From: Phil
To: Terrie Gillen
Subject: Correction in my comments tonight
Date: Tuesday, February 28, 2023 11:13:39 PM

Hi, Terrie,

In my comments at tonight's Board Meeting on the Water Supply Assessment, I mentioned another consultant who, along with Maddaus, had mentioned there were further opportunities for conservation. I had misremembered that it was Peter Mayer who spoke before the Board a few months ago, rather than Paul Mann. I wanted to make this correction to the record and apologize for my faulty recollection.

Is it possible you can make this correction available in the record tor Board members? I know it would not have made a difference to Board deliberations or votes, but I wanted to ensure they had the correct information.

Thanks for all you do to keep the Board meetings so accessible and helpful to members of the public!

Best, Phil Sotter
Woodacre

From: Guy
To: Guy
Subject: MMWD Credit Analysis
Date: Monday, March 6, 2023 12:44:42 PM
Attachments: MMWD Multi Analysis Mar 2023.pdf

I am just sharing this document to a very narrow audience of interested parties. The latter include individuals belonging to MMWD, MCWS, and $COST.

I kept the audience anonymous so any feedback or debate can be undertaken on a one-and-one basis.

Thank you for your interest in such matters.

Gaetan "Guy" Lion

MMWD
Multi-Dimensional Analysis
March 6, 2023

Gaetan Lion

Table of Contents

Introduction and objective

My starting objective was to conduct a credit analysis of the MMWD to:

- better understand its financial condition;
- assess its debt servicing capacity;
- estimate its prospective need for rate increases to sustain ongoing operations; and
- estimate rate increase to raise bond financing to fund water supply infrastructure projects.

As I shared my intent with specialized audiences, they asked about many other interesting considerations. Thus, this "credit analysis" covers many investigations within numerous domains including:

- Economics;
- Socioeconomics;
- Demographics;

- Hydrology;
- Pension liabilities; and
- Human capital costs.

Thus, this document is a lot more than just a credit analysis.

Main takeaways

Financial Condition

The MMWD financial disclosure up to June 30, 2022 (Annual Report) gives little predictive information regarding the current level of financial stress. The MMWD is operating below breakeven. Absent any rate increase, it is on pace to deplete its reserves funds in fiscal 2024. Shoring up the MMWD operating performance, funding replacement of aging fixed assets, and funding large water supply infrastructure projects will require a near doubling or more of water rates and fees by fiscal 2027.

Aging infrastructure

The MMWD has an aging infrastructure associated with huge backlogs of fixed assets needing replacement (pipes, pump stations, storage tanks). Annual capital expenditures to stabilize such backlogs (not reduce them) are $24 million per year. To fund these expenses alone requires about a 24% increase in rates.

Prospective rate increases

To restore operating performance and replace some of its capital assets, the MMWD has developed two rate increase scenarios. The first scenario (Scenario 3) would replace fewer capital assets. It would be associated with a 34.6% increase in rates in the first year and a cumulative increase of 73.1% by fiscal 2027 over the fiscal 2023 level. The second scenario (Scenario 4) would replace more capital assets. It would be associated with an overall 46% increase in rates in the first year and a 94.6% increase in rates by fiscal 2027 over the fiscal 2023 level. Scenario 4 is more realistic because it would stabilize the huge backlog of fixed asset replacement. Scenario 3 would cause the backlog to keep on growing. Over a decade, the backlog would increase by more than 5 years.

The water supply infrastructure projects considered to shore up the MMWD 4-year water supply security will represent substantial additional costs. Assuming an additional 5,000 AF at a minimum cost of $2,000 per AF and a debt covenant multiple of 1.25 will require another $12.5 million per year in operating revenues. In turn, this would result in an overall rate increase by fiscal 2027 of 85.8% for Scenario 3 and 107.3% for Scenario 4. As mentioned, Scenario 4 is better as it stabilizes the backlog level, meanwhile, Scenario 3 lets the backlog level run out of control.

Marin County profile

Marin County has an aging demographic profile. MMWD customer base may not grow as predicted by RHNA forecasts.

Marin County has favorable historical and prospective rainfall trends. Our local climate has been wetter since 1951 vs. the earlier much dryer period from 1917 to 1950. The NOAA forecasts that Climate Change will result in Marin County's rainfall increasing over time. The actual data confirms that the challenges facing the MMWD have little to do with Climate Change.

Water Management

MMWD customers use less water than they used to:
156.5 gallons per customer per day in 2001;
122.9 in 2021; and
under 100 in the 2022 water year.

Regarding water management, the MMWD has leaned mainly on water conservation. Instead, it could have used an inventory management approach. The MMWD avoids as much as possible buying water from Sonoma at around $1,500 per AF, and instead motivates its customers to conserve more. But it resells water to its customers for $2,500 per AF. That's a $1,000 profit and a 40% profit margin. The MMWD could afford to waste up to 40% of such purchased water and still break even or come way ahead. Given the predictable seasonality of demand, the MMWD should be able to profit a lot from such an inventory management strategy by wasting far less than 40% of such purchased water. Additionally, this strategy has positive implications for maintaining reservoir levels.

MMWD releases far more water than mandated during dry years. During the 2020 - 2021 water crisis when we were less than 12 months away from running out of water, the MMWD released an excess of 7,068 AF for maintaining stream flows. Based on current consumer consumption, this excess water release represents 33% of annual consumption (or 4 months of water supply).

MMWD ratepayers experience a near-chronic state of water scarcity. This is not because of Climate Change. It is because of an inadequate water supply infrastructure to support 192,500 during two consecutive years of less than 35 inches in rainfall. We call such levels a drought; it would still be considered an abundant rainfall in many West Coast cities.

Jacobs Engineering (JE) is working with the MMWD to resolve all the above water management issues. JE has proposed a list of water supply infrastructure projects to shore up MMWD's 4-year supply security. JE has suggested the MMWD purchases much more water from Sonoma (inventory management strategy). JE has suggested that MMWD improves the precision of its water release through automation to minimize excess water release above the relevant mandated levels. JE estimates that just optimizing purchases of Sonoma water and minimizing excess water release could yield close to 3,000 AFY.

Human capital

Regarding human capital, a few of the junior positions appear much overpaid. Office Assistant II's pay scale at MMWD is around 30% above its benchmark at Salary.com San Francisco. Similarly, Senior Customer Representative is about 45% above Salary.com San Francisco. Overall, there seem to be opportunities to bring several MMWD positions' pay scales in line with the local labor market.

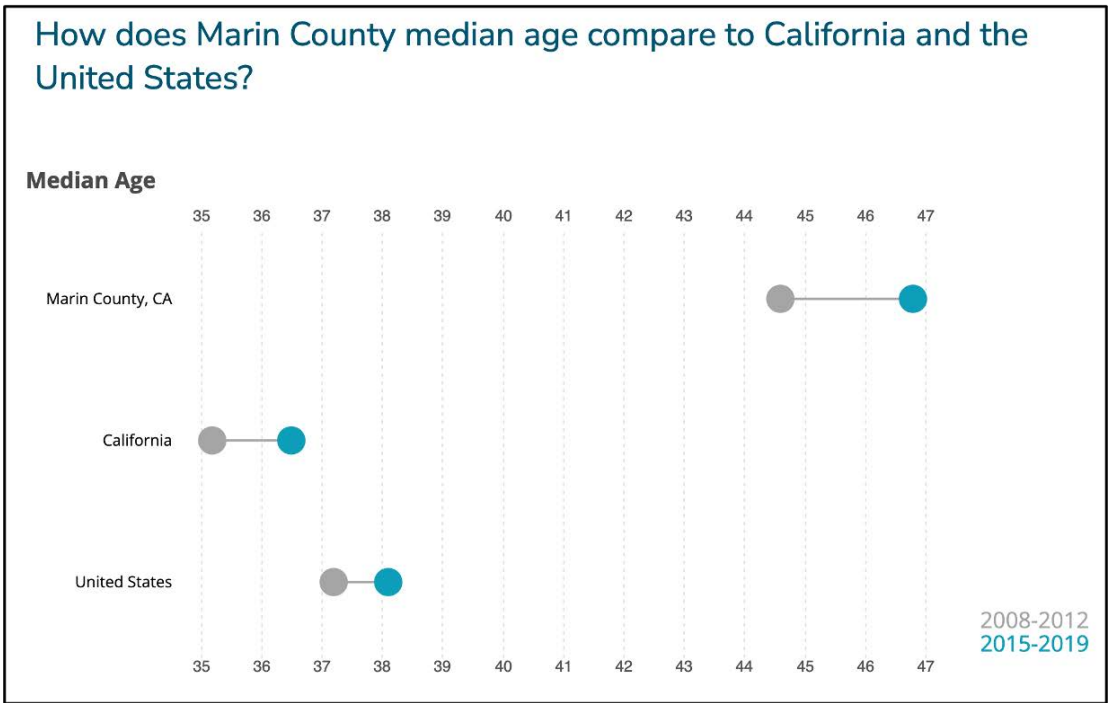
Pensions

CALPERS pension liabilities are high. Related CALPERS contributions by MMWD have risen from 23.3% of covered payroll in fiscal 2015 to 41.3% in fiscal 2022. When you include other post employment benefits (OPEB), the MMWD contributions were nearly 60% of the covered payroll in fiscal 2021. They were lower in fiscal 2022 due to favorable market movements measured two years earlier within the OPEB investment portfolio. However, we can anticipate these contributions will soon exceed 60% of the covered payroll. This is in part because the ratio of the number of pensioners divided by active employees keeps on rising. This trend is expected to continue. It will cause pension contributions to keep on rising too. This is a complex issue that is covered in detail at the end of this report.

Marin County profile

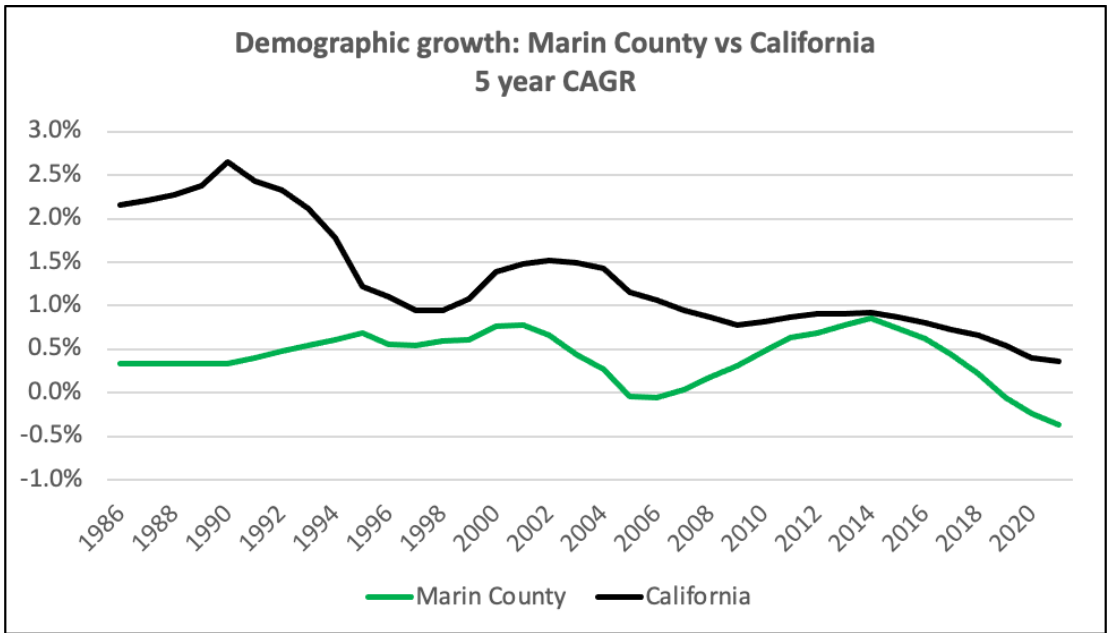
Demography

Marin County's demographics (rapid aging, low fertility, flat growth) are more similar to Japan (the oldest population) than the U.S. or California. Marin County, with a median age of 46.9 years is approaching Japan at 48.4 years; and is far higher than the US at 38.2 or California at 36.5.



Source: Livestories.com

Marin County's population growth rate has always been much lower than for California overall as shown on the graph below. Marin County's compounded annual growth rate (CAGR) over 5 year horizon has turned negative. Marin County's population peaked in 2016 at 263,010. It declined to 258,956 in 2020.



Source: California Department of Finance Research Demographics Unit (DRU)

The DRU projects that Marin County's population growth will remain much below California and will remain negative till 2060. At such time, the DRU forecasts that Marin County's population will decline to 231,338.

A recent San Francisco Chronicle article published a revealing table that showed that Marin was the county that lost population most rapidly among Bay Area counties over the period from July 2021 to July 2022.

Bay Area counties' population changes, July 2021-22

Region	Births per 1k	Deaths per 1k	Net foreign immigration per 1k	Net domestic migration per 1k
Alameda	10.3	6.6	3.2	−16.5
Contra Costa	10.1	7.8	2.4	−14.1
Marin	**9.2**	**8.2**	**1.1**	**−16.8**
Napa	8.3	9.6	1.8	−13.9
San Francisco	8.8	7.6	4.1	−10.4
San Mateo	10.2	6.7	2.7	−17.0
Santa Clara	10.2	5.9	3.2	−16.3
Solano	11.1	9.1	1.4	−11.7
Sonoma	9.2	9.4	1.2	−7.4
Statewide	10.8	8.1	2.3	−10.4

Rates are calculated using California Dept. of Finance July 2021 population estimates.

Source: San Francisco Chronicle.

On the table above, notice that the big driver of the population decline is net domestic migration, meaning individuals moving out of a county. And, Marin County experienced one of the highest net domestic migration at – 16.8 per thousand individuals.

The acceleration in the population decline is due to the Work From Home era. The latter has eliminated the need of working near companies' headquarters. Major local high tech companies keep on announcing layoffs in the tens of thousands.

Sacramento sees the situation differently. This has to do with the influence of the real estate lobby[1].
In summary, selling water in Marin County is not a growing business from a demographic standpoint.

Socioeconomics

Marin County socioeconomic profile is favorable, as it is one of the most well-off counties in the Nation. MMWD ratepayers represent a very good individual credit risk as they should not have trouble paying their water bills.

[1] I have done much demographic research on the topic. See my article at The Marin Post: https://marinpost.org/blog/2023/1/9/rhna-abag-demographic-projections-are-way-off. Also, on February 16, the Marin IJ published an article about how California's population has shrunk by half a million over just the past couple of years https://enewspaper.marinij.com/infinity/article_popover_share.aspx?guid=fbf19dee-46f8-4bdc-980c-bc466b1b7476. And, on the same day, the IJ published another article uncovering the influence of the real estate lobby regarding litigation associated with the implementation of local housing mandates that do not reflect actual demographic trends: https://enewspaper.marinij.com/infinity/article_popover_share.aspx?guid=64e965e6-6399-43ba-ac23-89e136428a91.

	Personal Income per capita	Change	Unemploy-ment rate
2005	$ 81,628		4.00%
2006	$ 89,197	9.3%	3.80%
2007	$ 91,729	2.8%	3.70%
2008	$ 93,263	1.7%	4.70%
2009	$ 89,139	-4.4%	8.10%
2010	$ 82,498	-7.5%	7.90%
2011	$ 85,761	4.0%	7.70%
2012	$ 93,407	8.9%	6.70%
2013	$ 97,124	4.0%	5.40%
2014	$ 98,626	1.5%	4.20%
2015	$ 109,076	10.6%	3.40%
2016	$ 115,952	6.3%	3.30%
2017	$ 124,552	7.4%	2.90%
2018	$ 134,275	7.8%	2.60%
2019	$ 141,735	5.6%	2.40%
2020	$ 145,575	2.7%	10.10%
2021	NA	NA	5.10%
2022	NA	NA	2.20%

Source: MMWD Annual Reports

Hydrology

Marin County's hydrology is very favorable. The Media confuses water being scarce in Marin County because of an inadequate MMWD water infrastructure to support 192,500 humans with Marin County being in a chronic state of drought and being a victim of Climate Change.

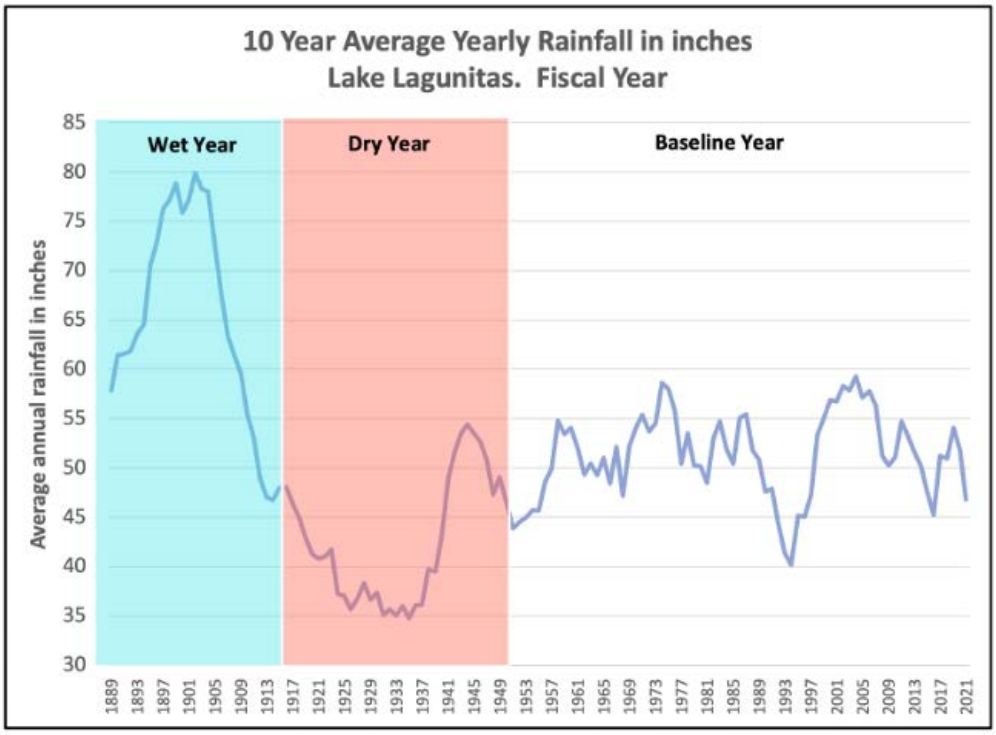
Wet vs Dry Periods

Marin County is not getting any dryer. The dry period was from 1917 to 1950. Thereafter, our climate has been much wetter.

Annual rainfall in inches, Lake Lagunitas, fiscal year

		Average	Median	St. deviation
1880 - 1916	Wet years	62.0	60.4	19.7
1917 - 1950	Dry years	40.9	39.2	14.9
1951 - 2021	Baseline	51.8	47.4	18.5

Source: MMWD

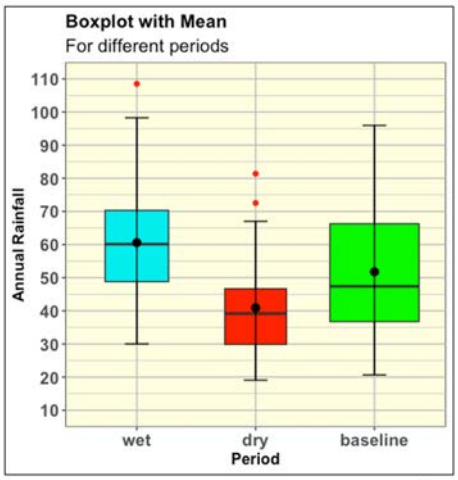


Source: MMWD

Below showing the three distinct periods with boxplots[2].

[2] I lifted a slide associated with earlier research I did on the topic.

Marin County/MMWD 3 very distinct periods disclosed with boxplots



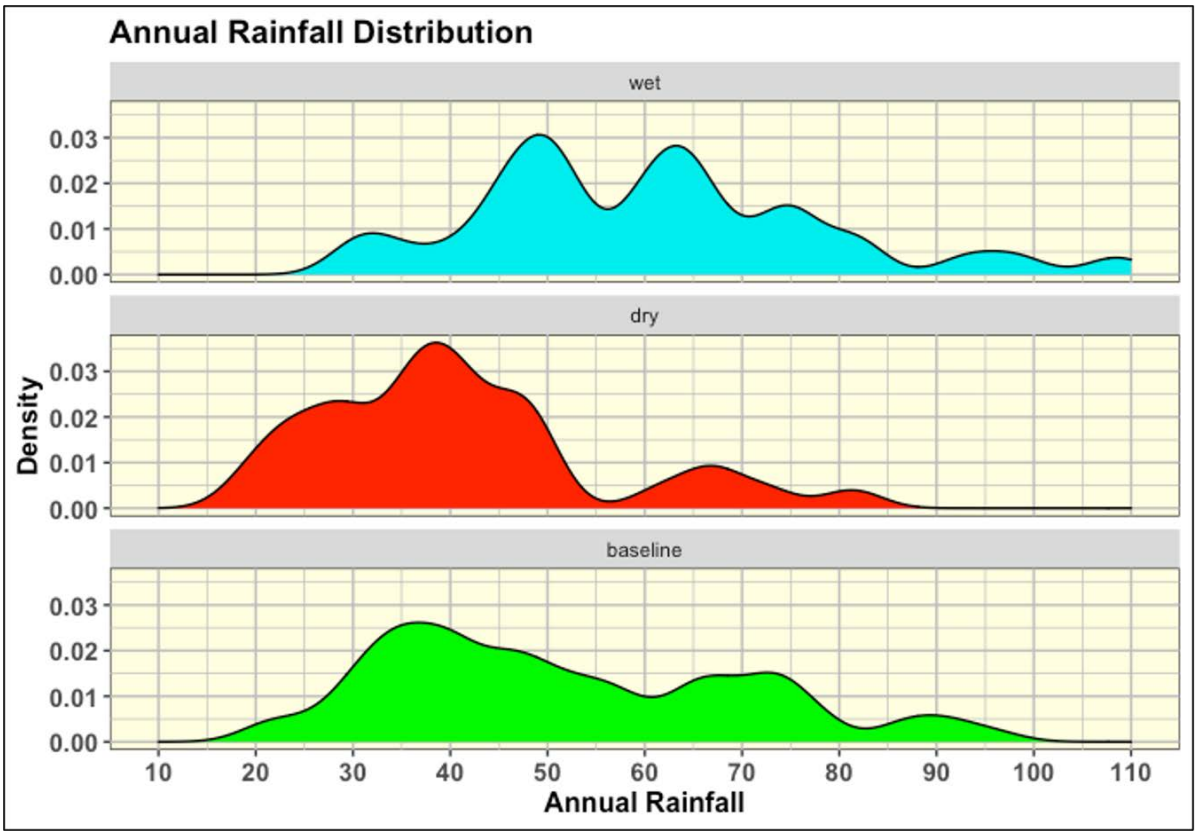
Source: MMWD, Lake Lagunitas rainfall

The boxplot shows very large differences in the distribution of the annual rainfall of the 3 periods.

The 25th percentile of the Wet period is much above the 75th percentile of the Dry period.

The 75th percentile of the Dry period is below the Median (50th percentile) of the Baseline period.

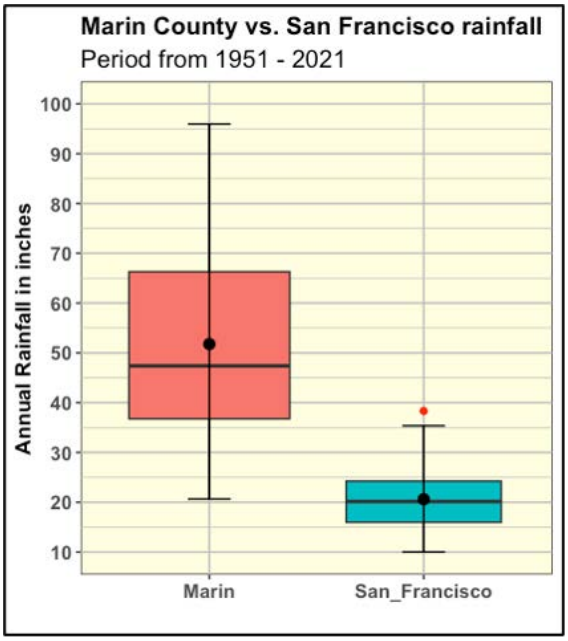
Showing the same data as smoothed distributions.



In all cases, the three periods are very distinct. The data (visual and stats) does support that our local climate is not getting any drier.

