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CITY OF PASADENA

May 20, 2021

Ken Kules' comments on Pasadena Water and Power's "2020 Urban Water Management Plan - Public Draft"

Summary

Pasadena Water and Power's "2020 Urban Water Management Plan - Public Draft" (PUWMP) includes a discussion of the Conservation Pricing element of Demand Management Measures in section 9.3. While the "Urban Water Management Plan Guidebook 2020" says that only a summary need be included in the main body of the UWMP, it suggests that more detail be included in an appendix. Contrary to that guidance, the PUWMP includes a description of Pasadena's water rates that is not only abbreviated but is also incomplete and no further detail is included in an appendix. Furthermore, it describes Pasadena's water rates as "sending a strong conservation signal to customers" without justifying that conclusion.

Analysis

The PUWMP portrays Pasadena's water rates in table 9-2:

Table 9-2: Tiered Rate Structure

1st Block	2nd Block	3rd Block	4th Block
$1.44852	$3.07637	$3.60615	$4.37569

This table is deceptive in that the tiered rates do suggest some conformance to Conservation Pricing, but those rates are not equitably charged for all residential customer classes. Residential customers with larger meters and larger properties receive a greater allocation of water in each block:

Customer Group Served	Meter Size	Block Allocations (in Units of One Hundred Cubic Feet)			
		Block 1	Block 2	Block 3	Block 4
Residential—Small SF Residential—MF	5/8 ", ¾"	0—8	9—24	25—34	35>
Residential—Medium SF/Small MF	1"	0—12	13 —40	41—60	61>
Residential—Large SF/ Small MF	1½"	0—22	23—86	87—132	133>
Residential—Large SF/ Small MF	2"	0—48	49—188	189—290	291>

This block allocation scheme has a dampening effect on the Conservation Pricing benefits of tiered water rates as single-family residences that would normally use about 8 billing units per month will have substantial lowest-cost water from block rate 1 to use for outdoor purposes. To illustrate this point, a large single-family residence will get 40 billing units more per month than is reasonably needed for indoor purposes at the tier 1 rate, which is enough to fill a swimming pool. In contrast, a small single-family residence gets only enough water for indoor uses.

Table 9-2 also describes only the volumetric Commodity Rate and ignores the fixed Distribution and Customer Charge and volumetric Capital Improvement Charge. This could be characterized as an inadvertent omission except for the fact that historically the definition of Conservation Pricing established by the California Urban Water Conservation Council (CUWCC) included analysis of all components of a water rate:

Adequacy of Volumetric Rate(s): A retail agency's volumetric rate(s) shall be deemed sufficiently consistent with the definition of conservation pricing when it satisfies at least one of the following three options.

Option 1: Let V stand for the total annual revenue from the volumetric rate(s) and M stand for total annual revenue from customer meter/service (fixed) charges, then:

$$\frac{V}{V+M} \geq 70\%$$

This calculation shall only include utility revenues from volumetric rates and monthly or bimonthly meter/service charges. It shall not include utility revenues from new service connection charges; revenue from special rates and charges for temporary service, fire protection, or other irregular services; revenue from grants or contributions from external sources in aid of construction or program implementation; or revenue from property or other utility taxes.

The CUWCC annual analysis of Conservation Pricing is no longer conducted, but an examination of CUWCC's historical calculation regarding Pasadena's water rates is instructive:

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.4 Retail Conservation Pricing — **On Track**

72 City of Pasadena

Implementation (Water Rate Structure)

Customer Class	Water Rate Type	Conserving Rate?	(V) Total Revenue Comodity Charges	(M) Total Revenue Fixed Carges
Single-Family	Increasing Block Seasonal	Yes	19228461	9576132
Multi-Family	Increasing Block Seasonal	Yes	6384446	3088290
Commercial	Increasing Block Seasonal	Yes	12648315	5621511
			38261222	**18285933**

Calculate: V / (V + M) **68 %**

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.4 Retail Conservation Pricing **On Track**

72 City of Pasadena

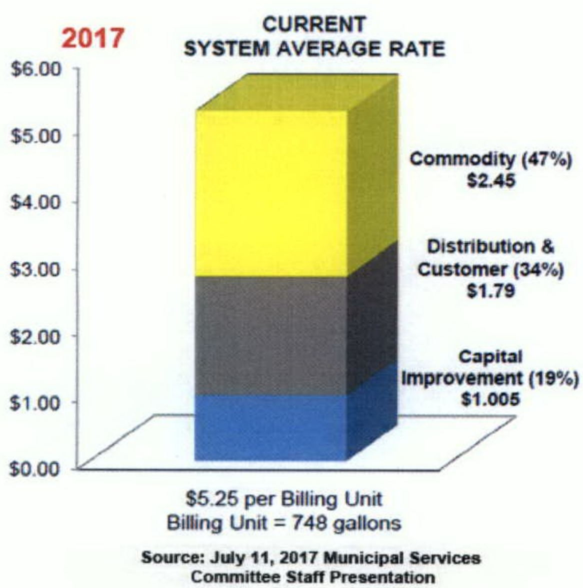
Implementation (Water Rate Structure)

