Forecast	Actual	Error	% Error	Forecast Assumes Drought Response
Central	Monterey	3,698,434	3,735,851	-37,417	-1.0%	No
Central	Central Sat. Systems	134,712	134,576	137	0.1%	No
Central	Chualar	36,933	42,198	-5,265	-12.5%	No
Southern	Baldwin Hills	1,152,709	1,010,398	142,311	14.1%	No
Southern	Duarte	2,179,011	1,880,149	298,862	15.9%	No
Southern	San Marino	3,955,999	3,551,422	404,577	11.4%	No
Southern	San Diego	4,093,994	4,091,727	2,268	0.1%	No
Southern	Ventura	5,908,686	4,971,699	936,987	18.8%	No
Northern	Sacramento	12,068,574	11,578,385	490,189	4.2%	No
Northern	Larkfield	337,618	296,703	40,914	13.8%	No
Northern	Meadowbrook	424,222	395,367	28,855	7.3%	No
	Total	**33,990,891**	**31,688,474**	**2,302,417**	**7.3%**	No
Central		**3,870,079**	**3,912,625**	**-42,546**	**-1.1%**	No
Southern		**17,290,399**	**15,505,394**	**1,785,005**	**11.5%**	No
Northern		**12,830,413**	**12,270,456**	**559,958**	**4.6%**	No

We expected the Baseline Sales Forecast to be off in 2022 because it does not account for the drought water use restrictions Cal Am put in place starting around the middle of 2021 and which started to really impact water use in 2022. If we turn on the forecast model's drought response parameter, the overall forecast error drops from 7.3% to 1.4%, as shown in Table 3. Now, however, the model underpredicts sales in the Central Division where the drought response was very muted, perhaps because Central Division water use is already very low, and customers are not able or willing to cutback much further.

Table 3. 2022 Drought Response Sales Forecast vs. Actual Sales

Division	District	GRC Forecast	Actual	Error	% Error	Forecast Assumes Drought Response
Central	Monterey	3,555,259	3,735,851	-180,592	-4.8%	Yes
Central	Central Sat. Systems	118,184	134,576	-16,392	-12.2%	Yes
Central	Chualar	33,872	42,198	-8,326	-19.7%	Yes
Southern	Baldwin Hills	1,096,632	1,010,398	86,234	8.5%	Yes
Southern	Duarte	1,991,573	1,880,149	111,424	5.9%	Yes
Southern	San Marino	3,561,657	3,551,422	10,236	0.3%	Yes
Southern	San Diego	3,836,320	4,091,727	-255,407	-6.2%	Yes
Southern	Ventura	5,295,204	4,971,699	323,505	6.5%	Yes
Northern	Sacramento	11,065,756	11,578,385	-512,630	-4.4%	Yes
Northern	Larkfield	302,013	296,703	5,310	1.8%	Yes
Northern	Meadowbrook	391,877	395,367	-3,490	-0.9%	Yes
	Total	**31,248,347**	**31,688,474**	**-440,127**	**-1.4%**	Yes
Central		**3,707,315**	**3,912,625**	**-205,310**	**-5.2%**	Yes
Southern		**15,781,387**	**15,505,394**	**275,992**	**1.8%**	Yes
Northern		**11,759,646**	**12,270,456**	**-510,809**	**-4.2%**	Yes

Lastly, we compared a forecast which implemented the model's drought response in the Northern and Southern Divisions but not in the Central Division. Under these assumptions, the overall forecast error is reduced to less than one percent, as shown in Table 4.