Comparing Marin County's rainfall vs. San Francisco and other West Coast cities

What we think as a near record drought with 20.7 inches in rainfall during the 2021 water year is actually an above average rainfall level for San Francisco (19.7).

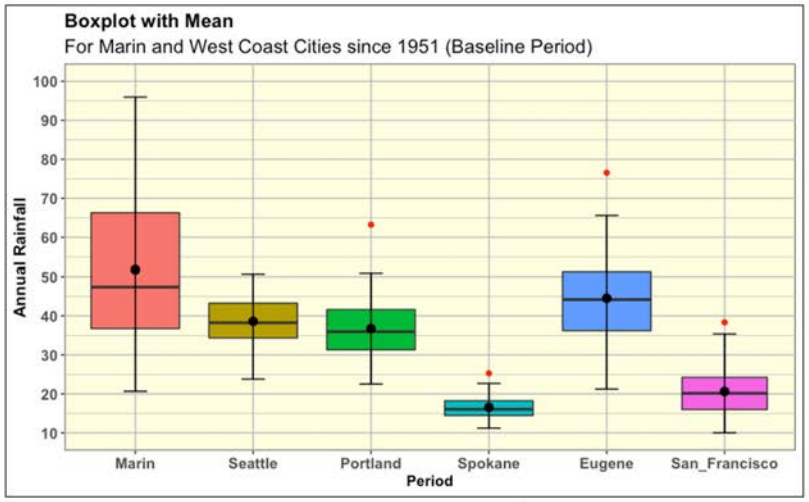


Source: MMWD, NOAA

Marin	San_Francisco
Min. :20.66	Min. : 3.37
1st Qu.:36.76	1st Qu.:15.61
Median :47.39	Median :19.34
Mean :51.77	Mean :19.69
3rd Qu.:66.29	3rd Qu.:24.06
Max. :95.95	Max. :38.33

Marin County gets even much more rain than Eugene, Portland and Seattle. The three mentioned cities are considered having a very wet climate. Marin County gets way more rain than Spokane. See below another slide I lifted off from earlier research on the topic.

Marin gets way more rain than all the mentioned cities



Marin	Seattle	Portland
Min. :20.66	Min. :23.79	Min. :22.51
1st Qu.:36.76	1st Qu.:34.34	1st Qu.:31.29
Median :47.39	Median :38.24	Median :35.95
Mean :51.77	Mean :38.60	Mean :36.74
3rd Qu.:66.29	3rd Qu.:43.26	3rd Qu.:41.62
Max. :95.95	Max. :50.68	Max. :63.23

Spokane	Eugene	San_Francisco
Min. :11.22	Min. :21.23	Min. : 3.37
1st Qu.:14.46	1st Qu.:36.22	1st Qu.:15.61
Median :16.06	Median :44.17	Median :19.34
Mean :16.56	Mean :44.52	Mean :19.69
3rd Qu.:18.23	3rd Qu.:51.32	3rd Qu.:24.06
Max. :25.27	Max. :76.55	Max. :38.33

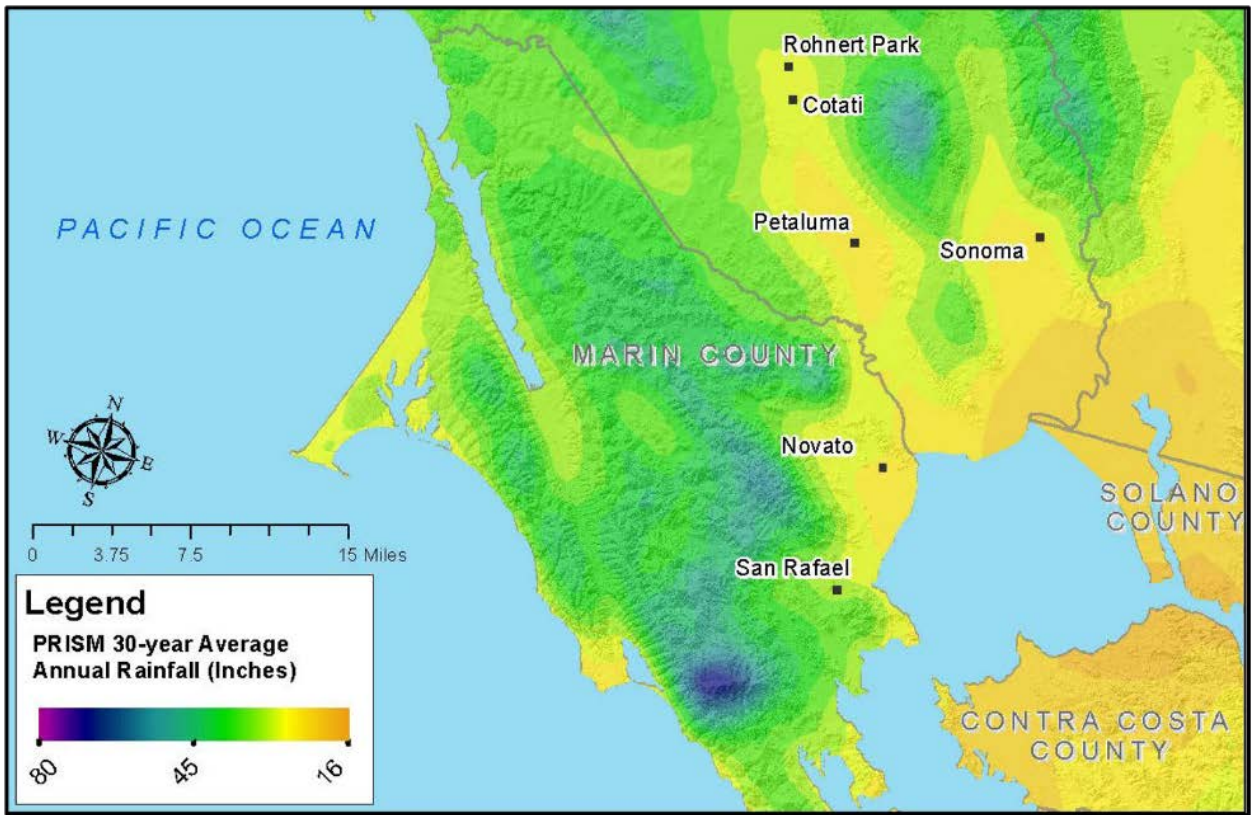
Source: MMWD, Lake Lagunitas rainfall. NOAA.

In average, nature is pretty generous to us. Look at Spokane and San Francisco! However, "our" nature is more unpredictable. See the wider bands in between the 25th and 75th percentiles, and the 99% confidence interval.

Mount Tam is a water production factory

The reason behind Marin County's favorable hydrology is Mount Tam. The latter is a natural water production factory thanks to the orographic lift effect[3]. As shown on the map below, the large footprint around Mount Tam is the only area that gets in average over 45 inches of rainfall per year.

[3] Mount Tam forces the moist air from the Pacific Ocean to rise. As it rises, the air cools. Cold air can't hold as much moisture. So, the latter condenses and turns into rain.



Marin County's rainfall outlook till 2100

Marin County's rainfall outlook till the year 2100 is good. Based on the NOAA models[4], Climate Change is expected to cause a rise in temperature commensurate with a rise in rainfall. Notice that the higher emission scenario associated with a faster rise in temperature is also associated with a larger increase in rainfall.

Notice that the NOAA rainfall figures for Marin County are derived at another weather station. Thus, they are lower than the ones recorded at Lagunitas (MMWD rainfall record). So, the key factor to focus on here is the upward rainfall trend, not the nominal rainfall level that is lower than at Lake Lagunitas.

MMWD Consumer Water Consumption

As shown on the table below, consumer water consumption reached a maximum of 31,808 acre feet (AF) or 157.3 gallons per customer per day in 2004 (water year ended in June 30). Consumption reached a minimum in the most recent water year (2022) of 21,164 AF and 98.2

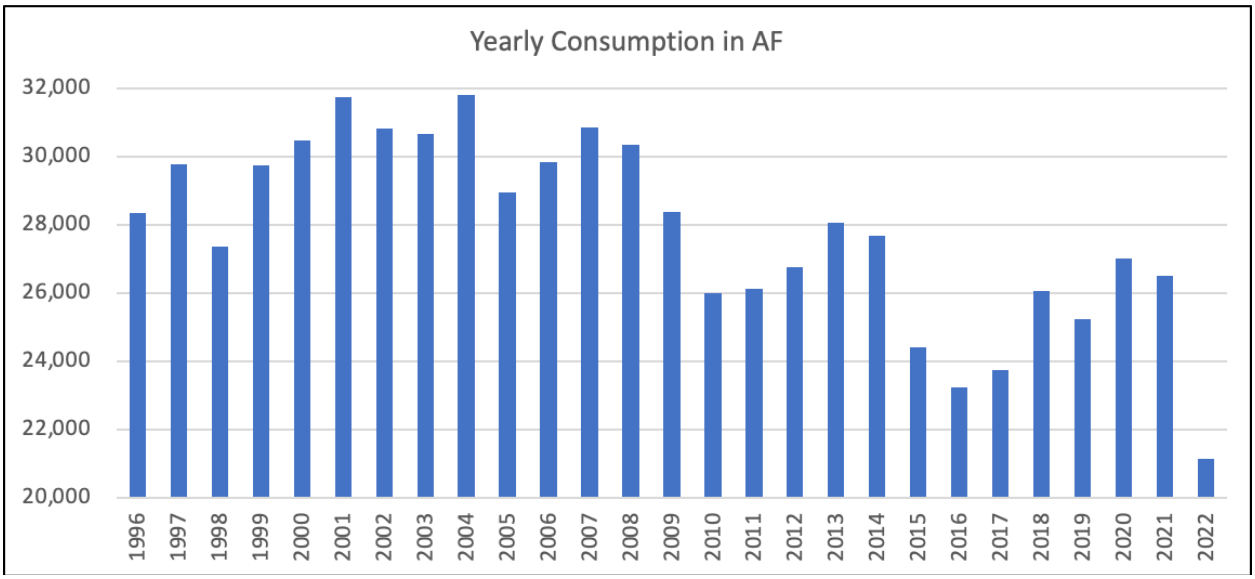
[4] Check the data within this section using the NOAA model, "The Climate Explorer" at the following URL: https://crt-climate-explorer.nemac.org/climate_graphs/?county=King%2BCounty&city=Seattle%2C+WA&fips=53033&lat=47.6062095&lon=-122.3320708&area-id=53033&zoom=7

gallons per customer per day. Relative to the maximum, this represented a decrease in consumption of – 33.5% and – 37.6% respectively.

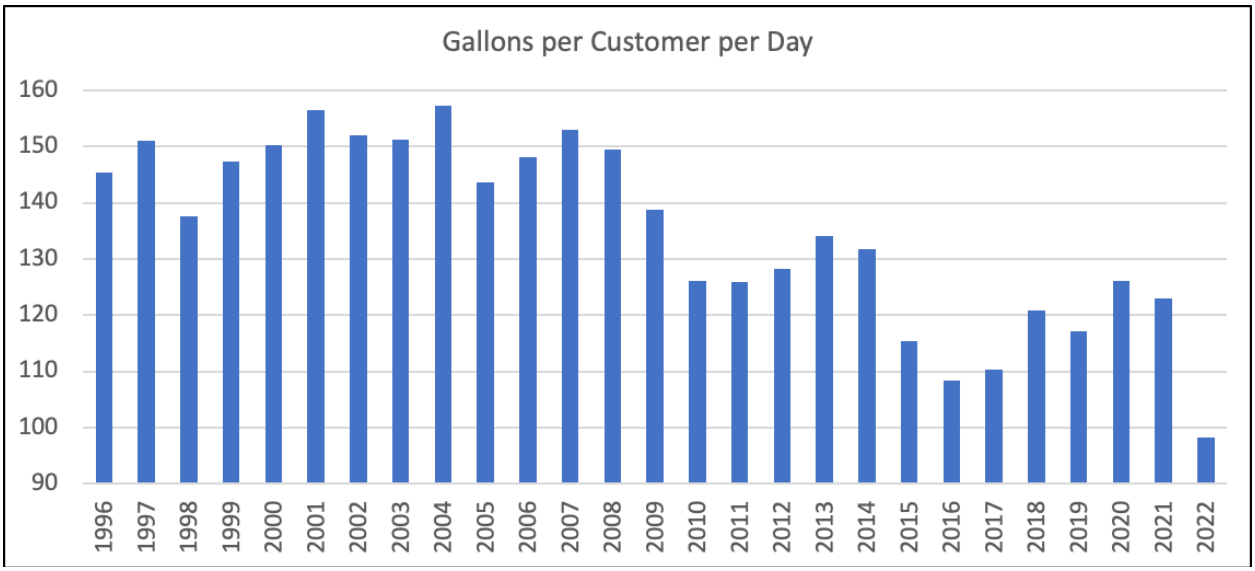
	Customer Water consumption		
	Water years ended June 30		
	AF	Customers	Gallons per cust. Per day
1996	28,345	174,000	145.4
1997	29,776	176,000	151.0
1998	27,364	177,500	137.6
1999	29,724	180,000	147.4
2000	30,465	181,000	150.3
2001	31,722	181,000	156.5
2002	30,831	181,000	152.1
2003	30,660	181,000	151.2
2004	31,808	180,500	157.3
2005	28,954	179,950	143.6
2006	29,842	179,950	148.0
2007	30,837	180,000	152.9
2008	30,342	181,250	149.5
2009	28,385	182,500	138.9
2010	25,988	183,900	126.2
2011	26,133	185,300	125.9
2012	26,759	186,200	128.3
2013	28,059	186,900	134.0
2014	27,689	187,500	131.8
2015	24,407	189,000	115.3
2016	23,248	191,700	108.3
2017	23,737	192,000	110.4
2018	26,061	192,500	120.9
2019	25,244	192,500	117.1
2020	27,010	191,269	126.1
2021	26,504	192,500	122.9
2022	21,164	192,500	98.2

Source: MMWD

In the graph below you can observe the declining trend in yearly consumption in AF from the peak in the first half of the 2000s to the present time.



The decline in consumption is more pronounced when looking at gallons per customer per day because of the slight increase in the customer population over that period.



Going forward, water consumption may not increase much because:

a) The mentioned demographic trends associated with flat to contracting population growth;

b) Ratepayers have become accustomed to constantly conserve as promoted by the MMWD. Also, it is the only way to get by given an inadequate water supply infrastructure when two consecutive rainfall seasons get less than 35 inches;

c) MMWD water will cost much more.

MMWD water release to sustain the fisheries

The MMWD releases a very large volume of water mandated by environmental regulations to sustain the local salmon population (mainly Koho salmon within Lagunitas Creek). The table below discloses actual water releases and compares them with mandated water releases.

Water Release data 2014 - 2022. Water Years ended June 30.

	Water Release (AF)	Release mandate (AF)	Excess Release (AF)	Dry Year	Runoff (AF)	Rain (inches)
2014	11,452	8,961	2,491	Yes	31,178	33.0
2015	12,147	10,604	1,543	No	61,297	39.9
2016	10,742	10,604	138	No	86,609	48.9
2017	7,394	10,604	(3,210)	No	243,371	96.0
2018	12,926	10,604	2,322	No	44,500	38.9
2019	9,660	10,604	(944)	No	143,540	74.0
2020	13,256	8,961	4,295	Yes	26,555	35.3
2021	11,734	8,961	2,773	Yes	5,428	20.3
2022	10,198	10,604	(406)	No	84,259	49.6
Average	11,164	9,988	1,176			

Source: MMWD[5]

The MMWD is mandated to release 8,961 AF during dry years and 10,604 AF during regular years. The cut-off for what is a dry year is unknown to me. I used as a cut-off any rainfall of fewer than 36 inches. This gives us three dry years: 2014, 2020, and 2021. I am confident no one will dispute 2020 and 2021 when we were less than 12 months from running out of water. Using this < 36 inches criteria also captures 2014 with 33 inches of rainfall which comes in lower than the rainfall in 2021.

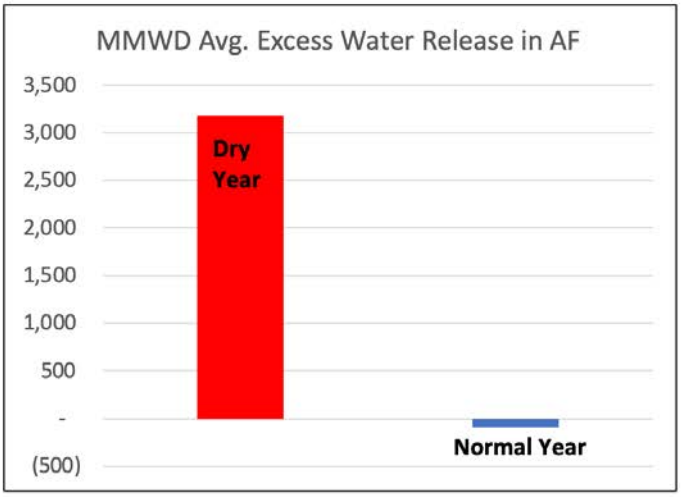
A closer look at the data uncovers divergent trends. As shown below, the MMWD releases much more water during dry years than normal ones. And, relative to the water release mandates, on average the MMWD releases during the dry years over 35% more water than mandated[6].

[5] I estimated the 2022 Runoff (AF) using a linear regression and capturing the relevant data in the earlier years. I used Rain(inches) as the X independent variable to estimate the Runoff (AF) as the Y dependent variable. Fortunately, the data was very predictive and made for a pretty precise model associated with an Adjusted R Square of 0.975 (a surprisingly high figure with such a small sample), and a standard error of 12,427 AF.

[6] 12,147/8,961 – 1 = 35.6% water being released in excess of water release mandated during dry years.

Water Release data 2014 - 2022. Water Years ended June 30.

	Water Release (AF)	Release mandate (AF)	Excess Release (AF)
Average			
Overall	11,057	10,056	1,000
Dry Year	12,147	8,961	3,186
Normal Year	10,511	10,604	(93)



Another way to observe this divergence is by looking at correlations between water release and rainfall or runoff.

	Correlation
Rain - water release	-0.87
Runoff - water release	-0.91
Rain - excess water release	-0.90
Runoff - excess water release	-0.93

As shown above, there are very strong negative correlations between rain vs. water release or runoff vs. water release. These negative correlations get even stronger when looking at excess water release.

The correlations indicate that the less rain & runoff we get the more water the MMWD releases for the fisheries. Similarly, the less rain & runoff we get the more excess water the MMWD releases for the fisheries.

Next, let's focus on how the MMWD managed its water release during 2020 – 2021 water crisis.

	Units in AF			
	Consumers	Fisheries	Excess water release	Cumulative excess release
2020	27,010	13,256	4,295	4,295
2021	26,504	11,734	2,773	7,067
2022	21,164			

By the second year of the mentioned water crisis, MMWD had released a cumulative 7,067 AF in excess of mandates during dry years. As shown in the table below, this 7,067 in excess water

release represented between 3.2 to 4.0 months of additional survival for the 192,500 MMWD customers[7].

Additional months of survival with no excess release			
Consumption pace	Extra months		
2021	3.2		
2022	4.0		

The numbers indicate that the MMWD prioritizes the seasonal intermittent lives of 600 salmon (in average) over the lives of its 192,500 customers.

Water is also money. The MMWD purchases water from the Sonoma Water Agency at about $1,500 per AF.

So, the 7,067 AF in excess water release represent $10.6 million if purchased from Sonoma.

The MMWD can't afford such large excess release during dry years for either the welfare and survival of its 192,500 customers or for its financial solvency.

Jacobs Engineering is proposing to improve the precision of the MMWD water stream release process through automation. This is a most critical and urgent endeavor. This initiative should be one of the lowest cost means to raise several thousands AF, especially in dry years when we need it.

Why are we in a near chronic state of water scarcity?

For decades, the MMWD and the Marin County community have blamed Climate Change and drought whenever our reservoirs are low.

The data shows that Marin County has an abundant rainfall. As mentioned earlier, during our recent driest year in 2021 we got 20.7 inches of rain. That is higher than an average rainfall year in San Francisco at just 19.7 inches. Over decadal periods, and prospectively our climate is not getting any dryer, much the contrary.

So, why are we chronically running out of water or having to conserve to get by until the next rainy season?

The first reason is because the MMWD has an inadequate water supply infrastructure to provide a secure water service for its 192,500 customers. Whenever we get less than 35 inches

[7] Without water humans die within days.

of rain[8] in two consecutive years, we are facing serious water scarcity. I actually do not know of another urban concentration of 192,500 residents who lives mainly on its water reservoirs within its own local footprint. If you look at any other urban concentrations, they all depend for their water supply on a far more developed water supply infrastructure including connections to major California State water projects. By comparison, the MMWD is a water-undersupplied nearly stand-alone entity that depends for 75% of its water on local rainfall. That can't keep on going. The MMWD Management knows it, and is onto it.

The second reason is because the MMWD has purchased much less water from Sonoma than it could have to optimize its financial condition and reservoir levels[9].

The third reason is the mentioned huge amount of excess water release that MMWD conducts during dry years. Going forward, we can't afford to release over 7,000 AF over regulatory mandates during consecutive dry years.

Inadequate water supply
+ less than optimal purchase of Sonoma water
+ excess water release
= water scarcity

How will we get out of our near chronic state of water scarcity?

A year ago, MMWD hired Jacobs Engineering to come up with a path to shore up our water supply.

Jacobs Engineering estimates that purchasing an adequate volume of water from Sonoma and improving the precision of water releases could raise close to 3,000 AFY. The cost per AF would be much lower than for AF raised through any of the large water supply infrastructure projects.

Jacobs Engineering has outlined several water supply infrastructure projects that would substantially shore up the MMWD 4-year water supply security.

Now, let's change domain and focus next on bond ratings.

How does Moody's assign bond ratings?

Moody's is one of the leading bond rating agencies. Moody's discloses on their website an excellent manual10 that gives you a pretty good idea of how they assign bond ratings. This manual is a lot clearer than Fitch's, another bond rating agency. Given that, I studied Moody's methodology and followed it throughout my analysis.

[8] No one outside Marin County would call 35 inches of rain a drought. We do so because our reservoirs are inadequate to supply 192,500 customers. That's a completely different issue.
[9] See Inventory Management within this report.
[10] US Municipal Utility Revenue Debt Methodology

A shortcut to figure out how Moody's assigns bond ratings is to study their scorecard shown below.

Appendix: US Municipal Utility Revenue Debt Scorecard

EXHIBIT 6

		Aaa	Aa	A	Baa	Ba	B and Below
Numerical score		0.5 to 1.5	1.5 to 2.5	2.5 to 3.5	3.5 to 4.5	4.5 to 5.5	5.5 to 6.5
System Characteristics (30%)							
Asset Condition (10%)	Net Fixed Assets/Annual Depreciation:	> 75 years	75 years ≥ n > 25 years	25 years ≥ n > 12 years	12 years ≥ n > 9 years	9 Years ≥ n > 6 Years	≤ 6 Years
System Size (7.5%)	Water and/or Sewer/ Solid Waste:	O&M > $65M	$65M ≥ O&M > $30M	$30M ≥ O&M > $10M	$10M ≥ O&M > $3M	$3M ≥ O&M > $1M	O&M ≤ $1M
	Stormwater:	O&M > $30M	$30M ≥ O&M > $15M	$15M ≥ O&M > $8M	$8M ≥ O&M > $2M	$2M ≥ O&M > $750K	O&M ≤ $750K
	Gas or Electric:	O&M > $100M	$100M ≥ O&M > $50M	$50M ≥ O&M > $20M	$20M ≥ O&M > $8M	$8M ≥ O&M > $3M	O&M ≤ $3M
Service Area Wealth (12.5%)		> 150% of US median	150% ≥ US median > 90%	90% ≥ US median > 75%	75% ≥ US median > 50%	50% ≥ US median > 40%	≤ 40% of US median
Financial Strength (40%)							
Annual Debt Service Coverage (15%)		> 2.00x	2.00x ≥ n > 1.70x	1.70x ≥ n > 1.25x	1.25x ≥ n > 1.00x	1.00x ≥ n > 0.70x	≤ 0.70x
Days Cash on Hand (15%)		> 250 Days	250 Days ≥ n > 150 Days	150 Days ≥ n > 35 Days	35 Days ≥ n > 15 Days	15 Days ≥ n > 7 Days	≤ 7 Days
Debt to Operating Revenues (10%)		< 2.00x	2.00x < n ≤ 4.00x	4.00x < n ≤ 7.00x	7.00x < n ≤ 8.00x	8.00x < n ≤ 9.00x	≥ 9.00x
Management (20%)							
Rate Management (10%)		Excellent rate-setting record; no material political, practical, or regulatory limits on rate increases	Strong rate-setting record; little political, practical, or regulatory limits on rate increases	Average rate-setting record; some political, practical, or regulatory limits on rate increases	Adequate rate-setting record; political, practical, or regulatory impediments place material limits on rate increases	Below average rate-setting record; political, practical, or regulatory impediments place substantial limits on rate increases	Record of insufficiently adjusting rates; political, practical, or regulatory obstacles prevent implementation of necessary rate increases
Regulatory Compliance and Capital Planning (10%)		Fully compliant OR proactively addressing compliance issues; Maintains sophisticated and manageable Capital Improvement Plan that addresses more than a 10-year period	Actively addressing minor compliance issues; Maintains comprehensive and manageable 10-year Capital Improvement Plan	Moderate violations with adopted plan to address issues; Maintains manageable 5-year Capital Improvement Plan	Significant compliance violations with limited solutions adopted; Maintains single year Capital Improvement Plan	Not fully addressing compliance issues; Limited or weak capital planning	Not addressing compliance issues; No capital planning
Legal Provisions (10%)							
Rate Covenant (5%)		> 1.30x	1.30x ≥ n > 1.20x	1.20x ≥ n > 1.10x	1.10x ≥ n > 1.00x	≤ 1.00x[14]	
Debt Service Reserve Requirement (5%)		DSRF funded at MADS	DSRF funded at lesser of standard 3-prong test	DSRF funded at less than 3-prong test OR springing DSRF	NO explicit DSRF;	OR funded with speculative grade surety[15]	

Source: Moody's Investors Service

Moody's scorecard weighs heavily qualitative factors.