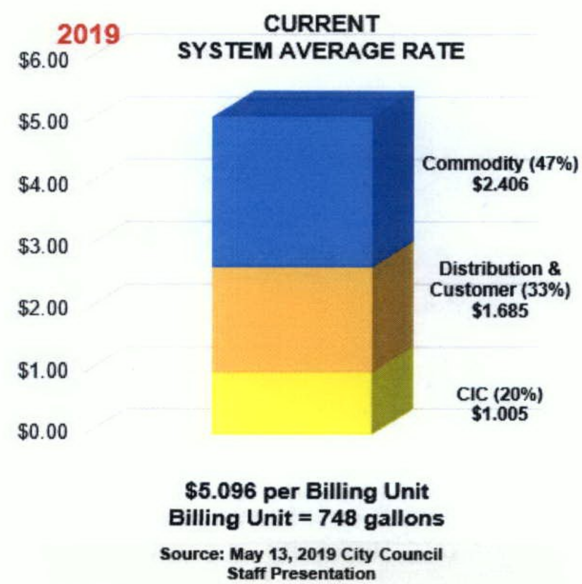
Customer Class	Water Rate Type	Conserving Rate?	(V) Total Revenue Comodity Charges	(M) Total Revenue Fixed Carges
Single-Family	Increasing Block Seasonal	Yes	20040751	9584323
Multi-Family	Increasing Block Seasonal	Yes	6479365	3101675
Commercial	Increasing Block Seasonal	Yes	13241334	5746615
			39761450	**18432613**

Calculate: V / (V + M) **68 %**

As shown above, the CUWCC analysis of Pasadena's water rates for 2013 and 2014 showed that Pasadena's water rate structure was 68% - less than 70% - in both years and was not "consistent with the definition of conservation pricing."

In 2017 and 2019, the Conservation Pricing calculations were even lower than 2013 and 2014 at 66% and 67%, respectively:





The above information must be considered in evaluation of Pasadena's Conservation Pricing.

June 4, 2021

Ken Kules' supplemental Comments on Pasadena's "Public Draft Urban Water Management Plan (April 2021)"

The California Department of Water Resources provides guidance for water suppliers regarding the Urban Water Management Plan (UWMP) in its "Urban Water Management Plan Guidebook 2020." The introduction to Chapter 6 (Water Supply Characterization) says:

> *A thorough characterization and analysis of water supplies can provide a realistic reliability assessment of a Supplier's water assets under various hydrological and regulatory conditions. A thorough analysis examines surface water rights, water entitlements (i.e., contracts for water delivery), groundwater supplies, raw water supplies, and recycled water supplies.*
>
> *The water supply analysis is critically important to Suppliers. The conclusions drawn about supply availability under various hydrological and regulatory conditions permeate all other components of the UWMP.*
>
> *Suppliers will need to characterize each source of water supply and consider any information pertinent to the reliability and risk analyses, including changes in supply due to climate change.*
>
> *The more details addressed in a water supply analysis, the better. Some details that are important to be considered for each water asset include: ... any uncertainties in the water asset itself ... that may impact the reliability of the water supply...*

In its instructions regarding groundwater supplies, it recommends including:

> *...a discussion of any known issues including changes in groundwater levels, water quality issues, yield, subsidence, or any information that may affect present or future groundwater use.*

Pasadena's UWMP fall short in its description of groundwater resources in Chapter 6 with regard to both groundwater reliability and quality as discussed below.

Reliability

The 1944 Raymond Basin Judgment (Judgment) established a safe yield[1] for the basin and allocated the right of each pumper in the basin to pump a share of the safe yield.[2] That allocation was adjusted upward in a subsequent amendment to the Judgment in 1955. Studies by the Raymond Basin Management Board have concluded that - in retrospect - the 1955 amendment resulted in an over-estimate of the basin safe yield for the Pasadena Subarea of the Raymond Basin (magenta line):

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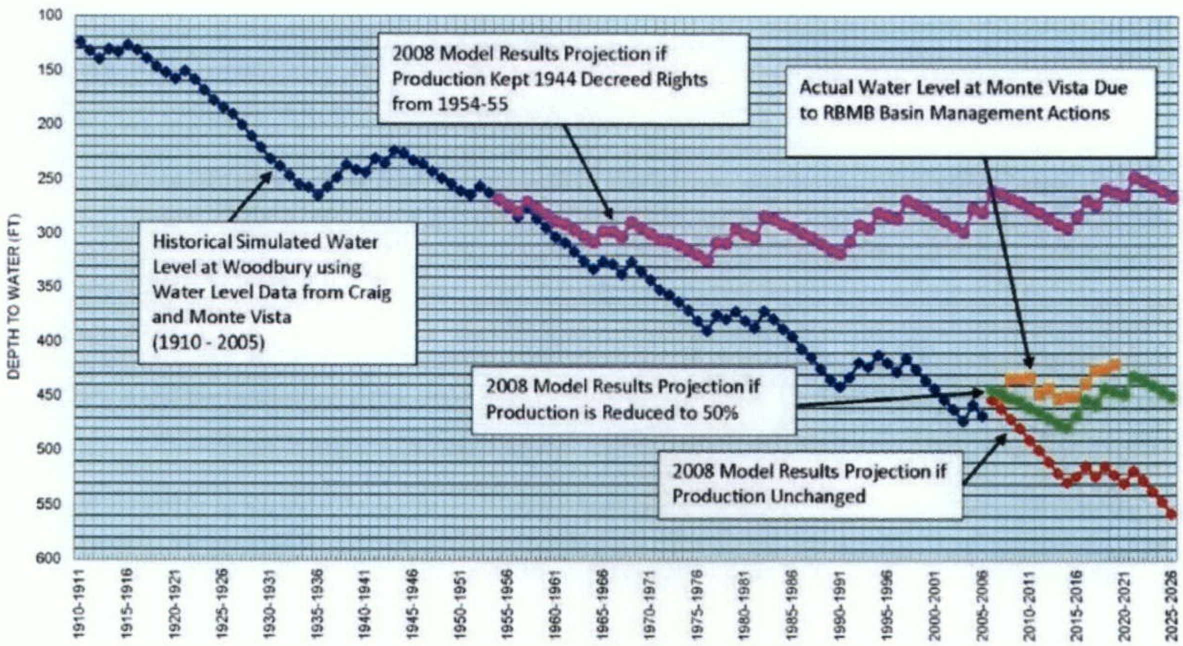
[1] "Safe yield" was defined in the Judgment as "the average annual amount or ground water that could be artificially extracted from the basin over an indefinitely long period of years...without causing a net lowering of ground water levels."
[2] See UWMP Figure 6-2 for basin and subarea boundaries.