Table 4. 2022 Mixed Drought Response Sales Forecast vs. Actual Sales

Division	District	GRC Forecast	Actual	Error	% Error	Forecast Assumes Drought Response
Central	Monterey	3,698,434	3,735,851	-37,417	-1.0%	No
Central	Central Sat. Systems	134,712	134,576	137	0.1%	No
Central	Chualar	36,933	42,198	-5,265	-12.5%	No
Southern	Baldwin Hills	1,096,632	1,010,398	86,234	8.5%	Yes
Southern	Duarte	1,991,573	1,880,149	111,424	5.9%	Yes
Southern	San Marino	3,561,657	3,551,422	10,236	0.3%	Yes
Southern	San Diego	3,836,320	4,091,727	-255,407	-6.2%	Yes
Southern	Ventura	5,295,204	4,971,699	323,505	6.5%	Yes

Northern	Sacramento	11,065,756	11,578,385	-512,630	-4.4%	Yes
Northern	Larkfield	302,013	296,703	5,310	1.8%	Yes
Northern	Meadowbrook	391,877	395,367	-3,490	-0.9%	Yes
	Total	**31,411,111**	**31,688,474**	**-277,363**	**-0.9%**	Mixed
Central		**3,870,079**	**3,912,625**	**-42,546**	**-1.1%**	No
Southern		**15,781,387**	**15,505,394**	**275,992**	**1.8%**	Yes
Northern		**11,759,646**	**12,270,456**	**-510,809**	**-4.2%**	Yes

Based on this review, we conclude the following:

- An adjustment to the forecasted number of services does not seem warranted. The overall service forecast error is under 1%.

- An adjustment to the Central Division sales forecast may not be warranted. The Baseline Forecast was accurate to within about 1% and it does not appear that Central Division customers adjusted their consumption in response to the drought, perhaps because they have already reduced it about as far as they can (or are willing to).

- There was a large drought response in the Southern Division -- larger even than the reductions during 2015-2016. It is likely that some residual drought response will persist into the Test Year and hence some adjustment to the Southern Division Test Year forecast seems warranted.

- The drought response in the Northern Division was not as strong as in the Southern Division and not as large as during 2015-2016. It is possible that sales will fully rebound by the Test Year, though in past drought cycles sales have not typically fully recovered to their pre-drought levels. A small adjustment to the forecast seems warranted to account for residual drought effects.

<u>Adjusted GRC Sales Forecast</u>

Based on the foregoing, we made the following adjustments to the GRC sales forecast:

1. The service forecast was left unchanged.

2. The 2022 drought response was taken to be the difference between 2021 and 2022 average water use per service if this difference was negative. For sake of consistency, this adjustment was applied to all divisions, including Central Division, though the resulting adjustment in Central Division is very small.

3. It was assumed that 80% of the drought response would dissipate by 2025 and 20% would persist due to long-term or permanent changes in water use associated with changes to water using capital (e.g., adoption of more efficient plumbing and irrigation equipment, changes in landscape plant materials) and state and local bans on non-functional turf at commercial

properties.

4. Test Year drought response was reduced by 20% to account for the demand hardening residual effects of the 2021-2022 drought response.

5. Forecasts of Industrial, Other, and Sales for Resale water uses, which are based on the most recent three-year average, were updated to incorporate 2022 sales data. These forecasts now are based on average use for 2020-2022.

As before, three forecasts of average use per service for Test Year 2024 are presented:

1. Baseline Forecast
2. Drought Restrictions Forecast
3. Weighted Average Forecast

Baseline Forecast – This forecast assumes a balanced COVID effect which is essentially half of the 2021 COVID effects reported in Tables 24 and 25 of our sales forecast report. The forecast is based on the average weather for the estimation period. This period was, on average, drier and warmer than the 30-year norms typically used to characterize average weather, and thus incorporates the warmer, drier climate California is now experiencing. The forecast assumes average water prices escalate, in real terms, by two percent annually between now and the Test Year and average water use is adjusted to reflect these higher prices in accordance with the price elasticities presented in Tables 15 and 16 of our sales forecast report. The revised Baseline Forecast incorporates residual effects on water use of the 2021-2022 drought response, as described above.

Drought Restrictions Forecast – This forecast provides an estimate of water use assuming drought restrictions are in place in the Test Year. The amount of reduction in average use is based on the average drought effects reported in Table 23 of our sales forecast report. The Test Year drought response was reduced by 20% in the revised Drought Restrictions Forecast to account for the demand hardening residual effects of the 2021-2022 drought response, as described above.