- Water Operating & Maintenance expense level (the higher the better) has a weight of 7.5%.
- Service area median income has a weight of 12.5%.
- Management has a weight of 20%.

Together these three factors account for 40% of the total weight driving Moody's bond rating. I don't find the above deserving such a high weighting because I question Moody's underlying assumptions, let me explain why.

Water Operating & Maintenance expense (weight 7.5%).
For Moody's the higher the better as they state in their manual. "Larger systems tend to be more diverse and enjoy economies of scale. The size of a system implies the flexibility and resilience not only of its operations, but also of its service base."

Regarding this one criterion, if you apply Moody's underlying assumptions to MMWD you would derive erroneous conclusions. The current MMWD water supply diversification is inadequate. That's why we have explored costly alternatives with Jacobs Engineering for nearly a year. The revenue base is a retail operation that has nothing to do with the level of expenditure. Remember Moody's believes that high expense levels entail revenue diversification. That is a nearly random assumption.

Service area median income (weight 12.5%).
The higher the better, as Moody's states "The income of the residents … conveys the capacity of its rate-payers to bear higher rates to fund operations and capital upgrades."

The above makes good sense, but only up to a point. With higher income comes higher more informed and litigious customers[11]. So, the assumption that a water district can charge anything they want because they serve a high-income area is not as evident as Moody's assumes.

Management (weight 20%).
Most of Moody's criteria to evaluate management are somewhat subjective. And, any management that has not demonstrated explicit incompetence is likely to get the top grade within this area.

What those three factors boil down to? 80% of success is showing up.
As reviewed, nearly half the weight[12] of the bond rating scorecard relies on three factors that do not amount to much beyond showing up.

[11] The nonprofit group $COST representing numerous ratepayers has filed a lawsuit against MMWD for charging fixed charges depending on the width of the pipe of a home instead of a ratepayer's water usage.
[12] 40%.

My analytical approach is different than Moody's

For the mentioned reasons, I will leave the qualitative factors out of my analysis as I don't find them informative or predictive. Instead, I will double down on the quantitative factors shown in the table below.

	Moody's quantitative factors	
	Weight	**System characteristics**
	10%	Asset conditions
		Financial strength
	15%	Annual debt service coverage
	15%	Days cash on hand
	10%	Debt to operating revenues
		Lega provisions
	5%	Rate covenant
Sum	55%	

When reviewing the above factors, I will often use many more quantitative ratios and other calculations than Moody's[13].

What does a bond rating mean?[14]

First, let's go through an exercise. Can you rank the bond ratings of:

1) Japan
2) California
3) MMWD

[13] I learned a lot from studying Moody's US Municipal Utility Revenue Debt Methodology. However, once I understood their relevant analytical framework, I felt they left many uncovered financial criteria that I added. I have proficiency in this domain as I spent 15 years in corporate credit analysis (analyzing Fortune 500 companies including utilities).

[14] I assume you actually know the basic meaning of bond ratings. You know that Aaa is the highest bond rating with the lowest risk of default. And, the ratings progressively decline to Aa, A, Baa (or BBB depending on the agency), etc. As the bond ratings decline, the risk of default increases. I am not going over this basics in order to take the discussion to a more interesting level. Moody's uses rating denominations of Aaa, Aa, A, Baa, etc. All other bond rating agencies use ratings of AAA, AA, A, BBB, etc. But they actually mean the same thing. And, there is an extremely high correlation between bond rating agencies actual issuers ratings. So, Baa = BBB, etc. more often than not.

You may think their respective bond ratings would rank as shown. Japan, being the largest economy, with by far the highest savings rate[15] would have the higher bond rating. California would come in second. And, the MMWD would come in a distant third. As we know, the MMWD needs to urgently raise rates to just breakeven.

This may surprise you as much as it did me, but, California and the MMWD are tied in first place with bond ratings in the AA range. Meanwhile, Japan is a distant third with a single A bond rating.

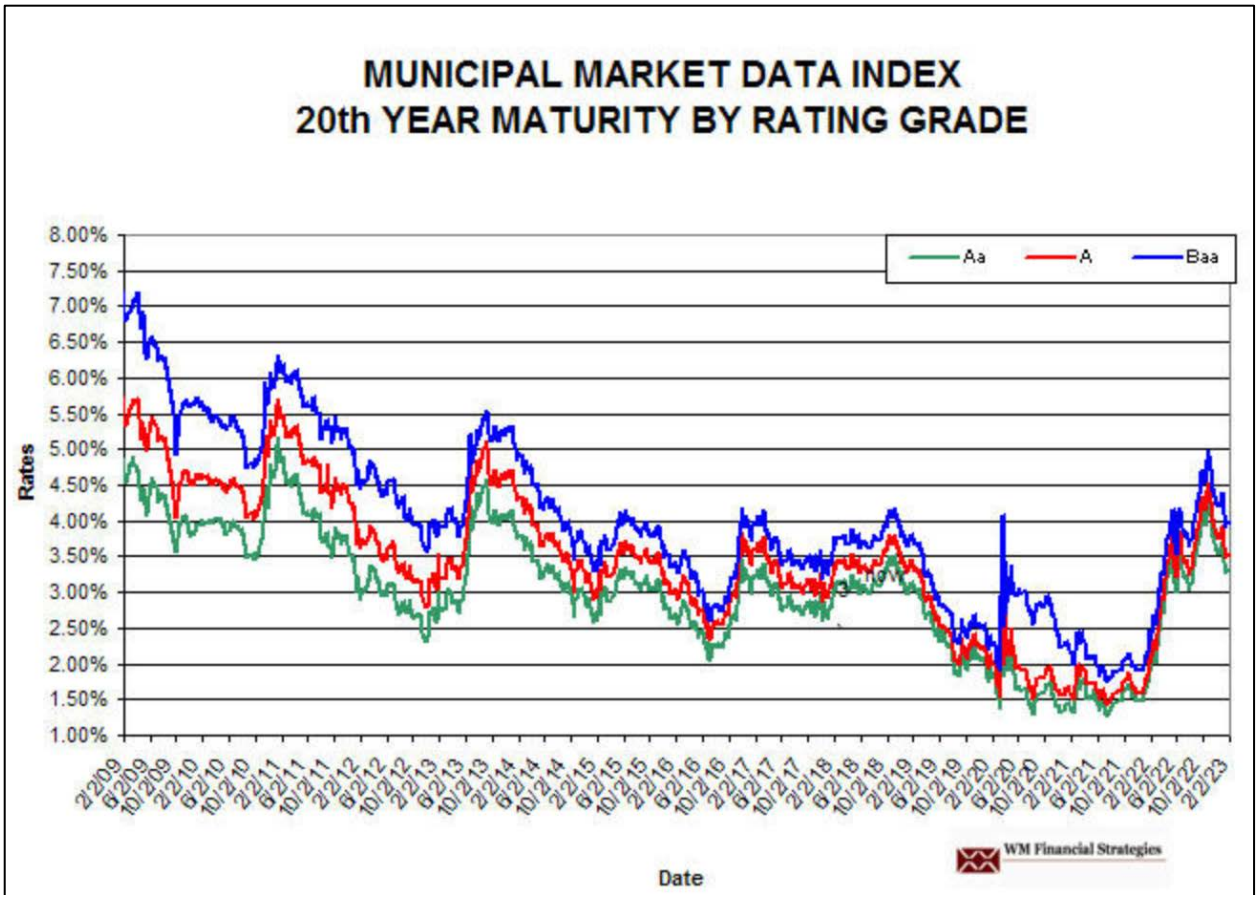
Given that, bond ratings are not nearly as meaningful, precise, or predictive as we think. As we know bond ratings were genuinely disastrously bad during the housing bubble and financial crisis over the 2007 – 2009 period. At the time, bond rating agencies routinely gave Aaa ratings to mortgage backed securities (MBS) that promptly went bust. And, John Paulson and Michael Burry[16] made fortunes by buying credit default swaps on those same AAA rated MBS.

Bond ratings are critical to the bond issuers

There is a marked difference in bonds' yields or rates with different ratings as shown on the graph below.

[15] Granted Japan has a very high level of public debt. But, it is just about entirely funded by Japanese themselves (that's where their high savings rate comes in).

[16] He is the one-eyed doctor turned hedge fund manager in Michael Lewis's "The Big Short." In the movie of the same name, Christian Bale played his character. Interestingly enough, Michael Burry has been invested in water-related type assets (water rights, land, etc.) after the Financial Crisis.



The blue line denoting the Baa rating (BBB depending on the rating agency) is associated with a much higher cost of borrowing than either the Aa or the A bond ratings. This is because Baa/BBB is at the lowest level of what is deemed "investment grade." The very next level is Ba/BB which falls into the high-yield bond category commonly referred to as "junk bonds." And, that is where bonds' yields or rates can jump up.

As of March 6, 2023 you can observe the differences in rates between AA, and A rated bonds. And, these differences are material for the MMWD.

AA RATED MUNI BONDS

ISSUE	MATURITY RANGE	TODAY	LAST WEEK
National	10 Year	2.75	2.65
National	20 Year	3.75	3.65
National	30 Year	4.00	3.95

A RATED MUNI BONDS

ISSUE	MATURITY RANGE	TODAY	LAST WEEK
National	10 Year	2.95	2.85
National	20 Year	3.90	3.80
National	30 Year	4.15	4.10

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As we know the Federal Reserve is far from being done raising rates. Current expectations are that the Fed Funds Rate could be 50 to 75 basis points above current level. So, Muni bond rates are not done rising.

For the MMWD it is critical to obtain a bond rating of at least A if not Aa or AA at the time it will issue new bonds to finance the water supply projects. It has a rating of AA currently. But the bond rating agencies will update their ratings at the time that MMWD will issue the bonds to finance the water supply projects. And, the bond rating agencies will factor in the prospective impact of the upcoming large bond issuance on MMWD's financial condition.

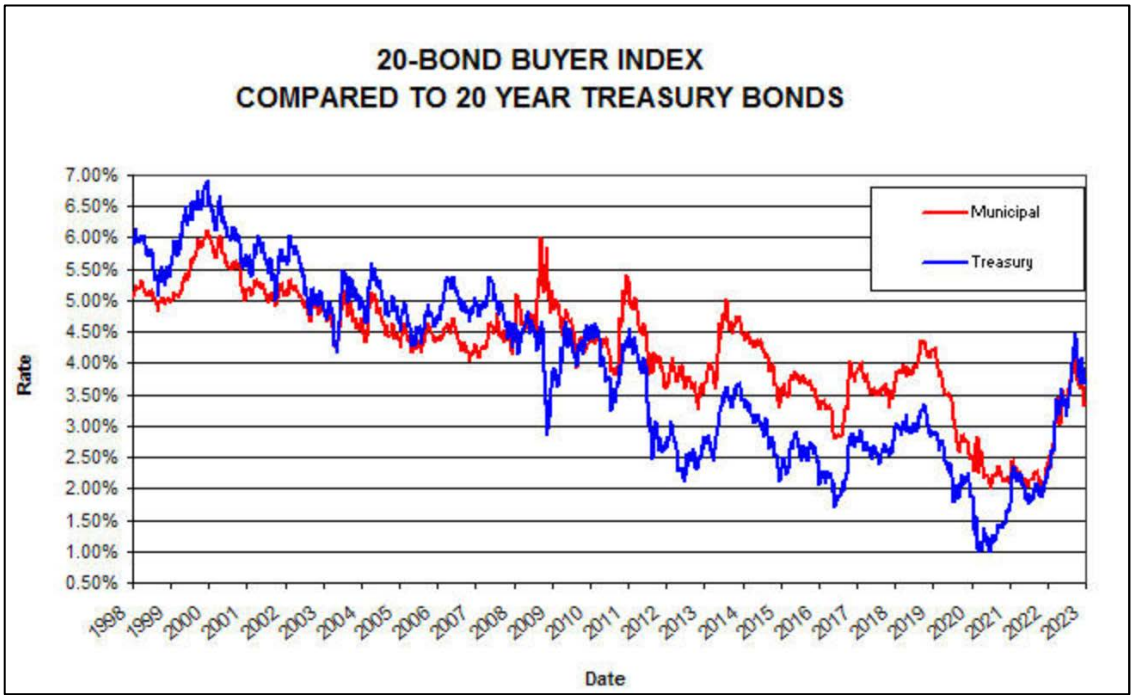
Prior to any prospective rate increases, the MMWD would most probably not maintain an investment grade rating[17] let alone its current very high rating of AA. However, after subsequent increase in water rates, it is pretty likely the MMWD could again earn an AA rating at the time it would issue large bond issuance to finance its water supply projects.

[17] Any bond rating that is at least at the BBB or Baa level or higher. Once a bond issuer's bond rating falls into the Ba or BB category, it is not investment grade category. It falls in the category referred to as High Yield or junk bond. And, many institutional investors are prohibited in investing in such low credit rating bonds. As a result, bond yields or rates really jump upward once the bond rating falls below investment grade.

Bond ratings are not that informative for investors

Remember California Muni bonds are exempt from Federal and State income taxes[18]. Meanwhile, Treasuries are exempt from State income taxes only. So, the relationship between the yield on Munis and Treasuries should be relatively constant with Munis having a lower yield because of their far greater tax benefits.

The graph below indicates that there is no steady relationship between Munis and Treasuries yield. It is because investors shy away from the Muni sector during times of economic stress[19].



As mentioned earlier, bond ratings were disastrous during the Financial Crisis[20]. A bond investor can't rely on bond ratings alone. If one invests in individual bonds, they should conduct their own credit analysis. Otherwise, they are better off investing in a bond mutual fund or ETF, where an institution will conduct such analysis. Another option is to invest in a bond index fund. Being a passive bond index fund investor does not mean that one relies on bond ratings, but more than one relies that active bond investors price the bonds correctly so that the bonds' yields reflect their true credit risk independent from the bond ratings alone.

Thus, bond ratings alone are not that informative for investors.

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[18] When the investor resides in the same State as the bond issuer.

[19] You can see this positive spread between Munis and Treasuries yield widen during the Financial Crisis (2007 – 2009), and its aftermath (good part of the following 2010s, and more recently during the abrupt COVID recession.

[20] This was one of the greatest fraudulent components during the 2007 – 2009 Financial Crisis. If MBS ratings had been honest, the whole castle of cards leveraging MBS that pretty much took the whole financial system down when they defaulted would never have occurred. Well, we also never had gotten Michael Lewis's "Big Short"; trivial compensation for a financially devastating impact on a worldwide basis.

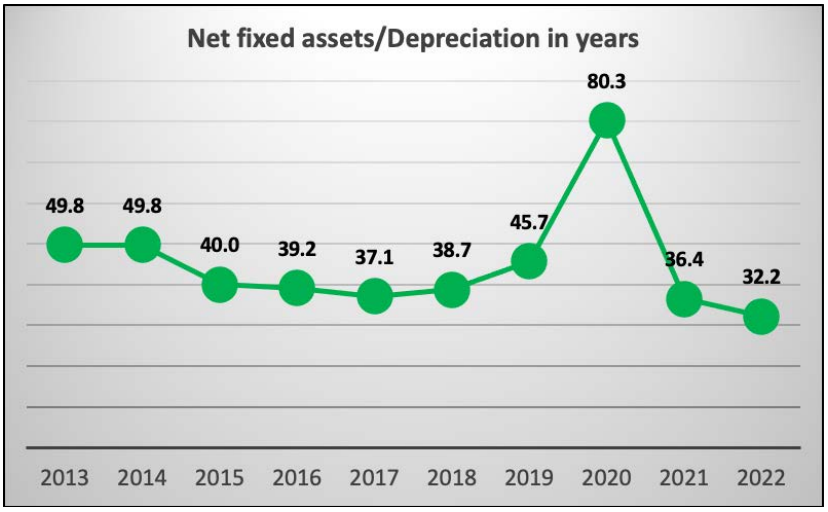
Credit Analysis of MMWD up to June 30, 2022

System characteristics. Asset conditions (Moody's weight 10%)

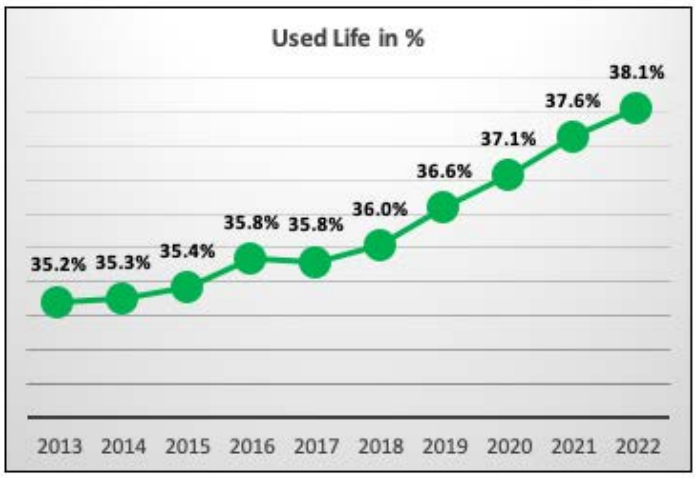
Since 2013, the fixed assets of MMWD are progressively aging.

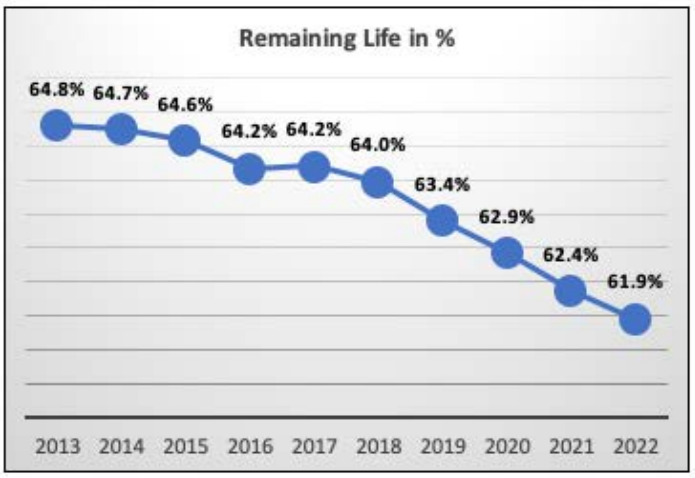
Asset condition (Moody's weight 10%)						
				Moody's		
	A	B	C	D = A/C	E = B/(A+B)	F = 1 - E
		Accumulated	Yearly	Net fixed assets	Used	Remaining
	Net fixed assets	Depreciation	Depreciation	/Depreciation	life in %	life in %
2013	345,844,486	(187,872,490)	6,951,606	49.8	35.2%	64.8%
2014	358,319,959	(195,074,858)	7,202,368	49.8	35.3%	64.7%
2015	372,717,617	(204,401,491)	9,326,633	40.0	35.4%	64.6%
2016	383,536,225	(214,197,589)	9,796,098	39.2	35.8%	64.2%
2017	403,743,858	(225,082,786)	10,885,197	37.1	35.8%	64.2%
2018	418,830,930	(235,908,831)	10,826,045	38.7	36.0%	64.0%
2019	424,772,300	(245,204,814)	9,295,983	45.7	36.6%	63.4%
2020	425,142,746	(250,499,901)	5,295,087	80.3	37.1%	62.9%
2021	434,853,456	(262,441,312)	11,941,411	36.4	37.6%	62.4%
2022	449,992,008	(276,413,769)	13,972,457	32.2	38.1%	61.9%
			Average	44.9	36.3%	63.7%
			Median	39.6	35.9%	64.1%
			St. deviation	13.7	1.0%	1.0%

To measure the aging of the fixed assets, Moody's divides the Yearly Depreciation by the Net fixed assets. This gives you an estimate of the remaining life of such assets in years. As shown on the graph below, that measure is at times volatile and trendless.



Instead of the above measure I focused on two other measures that disclose a clearer trend of fixed assets aging as shown on the graphs below.





The graph on the left shows the Used Life in % of the fixed assets. If the gross fixed assets were fully depreciated the ratio would be equal to 100%. If such assets were brand new, this ratio would be equal to 0%. Thus, it measures the age of the assets as a % of their Used or expected life. This ratio is calculated as follows:

Accumulated Depreciation/ Gross fixed assets.

The graph on the right shows the Remaining Life in % of the fixed assets. If the gross fixed assets were fully depreciated the ratio would be 0%. If such assets were brand new, this ratio would be 100%. Thus, it measures the age of the assets as a % of their Remaining Life. This ratio is calculated as follows:

Remaining Life = 1 – Used Life

As shown these two mentioned ratios disclose that MMWD fixed assets have continuously aged since 2013. This is resulting in very high capital expenditures to shore up and replace those aging capital assets.

Capital expenditures due to capital asset aging

The information within this section was extracted from the presentation to the Board "CIP Investment Alternatives, February 17, 2023 and the Rate Setting Update: Revenue Requirement, February 23, 2023.

Simply maintaining and replacing some of MMWD capital assets, requires $19.4 million per year as shown in the table below.

Category	Annual Est. Expenditures	Description
Pipeline Replacements	$4,010,000	2 miles per year*
Pump Station Replacements	$1,385,000	1 pump station per year
Storage Tanks	$5,525,000	1 small tank + 1 major project
Treatment Plants	$1,075,000	Preventative maintenance, backwash line, chemical feed pumps/tanks
Watershed	$3,327,000	Fire & fuels management, culverts
General Improvements	$4,100,000	IT, Facilities, Cap. Equip, Grant Matching, Master Planning
Total Current Baseline	$19,422,000	

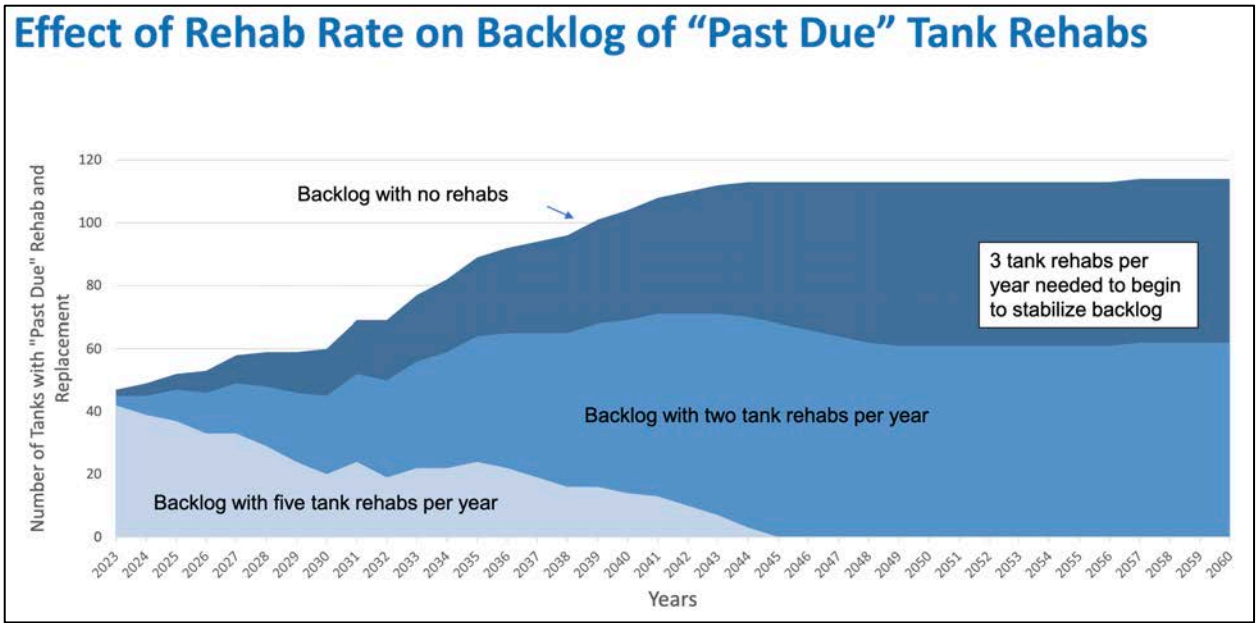
Approximately 20% of total goes toward ongoing capital maintenance

The $19.4 million are included in the current MMWD Budget and therefore does not require any water rate increase. However, this $19.4 million yearly capital expenditure does not suffice to stabilize the backlog of capital assets needing replacement. To do that, MMWD needs to spend an additional $24 million per year in capital expenditure not covered by current rates.