SIMULATED WATER LEVEL AT PASADENA'S WOODBURY WELL

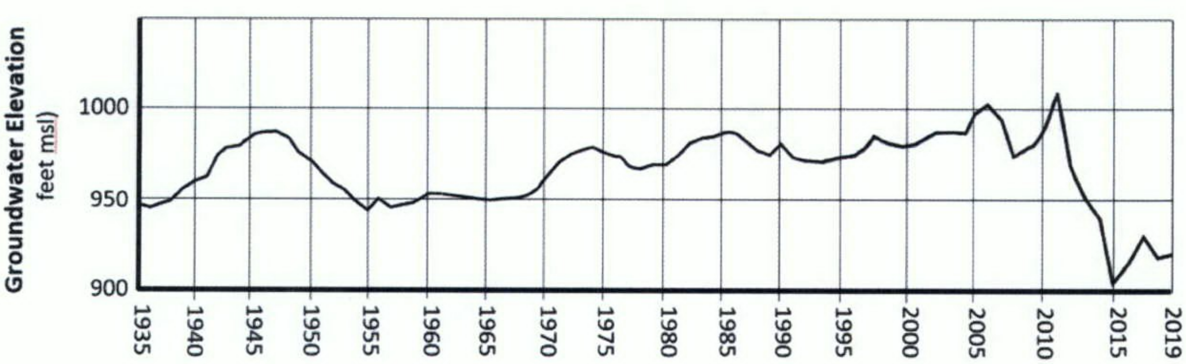


Source: Tony Zampiello (RBMB Executive Officer) May 11, 2021 Municipal Services Committee presentation

Action was taken by the RBMB in 2009 to reduce pumping in the Pasadena Subarea by 30% over a "ramp-down period" of 5 years. The RBMB then studied the impact of groundwater level decline in 2015 and concluded that the groundwater levels declined 14 feet during the ramp-down period – a slight reduction from the over 3-foot historic decline to just under 3 feet for the 2009-2014 period when the safe yield was reduced. Note that the above graph suggests that a 50% reduction in safe yield will be needed to have a durable effect on groundwater decline.

There are similar concerns regarding the Monk Hill Basin (another subarea of the Raymond Basin) but the conditions are less obvious:

Monk Hill Basin (Rubio Canon Land & Water Association Well No. 7)



Source: Composite of graphs from RBMB Annual Reports for 1992-93, 2005-06, 2007-08 & 1018-2019

In recent years, the Monk Hill groundwater elevations have declined to record low levels. While the 2012-16 drought was a major contributing factor to the decline, basin management policies related to spreading and pumping credits have also contributed to the decline. No analysis appears to have been done to assess the Monk Hill condition, but the RBMB have re-convened a Monk Hill study group to discuss concerns of some pumpers that the decline has affected their well production.

In 2017, the drought ended, there were several wet years and groundwater levels remained relatively stable. In response to concerns that there is insufficient action being taken by the RBMB to mitigate the declining groundwater, Pasadena has said that "Based on RBMB, reports submitted to the State conclude that for the last few years groundwater level is stable."[3] That is what was probably said in 1968, 1993 and 1998 when groundwater levels appeared to stabilize. Dry conditions began to return in 2020 and it is being reported that the current water year is the "third-driest year on record" and is drier than any of the 2012-2016 drought years.[4] The RBMB Executive Officer has said that "the Basin cannot sustain current pumping indefinitely."[5]

Climate Change

Chapter 10 of the UWMP says that "Information in this chapter covers both adaptation and mitigation, and includes an assessment of climate change vulnerability specifically for the water resources system in which PWP is embedded." There is much discussion on the challenges associated with analyzing climate change impacts but in the discussion of groundwater concludes that:[6]

> *Given that there is a lack of consensus on the effect of climate change on precipitation, there is little basis on which to estimate the impact of climate change to groundwater supplies. While the impact is likely to occur given the close correlation between local precipitation and yield (natural and operational), that impact cannot be predicted without a specific comprehensive study at the local level.*

In fact, the GoldSim model used to analyze reliability of water supply does not take into account climate change.[7] There is a study that has analyzed climate variability "at the local level" that PWP has relied on in the UWMP: the Kimbrough (2019) study referred to on p. 10-2. The Conclusion that the UWMP draws from that report is:

> *In the study analyzing climate change effects on streamflow, the streamflow in the Arroyo Seco was analyzed. Pasadena, Calif., has used the Arroyo Seco as a source of water for more than 100 years. During this period, local air temperatures have risen dramatically, resulting in a significant increase in streamflow.The median streamflow in the period 1962–2016 was 30% higher than the median streamflow in the period 1910–1961. A substantial portion of that increase has been in the form of extreme flow episodes, with flows greater than 1 m^3/s. If the data from the recent drought (2011–2016) are eliminated, the increase*

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[3] Steve Mermell, May 13, 2021

[4] https://www.accuweather.com/en/weather-news/california-reports-third-driest-year-on-record/927591