Weighted Average Forecast – This forecast averages these two forecasts based on the likelihood drought restrictions are in place in the Test Year. This likelihood is assumed to equal the frequency of critically dry years over the last 30 years. This frequency is 27 percent based on DWR's Sacramento and San Joaquin River Index Water Year Classifications. Thus, the Weighted Average Forecast assigns a weight of 0.73 to the Baseline Forecast and a weight of 0.27 to the Drought Restrictions Forecast. The Weighted Average Forecast is what a risk-neutral planner would likely put forward while the Drought Restrictions Forecast is what a risk-averse planner would likely advance.

Tables 5-7 provide the original and updated 2024 Test Year average use per service forecasts for each district. Tables 8-10 provide the original and updated 2024 Test Year sales volume forecasts for each district.

Table 5. Central Division 2024 Test Year Average Use/Service Forecasts (CCF/Service/Year)

	June 2022 Sales Forecast Report			**January 2023 Updated Forecast**		
Monterey	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	56	54	56	56	54	55
Multiresidential	266	258	264	259	253	258
Commercial	340	330	337	338	330	336
Industrial	1,531	1,508	1,525	1,376	1,359	1,371
Public Authority	377	377	377	375	375	375
Other	251	251	251	220	220	220
Sales for Resale	1,820	1,820	1,820	3,291	3,291	3,291
Central Satellite						
Residential	133	114	128	136	121	132
Multiresidential	0	0	0	0	0	0
Commercial	763	740	757	748	730	743
Industrial	0	0	0	0	0	0
Public Authority	626	626	626	698	698	698
Other	133	133	133	132	132	132
Sales for Resale	0	0	0	0	0	0
Chualar						
Residential	188	171	183	196	182	192
Multiresidential	0	0	0	0	0	0
Commercial	200	194	198	228	222	226
Industrial	0	0	0	0	0	0
Public Authority	637	637	637	586	586	586
Other	182	182	182	74	74	74
Sales for Resale	0	0	0	0	0	0

Table 6. Southern Division 2024 Test Year Average Use/Service Forecasts (CCF/Service/Year)

	June 2022 Sales Forecast Report			January 2023 Updated Forecast		
Baldwin Hills	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	161	151	158	150	143	148
Multiresidential	0	0	0	0	0	0
Commercial	342	342	342	337	337	337
Industrial	2,178	2,178	2,178	2,756	2,756	2,756
Public Authority	1,682	1,682	1,682	1,551	1,551	1,551
Other	37	37	37	21	21	21
Sales for Resale	0	0	0	0	0	0
Duarte						
Residential	200	181	195	186	172	182
Multiresidential	0	0	0	0	0	0
Commercial	1,032	989	1,020	995	962	986
Industrial	976	956	970	959	944	955
Public Authority	1,375	1,106	1,302	1,277	1,078	1,224
Other	876	876	876	794	794	794
Sales for Resale	0	0	0	0	0	0
San Marino						
Residential	230	204	223	217	197	212
Multiresidential	0	0	0	0	0	0
Commercial	572	547	565	574	554	569
Industrial	985	963	979	896	880	891
Public Authority	1,221	1,043	1,173	1,175	1,038	1,138
Other	189	189	189	165	165	165
Sales for Resale	0	0	0	0	0	0
San Diego						
Residential	99	91	97	98	92	96
Multiresidential	0	0	0	0	0	0
Commercial	693	668	686	688	668	682
Industrial	0	0	0	0	0	0
Public Authority	2,108	1,933	2,060	2,108	1,968	2,070
Other	311	311	311	226	226	226
Sales for Resale	0	0	0	0	0	0

Ventura	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	185	161	178	168	151	164
Multiresidential	0	0	0	0	0	0
Commercial	1,083	1,004	1,062	998	940	983
Industrial	3,118	3,003	3,087	3,136	3,044	3,111
Public Authority	2,327	2,131	2,274	2,091	1,950	2,053
Other	407	407	407	372	372	372
Sales for Resale	0	0	0	0	0	0

Table 7. Northern Division 2024 Test Year Average Use/Service Forecasts (CCF/Service/Year)