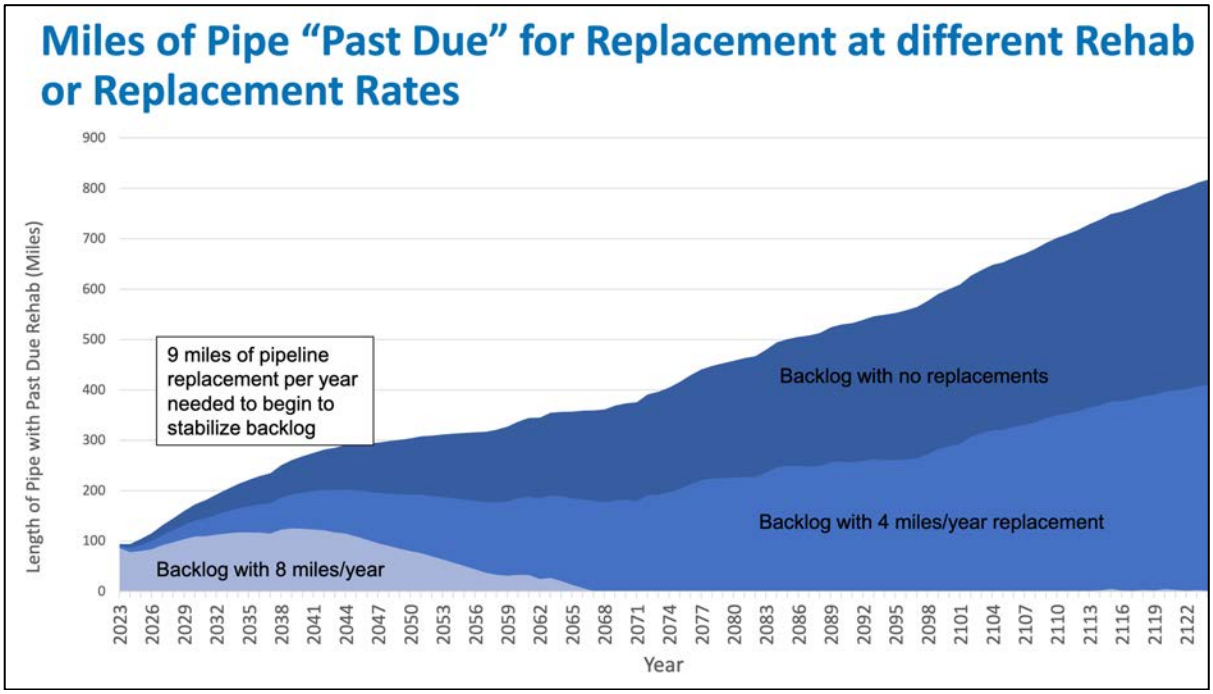
Assuming an overall revenue base of $100 million, it would result in a 24% increase in water rates and fees.

Annual Investment Needed to Stabilize Backlog	Additional Annual Investment	Fiscal Impact
9 miles of pipeline	5 miles of pipeline	$10M
3 tank rehabs	2 tank rehabs	$4M
1 pump stations	-	-
Other Asset Classes	Other capital projects for treatment plants, watershed, facilities, & capital equipment purchases	$10M
	Total	$24M

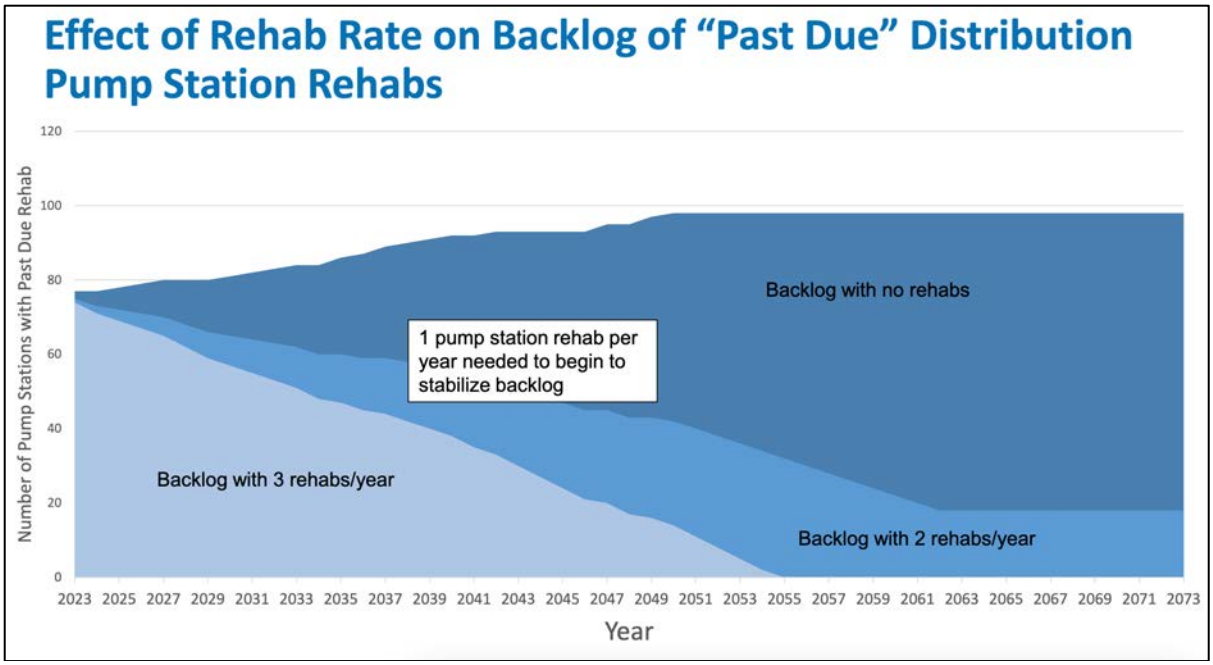
The MMWD has large backlogs of capital assets that need replacing, including water storage tanks as shown below.



See backlog for pipelines below.



See backlog for pump stations below.



The aging of the assets has material financial implications over numerous decades, including a potential 24% increase in water rates & fees just to sustain capital assets.

Financial strength

Annual debt service coverage (weight 15%) & Rate covenant (weight 5%)

I communicated with Helen Cregger at Moody's to clarify the calculations of such debt servicing ratios. They are calculated as follows:

Annual Debt Service Coverage = Net Revenues/Debt Service

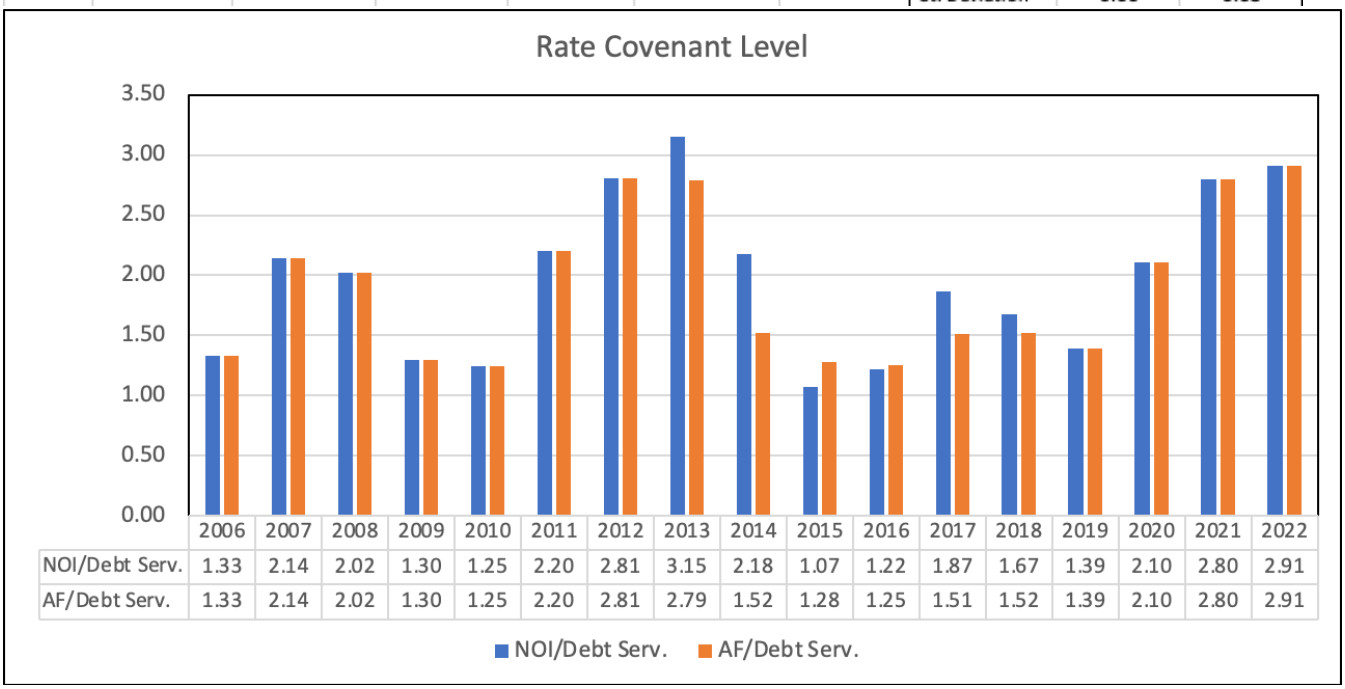
Rate Covenant = (Operating Revenues – Operating Expense + Depreciation)/Debt Service

The difference is that the Annual Debt Service Coverage includes Depreciation[21] in Operating Expense. Meanwhile, the Rate Covenant does not. Thus, the Rate Covenant is more lenient, and results in higher calculated debt servicing coverage ratios.

Starting with the Rate Covenant, I calculated this ratio twice. The first time I excluded transfers from the Stabilization fund (NOI/Debt Service). This was to observe the debt servicing capacity associated with the operating revenues in a specific fiscal year without relying on reserve funds to meet yearly debt service. The second time I did include transfers from the Stabilization fund (AF/Debt Service).

[21] My calculations are slightly more conservative because I also include Amortization which is most often bundled with Depreciation within the MMWD Annual Reports. During the most recent five years, this makes little difference as Amortization has become a small item.

Rate Covenant (weight 5%)									
	Operating & other revenues	Operating expense	Interest Income	Net Operating Income (NOI)	Rate Stabilization fund	Available funds (AF)	Debt Service	NOI/ Debt Service	AF/ Debt Service
2006				9,038,306	0	9,038,306	6,794,163	1.33	1.33
2007				14,561,088	0	14,561,088	6,810,325	2.14	2.14
2008				13,757,189	0	13,757,189	6,804,075	2.02	2.02
2009				8,834,643	0	8,834,643	6,808,750	1.30	1.30
2010				8,463,918	0	8,463,918	6,796,675	1.25	1.25
2011				12,495,098	0	12,495,098	5,675,363	2.20	2.20
2012				15,631,996	0	15,631,996	5,570,990	2.81	2.81
2013	69,530,426	48,905,820	132,261	20,756,867	(2,400,000)	18,356,867	6,585,476	3.15	2.79
2014	70,456,844	54,420,148	147,055	16,183,751	(4,900,000)	11,283,751	7,422,090	2.18	1.52
2015	61,279,514	54,237,270	171,383	7,213,627	1,400,000	8,613,627	6,755,140	1.07	1.28
2016	62,268,556	54,093,422	229,316	8,404,450	200,000	8,604,450	6,878,665	1.22	1.25
2017	70,640,738	58,851,561	321,992	12,111,169	(2,300,000)	9,811,169	6,483,680	1.87	1.51
2018	80,903,878	66,352,036	1,145,072	15,696,914	(1,400,000)	14,296,914	9,385,045	1.67	1.52
2019	79,572,164	68,129,330	1,598,276	13,041,110	0	13,041,110	9,390,653	1.39	1.39
2020	95,543,899	77,186,382	1,384,318	19,741,835	0	19,741,835	9,382,553	2.10	2.10
2021	105,431,610	79,551,668	409,770	26,289,712	0	26,289,712	9,386,043	2.80	2.80
2022	95,336,175	68,767,838	317,362	26,885,699	0	26,885,699	9,244,701	2.91	2.91
							Average	1.97	1.89
							Median	2.02	1.52
							St. Deviation	0.66	0.63



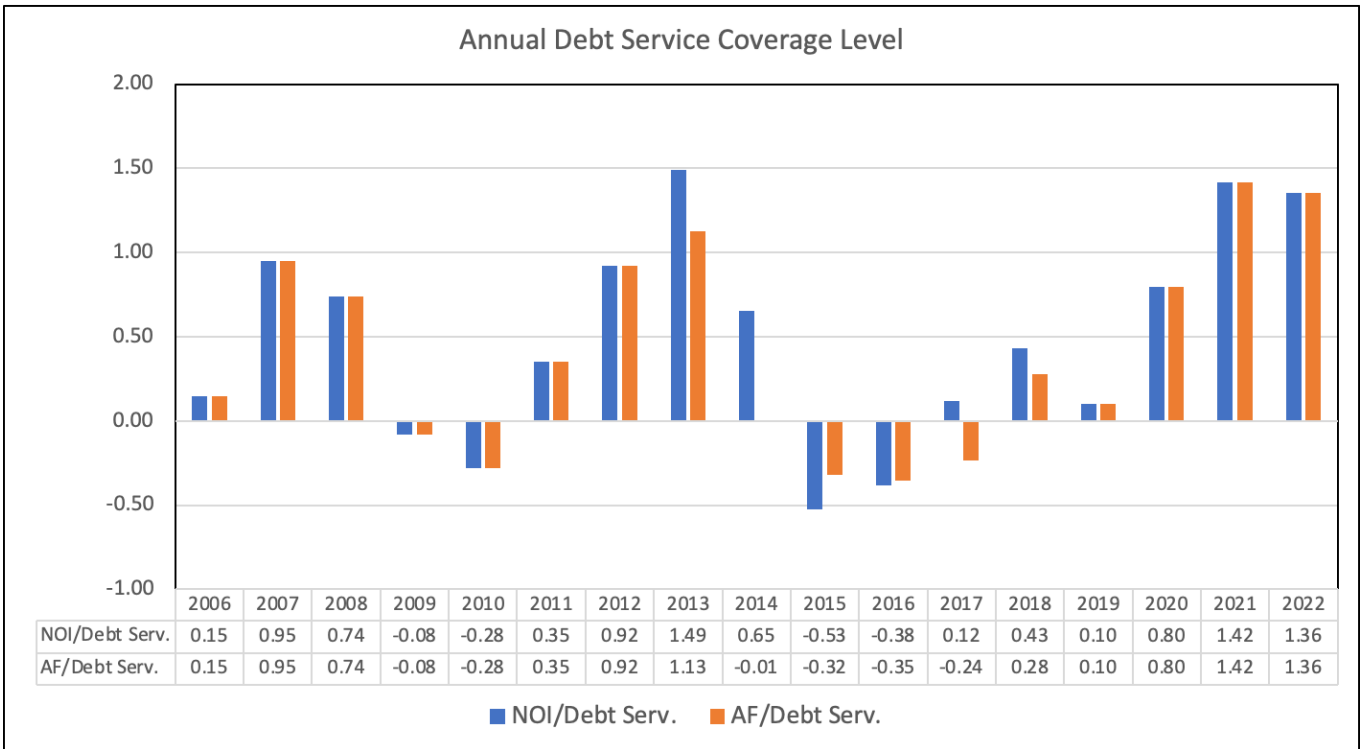
As shown above, in fiscal 2015 and 2016 MMWD had to rely on positive transfers from the Stabilization fund of $1.4 million and $200,000 respectively to meet a 1.25 debt service target level. Any Rate Covenant level greater than 1.20 x meets Moody's Aa rating criterion.

On a positive note, the Rate Covenant has steadily increased from fiscal 2019 to fiscal 2022. And, it is now at a very high level approaching 3 times. On a stand-alone basis, the ratio denotes a strong debt servicing capacity.

When looking at the Annual Debt Service Coverage ratio, it is lower because this ratio includes Depreciation within Operating expenses. I calculated this ratio twice (once including fund transfers from the Stabilization fund, and the second time excluding such transfers).

Annual Debt Service Coverage (weight 15%)

	Operating & other revenues	Operating expense	Depreciation & Amortiz.	Interest Income	Net Operating Income (NOI)	Rate Stabilization fund	Available funds (AF)	Debt Service	NOI/ Debt Service	AF/ Debt Service
2006			8,028,204		1,010,102	0	1,010,102	6,794,163	0.15	0.15
2007			8,073,345		6,487,743	0	6,487,743	6,810,325	0.95	0.95
2008			8,723,817		5,033,372	0	5,033,372	6,804,075	0.74	0.74
2009			9,384,921		(550,278)	0	(550,278)	6,808,750	-0.08	-0.08
2010			10,350,791		(1,886,873)	0	(1,886,873)	6,796,675	-0.28	-0.28
2011			10,480,987		2,014,111	0	2,014,111	5,675,363	0.35	0.35
2012			10,506,699		5,125,297	0	5,125,297	5,570,990	0.92	0.92
2013	69,530,426	48,905,820	10,935,168	132,261	9,821,699	(2,400,000)	7,421,699	6,585,476	1.49	1.13
2014	70,456,844	54,420,148	11,324,138	147,055	4,859,613	(4,900,000)	(40,387)	7,422,090	0.65	-0.01
2015	61,279,514	54,237,270	10,776,549	171,383	(3,562,922)	1,400,000	(2,162,922)	6,755,140	-0.53	-0.32
2016	62,268,556	54,093,422	11,032,196	229,316	(2,627,746)	200,000	(2,427,746)	6,878,665	-0.38	-0.35
2017	70,640,738	58,851,561	11,348,227	321,992	762,942	(2,300,000)	(1,537,058)	6,483,680	0.12	-0.24
2018	80,903,878	66,352,036	11,665,632	1,145,072	4,031,282	(1,400,000)	2,631,282	9,385,045	0.43	0.28
2019	79,572,164	68,129,330	12,108,529	1,598,276	932,581	0	932,581	9,390,653	0.10	0.10
2020	95,543,899	77,186,382	12,256,812	1,384,318	7,485,023	0	7,485,023	9,382,553	0.80	0.80
2021	105,431,610	79,551,668	12,960,365	409,770	13,329,347	0	13,329,347	9,386,043	1.42	1.42
2022	95,336,175	68,767,838	14,347,879	317,362	12,537,820	0	12,537,820	9,244,701	1.36	1.36
								Average	0.48	0.41
								Median	0.43	0.28
								St. Deviation	0.63	0.60



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NOI/Debt Serv.	0.15	0.95	0.74	-0.08	-0.28	0.35	0.92	1.49	0.65	-0.53	-0.38	0.12	0.43	0.10	0.80	1.42	1.36
AF/Debt Serv.	0.15	0.95	0.74	-0.08	-0.28	0.35	0.92	1.13	-0.01	-0.32	-0.35	-0.24	0.28	0.10	0.80	1.42	1.36

When focusing on the above Annual Debt Service Coverage ratio, the trends are identical than when looking at the Rate Covenant. But, the ratio levels, as expected, are a lot lower. The Annual Debt Service Coverage ratio denotes an impaired debt servicing capacity from 2015 to 2017 (with often a negative ratio). However, since 2020 this ratio is reasonably strong and still exceeds the target of 1.25 times. The current level at 1.40 would fall within Moody's category of A rating (range 1.25 – 1.70) for this one measure.

Which debt servicing measure is the most relevant?

The more conservative Annual Debt Service Coverage suggests that the cash flow from depreciation should not be earmarked for meeting annual debt servicing, but instead earmarked for maintaining and replacing the fixed assets. Given the MMWD high capital expenditure funding requirements, the Annual Debt Service Coverage ratio is the most relevant one.

Liquidity including days cash on hand (weight 15%)

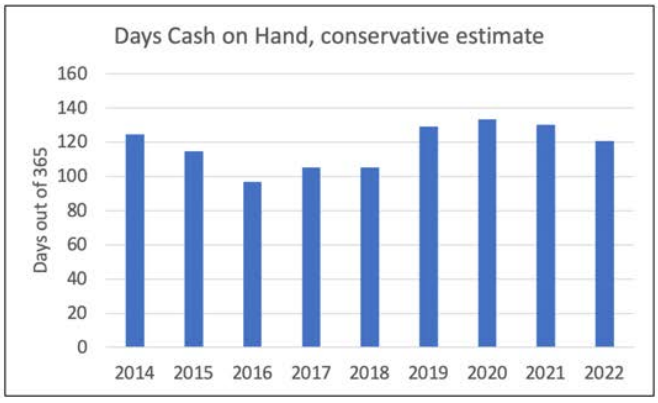
Days cash on hand is another Moody's financial ratio. It is equal to unrestricted cash balances + liquid investments divided by operating expenses. And, then it is multiplied by 365 days. So, if the ratio is equal to 50%, it means you have enough cash to cover your operating expenses for half a year or 182 days. Any figure above 150 days would meet Moody's Aa bond rating for this one measure.

I calculate this ratio twice. The first time I do not include depreciation within operating expenses (OE). The second time I do include depreciation by adding it to operating expenses (OED). Using OED gives you a more conservative estimate resulting in a shorter amount of days of operations covered by cash on hand.

In general, I believe that Moody's does include depreciation within operating expenses. When they exclude it, they say so.

Days Cash on Hand (15%)

	Unrest. Cash & Investments	Operating Expense (OE)	Depreciation	Operating Exp. & Depreciat.(OED)	Days Cash to OE	Days Cash to OED
2014	21,026,899	54,420,148	7,202,368	61,622,516	141	125
2015	19,959,569	54,237,270	9,326,633	63,563,903	134	115
2016	16,947,252	54,093,422	9,796,098	63,889,520	114	97
2017	20,077,803	58,851,561	10,885,197	69,736,758	125	105
2018	22,264,658	66,352,036	10,826,045	77,178,081	122	105
2019	27,359,342	68,129,330	9,295,983	77,425,313	147	129
2020	30,162,068	77,186,382	5,295,087	82,481,469	143	133
2021	32,619,471	79,551,668	11,941,411	91,493,079	150	130
2022	27,365,294	68,767,838	13,970,457	82,738,295	145	121
				Average	136	118
				Median	141	121
				St. deviation	12	13

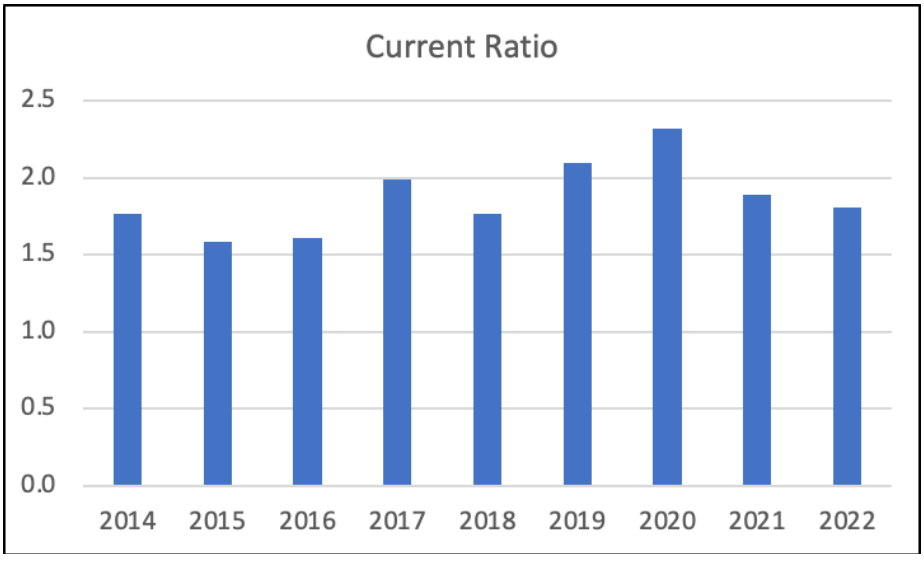


Regardless of measure used, Cash on hand is steady except for the fiscal years from 2016 to 2018 when it was lower.