[5] Tony Zampiello, May 11, 2021 Municipal Services Committee meeting

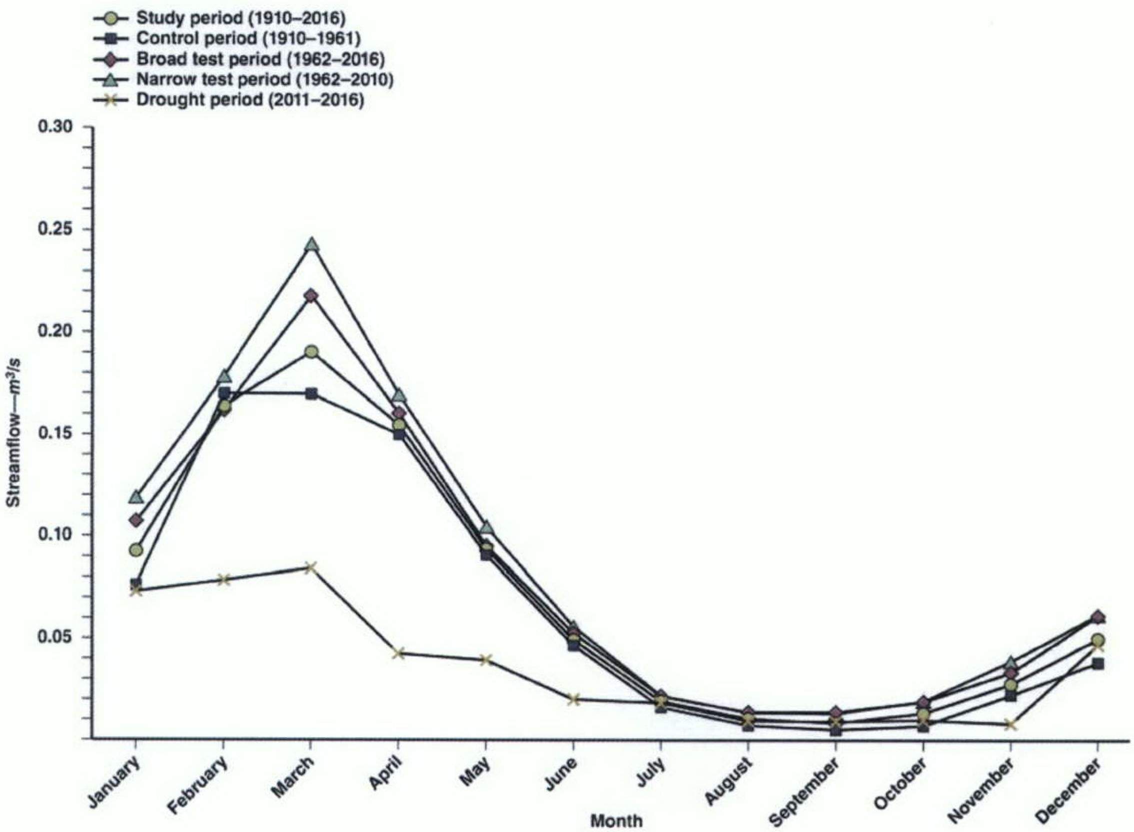
[6] UWMP, p. 10-6

[7] "The analysis uses historical data from 1922 to 2018 to evaluate future years under multiple hydrologic conditions" and "Climate change variables were not applied to future years." UWMP pp. 7-1 & 7-2

in streamflow is even greater. The study would suggest that the impacts of local climate change in the Pasadena area are positive for water supply, given that more water is flowing in the stream.

That conclusion does not translate to an increase in groundwater supplies because streamflows greater than 1 m^3/s cannot readily be percolated into the ground and are conveyed out of the Raymond Basin through concrete-lined flood control channels. An examination of the following graph from the Kimbrough (2019) report points out the impact of drought periods on streamflows:

FIGURE 3 Median streamflow by month, 1910–2016



It is clear that drought conditions severely affect stream flows in February through June months and increased drought frequency resulting from climate change will reduce groundwater replenishment in the future. The Kimbrough (2019) report provides the data for a sensitivity analysis that can assess the magnitude of that adverse impact and that has not been done for the UWMP.

Water Quality

The UWMP Guidebook says:

An analysis of reliability would not be complete or useful to the Supplier without pertinent information on the constraints to water supply sources. To the extent practicable, Suppliers should include a description of any constraints on their water supply that have been identified by the Supplier, such as inconsistent availability or water quality issues.

The UWMP glosses over the magnitude of the water quality issues in the groundwater supplies and dismisses them by saying that "PWP uses a combination of removing wells from service, blending, and treatment to ensure water delivered to customers does not exceed the Maximum Contaminant Levels (MCLs) established by the State Board and the United States Environmental Protection Agency."[8]

The following table provides insights into the pervasive problems with Pasadena's groundwater supply quality:[9]