	June 2022 Sales Forecast Report			January 2023 Updated Forecast		
Sacramento	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	133	120	129	129	119	127
Multiresidential	0	0	0	0	0	0
Commercial	756	722	747	745	718	738
Industrial	167,519	163,731	166,496	144,253	141,643	143,548
Public Authority	2,481	2,122	2,384	2,284	2,020	2,213
Other	369	369	369	354	354	354
Sales for Resale	0	0	0	0	0	0

Larkfield						
Residential	101	88	97	100	89	97
Multiresidential	0	0	0	0	0	0
Commercial	370	347	363	365	347	361
Industrial	0	0	0	0	0	0
Public Authority	715	611	687	560	495	543
Other	0	0	0	1	1	1
Sales for Resale	0	0	0	0	0	0

Meadowbrook						
Residential	204	187	199	198	185	194
Multiresidential	0	0	0	0	0	0
Commercial	1,425	1,360	1,407	1,376	1,326	1,362
Industrial	0	0	0	0	0	0
Public Authority	0	0	0	0	0	0
Other	0	0	0	41	41	41
Sales for Resale	0	0	0	0	0	0

Table 8. Central Division 2024 Test Year Sales Volume (CCF)

	June 2022 Sales Forecast Report			January 2023 Updated Forecast		
Monterey	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	1,868,217	1,774,909	1,843,024	1,858,444	1,784,188	1,838,395
Multiresidential	462,428	447,740	458,462	450,456	439,011	447,366
Commercial	1,113,790	1,080,331	1,104,756	1,108,324	1,081,689	1,101,133
Industrial	6,125	6,033	6,100	5,504	5,438	5,486
Public Authority	191,148	191,148	191,148	190,119	190,119	190,119
Other	18,031	18,031	18,031	15,806	15,806	15,806
Sales for Resale	3,640	3,640	3,640	6,583	6,583	6,583
Total	**3,663,379**	**3,521,833**	**3,625,162**	**3,635,236**	**3,522,833**	**3,604,887**
Central Satellite						
Residential	115,065	99,080	110,749	117,669	104,591	114,138
Multiresidential	0	0	0	0	0	0
Commercial	18,309	17,759	18,160	17,955	17,523	17,838
Industrial	0	0	0	0	0	0
Public Authority	1,253	1,253	1,253	1,395	1,395	1,395
Other	133	133	133	132	132	132
Sales for Resale	0	0	0	0	0	0
Total	**134,760**	**118,224**	**130,295**	**137,151**	**123,642**	**133,504**
Chualar						
Residential	34,196	31,181	33,382	35,702	33,183	35,022
Multiresidential	0	0	0	0	0	0
Commercial	1,200	1,164	1,190	1,367	1,334	1,358
Industrial	0	0	0	0	0	0
Public Authority	1,273	1,273	1,273	1,173	1,173	1,173
Other	104	104	104	42	42	42
Sales for Resale	0	0	0	0	0	0
Total	**36,773**	**33,722**	**35,949**	**38,284**	**35,733**	**37,595**

Table 9. Southern Division 2024 Test Year Sales Volume (CCF)