During the most recent fiscal year in 2022, Cash on hand falls within Moody's A bond rating category (range 35 to 150 days).

Next, I look at the Current Ratio, a standard measure of liquidity. It is current assets divided by current liabilities. I included unrestricted cash, investments, and receivables among current assets. As shown in the table below, the Current Ratio is steady and high; as current assets cover current liabilities by a multiple of about 1.8 times or more.

Liquidity: Current Ratio				
	A	B	C	D = (A + B)/C
	Unrest. Cash & Investments	Receivables	Current liabilities	Current Ratio
2014	21,026,899	10,507,823	17,873,140	1.8
2015	19,959,569	9,114,316	18,335,354	1.6
2016	16,947,252	13,194,714	18,687,377	1.6
2017	20,077,803	12,759,696	16,472,017	2.0
2018	22,264,658	13,322,117	20,167,164	1.8
2019	27,359,342	13,672,221	19,558,535	2.1
2020	30,162,068	16,529,880	20,144,930	2.3
2021	32,619,471	16,390,985	25,958,765	1.9
2022	27,365,294	15,068,260	23,457,218	1.8
			Average	1.9
			Median	1.8
			St. deviation	0.2

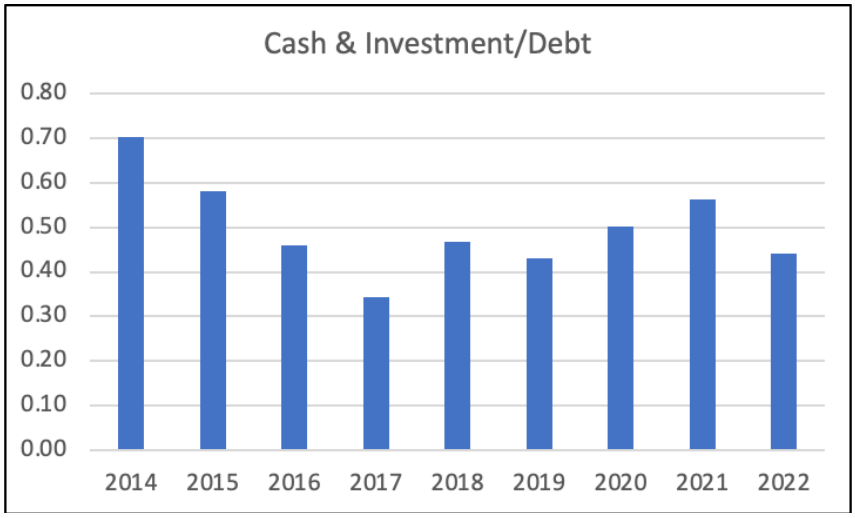


Next, I looked at the ratio of Cash & Investments divided by all funded debt (bond principal outstanding[22] and interest payable). This ratio denotes a worst-case basis that if MMWD would breach bond covenants in such a way that all bond outstanding became immediately payable how much of such bond debt could the MMWD repay immediately. The most recent ratio in

[22] I split that into long term debt and long term debt due within one year that I call short term debt.

fiscal 2022 at 0.44 (or 44%) is a bit low by historical standard. It is associated with a near $20 million reduction in reserve funds between fiscal 2021 and fiscal 2022.

Liquidity: Cash & Investments/Debt						
	Cash & Investments			Interest		Cash & Invest.
	Current	Restricted	S/t debt	payable	L/t debt	/Debt
2014	21,026,899	75,110,366	1,707,250	2,745,369	132,511,806	0.70
2015	19,959,569	58,621,138	1,767,250	2,716,670	130,422,903	0.58
2016	16,947,252	43,947,119	1,677,250	2,685,282	128,179,001	0.46
2017	20,077,803	27,569,183	2,226,153	2,769,590	133,910,936	0.34
2018	22,264,658	61,392,543	3,018,614	3,464,326	172,371,477	0.47
2019	27,359,342	48,291,060	3,202,570	3,418,776	168,654,080	0.43
2020	30,162,068	55,875,258	3,210,852	3,379,726	164,861,422	0.50
2021	32,619,471	61,573,890	3,336,684	3,328,882	160,942,931	0.56
2022	27,365,294	41,781,058	5,582,268	1,616,293	149,459,905	0.44
					Average	0.50
					Median	0.47
					St. deviation	0.10



Debt to operating revenues (weight 10%)

This is another Moody's ratio. It is equal to:

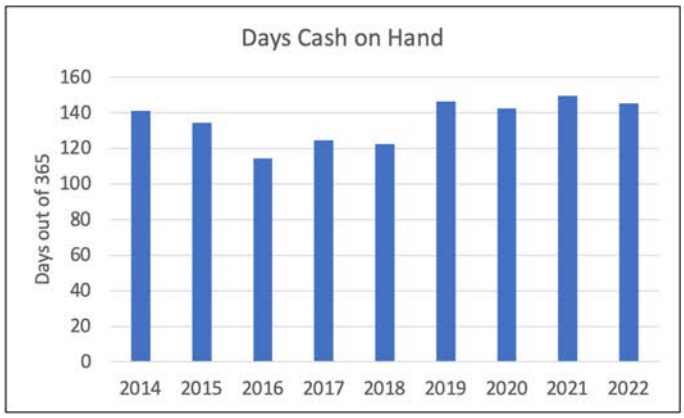
Net debt/Operating Revenues

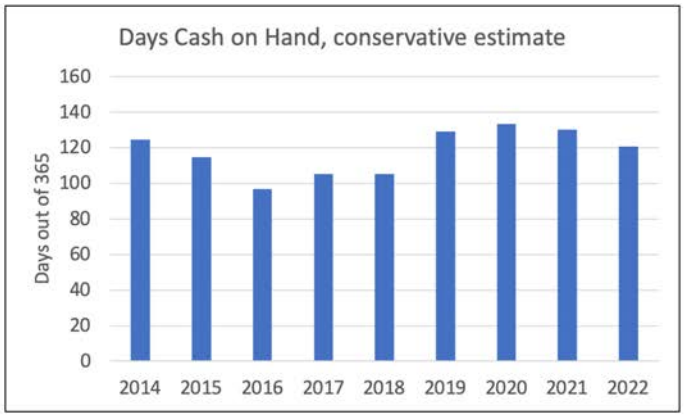
Net debt = Long term debt – debt service reserve funds

This ratio as shown below is pretty steady at around 1.6. I calculate this ratio twice. The first time I include the Rate Stabilization fund in the calculation. The second time I exclude it. The bond documentation excludes the Rate Stabilization fund from the "bond related funds." I am not sure why that is the case. Doing so appears too restrictive. As shown below, using either calculation does not make that much difference because the Rate Stabilization fund is relatively small.

Debt to Operating Revenues (10%)

		Bond related Funds in Note 3			Rate			
		Principal &			Stabilization	Operating	Debt to Operating Rev.	
	Long term debt	Interest Fd	Reserve	Project	(RS)	revenues	with RS	no RS
2014	134,219,056	6,897,753	1,275,506	39,817,798	7,300,000	67,734,729	1.17	1.27
2015	132,190,153	8,186,445	1,275,563	21,484,576	5,900,000	59,241,096	1.61	1.71
2016	129,856,251	7,210,582	1,275,620	10,367,067	5,700,000	60,100,547	1.75	1.85
2017	136,137,089	7,905,313	974,445	63	8,000,000	68,513,918	1.74	1.86
2018	175,390,091	8,378,280	981,040	29,129,814	9,400,000	78,672,288	1.62	1.74
2019	171,856,650	4,640,206	997,312	16,884,209	9,400,000	77,993,146	1.79	1.91
2020	168,072,274	8,124,605	1,008,090	5,900,097	9,400,000	97,271,194	1.48	1.57
2021	164,279,615	8,146,519	1,008,151	1,471,253	9,400,000	103,434,538	1.39	1.49
2022	155,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	1.60	1.62
						Average	1.57	1.67
						Median	1.61	1.71
						St. deviation	0.20	0.20





The Debt to Operating Revenues at around 1.6 times is very low (a good thing). As of fiscal 2022, it meets Moody's threshold for the top Aaa rating (< 2 times). Next, I explored how much long-term debt could the MMWD raise and still meet an adequate Aa rating on this one measure. As shown in the table below, the MMWD could add $200 million in debt and still meet Moody's Aa rating on this measure.

Debt to Operating Revenues (10%)								
	Bond related Funds in Note 3			Rate				
	Principal &			Stabilization	Operating	Debt to Operating Rev.		Moody's
Long term debt	Interest Fd	Reserve	Project	(RS)	revenues	with RS	no RS	rating
155,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	1.60	1.62	Aaa
180,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	1.87	1.90	Aaa
205,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	2.15	2.17	Aa
230,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	2.43	2.45	Aa
255,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	2.70	2.72	Aa
280,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	2.98	3.00	Aa
305,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	3.25	3.27	Aa
330,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	3.53	3.55	Aa
355,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	3.80	3.82	Aa
380,042,173	5,519,315	1,008,347	1,490,003	1,942,000	90,745,884	4.08	4.10	A

Keep in mind, that this stand-alone measure does not provide much information regarding the overall debt servicing capacity of the MMWD. Given its current operating performance, the MMWD could not possibly service an extra $200 million in debt.

Moody's financial ratios scorecard for MMWD

Below I disclose Moody's financial ratios and their corresponding ratings with their assigned weights.

Moody's financial ratios & corresponding ratings		
Weight	**System characteristics**	**Rating**
10%	Asset conditions	Aa
	Financial strength	
15%	Annual debt service coverage	A
15%	Days cash on hand	A
10%	Debt to operating revenues	Aaa
	Lega provisions	
5%	Rate covenant	Aaa
55%		

Next, I prorate the financial ratios weight on a scale to equal 1 or 100% to explore the mix in ratings when concentrating solely on the financial ratios.

Moody's financial ratios rating mix			
	% of total	% of financial ratios	
Aaa	15%	27%	
Aa	10%	18%	
A	30%	55%	
	55%	100%	

tAs shown above, on a combined basis the financial ratios tilt towards a high A or a low Aa Moody's ratings. If we combined the qualitative ratings where MMWD is most likely to get very high ratings, the overall Moody's ratings would most probably be at the Aa level.

Let's keep in mind that is as of June 30, 2022. Since then, based on MMWD financial updates, the financial condition has weakened. And, the MMWD is considering large capital expenditures associated with the shoring up of the water supply. Before, it can contemplate financing such projects the MMWD has to raise rates to operate above break even.

Thus, the Moody's estimated bond rating shown above is not representative of MMWD's current financial condition.

As one additional caveat, many of Moody's financial ratios Aaa criteria seem way too lenient. Here are some examples below.

Moody's Aaa standard		
1)	Rate Covenant	> 1.30
2)	Debt/Oper. Revenue	< 2.00
3)	Net fixed asset/Depreciation	> 75 years

The Rate Covenant margin is way too low. A small decrease in operating revenues or increase in operating expenses could quickly wipe out the safety margin (of 1.3 x) to be able to service the existing debt level.

The Debt/Operating Revenue criteria seems too high. Also, this ratio is not informative. It does not convey anything about the District having adequate cash flow to support and service existing debt level.
Net fixed asset/Depreciation is so volatile and uninformative. I found this ratio to be nearly meaningless. I suggested a couple of alternatives that were far more informative, stable and precise regarding the measurement of the aging of capital assets.

Keep in mind that qualitative factors account for 45% of the overall scorecard bond rating. And, these are very lenient.

Moody's bond rating may not provide Muni bond investors any more predictive information than Moody's MBS bond ratings did during the Financial Crisis of 2007 – 2009.

Financial Leverage & Balance Sheet Structure

	ASSETS					LIABILITIES					NET ASSETS
	Cash & Invest.										
	Unrest.	Restricted	Net capital asset	Other	Total	Debt	Pension	OPEB	Other	Total	NA Total
2014	21,026,899	75,110,366	358,319,959	11,910,621	466,367,845	132,511,806	-	-	22,205,292	154,717,098	311,650,747
2015	19,959,569	58,621,138	372,717,620	11,040,485	462,338,812	132,190,153	62,139,077	-	21,350,029	215,679,259	246,659,553
2016	16,947,252	43,947,119	383,536,225	15,599,604	460,030,200	129,856,251	69,753,895	-	22,297,968	221,908,114	238,122,086
2017	20,077,803	27,569,183	403,743,858	15,814,136	467,204,980	136,137,089	82,340,699	-	20,449,798	238,927,586	228,277,394
2018	22,264,658	61,392,543	418,830,930	14,889,102	517,377,233	175,390,091	92,519,977	33,978,000	23,281,279	325,169,347	192,207,886
2019	27,359,342	48,291,060	424,772,300	15,727,214	516,149,916	171,856,650	91,839,490	32,881,000	21,850,999	318,428,139	197,721,777
2020	30,162,068	55,875,258	425,142,746	19,549,252	530,729,324	168,072,274	97,305,920	24,128,077	27,236,841	316,743,112	213,986,212
2021	32,619,471	61,573,890	434,853,456	18,646,862	547,693,679	164,279,615	102,725,958	23,166,623	36,909,538	327,081,734	220,611,945
2022	27,365,294	41,781,058	449,992,008	29,036,077	548,174,437	155,042,173	75,422,129	7,228,281	27,139,718	264,832,301	283,342,136

OPEB means Other Post Employment Benefits

The table above parses the balance sheet into its main Assets and Liabilities components. It also calculates Net Assets as being the difference between Assets and Liabilities. Within a corporation Net Assets would be called Equity.

Using the above table, we can calculate the proportion of various assets and liabilities as a portion of Net Assets (equivalent of Equity) or Assets (same as the whole balance sheet).

	As a portion of Net Assets. (1 = 100%)		
	Liabilities	Debt	Pension & OPEB
2014	0.50	0.43	0.00
2015	0.87	0.54	0.25
2016	0.93	0.55	0.29
2017	1.05	0.60	0.36
2018	1.69	0.91	0.66
2019	1.61	0.87	0.63
2020	1.48	0.79	0.57
2021	1.48	0.74	0.57
2022	0.93	0.55	0.29
Average	1.17	0.66	0.40
Median	1.05	0.60	0.36
St. deviat.	0.41	0.17	0.22

	As a portion of Assets. (1 = 100%)		
	Liabilities	Debt	Pension & OPEB
2014	0.33	0.28	0.00
2015	0.47	0.29	0.13
2016	0.48	0.28	0.15
2017	0.51	0.29	0.18
2018	0.63	0.34	0.24
2019	0.62	0.33	0.24
2020	0.60	0.32	0.23
2021	0.60	0.30	0.23
2022	0.48	0.28	0.15
Average	0.52	0.30	0.17
Median	0.51	0.29	0.18
St. deviat.	0.10	0.02	0.08

Reviewing the above table, back in 2014 Pension & OPEB liabilities were not disclosed on the balance sheet. Accounting standards changed, and starting in 2015 such off-balance sheet liabilities had to be recognized on-balance sheet[23].

[23] The same was true for private corporations under GAAP several decades ago. It caused such corporations to immediately freeze all defined benefit retirement plans and move into defined contribution retirement plans (401K). This was to dwindle down and eventually eliminate rapidly ballooning unfunded pension plan liabilities that were recognized on the liabilities side of the balance sheet. Public State level entities do not have such

Pension & OPEB liabilities show favorable declining trends since 2018. These liabilities rose as a proportion of Net Assets or Assets from 2014 (starting at Zero) to 2018. In that year, these liabilities reached 66% of Net Assets (left table) and 24% of assets (right table). Then, these liabilities declined to 29% of Net Assets and 15% of Assets in 2022. On a stand-alone basis, this is a very favorable development.

Debt which represents bonds show favorable trends. Debt as a proportion of the overall balance sheet (Assets) also peaked in 2018, and declined ever since.

Overall, MMWD financial leverage has declined since 2018 because of the favorable mentioned trends. As shown below, both measures of financial leverage declined since 2018. Net Assets/Assets is the equivalent of an Equity/Asset ratio. And, Liabilities/Net Assets is the equivalent of a Liabilities/Equity or Debt/Equity ratio.

	Net Assets/ Assets	Liabilities/ Net Assets
2014	0.67	0.50
2015	0.53	0.87
2016	0.52	0.93
2017	0.49	1.05
2018	0.37	1.69
2019	0.38	1.61
2020	0.40	1.48
2021	0.40	1.48
2022	0.52	0.93
Average	0.48	1.17
Median	0.49	1.05
St. deviat.	0.10	0.41

Next let's focus on the liabilities over which the MMWD has little control. These are the Pension & OPEB liabilities. They represent a declining portion of the balance sheet (or Assets) since 2018. That is a very good trend.

options. They are mandated to remain with the CALPERS pension system, and bear the burden of associated unfunded pension liabilities.

Liabilities outside of MMWD control as % of balance sheet			
	Pension	OPEB	Total
2014	0.0%	0.0%	0.0%
2015	13.4%	0.0%	13.4%
2016	15.2%	0.0%	15.2%
2017	17.6%	0.0%	17.6%
2018	17.9%	6.6%	24.4%
2019	17.8%	6.4%	24.2%
2020	18.3%	4.5%	22.9%
2021	18.8%	4.2%	23.0%
2022	13.8%	1.3%	15.1%
Average	14.8%	2.6%	17.3%
Median	17.6%	1.3%	17.6%
St. deviat.	5.9%	2.9%	7.8%

However, the MMWD has little control over such liabilities because they represent the net present value from Pension & OPEB plans that are driven by investment return assumptions and market movements experienced at CALPERS investment portfolio level. MMWD has no control over any of that. As recognized by CALPERS during fiscal 2022, those factors (market movements at CALPERS invested funds) were very favorable. Thus, it much lowered unfunded pension liabilities for all entities participating in the CALPERS plan. Given less favorable market movements over the next 12 months, these pension-related liabilities may increase. It would boost pension and OPEB liabilities on MMWD's balance sheet.

Next, let's look at the breakdown of Assets mix in %.

	Assets mix in %				
	Cash & Invest.		Net		
	Unrest.	Restricted	capital asset	Other	Sum
2014	4.5%	16.1%	76.8%	2.6%	100.0%
2015	4.3%	12.7%	80.6%	2.4%	100.0%
2016	3.7%	9.6%	83.4%	3.4%	100.0%
2017	4.3%	5.9%	86.4%	3.4%	100.0%
2018	4.3%	11.9%	81.0%	2.9%	100.0%
2019	5.3%	9.4%	82.3%	3.0%	100.0%
2020	5.7%	10.5%	80.1%	3.7%	100.0%
2021	6.0%	11.2%	79.4%	3.4%	100.0%
2022	5.0%	7.6%	82.1%	5.3%	100.0%
Average	4.8%	10.5%	81.3%	3.3%	
Median	4.5%	10.5%	81.0%	3.4%	
St. deviat.	0.7%	3.0%	2.7%	0.8%	

Unrestricted Cash & Investments represent a fairly steady 4% to 6% of the total Asset base (or total balance sheet). However, Restricted Cash & Investments, consisting of all the reserve funds, show a marked decline in 2022. The latter declined precipitously from 11.2% of total Assets in 2021 to 7.6% in 2022.

Let's have a closer look at these Cash & Investment funds. On both a nominal $dollar basis and as a % of total Assets, Restricted cash (the reserve funds) in 2022 is at its second lowest level over the past 9 years. In 2022, Restricted cash at 7.6% of Assets is close to a full standard deviation[24] below the average of 10.5%.

	Cash & Invest.			Total	Cash & Invest. As % of Assets		
	Unrest.	Restricted	Sum	Assets	Unrest.	Restricted	Sum
2014	21,026,899	75,110,366	96,137,265	466,367,845	4.5%	16.1%	20.6%
2015	19,959,569	58,621,138	78,580,707	462,338,812	4.3%	12.7%	17.0%
2016	16,947,252	43,947,119	60,894,371	460,030,200	3.7%	9.6%	13.2%
2017	20,077,803	27,569,183	47,646,986	467,204,980	4.3%	5.9%	10.2%
2018	22,264,658	61,392,543	83,657,201	517,377,233	4.3%	11.9%	16.2%
2019	27,359,342	48,291,060	75,650,402	516,149,916	5.3%	9.4%	14.7%
2020	30,162,068	55,875,258	86,037,326	530,729,324	5.7%	10.5%	16.2%
2021	32,619,471	61,573,890	94,193,361	547,693,679	6.0%	11.2%	17.2%
2022	27,365,294	41,781,058	69,146,352	548,174,437	5.0%	7.6%	12.6%
				Average	4.8%	10.5%	15.3%
				Median	4.5%	10.5%	16.2%
				St. deviation	0.7%	3.0%	3.0%

The mentioned abrupt drop in Restricted cash in 2022 is one of the lone unfavorable financial trends experienced during fiscal 2022.

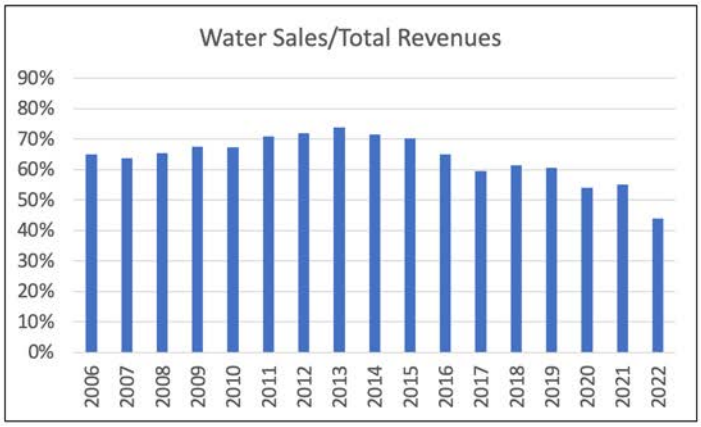
Operating performance

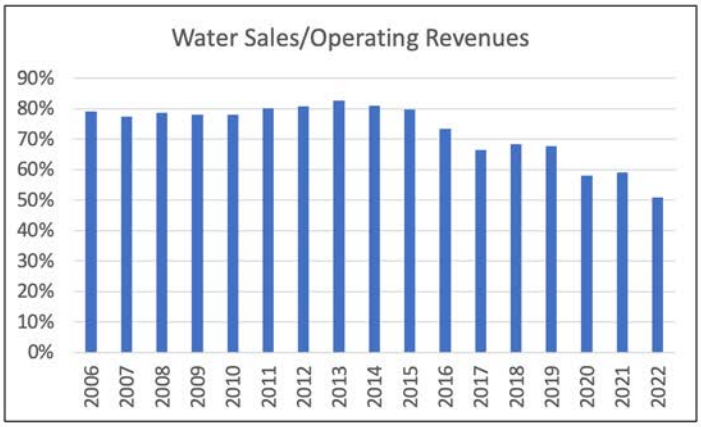
Revenue mix

As shown on the table below, water sales represent a rapidly declining % of Total Revenues and Operating Revenues (OR). Water sales peaked at 82.7% of Operating Revenues in 2013; and, declined to 50.9% in 2022.

[24] Assuming a normal distribution, an observation that is one standard deviation below the average would be at the 17th percentile (near the bottom) of the whole sample or population. Given the small sample size (9 years), one should technically use a t-distribution with 8 degrees of freedom. Doing so, would result in slightly increasing the percentile from 17th to probably 20th.