Table 4-1: Well Water Quality Deficiencies

	Well	Water Quality Detections
	Active Wells	
1	Arroyo	Perchlorate, carbon tetrachloride (CTC), trichloroethylene (TCE), tetrachloroethene (PCE), and 1,2,3-trichloropropane (1,2,3-TCP)
2	Bangham	Nitrate, perchlorate, TCE, PCE, and 1, 2, 3-TCP
3	Chapman	Nitrate
4	Sunset	Nitrate, perchlorate, TCE, PCE, cis-1,2-Dichloroethylene (c-1,2-DCE) and 1,2,3-TCP
5	Twombly	Nitrate
6	Ventura	Nitrate, perchlorate, TCE, PCE and 1,2,3-TCP
7	Wadsworth	Nitrate , PCE, TCE and 1,2,3-TCP
8	Well 52	Nitrate, perchlorate, TCE and PCE
9	Woodbury	Nitrate, perchlorate and 1,2,3-TCP
	Inactive Wells	
1	Copelin	Nitrate, perchlorate, TCE, PCE, and DCE
2	Sheldon	Nitrate and PCE
3	Craig	Nitrate and perchlorate
4	Eaton	Under influence of surface water
5	Garfield	Nitrate, perchlorate
6	Jourdan	Nitrate, PCE, TCE and DCE
7	Monte Vista	Nitrate, perchlorate, 1, 2, 3-TCP, and CTC
8	Villa	Nitrate, perchlorate, and TCE
9	Windsor	Well used for irrigation since September 2020. Current water quality meets the state and federal drinking water regulations; In the past the well exceeded the nitrate, perchlorate, VOC drinking water limits.

All of the groundwater delivered to the four major reservoirs in Pasadena's water delivery system are blended with imported supplies to meet drinking water quality regulations. The both reservoirs at Sunset Reservoir

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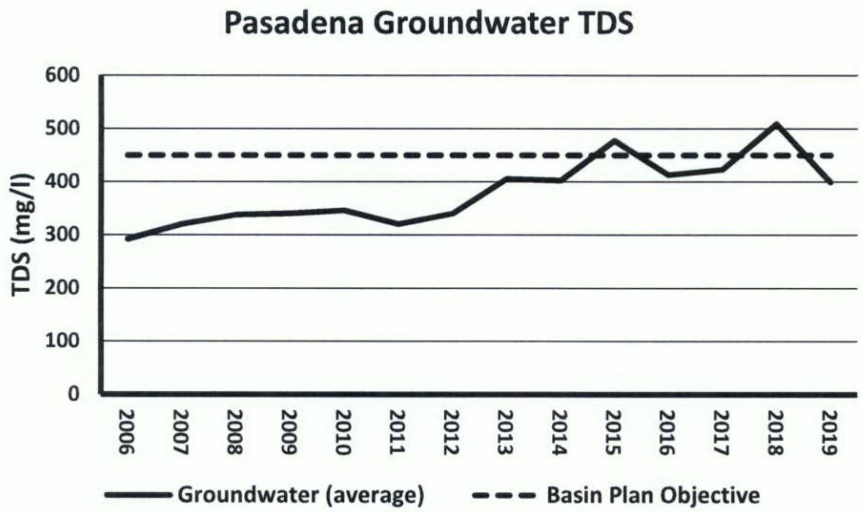
[8] UWMP, p. 6-9.

[9] WSRP Final Report (December 2020), Table 4-1

complex "were taken out of service in 2020 after it was determined that they did not meet the state's drinking water requirements."[10] The contaminated wells that deliver water to that complex were also taken out of service as the blending capability was no longer available. A replacement reservoir is planned but will not be completed until 2025.[11] That circumstance was a contributing factor in Pasadena's reduced pumping in 2019.[12]

Total Dissolved Solids in Pasadena's groundwater is also a limiting factor. The following graph was developed using data from Pasadena's annual Consumer Confidence Reports:



As the data shows, TDS levels began increasing in 2013 and in recent years has exceeded the Regional Water Quality Control Board's Basin Plan Objectives. This is not reflected in the Raymond Basin Management Board's Salt and Nutrient Management Plan that determined that there is assimilative capacity in the basin but did not included post-20212 data in its analysis. This would likely affect Pasadena's ability to implement recycled water projects or use imported water from Metropolitan Water District to replenish the Raymond Basin groundwater. This is a serious omission from the UWMP.

[10] Steve Mermell, May 13, 2021
[11] UWMP, Section 6.7.1
[12] See UWMP, Table 6-2

Jomsky, Mark

From: Kennedy, John J.
Sent: Monday, June 7, 2021 7:13 AM
To: Jomsky, Mark
Cc: Morey Wolfson; kules.ken@gmail.com; mrdavid@davidcutterpiano.com; Porras, Susana; tim@arroyoseco.org; Porras, Susana
Subject: Budget based pricing description for Palo Alto 2019.pdf
Attachments: Budget based pricing description for Palo Alto 2019.pdf

Good morning Mark,

Is it possible that you could include the attached into the minutes and record on Agenda Item No. 11 so that I do not have to spend a lot of the Council's precious time reviewing the matter in detail?

Sincerely,

John

Sent from my iPhone

RAFTELIS

MEMO

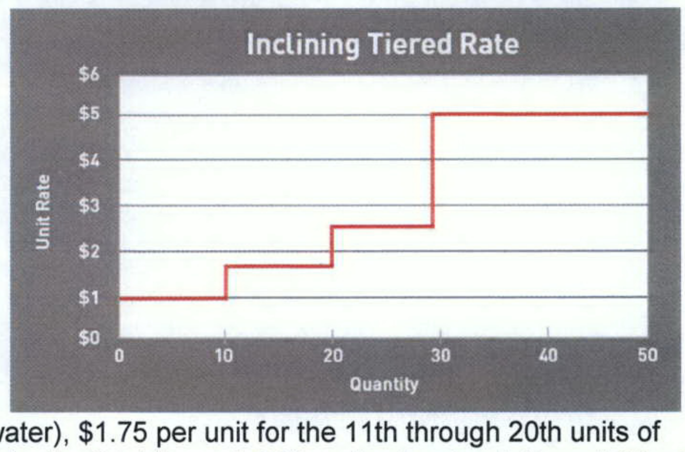
To: Lisa Bilir, Resource Planner
From: Sudhir Pardiwala/Hannah Phan
Date: May 20, 2019
Re: Water Budget Rate Structure Evaluation

The City of Palo Alto (City) engaged Raftelis Financial Consultants, Inc. (Raftelis) to prepare a short memorandum evaluating water budget rate structures. The goal of the memorandum is to provide a high-level overview of water budget rate structures that will assist City staff in assessing the feasibility of developing and implementing a water budget rate structure for the City.