	June 2022 Sales Forecast Report			**January 2023 Updated Forecast**		
Baldwin Hills	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	898,715	842,665	883,581	838,310	796,484	827,017
Multiresidential	0	0	0	0	0	0
Commercial	204,950	204,950	204,950	202,166	202,166	202,166
Industrial	6,533	6,533	6,533	8,267	8,267	8,267
Public Authority	41,515	41,515	41,515	38,271	38,271	38,271
Other	259	259	259	149	149	149
Sales for Resale	0	0	0	0	0	0
Total	**1,151,973**	**1,095,922**	**1,136,839**	**1,087,163**	**1,045,337**	**1,075,870**
Duarte						
Residential	1,318,686	1,191,549	1,284,359	1,224,892	1,130,416	1,199,384
Multiresidential	0	0	0	0	0	0
Commercial	669,957	642,389	662,514	646,319	625,042	640,574
Industrial	15,611	15,290	15,525	15,352	15,099	15,284
Public Authority	163,426	131,516	154,811	151,874	128,150	145,468
Other	6,915	6,915	6,915	6,270	6,270	6,270
Sales for Resale	0	0	0	0	0	0
Total	**2,174,597**	**1,987,659**	**2,124,124**	**2,044,707**	**1,904,978**	**2,006,980**
San Marino						
Residential	2,931,075	2,596,690	2,840,791	2,763,834	2,511,589	2,695,728
Multiresidential	0	0	0	0	0	0
Commercial	816,736	780,870	807,052	820,056	791,247	812,277
Industrial	42,282	41,354	42,031	38,445	37,770	38,263
Public Authority	154,513	131,999	148,434	148,586	131,265	143,909
Other	5,175	5,175	5,175	4,538	4,538	4,538
Sales for Resale	0	0	0	0	0	0
Total	**3,949,781**	**3,556,088**	**3,843,484**	**3,775,459**	**3,476,409**	**3,694,715**
San Diego						
Residential	1,898,232	1,748,234	1,857,732	1,883,928	1,764,835	1,851,773
Multiresidential	0	0	0	0	0	0
Commercial	1,513,929	1,460,939	1,499,622	1,503,082	1,460,993	1,491,718
Industrial	0	0	0	0	0	0
Public Authority	617,831	566,571	603,991	617,831	576,823	606,759
Other	9,905	9,905	9,905	7,180	7,180	7,180
Sales for Resale	0	0	0	0	0	0
Total	**4,039,897**	**3,785,649**	**3,971,250**	**4,012,022**	**3,809,831**	**3,957,430**

Ventura	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	3,574,779	3,120,806	3,452,206	3,255,526	2,924,782	3,166,225
Multiresidential	0	0	0	0	0	0
Commercial	1,248,445	1,156,859	1,223,717	1,150,555	1,083,032	1,132,324
Industrial	569,850	548,948	564,206	573,247	556,426	568,705
Public Authority	444,607	407,004	434,454	399,481	372,452	392,183
Other	800	800	800	731	731	731
Sales for Resale	0	0	0	0	0	0
Total	**5,838,480**	**5,234,417**	**5,675,383**	**5,379,540**	**4,937,422**	**5,260,168**

Table 10. Northern Division 2024 Test Year Sales Volume (CCF)

	June 2022 Sales Forecast Report			January 2023 Updated Forecast		
Sacramento	Baseline Forecast	Drought Restricted	Weighted Average	Baseline Forecast	Drought Restricted	Weighted Average
Residential	7,482,474	6,757,457	7,286,720	7,306,292	6,739,935	7,153,375
Multiresidential	0	0	0	0	0	0
Commercial	3,773,931	3,603,249	3,727,847	3,720,857	3,586,232	3,684,508
Industrial	167,519	163,731	166,496	144,253	141,643	143,548
Public Authority	865,797	740,616	831,998	797,117	704,916	772,223
Other	6,142	6,142	6,142	5,895	5,895	5,895
Sales for Resale	0	0	0	0	0	0
Total	**12,295,862**	**11,271,195**	**12,019,202**	**11,974,413**	**11,178,621**	**11,759,549**
Larkfield						
Residential	213,767	186,028	206,278	212,269	190,233	206,319
Multiresidential	0	0	0	0	0	0
Commercial	120,874	113,342	118,840	119,530	113,572	117,921
Industrial	0	0	0	0	0	0
Public Authority	2,144	1,834	2,060	1,680	1,486	1,628
Other	0	0	0	1	1	1
Sales for Resale	0	0	0	0	0	0
Total	**336,785**	**301,204**	**327,178**	**333,480**	**305,291**	**325,869**
Meadowbrook						
Residential	338,731	310,227	331,035	328,823	306,686	322,846
Multiresidential	0	0	0	0	0	0
Commercial	87,608	83,646	86,538	84,594	81,533	83,768
Industrial	0	0	0	0	0	0
Public Authority	0	0	0	0	0	0
Other	0	0	0	0	0	0
Sales for Resale	0	0	0	0	0	0
Total	**426,340**	**393,873**	**417,573**	**413,417**	**388,220**	**406,614**