	Total Revenues	Operating Revenues (OR)	Water sales	Water/ Total	Water/ OR
2006	54,210,388	44,561,172	35,288,474	65.1%	79.2%
2007	61,966,512	50,916,502	39,462,839	63.7%	77.5%
2008	63,196,220	52,472,384	41,305,864	65.4%	78.7%
2009	63,134,332	54,549,936	42,628,226	67.5%	78.1%
2010	61,703,450	53,150,279	41,557,677	67.4%	78.2%
2011	63,506,733	56,279,410	45,101,916	71.0%	80.1%
2012	66,837,996	59,418,736	48,069,979	71.9%	80.9%
2013	74,641,897	66,672,109	55,125,168	73.9%	82.7%
2014	76,536,722	67,734,729	54,840,298	71.7%	81.0%
2015	67,203,723	59,241,096	47,239,263	70.3%	79.7%
2016	68,077,139	60,100,547	44,206,306	64.9%	73.6%
2017	76,476,795	68,513,918	45,524,376	59.5%	66.4%
2018	87,639,692	78,672,288	53,888,079	61.5%	68.5%
2019	87,089,938	77,993,146	52,832,678	60.7%	67.7%
2020	104,646,989	97,271,194	56,563,572	54.1%	58.2%
2021	110,874,064	103,434,538	61,099,872	55.1%	59.1%
2022	104,816,473	90,745,884	46,192,851	44.1%	50.9%





Fixed charges, including Capital Maintenance Fee, Watershed Management Fee make a rising portion of Revenues.

During public forums[25], Larry Bragman, a former Board member, mentioned that the MMWD is moving away from selling water as a commodity[26] to selling water as a service. You pay substantial fixed charges just to have access to potable water regardless of how little water you use.

[25] Board meetings, MMWD Board candidate debates, etc.

[26] That means a volume driven business. The more water you consume, the more you pay.

The table below shows how those fixed charges and non-water related revenues are now accounting for nearly half or more of revenues, depending on what revenue base you are considering.

	Fixed charges % of Revenues	
	Total Rev.	Op. Rev.
2006	34.9%	20.8%
2007	36.3%	22.5%
2008	34.6%	21.3%
2009	32.5%	21.9%
2010	32.6%	21.8%
2011	29.0%	19.9%
2012	28.1%	19.1%
2013	26.1%	17.3%
2014	28.3%	19.0%
2015	29.7%	20.3%
2016	35.1%	26.4%
2017	40.5%	33.6%
2018	38.5%	31.5%
2019	39.3%	32.3%
2020	45.9%	41.8%
2021	44.9%	40.9%
2022	55.9%	49.1%

The above trend of rising fixed charges as a % of revenue is a very favorable trend given that the demand for MMWD water is chronically suppressed due to water conservation, ongoing environmental water release to sustain the fisheries, and very slow to flat demographic growth[27].

Operating Profit Margins

Below, I am aggregating the main components we need to calculate Operating Profit Margins.

[27] Sharing my earlier reference on the subject. https://marinpost.org/blog/2023/1/9/rhna-abag-demographic-projections-are-way-off

	Operating Revenues	Operating Expenses	Interest Expense	Grants	Investment Income	Other	Capital contribution	Increase in Net Position
2006	44,561,172	(49,538,626)	(2,923,885)	705,957	(1,094,893)	3,990,708	6,047,444	1,747,877
2007	50,916,502	(50,508,668)	(2,857,380)	1,331,428	802,024	3,614,525	5,302,034	8,600,465
2008	52,472,384	(52,221,764)	(2,707,312)	953,276	287,149	3,397,203	6,086,208	8,267,144
2009	54,549,936	(58,500,089)	(2,574,404)	1,487,759	(560,702)	2,558,935	5,098,404	2,059,839
2010	53,150,279	(57,494,968)	(2,399,793)	496,263	(52,176)	1,961,553	6,147,539	1,808,697
2011	56,279,410	(56,232,567)	(3,887,448)	321,968	75,634	1,645,300	5,184,421	3,386,718
2012	59,418,736	(56,744,298)	(3,730,202)	736,079	88,242	1,714,780	4,880,159	6,363,496
2013	66,672,109	(59,841,088)	(4,090,263)	1,113,955	75,509	1,876,623	4,903,701	10,710,546
2014	67,734,729	(65,744,284)	(4,686,280)	1,137,330	69,251	1,731,840	5,863,573	6,106,159
2015	59,241,096	(65,013,819)	(4,465,063)	865,443	4,630	1,344,368	5,748,183	(2,275,162)
2016	60,100,947	(65,125,618)	(3,578,557)	245,335	4,558	2,151,990	5,574,709	(626,636)
2017	68,513,918	(70,199,788)	(3,959,306)	506,886	(55,433)	1,941,926	5,569,498	2,317,701
2018	78,672,288	(78,017,668)	(6,343,751)	756,220	(27,416)	2,620,442	5,618,158	3,278,273
2019	77,993,146	(80,237,859)	(7,080,696)	12,154	57,764	3,165,140	5,861,734	(228,617)
2020	97,271,194	(89,443,194)	(6,659,512)	173,811	322,461	(516,788)	7,396,311	8,544,283
2021	103,434,538	(92,512,034)	(6,516,310)	280,632	(323,701)	2,126,210	5,356,385	11,845,720
2022	90,745,884	(83,115,717)	(5,276,537)	2,826,980	2,964,732	2,080,673	6,198,204	16,424,219

I will specifically exclude Grants, Investment Income, and Other from any calculations of Operating Profit Margins. I will calculate such margins in three different ways as shown in the table below.

Spec 1. Operating Revenues - Operating Expenses	
Spec 2. Spec 1 - Interest Expense	
Spec 3. Spec 2 + Capital contribution	

The first specification is simply Operating Revenues – Operating Expenses.

The second specification additionally deducts Interest Expense from Operating Revenues.

The third specification adds Capital contribution to Operating Revenues. That is because the majority of the items within this category are really operating revenues too. But, they are not related to water sales. They include such items as Fire flow fee, license fees, etc. that we can be comfortable including in overall Operating Revenues.

The table below shows the resulting Operating Profit using the three different specifications.

	Operating Profit		
	Spec 1	Spec 2	Spec 3
2006	(4,977,454)	(7,901,339)	(1,853,895)
2007	407,834	(2,449,546)	2,852,488
2008	250,620	(2,456,692)	3,629,516
2009	(3,950,153)	(6,524,557)	(1,426,153)
2010	(4,344,689)	(6,744,482)	(596,943)
2011	46,843	(3,840,605)	1,343,816
2012	2,674,438	(1,055,764)	3,824,395
2013	6,831,021	2,740,758	7,644,459
2014	1,990,445	(2,695,835)	3,167,738
2015	(5,772,723)	(10,237,786)	(4,489,603)
2016	(5,024,671)	(8,603,228)	(3,028,519)
2017	(1,685,870)	(5,645,176)	(75,678)
2018	654,620	(5,689,131)	(70,973)
2019	(2,244,713)	(9,325,409)	(3,463,675)
2020	7,828,000	1,168,488	8,564,799
2021	10,922,504	4,406,194	9,762,579
2022	7,630,167	2,353,630	8,551,834

The next table calculates the actual Operating Profit Margin which is equal to Operating Profit divided by Operating Revenues.

Operating Profit Margin as % of Operating Revenues			
	Spec 1	Spec 2	Spec 3
2006	-11.2%	-17.7%	-4.2%
2007	0.8%	-4.8%	5.6%
2008	0.5%	-4.7%	6.9%
2009	-7.2%	-12.0%	-2.6%
2010	-8.2%	-12.7%	-1.1%
2011	0.1%	-6.8%	2.4%
2012	4.5%	-1.8%	6.4%
2013	10.2%	4.1%	11.5%
2014	2.9%	-4.0%	4.7%
2015	-9.7%	-17.3%	-7.6%
2016	-8.4%	-14.3%	-5.0%
2017	-2.5%	-8.2%	-0.1%
2018	0.8%	-7.2%	-0.1%
2019	-2.9%	-12.0%	-4.4%
2020	8.0%	1.2%	8.8%
2021	10.6%	4.3%	9.4%
2022	8.4%	2.6%	9.4%
Average	-0.2%	-6.5%	2.4%
Median	0.5%	-6.8%	2.4%
St. deviation	7.1%	7.1%	6.0%

As shown above, the Operating Profitability in 2022 compares favorably with history. The Operating Profit Margins are the third highest over the past 17 years. Over the past three fiscal years, all Operating Profit Margins are positive.

Meanwhile, over the previous 14 years, 13 have at least one negative Operating Profit Margin or more. Thus, the profitability trend is positive.

Cash Flow

How sustainably profitable is the MMWD when recording operations on a cash basis? This is a critical question for any operating entity. The overall cash flows are complex. So, I studied them in two different ways.

The first method entailed reconstructing a streamlined cash flow from operations. I will describe the method shortly.

The second way, I focused on cash flow from operations as disclosed in the financial statements, excluding capital expenditures and bond financing flows, to understand how much cash ongoing operations are generating.

Using the first method, when reconstructing the cash flow from operations, my starting point was to observe the change in Cash & Investments.

Next, I would add back the change in Capital Assets that represents yearly capital expenditures. In summary, the equality is as follows:

Cash Flow = Chg. In Cash & Investment + Capital Expenditure + or - Bond repayment(new Bond issuance)

The table below discloses the first item, the change in Cash & Investment.

	Cash & Investments			
	Current	Restricted	Total	Change
2014	21,026,899	75,110,366	96,137,265	
2015	19,959,569	58,621,138	78,580,707	(17,556,558)
2016	16,947,252	43,947,119	60,894,371	(17,686,336)
2017	20,077,803	27,569,183	47,646,986	(13,247,385)
2018	22,264,658	61,392,543	83,657,201	36,010,215
2019	27,359,342	48,291,060	75,650,402	(8,006,799)
2020	30,162,068	55,875,258	86,037,326	10,386,924
2021	32,619,471	61,573,890	94,193,361	8,156,035
2022	27,365,294	41,781,058	69,146,352	(25,047,009)

The table below discloses the second item, the change in Capital Assets represent the yearly capital expenditures that I add back to the Cash Flow.

	Capital Assets	Change
2014	553,394,817	
2015	577,119,108	23,724,291
2016	597,733,814	20,614,706
2017	628,826,644	31,092,830
2018	654,739,761	25,913,117
2019	669,977,114	15,237,353
2020	675,642,647	5,665,533
2021	697,294,768	21,652,121
2022	726,405,777	29,111,009

The table below discloses the change in bond outstanding.

	Funded Debt or Bond outstanding			
	L/T Debt	S/T Debt	Total	Change
2014	132,511,806	1,707,250	134,219,056	
2015	130,422,903	1,767,250	132,190,153	(2,028,903)
2016	128,179,001	1,677,250	129,856,251	(2,333,902)
2017	133,910,936	2,226,153	136,137,089	6,280,838
2018	172,371,477	3,018,614	175,390,091	39,253,002
2019	168,654,080	3,202,570	171,856,650	(3,533,441)
2020	164,861,422	3,210,852	168,072,274	(3,784,376)
2021	160,942,931	3,336,684	164,279,615	(3,792,659)
2022	149,459,905	5,582,268	155,042,173	(9,237,442)

If bond outstanding increased, we deduct it from cash flows. If bond outstanding decreased we add it to cash flows.

Now, putting all three pieces together we can get a high level view of MMWD Cash Flow coming mainly from operations. I also divide the resulting Cash Flow by Operating & other revenues[28].

	Cash Flow Estimation				
	Change in Cash & Invest.	Cap. Ex.	Bond repay	Cash flow	% of Operat. & other revenue
2015	(17,556,558)	23,724,291	2,028,903	8,196,636	13.4%
2016	(17,686,336)	20,614,706	2,333,902	5,262,272	8.5%
2017	(13,247,385)	31,092,830	(6,280,838)	11,564,607	16.4%
2018	36,010,215	25,913,117	(39,253,002)	22,670,330	28.0%
2019	(8,006,799)	15,237,353	3,533,441	10,763,995	13.5%
2020	10,386,924	5,665,533	3,784,376	19,836,833	20.8%
2021	8,156,035	21,652,121	3,792,659	33,600,815	31.9%
2022	(25,047,009)	29,111,009	9,237,442	13,301,442	14.0%
				Average	18.3%
				Median	15.2%
				St. deviation	8.0%

Cash Flow is interesting to look at. While, fiscal 2022 showed a strong Operating Profitability performance (3d highest over the past 17 years), when looking at Cash Flow, 2022 performed below average vs. the past 8 year history.

[28] This was the revenue level used to assess the MMWD Debt Servicing capacity. Using other revenue levels (there are many within the Annual Reports) would not change the relative position of each year's performance.

Notice the huge downswing in such Cash Flow levels between fiscal 2021 (the highest in the history) vs. fiscal 2022, when such Cash Flow falls below Average level.

Now onto the second method, just observing Cash from Operations as disclosed in the financial statements.

	Cash from Operations				
	Customers	Employees	Suppliers	Other	Sum
2014	68,690,532	(33,144,469)	(21,970,760)	1,182,278	14,757,581
2015	59,615,388	(34,706,642)	(19,028,571)	917,793	6,797,968
2016	56,129,740	(35,684,885)	(18,538,645)	(199,045)	1,707,165
2017	68,170,286	(37,717,364)	(20,562,777)	2,430,033	12,320,178
2018	78,624,160	(38,224,807)	(20,546,443)	1,087,225	20,940,135
2019	76,231,813	(41,002,858)	(24,228,125)	2,531,969	13,532,799
2020	92,838,430	(43,379,363)	(24,168,653)	2,436,452	27,726,866
2021	103,473,837	(45,223,949)	(27,020,933)	2,449,883	33,678,838
2022	89,743,836	(42,888,600)	(42,277,604)	2,551,877	7,129,509

Next, I calculate a Cash Flow Margin. And, I calculate it twice. The first one I exclude the "Other" item from Cash Flows. In the second one, I do include the "Other" item. And, this margin equals the "Sum" of the cash flows as shown in the right hand column within the table above. The Cash Flow Margins are shown below.

	Cash flow margins	
	Margin 1	Margin 2
2014	13,575,303	14,757,581
2015	5,880,175	6,797,968
2016	1,906,210	1,707,165
2017	9,890,145	12,320,178
2018	19,852,910	20,940,135
2019	11,000,830	13,532,799
2020	25,290,414	27,726,866
2021	31,228,955	33,678,838
2022	4,577,632	7,129,509

Next, I divide these Cash Flow Margins by the cash receipt from Customers, the first left hand column in the earlier table depicting the Cash from Operations.

Cash flow margins % of Customers receipt		
	Margin 1	Margin 2
2014	19.8%	21.5%
2015	9.9%	11.4%
2016	3.4%	3.0%
2017	14.5%	18.1%
2018	25.3%	26.6%
2019	14.4%	17.8%
2020	27.2%	29.9%
2021	30.2%	32.5%
2022	5.1%	7.9%
Average	16.6%	18.7%
Median	14.5%	18.1%
St. deviation	9.6%	10.0%

The cash flow performance in 2022 is very weak. Both margins in % are far lower than the Average. And, they are the second lowest over the past 9 years.

Statistical Summary

Within this section I aggregate together the main financial ratios time series to benchmark the financial performance of each year.

First, let's look at the financial ratios with data going back to 2006. These include the debt service coverage ratios, Fixed charge/Total Revenues, and an Operating Profit margin ratio[29].

[29] In this case, I used the most straightforward ratio where the numerator is simply Operating Expenses minus Operating Expenses and the denominator is Operating Revenues.

	Rate Covenant	Service Coverage				Percentiles			
	NOI/Debt Serv.	NOI/Debt Serv.	Fixed charge/ Total Rev.	Operating profit margin		Rate Covenant NOI/Debt Serv.	Service Coverage NOI/Debt Serv.	Fixed charge/ Total Rev.	Operating profit margin
2006	1.33	0.15	34.9%	-11.2%	2006	25%	38%	50%	0%
2007	2.14	0.95	36.3%	0.8%	2007	63%	81%	63%	56%
2008	2.02	0.74	34.6%	0.5%	2008	50%	63%	44%	50%
2009	1.30	-0.08	32.5%	-7.2%	2009	19%	19%	31%	25%
2010	1.25	-0.28	32.6%	-8.2%	2010	13%	13%	38%	19%
2011	2.20	0.35	29.0%	0.1%	2011	75%	44%	19%	44%
2012	2.81	0.92	28.1%	4.5%	2012	88%	75%	6%	75%
2013	3.15	1.49	26.1%	10.2%	2013	100%	100%	0%	94%
2014	2.18	0.65	28.3%	2.9%	2014	69%	56%	13%	69%
2015	1.07	-0.53	29.7%	-9.7%	2015	0%	0%	25%	6%
2016	1.22	-0.38	35.1%	-8.4%	2016	6%	6%	56%	13%
2017	1.87	0.12	40.5%	-2.5%	2017	44%	31%	81%	38%
2018	1.67	0.43	38.5%	0.8%	2018	38%	50%	69%	63%
2019	1.39	0.10	39.3%	-2.9%	2019	31%	25%	75%	31%
2020	2.10	0.80	45.9%	8.0%	2020	56%	69%	94%	81%
2021	2.80	1.42	44.9%	10.6%	2021	81%	94%	88%	100%
2022	2.91	1.36	55.9%	8.4%	2022	94%	88%	100%	88%
Average	1.97	0.48	36.0%	-0.2%					
Median	2.02	0.43	34.9%	0.5%					
St. dev.	0.66	0.63	7.7%	7.1%					

The table on the left discloses the ratios. The table on the right essentially benchmarks and ranks the ratios so you can readily compare the performance of one year vs. the others. The percentages represent the percentile for a given financial ratio in a specific year. So, the year with the best or highest ratio is equal to 100% (the top percentile); and the one with the lowest or worst ratio is equal to 0% (the bottom percentile). Additionally, the best ratio is colored green, the worst one is red. And, one around the Median (50%) is yellow.

Reviewing the colored tiering above, you can readily see that when looking at these respective four financial ratios, 2015 and 2016 were by far the two weakest years. During both years, MMWD had to withdraw funds from the Rate Stabilization Fund in order to meet a target rate covenant of 1.25 times [30].

Within the same colored tiering table, we can see that the most recent three years (2020 - 2022) were relatively strong performers as measured by the specific ratios (as you see a lot of green throughout those three years).

[30] Notice that my calculations of the Rate Covenant followed Moody's methodology that does not include Interest Income. As a result, my calculations generate slightly lower ratios than the ones disclosed within the MMWD Annual Reports.

Next, let's focus on the financial ratios with a shorter time series going back to 2014. Starting from the left, they include five ratios associated with Liquidity and Financial Leverage. For the first four, a higher is better. For the fifth one (Liabilities/Assets), a lower figure is better. To denote that these five ratios belong together, they are in a rectangular box. The Cash flow margin[31] stands alone in a separate box since it is completely different in nature.

	Days cash on hand to OE	Current ratio	Cash & Invest./Debt	Cash & Invest./ Assets	Liabilities/ Assets	Cash flow margin
2014	141	1.76	0.70	0.21	0.33	19.8%
2015	134	1.59	0.58	0.17	0.47	9.9%
2016	114	1.61	0.46	0.13	0.48	3.4%
2017	125	1.99	0.34	0.10	0.51	14.5%
2018	122	1.76	0.47	0.16	0.63	25.3%
2019	147	2.10	0.43	0.15	0.62	14.4%
2020	143	2.32	0.50	0.16	0.60	27.2%
2021	150	1.89	0.56	0.17	0.60	30.2%
2022	145	1.81	0.44	0.13	0.48	5.1%
Average	136	1.87	0.50	0.15	0.52	16.6%
Median	141	1.81	0.47	0.16	0.51	14.5%
St. dev.	12	0.23	0.10	0.03	0.10	9.6%

	Percentiles					
	Days cash on hand to OE	Current ratio	Cash & Invest./Debt	Cash & Invest./ Assets	Liabilities/ Assets	Cash flow margin
2014	50%	25%	100%	100%	0%	63%
2015	38%	0%	88%	75%	13%	25%
2016	0%	13%	38%	25%	25%	0%
2017	25%	75%	0%	0%	50%	50%
2018	13%	38%	50%	50%	100%	75%
2019	88%	88%	13%	38%	88%	38%
2020	63%	100%	63%	63%	63%	88%
2021	100%	63%	75%	88%	75%	100%
2022	75%	50%	25%	13%	38%	13%

Looking at the colored tiering associated with this next set of ratios tells a different story. Notice that 2022 now has a lot of yellow/orange/red. It is not so green anymore. Based on those six different financial ratios, it is not such a strong performer anymore.

[31] This is the Cash Flow Margin 1 where I exclude "Other" from Cash Flow from Operations. Notice that whether I include "Other" or not (Margin 2 vs Margin 1) does not make any difference regarding the relative ranking of the years. Both Margins convey very much the same information. Even their respective levels are not much different.

Several financial ratios from the two different time series are informative. Focusing on the Rate Covenant, Operating profit margin, and Cash flow margin, you would expect the three measures would be convergent. And, they are the majority of the time. 2015 and 2016 (mainly red) convey they were challenging years on all counts (debt servicing, operating profitability, and cash flow). Meanwhile, 2020 and 2021 were both strong performers (mainly green). But, look at 2022. Its performance was strong on debt servicing and operating profitability, but very weak on cash flow.

	Rate Covenant NOI/Debt Serv.	Operating profit margin	Cash flow margin		Percentiles: Rate Covenant NOI/Debt Serv.	Operating profit margin	Cash flow margin
2014	2.18	2.9%	19.8%	2014	75%	63%	63%
2015	1.07	-9.7%	9.9%	2015	0%	0%	25%
2016	1.22	-8.4%	3.4%	2016	13%	13%	0%
2017	1.87	-2.5%	14.5%	2017	50%	38%	50%
2018	1.67	0.8%	25.3%	2018	38%	50%	75%
2019	1.39	-2.9%	14.4%	2019	25%	25%	38%
2020	2.10	8.0%	27.2%	2020	63%	75%	88%
2021	2.80	10.6%	30.2%	2021	88%	100%	100%
2022	2.91	8.4%	5.1%	2022	100%	88%	13%
Average	1.91	0.8%	16.6%				
Median	1.87	0.8%	14.5%				
St. dev.	0.65	7.3%	9.6%				

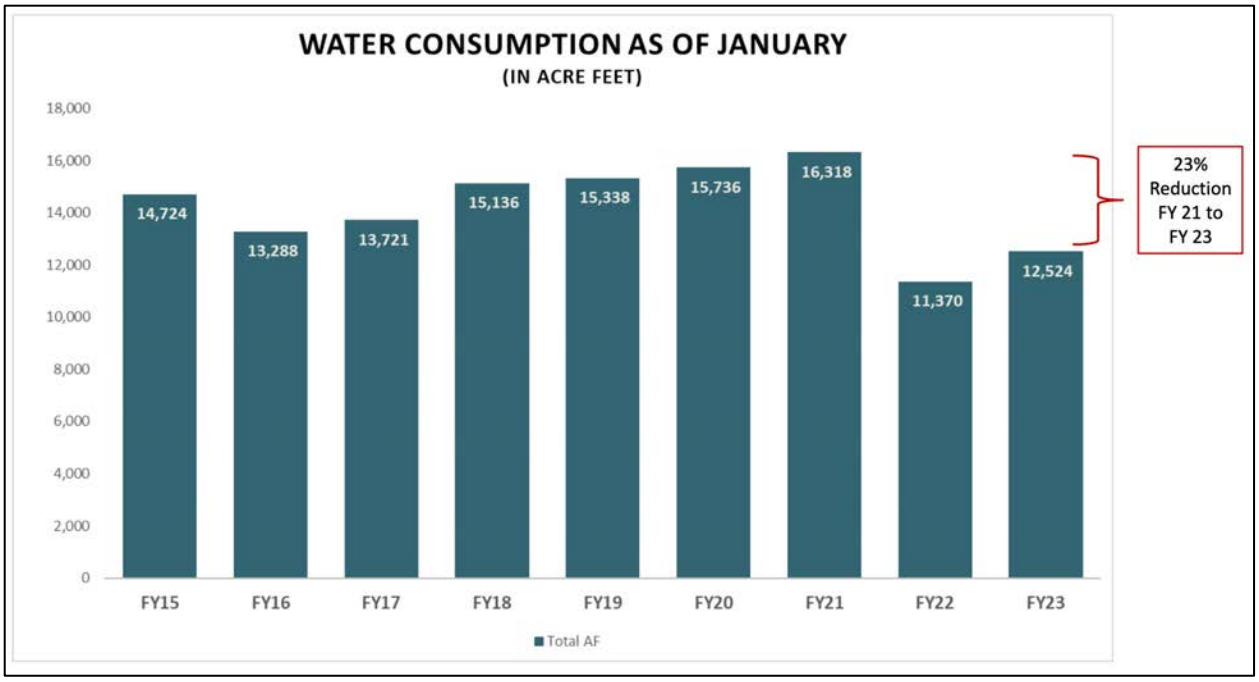
Fiscal 2022 weak Cash flow performance was the one indicative precursor of the MMWD fiscal 2023 financial condition. Currently, the MMWD is under substantial financial pressure to raise its rates and fees to remain solvent with adequate liquidity to support its ongoing operations.