Overview of Water Budget-Based Rates

Public water service providers generally assess both fixed charges (typically based on each customers' water meter size) and commodity charges (based on the volume of water delivered to each customer). Fixed charges are generally designed to recover all or a portion of the water agency's fixed costs of providing water service, and therefore are not assessed per unit of water delivered to each customer. Please note that this memorandum does not include any further discussion of fixed charges, as water budget-based rates pertain to commodity charges only.

Before water budget-based rates were first implemented by water service providers in Southern California in the early 1990s, other existing water rate structures were already commonly used to promote water conservation and discourage wasteful use of scarce water resources. The most common example of this kind of conservation-minded rate structure is the inclining tiered rate structure, in which the commodity charge rate increases as the level of water usage per billing period increases. The figure to the right provides an example of a four-tier inclining tiered rate structure. In this example, a customer would pay $1 per unit for the first 10 units of water delivered (referred to as Tier 1 water), $1.75 per unit for the 11th through 20th units of water delivered (Tier 2), $2.50 per unit for the 21st through 30th units of water delivered (Tier 3), and $5 per unit for each unit above 30 units (Tier 4). Such a rate structure provides lower priced water for essential indoor water uses while discouraging wasteful use above a given threshold.



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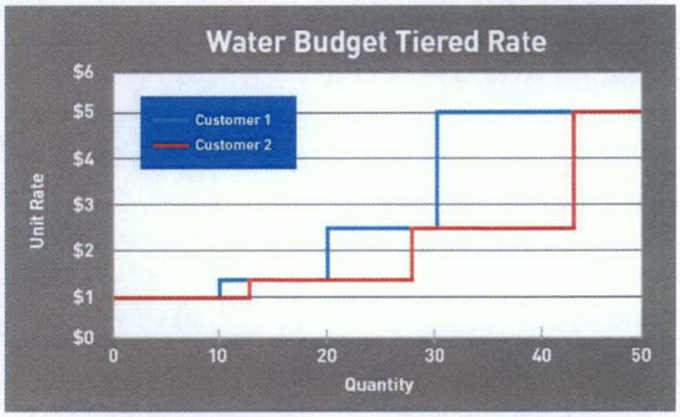
Los Angeles, CA 90071
www.raftelis.com

Although the example above includes four tiers, it is common for agencies to have fewer tiers. Note that the City currently has in place a two-tier inclining tiered rate structure for residential water customers.

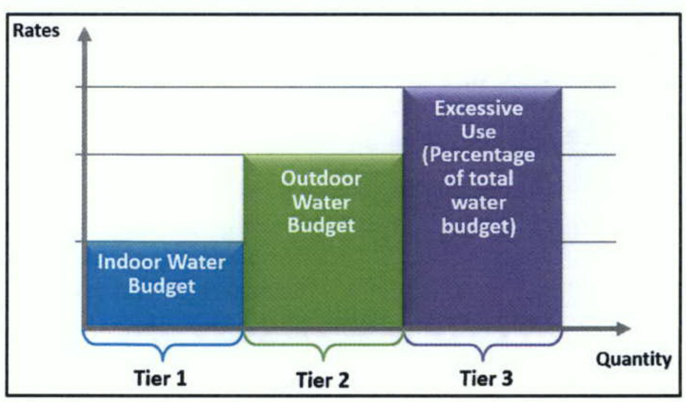
Water budget-based rates are structured similarly to inclining tiered rates. The fundamental difference however between inclining tiered rates and water budget-based rates is that the latter includes individualized tier definitions based on each customer's unique characteristics. Water budget rates send a signal to customers to use water more efficiently, whereas the inclining rate structures send conservation signals to larger water users. In the figure on the previous page, the tier definition (i.e. 0-10 units for Tier 1) is the same for every customer under the example for inclining tiered rates. The figure to the right shows a sample water budget rate structure, in which each customer has unique tier definitions. For example, Tier 1 for Customer 1 goes up to 10 units while Tier 1 for Customer 2 goes up to 13 units. The factors commonly used by agencies to determine each customer's tier definitions will be discussed in greater detail below but may include household size and landscape area for example. Customer 1's smaller tier allotments could be due to a smaller household size or smaller landscape area relative to Customer 2.



Each individualized tier definition is commonly referred to as a customer's "water budget." The American Water Works Association Journal defines a water budget as "the quantity of water required for an efficient level of water use by that customer[1]." This emphasis on efficiency provides the conceptual basis behind water budget rate structures. Inclining tiered rate structures are primarily structured to incentivize conservation. Conservation focuses on minimizing the total use of water. Efficiency on the other hand focuses on using the minimum required amount of water to satisfy a certain use. By determining efficient levels of usage on an individualized basis, water budget rate structures aim to reduce wasteful use of water and establish metrics to equitably allocate limited water supplies to customers.