Credit Analysis of MMWD post June 30, 2022

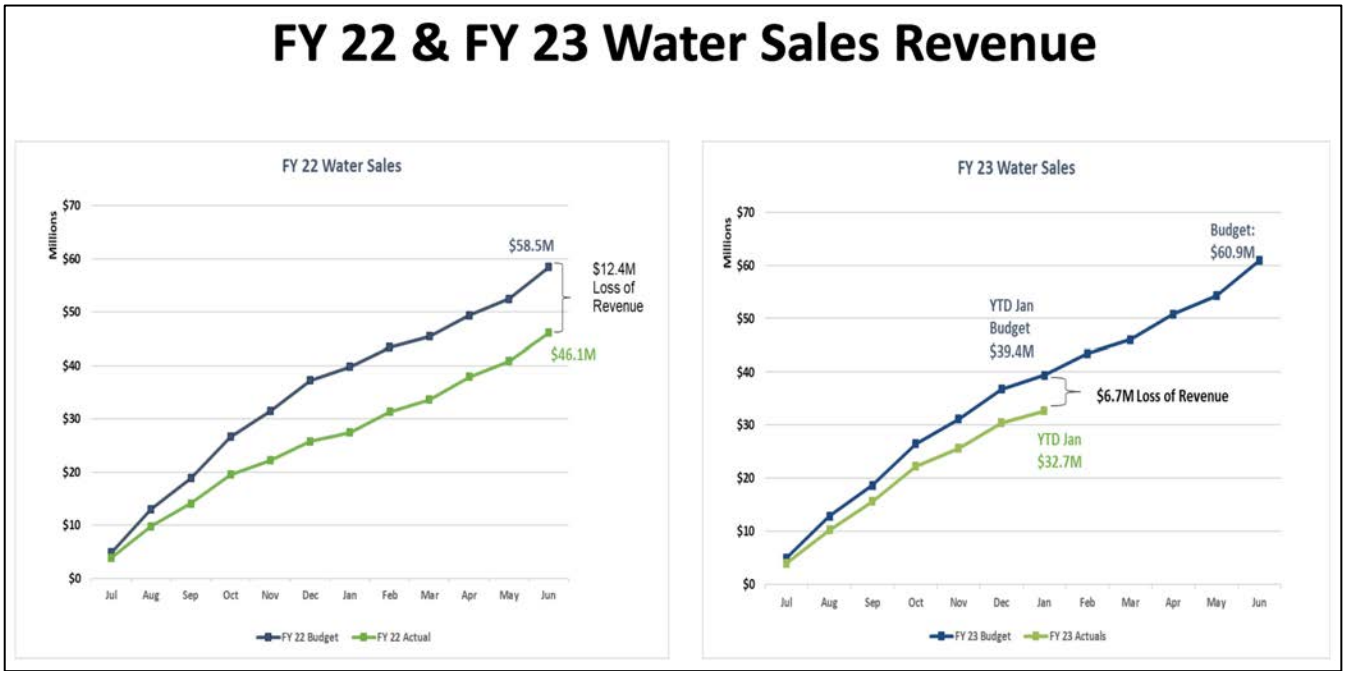
A good way to capture what is the current and prospective financial condition of the MMWD is to copy a few slides from:

a) the Water Rate Study Overview of December 12, 2022;
b) the Financial Update of February 23, 2023; and
c) Rate Setting Update Revenue Requirement of February 23, 2023.

Consumer conservation is still really high as shown on the graph below.



Water sales are coming way under Budget due to ongoing consumer conservation.



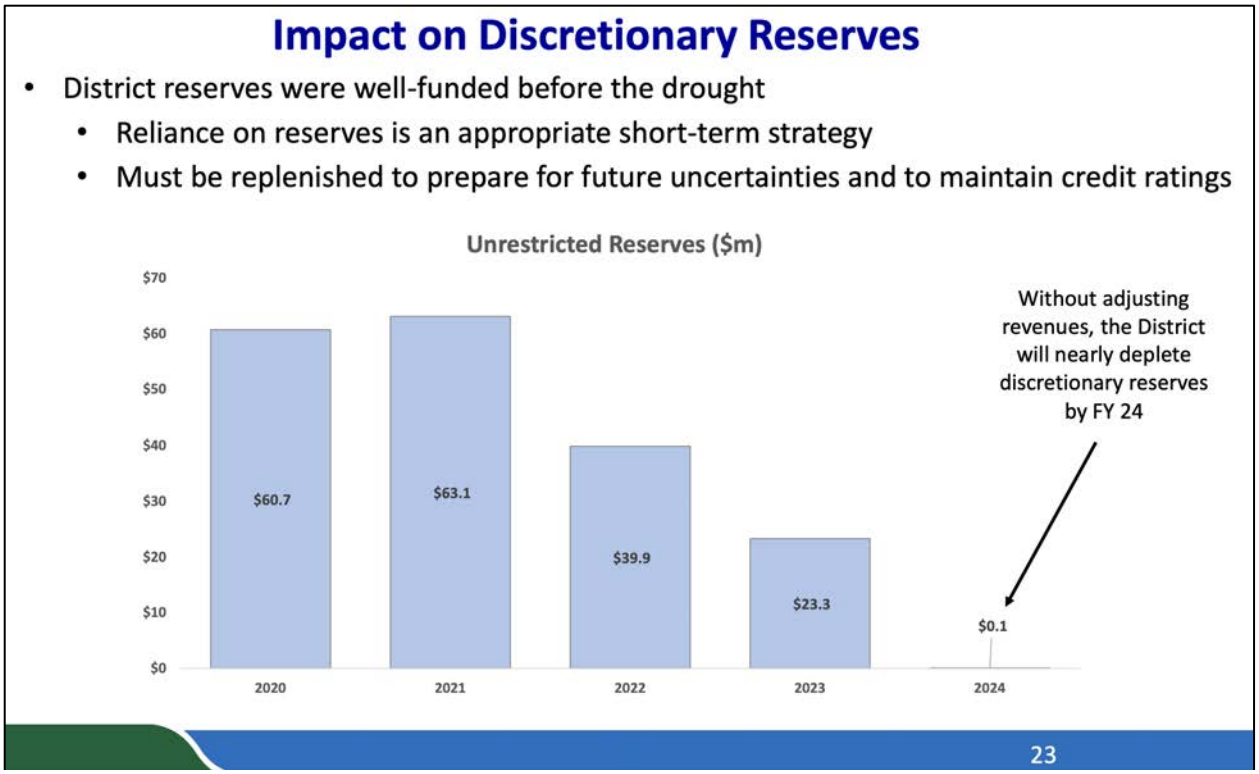
The MMWD is on an unsustainable financial path. It needs to raise rates simply to break-even.

Financial Plan – Baseline Budget without rate increases

Operating and Capital Fund ($m)	FY 2024 Plan	FY 2025 Plan	FY 2026 Plan	FY 2027 Plan
Rate Revenue	$98.5	$98.7	$99.1	$99.7
Expenditures	$119.2	$125.6	$131.5	$137.6
Operating Income (loss)	($20.7)	($26.9)	($32.3)	($37.9)

- Current rate structure produces an ongoing budgetary shortfall for existing (baseline) services
  - Due to inflation, deficit increases throughout the 4 year rate cycle
- Positive revision compared to December 2022
  - Reflects current water sales trends
  - Removes reserve replenishment from baseline

Absent rate increases, the weakening operating performance shown above would wipe out the reserves funds by the end of fiscal 2024.



Combined with needed capital expenditures to replace its aging water storage and distribution infrastructure, the MMWD is proposing hefty water rates & fees increases simply to maintain ongoing operations.

Prospective rate increases to shore up financial condition and fund capital expenditures

This section uses as a reference: Rate Setting Update: Revenue Requirement, February 23, 2023.

Within the mentioned document, the MMWD presents a Financial Plan disclosing what is really needed to increase operating revenues so it breaks even, stabilize the backlog so it does not fall further behind, fund capital expenses to increase the water supply by 3,500 AFY, and fund other operational initiatives. It also discloses four different rate scenarios to accommodate the Financial Plan. Only two of the rate scenarios could be deemed better than being grossly insufficient to achieve the above financial goals. They are Scenarios 3 and 4. In the end, only Scenario 4 truly makes the cut.

Below I summarize and compare the Financial Plan with Scenarios 3 and 4.

Increasing revenues to cover operating losses and stabilize backlog				
in $ million				
	2024	2025	2026	2027
Financial Plan				
Operating loss	20.7	26.9	32.3	37.9
Backlog	23.9	23.9	23.9	23.9
Other	27.4	30.3	30.3	30.1
Revenue requirement	72.0	81.1	86.5	91.9
Scenario 3				
Operating loss	20.7	26.9	32.3	37.9
Backlog	3.0	6.0	9.0	12.0
Other	10.4	18.5	23.7	20.9
Revenue generated	34.1	51.4	65	70.8
Pseudo savings:				
a) From backlog	20.9	17.9	14.9	11.9
b) Other	17.0	11.8	6.6	9.2
	37.9	29.7	21.5	21.1
Scenario 4				
Operating loss	20.7	26.9	32.3	37.9
Backlog	6.0	12.0	18.0	24.0
Other	18.6	21.5	30.4	30.1
Revenue generated	45.3	60.4	80.7	92
Pseudo savings:				
a) From backlog	17.9	11.9	5.9	-0.1
b) Other	8.8	8.8	-0.1	0.0
	26.7	20.7	5.8	-0.1

Both Scenarios skimp on yearly capital expenditures to stabilize the backlog at current level in order to pass on more reasonable increases in rates & fees. Scenario 3 does it by phasing the backlog expenditures very slowly up to only 50% of the necessary level by fiscal 2027 at $12 million instead of $24 million. Scenario 4 follows the same backlog capital expenditure phase in schedule, but it funds these expenditures fully by fiscal 2027 at the $24 million level.

These Scenarios have the benefit of passing on much lower rates & and fees increases than as required by the Financial Plan.

Revenues (Operating and Capital Fund) in $ million					
	2024	2025	2026	2027	
No rate increase	98.5	98.7	99.1	99.7	
Financial Plan	170.5	179.8	185.6	191.6	
Scenario 3	132.6	150.1	164.1	170.5	
Scenario 4	143.8	159.1	179.8	191.7	
Rate & fee increase from year to year					
	2024	2025	2026	2027	Cumulative
Financial Plan	73.1%	5.5%	3.2%	3.2%	94.5%
Scenario 3	34.6%	13.2%	9.3%	3.9%	73.1%
Scenario 4	46.0%	10.6%	13.0%	6.6%	94.6%

No matter what path the MMWD will take, the prospective increase in rates & fees in fiscal 2024 will be at a record high ranging from 34.6% with Scenario 3 up to 73.1% with the Financial Plan. By fiscal 2027 such fees would range from 73.1% to 94.6% above fiscal 2023.

You would think that Scenario 3 looks the best. However, think of the MMWD backlog as a credit card. If you don't pay what is currently due, your credit card balance keeps on rising. It is exactly the same with MMWD backlog. If we don't replace the capital assets that should be replaced in a given year, the backlog keeps on rising. And, the situation only gets worse over time. This describes exactly Scenario 3.

Adding to the backlog				
in $ million				
	2024	2025	2026	2027
Financial Plan	0	0	0	0
Scenario 3	20.9	38.8	53.7	65.6
Scenario 4	17.9	29.8	35.7	35.6

By deferring backlog capital expenditures, Scenario 3 would add another $65.6 million to the backlog schedule by the end of fiscal 2027. Scenario 4 would add only $35.6 million. More importantly, Scenario 4 would fully stabilize the backlog beyond fiscal 2027. Meanwhile, Scenario 3 would not.

Adding to the backlog in years			
	by 2027	by 2037	by 2047
Scenario 3	2.7	7.7	12.7
Scenario 4	1.5	1.5	1.5

By fiscal 2027, Scenario 3's backlog would already be 2.7 years longer than under the Financial Plan. And, for every decade the backlog would extend for another 5 years. Clearly, Scenario 3 does not describe a sustainable backlog scheduling situation.

Scenario 4 is far more realistic as it would add only 1.5 year to the backlog by fiscal 2027. Thereafter, it would fully stabilize the backlog level.

From a backlog management, the only two realistic options are to go with the Financial Plan or Scenario 4. By contrast, Scenario 3 lets the backlog rise out of control forever.

The other side of the coin is how can the MMWD pass a 46% to 73% increase in rates & fees on July 1st, 2023 (first day of Fiscal 2024?

Prospective rate increase when adding the new water supply infrastructure projects

Jacobs Engineering and I have independently estimated we would need about 8,500 AF per year (AFY) to secure a 4-year water supply.

Within the Financial Plan of February 28, 2023[32], it includes already an estimated 3,500 AFY in added water supply associated with:

1) Rendering the Soulajule reservoir operational. This adds 420 AFY;
2) Providing connection from Phoenix Lake to Bon Tempe. This adds 260 AFY;
3) Purchasing more water from Sonoma; and
4) Improving precision of water stream release through automation.

As described, the brunt of the 3,500 AFY is provided by item 3) and 4). In combination, they could provide about 3,000 AFY. This strategy was developed by Jacobs Engineering. And, I agree wholeheartedly with it[33]. Elsewhere within this analysis, I describe purchasing more water from Sonoma as an inventory management strategy. And, I identified the enormous excess water stream release above mandates during the 2020 – 2021 water crisis[34]. This supports Jacobs Engineering strategy of improving the precision of water stream releases.

[32] The Financial Plan goes out to Fiscal 2027.
[33] I pointed out that same strategy within my report MMWD Water Perspectives & Strategy. December 18, 2022.
[34] Over this two year period the excess water release above regulatory mandates were above 7,000 AF.

When combining both improved precision of stream release and additional purchases of water from Sonoma, the 3,000 AFY estimate seems realistic.

To reach 8,500, the MMWD still needs an additional 5,000 AFY to be raised through large water supply infrastructure projects not included within the Financial Plan

Below I am building a simple model to figure the impact on rates & fess of these large projects.

Assumptions				
AFY	5,000			
$AFY	$ 2,000			
Revenue base	$ 100	in $ million		
Target multiple	1.25	Debt service coverage multiple		
Output				
Annual cost	$ 10,000,000			
" with debt service	$ 12,500,000			
As % of revenue	12.5%			

My starting assumptions include:

- An added 5,000 AFY to get us from 3,500 AFY to 8,500 AFY.

- A cost of $2,000 per AFY. This is a low-end assumption. The majority of such projects are associated with higher costs typically ranging from $2,400 to $3,000. But, with selective discipline it may be possible to reach the low estimate of $2,000 per AFY.

- A revenue base of $100 million and a debt service covenant of 1.25.

The starting output:

- Annual cost of the 5,000 AFY is $5,000 x $2,000 = $10,000,000

- Factoring the debt covenant of 1.25, we would need $12,500,000 in additional operating revenues to cover the $10,000,000 in expenses.

- And, the $12,500,000 represent 12.5% of the revenue base. This would equal the incremental increase in water rates & fees to develop the mentioned 5,000 AFY with bond financing.

Below, I sensitize the AFY from 5,000 to 8,500 AFY showing a progressively lower reliance on the strategies that generate the first 3,500 AFY. This contemplates a set of worsening scenarios

whereby either the strategies do not work as well in practice as on paper or we need more than 8,500 AFY in total[35].

Resulting increase in rates & fees sensitizing $AFY and AFY								
		$AFY						
		$ 1,800	$ 2,000	$ 2,200	$ 2,400	$ 2,600	$ 2,800	$ 3,000
	5,000	11.3%	12.5%	13.8%	15.0%	16.3%	17.5%	18.8%
	5,500	12.4%	13.8%	15.1%	16.5%	17.9%	19.3%	20.6%
	6,000	13.5%	15.0%	16.5%	18.0%	19.5%	21.0%	22.5%
AFY	6,500	14.6%	16.3%	17.9%	19.5%	21.1%	22.8%	24.4%
	7,000	15.8%	17.5%	19.3%	21.0%	22.8%	24.5%	26.3%
	7,500	16.9%	18.8%	20.6%	22.5%	24.4%	26.3%	28.1%
	8,000	18.0%	20.0%	22.0%	24.0%	26.0%	28.0%	30.0%
	8,500	19.1%	21.3%	23.4%	25.5%	27.6%	29.8%	31.9%

The resulting increase in rates & fees range from 11.3% given 5,000 AFY at only $1,800 per AFY to 31.9% given 8,500 AFY at $3,000 per AFY. Green indicates more favorable scenarios with lower rate increases. Red indicates less favorable scenarios with higher rate increases.

Now, if we add on this additional cost of funding the large water supply infrastructure project by fiscal 2027, all the cumulative increases in rate & fee increases over fiscal 2023 level rise substantially. For the Financial Plan and Scenario 4, they more than double in all shown cases.

Cumulative increase in rates & fees by fiscal 2027				
AFY	-	5,000	6,000	7,000
$AFY	$ -	$ 2,000	$ 2,200	$ 2,400
Financial Plan	94.5%	107.0%	111.0%	115.5%
Scenario 3	73.1%	85.8%	89.8%	94.4%
Scenario 4	94.6%	107.3%	111.4%	115.9%

The range of large projects considered would add between 5,000 to 7,000 AFY above the 3,500 AFY provided mainly by purchasing more water from Sonoma and more precisely managing water stream releases. Cost per AFY considered within the table ranges from $2,000 to $2,400 per AFY.

In summary, as shown above our water rates & fees will most likely double or more by fiscal 2027.

[35] This could be due to how successful or not the implementation of the Residential Housing Needs Assessment – Housing Elements will be. They anticipate an increase in Marin County population of about 13% out to 2030. As mentioned earlier, this defies all historical and contemporary demographic trends. But, this may not prevent Sacramento driven housing mandates to succeed. The probability of the 13% increase in population is probably very low. But, it is hard to quantify.

Special Section 1. Water conservation vs. Inventory Management

I addressed this subject at great length in an earlier study I shared with the audience[36]. I will make the narrative a lot shorter here. As indicated, I derive much comfort that Jacobs Engineering has reached very much the same strategic endpoint. We just phrase it slightly differently, while stating the exact same thing. I just spell out the financial implication while Jacobs Engineering remains focused on the water management (the main focus of its consulting mandate)[37].

Water conservation is financially a very challenging strategy. It is difficult to stay in business when forcing customers to buy less of what you are selling. The MMWD is contemplating drought surcharges to compensate for the loss in water volume sales by a commensurate increase in rates. The resulting arithmetic is forbidding as shown in the table below.

Rate increase to break-even

Conservation	Rate increase
20%	25%
30%	43%
40%	67%
50%	100%

- If the conservation rate is at 20%, you need to increase rates by 25% to maintain your water sales level unchanged.

- If the conservation rate is 50% you need to double the rates to maintain you water sales level unchanged.

That's pretty tough.

The MMWD has leaned on water conservation as its main strategy to boost water supply. "Water saved is the cheapest source of water" works well in theory, not so well in practice. It is the cheapest source until a water district becomes financially insolvent, and the water district has to potentially double the water rate to stay in business. Suddenly, the water conserved is not cheap anymore.

[36] MMWD Water Perspectives & Strategy factoring Climate, Demographics, Economics. December 18, 2022.
[37] Jacobs Engineering does emphasize water conservation much more than I do. That may be in part due to consulting constraints emphasizing catering to the customer's preferences. Otherwise, I am comfortable that Jacobs Engineering pretty much agree on the inventory management concept that entails that MMWD has purchased historically way less water from Sonoma than would have been optimal for the maintenance of its reservoir levels.

The MMWD has relied a lot more on water conservation than needed. It has done that by buying as little water from Sonoma because the water from Sonoma is more expensive at about $1,500 per AF than the one generated by the reservoirs.

That's not the optimal way to look at this issue which is an inventory management problem. The MMWD earns about $2,500 per AF from customers on water rates alone. So, on every AF it buys from Sonoma, it makes the following profit:

$2,500 - $1,500 = $1,000 in profit

$1,000/$2,500 = 40% profit margin

Instead, the MMWD has avoided as much as possible buying that extra AF from Sonoma. And, has forfeited the mentioned $1,000 profit per AF. As a result, the MMWD is under much greater financial stress because of the loss of water sales than otherwise.

But this is still an inventory management problem because if the MMWD buys an AF from Sonoma that it ultimately did not need, it could waste $1,500 per AF. However, with a huge profit margin of 40% it has a lot of room for still earning a decent profit per AF as long as it wastes less than 40%, as shown in the table below.

Cost	Sales price	% wasted	Sales revenue	Profit	Profit margin
$ 1,500	$ 2,500	0%	$ 2,500	$ 1,000	40%
$ 1,500	$ 2,500	10%	$ 2,250	$ 750	30%
$ 1,500	$ 2,500	20%	$ 2,000	$ 500	20%
$ 1,500	$ 2,500	30%	$ 1,750	$ 250	10%
$ 1,500	$ 2,500	40%	$ 1,500	$ -	0%

The seasonality of water sales is highly predictable. That should facilitate the MMWD being able to use this inventory management strategy very profitably.

Special Section 2: Human Capital Cost

On occasion I have heard that MMWD employees are overpaid. And, that the average cost per employee is around $200,000. The latter is partly due to expensive CALPERS public pensions reviewed in the next section.

Pay scale MMWD staff for fiscal 2023

I gathered the fiscal 2023 MMWD wage pay scale for several jobs from the website. The pay scale has five different levels. I picked up the lowest one (1), the medium one (3), and the top one (5).

I sorted the wages in ascending order (low to high salaries).

Pay scale (wage) for fiscal 2023						
		Low (1)		Medium (3)		High (5)
Office Assitant II	$	60,972	$	67,044	$	74,148
Meter Reader & Repair Worker I	$	67,668	$	74,748	$	81,768
Administrative Assistant -Confidential	$	79,464	$	87,048	$	96,252
Maintenance Worker II	$	81,252	$	88,620	$	97,452
Utility Worker II	$	81,252	$	88,620	$	97,452
Engineering Technician	$	83,748	$	91,368	$	100,464
Project Coordinator	$	85,728	$	94,560	$	105,276
Senior Customer Rep	$	85,908	$	95,268	$	105,420
Senior Administrative Assistant	$	88,764	$	97,572	$	108,324
Senior Park Ranger	$	90,588	$	98,820	$	108,672
Water System Technician	$	91,056	$	99,264	$	109,128
Water Quality Technician	$	91,536	$	99,864	$	109,848
Junior Engineer	$	91,068	$	100,992	$	111,684
Finance Analyst	$	91,500	$	101,616	$	112,056
Treatment Plant/System Operator III	$	96,828	$	107,580	$	118,572
Business Systems Analyst II	$	107,232	$	118,932	$	131,592
Information System Analyst II	$	107,232	$	118,932	$	131,592
Senior Chemist	$	110,748	$	123,000	$	135,588
Senior Engineer I	$	131,748	$	144,840	$	159,480
Average	$	90,752	$	99,931	$	110,251
Median	$	90,588	$	98,820	$	108,672

Next, I benchmarked several job positions vs. Salary.com data focused on San Francisco. With the Salary.com data, I focused on the 25th percentile, Median, and 75th percentile as equivalent to MMWD Low (1), Medium (2), and High (5). Correspondence between Salary.com job titles and job functions vs. MMWD is not always a precise fit. But, the benchmarking is still informative.

On occasion, I also compared MMWD pay scale to the average regular pay at the Santa Clara Valley Water District (SCVWD). SCVWD has over 10 times more customers than MMWD. Given that, its salaries should be higher. On the other hand, SCVWD's salaries date back to 2021[38], so they should be lower. Hopefully, these two opposing factors net each other out; and, they render SCVWD a reasonable benchmark for MMWD.

[38] Source is the Transparent California website.