Determination of Water Budgets

The methodology for determining individualized water budgets for each customer varies significantly in complexity among agencies that have implemented water budget rates structures. The total water budget for residential customers is generally divided up into an indoor water budget and an outdoor water budget. As domestic indoor water needs are typically considered as the highest priority use of water, the



[1] American Water Works Association Journal, May 2008, Volume 100, Number 5.

indoor water budget usually provides the basis for a customer's Tier 1 allotment under most water budget rate structures. Tier 2 allotments are often based on a customer's outdoor water budget, which represents an efficient amount of water use for landscaping and irrigation. Tiers 3 and higher generally represent inefficient and/or excessive use in excess of a customer's total budget. The figure above represents an example of how an agency might define its residential tiers. Please note however that number of tiers and tier definitions vary among different agencies' water budget rate structures.

An indoor water budget is commonly determined based on average winter water use and/or household size. Average winter water use is commonly used in climates where little or no outdoor usage is needed during winter months. Household size takes into account the size of the household and the estimated water use per household member. An outdoor water budget is typically determined by the irrigable landscape area of each customers' parcel, weather data, and an adjustment factor that takes into account the water requirements of a particular parcel's landscape/crop type. Agencies commonly define empirical formulas to be used to calculate the indoor and outdoor water budgets for each customer. While some agencies have water budget rate structures in place only for residential customers or only for dedicated landscape irrigation accounts, others may have water budget-based rates for multiple customer classes. If so, a unique water budget calculation methodology will be used for each customer class to determine each class' appropriate level of "efficient use." Water budgets for commercial customers are usually designed based on the historical water use and/or based on needs evaluated for each customer.

Policy Considerations

Water budget-based rates were pioneered in the early 1990s in Southern California by Capistrano Valley, Irvine Ranch Water District, and Otay Water District to address the need to incentivize efficient water use under uncertain water supply conditions. Since then, water budget rate structures have been implemented by at least 25 water providers across the United States[2]. While still most prevalent in California, water budget rate structures have been adopted by utilities in other states including Utah, Nevada, Colorado, North Carolina, and Florida. Water budget-based rates have also been implemented across a variety of agencies in terms of agency size and technological resources.

While water efficiency is the guiding principle that generally motivates agencies to adopt water budget rate structures, a variety of policy considerations must be evaluated in order to assess whether water budget-based rates are appropriate for a specific water provider. A list of the primary advantages and disadvantages of water budget rate structures are outlined below. An important step in evaluating the appropriateness of water budget-based rates is for City staff to consider which factors listed below are particularly pertinent to Palo Alto.

Advantages

1. **Promotes a culture of efficiency:** Water budget rate structures are an effective method of signaling to customers that efficiency is a key value within a given service area. When water budget-based rates are well designed, they should result in effective price signaling to customers to reduce wasteful or inefficient water use. Coupled with separate conservation measures and targeted messaging to stakeholders, a water budget rate structure can drive home the point to customers that both water efficiency and conservation are essential to the well-being of the service area. This is particularly

[2] AWWA Research Foundation. Water Budgets and Rate Structures: Innovative Management Tools. 2008.

relevant in regions particularly vulnerable to water supply insecurity. This may be the primary reason water budget rate structures were pioneered by agencies in regions of Southern California particularly sensitive to water supply shortage.

2. **Pricing/accuracy:** Water budget rate structures provide for lower priced water for essential indoor water usage needs by charging customers at the lowest Tier 1 rate for indoor domestic water usage. This aligns well with the current interpretation of the "beneficial use" doctrine in California, which states that indoor domestic needs are of the highest water use priority. Water budget-based rates can result in decreased water bills for low water usage residential customers, compared to what those same customers would be charged under uniform commodity rates[3]. Furthermore, water budget-based rates can provide another equitable rate design option, because they account for different amounts of water required to efficiently meet the water needs of each household. Thus, a water budget rate structure, if based on accurate customer data and characteristics, offers another way to add accuracy and precision into the rate structure.
3. **Effective drought management response:** As stated earlier, water budget rate structures are perhaps most appropriate in areas that are aggressively trying to reduce water demand due to water supply shortages or lack of reliability. In fact, Irvine Ranch Water District in Orange County implemented one of the first water budget rate structures in the nation in direct response to drought conditions in the late 1980s and early 1990s in Southern California. The District was particularly motivated to take aggressive action because its wholesaler, Metropolitan Water District of Southern California, was forced by drought conditions to implement penalties for agencies that exceeded their allotment. An independent evaluation found that Irvine Ranch Water District's water budget rate structure implementation led to a 37% decline in water applied for landscape irrigation, demonstrating the potential for well-designed water budget-based rates to significantly reduce inefficient and wasteful water use[4].

Disadvantages

1. **Ease of understanding:** Water budget rate structures are inherently more complex than other common rate structures utilized by water utilities. There may therefore be some challenges in helping customers understand their water bills after the initial implementation of water budget-based rates. This is particularly true for agencies transitioning from a uniform commodity rate to water budget-based commodity rates. Although the City does currently have two-tiered commodity rates for residential customers, water budget rate structures usually include four or five tiers. A change over to water budget-based rates would therefore require effective communication with customers before implementation and enhanced temporary customer service support afterwards.
2. **Customer data requirements:** Although dependent on the specifics of each water budget rate structure, substantial increases in customer data are generally required to implement and administer water budget-based rates. This data typically includes customer lot size data to determine landscape area and climatic data such as evapotranspiration. The level of detail does vary considerably by water budget rate structure. For example, Irvine Ranch Water District uses real-time evapotranspiration

[3] This assumes the different rate structures are designed to collect the same amount of revenue. Because the City uses a tiered rate structure, residential customers already have a first tier allowance of 6 ccf per month, which is designed to cover essential indoor use. Thus, these customers are unlikely to see savings unless they have a large household or some other factors that makes their current first tier allowance of 6 ccf per month inadequate.
[4] AWWA Research Foundation. Water Budgets and Rate Structures: Innovative Management Tools. 2008.

data while the City of San Clemente simply uses seasonal averages. This variability in level of detail applies to landscape area as well. While lack of data availability is rarely an issue, obtaining and compiling necessary landscape data during initial implementation, as well as maintaining and updating the initial data so that the water budget rate structure can remain equitable and useful, can require significant staff effort. Many agencies use the California Irrigation Management Information System (CIMIS) network of weather data to determine efficient outdoor budgets.

3. **Cost of implementation/administration:** The cost of implementation relates to the gathering of appropriate data, billing system purchase or upgrade (if the current system is not capable of handling water budget rate structures), and public outreach efforts. Administrative costs include labor costs resulting from additional staffing requirements for customer service after implementation to address questions and variances, as well as changes in customer characteristics, to water budgets resulting from various legitimate reasons such as medical needs, needs of large animals, pools, etc. Water budget rate structure implementation costs can vary significantly by agency based on the complexities of the selected rate structure, making comparison between agencies difficult. Examples of actual agency costs relating to the adoption of rate structures are provided at the end of this memorandum.

Based on the advantages and disadvantages of water budget rate structures outlined above, some general rules can be derived to determine under what circumstances water budget rates may be most appropriate and beneficial:

- Water budget-based rates have historically been most useful to agencies with significant outdoor landscaping usage that are trying to send a strong efficiency and conservation message to customers.
- Agencies with multiple water supply sources, including more expensive and less reliable imported water supplies, are more likely to benefit financially from reductions in water demand resulting from water budget rate structures.
- Water budgets can offer increased use and demand accuracy for service areas with larger variability in customer lot size and weather patterns.
- Water budget rate structures are most likely to generate support from customers in service areas with a strong existing water conservation ethic.

Costs of Implementation & Administration

Examples of the start-up data and billing costs associated with implementing water budget-based rates are provided in Table 1 below, taken from the AWWA Research Foundation "Water Budgets and Rate Structures: Innovative Management Tools" publication. As noted previously, there is considerable variability in cost based on agency size, existing billing system infrastructure, types of water budget rate structure implemented, and other characteristics. The costs provided are specific to each agency and may not be representative for the City, depending on the aforementioned factors. For example, Irvine Ranch Water District service area encompasses 181 square miles in Orange County, CA, provides service to a population of about 500,000 people. Irvine Ranch was a pioneer in water budget rate structures – the first iteration was implemented in 1991 by the District's in-house staff with no outside help. The original five-tier rate structure was implemented only for single family customers with a fixed indoor water budget and a default lot size of 1,300 square feet, with a variance or appeals process so that customers could change the default values. Since then, there have been numerous improvements to the structure to make it more sophisticated and equitable.

Los Angeles Department of Water and Power (DWP), which provides service to a population of 4 million people over 473 square miles, implemented its water budget rate structure in 1995. However, their structure was significantly different than Irvine Ranch. The two-tier seasonal water budget rate structure is applied to all customers. However, the tier definition is different for each customer class. Single family customers' first tier break is based on five lot sizes, three temperature zones, and a sliding scale for household size.
San Juan Capistrano's service area is approximately 14.4 square miles and is home to a population of about 37,000 people. The City implemented its water budget rate structure in 2006, consisting of a three-tiered rate structure that applies to all residential customers and dedicated irrigation and agricultural accounts. Single family customers were divided into two categories: lots with less than 7,000 square feet, which are all given the same outdoor water allotment, and lots greater than 7,000 square feet, which are given individualized budgets.

For reference, the City's water utility serves a population of approximately 67,082 over 25.85 square miles. The example agencies in Table 1 and 2 are located in Southern California, which according to the State Water Resources Control Board had an average residential water usage of approximately 143 gallons per capita per day (gpcd) between September 2014 through February 2019. In contrast, the average residential water usage in the San Francisco Bay region, where the City is located, is approximately 86 gpcd for the same time period. This data could indicate that the climate and water usage behaviors between Southern California and Northern California are quite different. As the examples show, there is no one "correct" water budget rate structure that can be implemented. Agencies have a choice in how detailed they want to implement water budget rates, based on their goals and objectives. The options range from simplified budgets with default values for certain customer groups to completely individualized budgets for all customers. The more individualized the rate structure, the higher the implementation costs.

Table 1
Start-up Data and Billing System Costs of Water Budget Rate Structure Implementation[5]

Data/Billing System Costs	$	Notes
Irvine Ranch Water District	$0	*No additional resources or staff required*
San Juan Capistrano	$6,000	*$5,000 for new billing forms; $1,000 for database of lot sizes*
Los Angeles DWP	$300,000	*Direct consulting costs of implementation*

Examples of the additional levels of staffing effort required after the initial implementation of water budget-based rates are shown in Table 2 below.

[5] AWWA Research Foundation. Water Budgets and Rate Structures: Innovative Management Tools. 2008. Note that figures are nominal dollars and are not adjusted for inflation.

Table 2
Additional Staffing Needs for Water Budget Rate Structure Implementation[6]

Additional Staffing Needs	Number of Positions
City of Corona	*Two full-time temporary positions for first 6-9 months*
Western MWD (Murrieta service area)	*Four full-time temporary positions for first 6 months*
El Toro Water District	*One full-time temporary position for first 9 months*

[6] City of Corona has a population of approximately 167,000 within 39.55 square miles. Western MWD Murrieta service area serves a population of approximately 113,000 within 6.5 square miles. El Toro Water District provides service to a population of approximately 49,000 within 8.5 square miles.