	Low (1)	Medium (3)	High (5)
Senior Chemist	$ 110,748	$ 123,000	$ 135,588
Salary.com - San Francisco	**25%**	**Median**	**75%**
Chemist III	$ 109,003	$ 122,419	$ 138,229
Chemist IV	$ 136,500	$ 151,085	$ 165,765
Chemist V	$ 149,906	$ 169,293	$ 191,152
Difference vs. Level III	1.6%	0.5%	-1.9%
Santa Clara Valley Water District 2021			
Chemist III		$ 127,157	
Difference Level III		-3.3%	

Senior Chemist's wages at MMWD seem reasonable relative to the San Francisco labor market as disclosed by Salary.com. Senior Chemist fits closely Chemist III at Salary.com and at SCVWD.

	Low (1)	Medium (3)	High (5)
Office Assitant II	$ 60,972	$ 67,044	$ 74,148
Salary.com - San Francisco	**25%**	**Median**	**75%**
Office Assistant II	$ 46,163	$ 51,033	$ 57,163
Difference	32.1%	31.4%	29.7%

Office Assistant II's wages at MMWD is very high. As shown, it is around 30% higher than the same position at Salary.com (San Francisco).

	Low (1)	Medium (3)	High (5)
Finance Analyst	$ 91,500	$ 101,616	$ 112,056
Salary.com - San Francisco	**25%**	**Median**	**75%**
Financial Analyst II	$ 85,960	$ 95,071	$ 106,420
Financial Analyst III	$ 107,745	$ 118,002	$ 129,783
Financial Analyst IV	$ 130,094	$ 143,570	$ 158,513
Budget Analyst I	$ 68,847	$ 78,510	$ 87,948
Budget Analyst II	$ 85,875	$ 94,987	$ 105,045
Budget Analyst III	$ 108,111	$ 119,665	$ 134,495
Budget Analyst IV	$ 128,862	$ 146,951	$ 166,178

MMWD Finance Analyst's wage seems in line with the market as specified.

	Low (1)	Medium (3)	High (5)
Senior Customer Rep	$ 85,908	$ 95,268	$ 105,420
Salary.com - San Francisco	**25%**	**Median**	**75%**
Customer Service Representative III	$ 54,926	$ 60,577	$ 68,047
Customer Service Representative IV	$ 58,633	$ 65,282	$ 73,735
Difference vs. Level IV	46.5%	45.9%	43.0%

Senior Customer Representative's wages at MMWD are way higher than market as they are about 45% higher than the wages for Customer Service Representative IV (the highest level) at Salary.com San Francisco.

	Low (1)	Medium (3)	High (5)
Administrative Assistant -Confid.	$ 79,464	$ 87,048	$ 96,252
Salary.com - San Francisco	**25%**	**Median**	**75%**
Administrative Assistant II	$ 57,115	$ 63,957	$ 71,908
Administrative Assistant III	$ 68,998	$ 77,640	$ 87,049
Administrative Assistant IV	$ 79,848	$ 88,381	$ 98,005
Difference vs. Level II	39.1%	36.1%	33.9%
Difference vs. Level III	15.2%	12.1%	10.6%
Difference vs. Level IV	-0.5%	-1.5%	-1.8%
Santa Clara Valley Water District 2021			
Administrative Assistant		$ 81,673	
Difference Level III		6.6%	

Administrative Assistant is another job function where MMWD's pay scale seems high. Only the highest corresponding job title at Salary.com (Administrative Assistant IV) matched MMWD's wage level. MMWD's pay scale is also a bit higher than SCVWD.

	Low (1)	Medium (3)	High (5)
Information Systems Analyst I	$ 94,128	$ 102,696	$ 112,896
Information Systems Analyst II	$ 107,232	$ 118,932	$ 131,592
Information Systems Analyst III	$ 117,924	$ 130,836	$ 144,720
Salary.com - San Francisco	**25%**	**Median**	**75%**
Information Systems Architect I	$ 91,590	$ 100,720	$ 118,950
Information Systems Architect II	$ 114,130	$ 128,210	$ 141,970
Information Systems Architect III	$ 139,500	$ 152,530	$ 166,190
Difference Level I	2.8%	2.0%	-5.1%
Difference Level II	-6.0%	-7.2%	-7.3%
Difference Level III	-15.5%	-14.2%	-12.9%
Santa Clara Valley Water District 2021			
Information Systems Analyst II		$ 123,397	
Information Systems Analyst III		$ 131,341	
Difference Level II		-3.6%	
Difference Level III		-0.4%	

If Information Systems Analyst does correspond to Information Systems Architect at Salary.com, this position is a bit underpaid at MMWD. Notice the higher the skill set or qualifications, the more underpaid the position is at MMWD. At the Level I at the 25th percentile, MMWD pays 2.8% above market. But, at Level III at the 75th percentile, MMWD pays 12.9% below market.

On the other hand, the MMWD pay scale for Information Systems Analyst II & III seems very much in line with the SCVWD average regular pay.

	Low (1)	Medium (3)	High (5)
Business Systems Analyst I	$ 94,128	$ 102,696	$ 112,896
Business Systems Analyst II	$ 107,232	$ 118,932	$ 131,592
Business Systems Analyst III	$ 117,924	$ 130,836	$ 144,720
Salary.com - San Francisco	**25%**	**Median**	**75%**
Business Systems Analyst I	$ 71,633	$ 79,427	$ 87,945
Business Systems Analyst II	$ 89,722	$ 99,220	$ 109,731
Business Systems Analyst III	$ 113,348	$ 124,359	$ 136,973
Business Systems Analyst IV	$ 137,324	$ 150,046	$ 163,439
Difference at Level I	31.4%	29.3%	28.4%
Difference at Level II	19.5%	19.9%	19.9%
Difference at Level III	4.0%	5.2%	5.7%

This is a position where MMWD substantially overpays at the lower levels. But, as the position level rises, MMWD progressively overpays less.

	Low (1)	Medium (3)	High (5)
Junior Engineer	$ 91,068	$ 100,992	$ 111,684
Senior Engineer I	$ 131,748	$ 144,840	$ 159,480
Salary.com - San Francisco	**25%**	**Median**	**75%**
Engineer I	$ 84,349	$ 90,548	$ 99,558
Engineer II	$ 96,467	$ 104,833	$ 114,353
Engineer III	$ 117,278	$ 127,921	$ 141,946
Engineer IV	$ 145,589	$ 157,551	$ 170,700
Junior Engineer vs. Engineer I	8.0%	11.5%	12.2%
Senior Engineer I vs Engineer III	12.3%	13.2%	12.4%
Santa Clara Valley Water District 2021			
Associate Engineer - Civil		$ 142,295	
Difference vs. Senior Engineer I		1.8%	

If the Engineer job titles matching is appropriate, MMWD engineers are overpaid according to Salary.com San Francisco data. When looking at SCVWD data, if the Engineer job title matching is appropriate, MMWD engineers pay may be in line with this specific industry labor market.

	Low (1)	Medium (3)	High (5)
Accountant I	$ 80,856	$ 89,160	$ 98,316
Accountant II	$ 91,512	$ 101,616	$ 112,056
Salary.com - San Francisco	**25%**	**Median**	**75%**
Accountant I	$ 67,649	$ 74,379	$ 81,894
Accountant II	$ 78,079	$ 86,204	$ 95,380
Accountant III	$ 97,029	$ 107,255	$ 118,779
Accountant IV	$ 118,557	$ 131,376	$ 146,235
Difference at Level I	19.5%	19.9%	20.1%
Difference at Level II	17.2%	17.9%	17.5%
Santa Clara Valley Water District 2021			
Accountant I		$ 100,901	
Accountant II		$ 104,492	
Difference at Level I		-11.6%	
Difference at Level II		-2.8%	

If the levels (I and II) correspond between the two (MMWD vs. Salary.com San Francisco), then accountants at MMWD are overpaid. When comparing MMWD with SCVWD then accountants pay seem in line with the specific industry labor market.

MMWD fiscal 2023 pay scale is more often above market rather than below market. This is especially the case for some of the lower positions such as Office Assistant (about 30% overpaid) and Customer Representative (about 45% overpaid).

Pay scale MMWD Management for fiscal 2023

At MMWD website, I gathered the pay scale information for fiscal 2023 for Management positions.

		Step 1	Step 2	Step 3	Step 4	Step 5
1	Assistant Superintendent of Operations	$145,284	$152,376	$159,612	$167,304	$175,596
2	Assistant Superintendent of Water Treatr	$141,228	$148,260	$155,700	$163,464	$171,648
3	Communications & Public Affairs Manage	$163,548	$174,528	$185,460	$196,464	$207,432
4	Customer Service Manager	$134,616	$141,528	$148,332	$155,556	$162,972
5	Director of Engineering	$201,852	$211,944	$222,540	$233,676	$245,388
6	Director or Water Resources	$201,852	$211,944	$222,540	$233,676	$245,388
7	Director General Counsel	$253,200	$253,200	$253,200	$253,200	$253,200
8	Engineering Manager I	$147,924	$155,088	$162,648	$170,520	$179,088
9	Engineering Manager II	$160,788	$171,564	$182,364	$193,152	$203,988
10	Engineering Support Services Manager	$149,892	$157,812	$166,116	$174,816	$184,056
11	Finance Director/Treasurer	$201,852	$211,944	$222,540	$233,676	$245,388
12	Finance Manager	$163,548	$174,528	$185,460	$196,464	$207,432
13	Financial Management Analyst	$121,860	$127,956	$134,340	$141,072	$148,140
14	General Manager	$281,268	$281,268	$281,268	$281,268	$281,268
15	Grant Program Coordinator	$111,804	$117,708	$123,888	$130,380	$137,256
16	Human Resources Manager	$163,548	$174,528	$185,460	$196,464	$207,432
17	Information Technology Manager	$163,548	$174,528	$185,460	$196,464	$207,432
18	Natural Resources Program Manager	$125,532	$132,588	$139,392	$146,700	$153,804
19	Operations Director	$201,852	$211,944	$222,540	$233,676	$245,388
20	Principla Human Resources Analyst	$123,516	$130,452	$137,232	$144,252	$153,120
21	Safety & Emergency Response Manager	$125,532	$132,588	$139,392	$146,700	$153,804
22	Staff Attorney I	$127,908	$134,316	$141,036	$148,092	$155,484
23	Staff Attorney II	$155,928	$163,740	$171,936	$180,504	$189,540
24	Staff Attorney III	$180,780	$189,828	$199,320	$209,280	$219,732
25	Superintendent of Operations	$152,604	$159,876	$167,580	$175,848	$184,356
26	Superintendent of System Mnt & Sup. Svc	$156,432	$164,028	$171,840	$180,168	$189,012
27	Water Efficiency Manager	$148,200	$156,516	$164,640	$173,052	$181,428
28	Water Quality Laboratory Manager	$149,232	$156,324	$163,884	$171,996	$180,312
29	Water Quality Manager	$160,788	$171,564	$182,364	$193,152	$203,988

In a similar way as for the staff positions, I compared MMWD pay scale for Management with the Salary.com San Francisco data. I did that for only several of the positions.

	Low (1)	Medium (3)	High (5)
Human Resources Manager	$ 163,548	$ 185,460	$ 207,432
Salary.com - San Francisco	**25%**	**Median**	**75%**
Human Resources Director	$ 193,059	$ 218,713	$ 271,989
Difference	-15.3%	-15.2%	-23.7%

As indicated above, the senior HR Manager appears to be underpaid relative to the San Francisco labor market. This is probably partly explainable due to organization size and industry sector.

	Low (1)	Medium (3)	High (5)
Customer Service Manager	$ 134,616	$ 148,332	$ 162,972
Salary.com - San Francisco	**25%**	**Median**	**75%**
Customer Service Manager	$ 106,698	$ 119,957	$ 135,201
Difference	26.2%	23.7%	20.5%

As we saw earlier, Customer Reps are substantially overpaid. This is also true at the Manager level.

	Low (1)	Medium (3)	High (5)
Information Technology Manager	$ 163,548	$ 185,460	$ 207,432
Salary.com - San Francisco	**25%**	**Median**	**75%**
Information Technology Manager	$ 155,221	$ 172,120	$ 188,234
Information Technology Director	$ 219,221	$ 243,042	$ 271,234

This position appears to be fairly priced as it comes in between the IT Manager and IT Director at Salary.com San Francisco.

	Low (1)	Medium (3)	High (5)
Staff Attorney I	$ 127,908	$ 141,036	$ 155,484
Staff Attorney II	$ 155,928	$ 171,936	$ 189,540
Staff Attorney III	$ 180,780	$ 199,320	$ 219,732
Salary.com - San Francisco	**25%**	**Median**	**75%**
Attorney I	$ 108,466	$ 127,235	$ 147,178
Attorney II	$ 142,919	$ 167,517	$ 191,694
Attorney III	$ 183,727	$ 206,252	$ 230,014
Attorney IV	$ 202,019	$ 231,827	$ 259,011
Difference Level I	17.9%	10.8%	5.6%
Difference Level II	9.1%	2.6%	-1.1%
Difference Level III	-1.6%	-3.4%	-4.5%

Attorneys pay are not that far off from market. Notice how the Level I is overpaid, but as you move upward in Level and percentiles or range, attorneys are progressively less overpaid. And, they even end up being a bit underpaid at the higher Level III.

	Low (1)	Medium (3)	High (5)
Director General Counsel	$ 253,200	$ 253,200	$ 253,200
Salary.com - San Francisco	**25%**	**Median**	**75%**
General Counsel	$ 376,690	$ 452,090	$ 545,290
Difference	-32.8%	-44.0%	-53.6%
Santa Clara Valley Water District 2021			
Senior Assistant District Counsel		$ 282,195	
Difference		-10.3%	

The General Counsel seems grossly underpaid. This is due to organization size and industry sector considerations that are not factored within the Salary.com San Francisco data. When comparing the MMWD General Counsel pay scale with the Senior Assistant District Counsel[39] at SCVWD, the discrepancy between the two is not that great.

[39] That is the highest Counsel paying position at SCVWD disclosed at Transparent California.

	Low (1)	Medium (3)	High (5)
Finance Director/Treasurer	$ 201,852	$ 222,540	$ 245,388
Salary.com - San Francisco	**25%**	**Median**	**75%**
Treasurer	$ 229,198	$ 282,055	$ 347,056
Difference	-11.9%	-21.1%	-29.3%
Santa Clara Valley Water District 2021			
Chief Financial Officer		$ 266,569	
Difference		-16.5%	

The Treasurer position also appears underpaid. This is probably due in part to organization size and industry sector considerations that are not factored within the Salary.com San Francisco data. When compared with the CFO position at SCVWD. The MMWD Treasurer pay scale does not seem that far off line with this specific industry labor market.

	Low (1)	Medium (3)	High (5)
Finance Manager	$ 163,548	$ 185,460	$ 207,432
Salary.com - San Francisco	**25%**	**Median**	**75%**
Finance Manager	$ 141,838	$ 158,048	$ 179,053
Difference	15.3%	17.3%	15.8%

The Finance Manager position appears overpaid. Notice that at Salary.com there is a large difference in pay between Treasurer and Finance Manager (78% difference at the Medium or Median level). Meanwhile, at MMWD the respective difference between the two is a lot less at 20.0%.

	Low (1)	Medium (3)	High (5)
Financial Management Analyst	$ 121,860	$ 134,340	$ 148,140
Salary.com - San Francisco	**25%**	**Median**	**75%**
Financial Management Analyst	$ 77,096	$ 88,309	$ 100,799
Difference	58.1%	52.1%	47.0%

The Financial Management Analyst seems grossly overpaid. This may be due to difference in specific job function despite the identical job title. At MMWD, this position is a managerial level position. Meanwhile, at Salary.com it is treated as an analyst position.

Overall, at the Management level, MMWD pay scale seemed to overpay less often than at the Staff level as reviewed earlier.

MMWD vs. Northern Marin Water District (NMWD) pay scale

The two water districts are within Marin County. Comparing the two water districts controls for:

1. Specialized industry sector (water district);
2. Organization scale. Even though MMWD is larger than NMWD, both districts are of a similar size relative to the other much larger Bay Area water districts;
3. Geographical location. The two districts are contiguous and both tap into the same labor market.

Overall, we would expect the two districts to pay about the same.

I went to the NMWD website where I was able to find out their respective current pay scale. And, I extracted the data for as many positions that seemed comparable.

The colored tiering ranges from green when the MMWD pays much less than the NMWD to orange and red when it pays much more than the NMWD. Figures within the yellow range reflect when both organizations pay about the same.

North Marin Water District (NMWD)		MMWD		Difference
Field Service Rep I	$ 77,172	Customer Service Rep I	$ 62,952	-18.4%
Engineering Secretary	$ 79,740	Engineering Aide	$ 80,616	1.1%
Field Service Rep II	$ 82,584	Customer Service Rep II	$ 73,752	-10.7%
Chemist I	$ 93,312	Chemist I	$ 98,784	5.9%
Engineering Technician IV	$ 103,872	Engineering Technician	$ 91,368	-12.0%
Consumer Services Supervisor	$ 108,276	Customer Service Mg	$ 148,332	37.0%
Chemist II	$ 111,144	Chemist II	$ 113,856	2.4%
Senior Accountant	$ 113,040	Accountant II	$ 101,616	-10.1%
Junior Engineer	$ 118,548	Junior Engineer	$ 100,992	-14.8%
Assistant Civil Engineer	$ 118,548	Assistant Engineer - Civil	$ 117,084	-1.2%
Human Resource/Safety Mg.	$ 119,748	Human Resources Manager	$ 185,460	54.9%
Senior Chemist	$ 121,644	Senior Chemist	$ 123,000	1.1%
Accounting Supervisor	$ 121,728	Accounting Supervisor	$ 120,048	-1.4%
Water Conservation Coordinator	$ 135,108	Water Conservat. Specialist Supervisor	$ 126,768	-6.2%
Associate Civil Engineer	$ 139,380	Associate Engineer - Civil	$ 134,772	-3.3%
Water Quality Supervisor	$ 142,392	Water Quality Field Supervisor	$ 118,656	-16.7%
Senior Engineer	$ 153,300	Senior Engineer I	$ 144,840	-5.5%
Chief Engineer	$ 172,716	Engineering Manager II	$ 182,364	5.6%
Auditor - Controller	$ 187,212	Finance Director/Treasurer	$ 222,540	18.9%
Auditor - Controller	$ 187,212	Finance Manager	$ 185,460	-0.9%
Assist. Gen. Mg/Chief Engineer	$ 197,544	Director of Engineering	$ 222,540	12.7%
General Manager	$ 236,148	General Manager	$ 281,268	19.1%
Average	$ 132,744	Average	$ 138,049	4.0%
Median	$ 120,696	Median	$ 121,524	0.7%

The majority of the job titles fall within the yellow - light orange zone denoting there is not a very large difference in pay between the two districts. Two titles stand out. The HR Manager pay scale is much higher at MMWD (54.9% above NMWD). The Customer Service Manager is also much overpaid compared to his counterpart at NMWD (+37%).

MMWD Human Capital Cost

The table below shows the number of employees and total employee costs including Covered payroll and Cash payment to employees.

	Employees	Covered payroll	Cash payment to employees
2014	242	$ 20,899,731	$ 33,144,469
2015	235	$ 22,791,661	$ 34,706,642
2016	232	$ 23,093,818	$ 35,684,885
2017	228	$ 23,117,501	$ 37,717,364
2018	228	$ 24,500,232	$ 38,224,807
2019	229	$ 23,591,969	$ 41,002,858
2020	225	$ 23,991,638	$ 43,379,363
2021	226	$ 24,743,973	$ 45,223,949
2022	218	$ 25,147,674	$ 42,888,600

Covered payroll represents mainly wages, and Cash payment to employees captures all benefit costs. So, next let's look at the mix of wages and benefits as a % of total costs.

	Wages	Benefits	Total cost
2014	63.1%	36.9%	100%
2015	65.7%	34.3%	100%
2016	64.7%	35.3%	100%
2017	61.3%	38.7%	100%
2018	64.1%	35.9%	100%
2019	57.5%	42.5%	100%
2020	55.3%	44.7%	100%
2021	54.7%	45.3%	100%
2022	58.6%	41.4%	100%

As shown above, the benefits financial burden is very high. It is due to the CALPERS public pensions and other pension employee benefits (OPEB) reviewed in the next section.

Next, let's focus on cost per employees. This is where the $200,000 cost per employee rumor comes from. It was indeed the cost per employee from 2020 to 2022. But, it does not mean

that the MMWD employees are that overpaid[40]. They are instead over-pensioned. And, the pension and benefit costs are outside of the MMWD's control.

	Cost per employee	
	Covered payroll	Cash payments to employees
2014	$ 86,363	$ 136,961
2015	$ 96,986	$ 147,688
2016	$ 99,542	$ 153,814
2017	$ 101,393	$ 165,427
2018	$ 107,457	$ 167,653
2019	$ 103,022	$ 179,052
2020	$ 106,630	$ 192,797
2021	$ 109,487	$ 200,106
2022	$ 115,356	$ 196,737

In 2022, the total cost per employee was close to $200,000. But, the Covered payroll per employee, a proxy for wages, was far lower around $115,000. Let's take a closer look at the Covered payroll per employee of $115,356, the proxy for wages. Is it too high?

First, I adjust this figure by taking out the Management wages at the mid-level pay scale.

As shown in the table below, when doing so I get that for non-managerial staff the average estimated wage compensation is $105,659. Notice this figure is over-estimated because I deducted Management salaries using the fiscal 2023 pay scale. However, it is under-estimated because there are more Managers than the number of Manager titles. Hopefully, these two omissions cancel themselves out.

	Employee	Covered payroll	Average
Total	218	$ 25,147,674	$ 115,356
Management	29	$ 5,178,084	$ 178,555
Staff	189	$ 19,969,590	$ 105,659

How does this $105,659 compare with the San Francisco labor market?

To answer this question, I took the median salary for San Francisco at Salary.com for numerous positions as shown in the long table below.

[40] Well a few paragraphs earlier, I disclosed some data that suggests that the junior positions at MMWD could be at times much overpaid. But, the senior and higher skilled positions seem reasonably compensated.

Category Weight	Job category	Job Weight	Salary Median
11%	Chemist I	2.3%	$ 78,514
	Chemist II	2.3%	$ 99,000
	Chemist III	2.3%	$ 122,419
	Chemist IV	2.3%	$ 151,085
	Chemist V	2.3%	$ 169,293
15%	Financial Analyst I	1.9%	$ 79,014
	Financial Analyst II	1.9%	$ 95,071
	Financial Analyst III	1.9%	$ 118,002
	Financial Analyst IV	1.9%	$ 143,570
	Budget Analyst I	1.9%	$ 78,510
	Budget Analyst II	1.9%	$ 94,987
	Budget Analyst III	1.9%	$ 119,665
	Budget Analyst IV	1.9%	$ 146,951
20%	Customer Service Representative I	5.0%	$ 44,981
	Customer Service Representative III	5.0%	$ 51,144
	Customer Service Representative III	5.0%	$ 60,577
	Customer Service Representative IV	5.0%	$ 65,282
20%	Adminstrative Assistant I	5.0%	$ 54,962
	Administrative Assistant II	5.0%	$ 63,957
	Administrative Assistant III	5.0%	$ 77,640
	Administrative Assistant IV	5.0%	$ 88,381
11%	Software Engineer I	3.8%	$ 94,301
	Software Engineer II	3.8%	$ 118,519
	Software Engineer III	3.8%	$ 147,290
11%	Business Systems Analyst I	2.8%	$ 79,427
	Business Systems Analyst II	2.8%	$ 99,220
	Business Systems Analyst III	2.8%	$ 124,359
	Business Systems Analyst IV	2.8%	$ 150,046
11%	Engineer I	2.8%	$ 90,548
	Engineer II	2.8%	$ 104,833
	Engineer III	2.8%	$ 127,921
	Engineer IV	2.8%	$ 157,551
100%		100%	

The lefthand column in green assigns a % mix in 7 different job categories. The column in blue allocates the mix in % among several specific job functions within a job category. For instance, the Customer Service Rep category is assigned a 20% mix of total employees. And, it allocates this 20% equally among four different Customer Service Rep level. Thus, each level gets 5%.

A driving factor that I will sensitize is the percentage mix of junior positions. Junior positions include the Customer Service Reps and the Administrative Assistants. All other job categories receive an equal % mix allocation after deduction for the two junior positions[41].

Using the above model, I can now calculate the median salary from the Salary.com – San Francisco data relevant as a benchmark for MMWD. I also add bonus levels as a % of salary ranging from 0% to 10%. And, the resulting median salaries are shown below.

Calculated Median Salary (and bonuses) using Salary.com - San Francisco

		Bonus as % of salary				
		0%	2.5%	5.0%	7.5%	10.0%
Junior position %	40%	$ 92,301	$ 94,608	$ 96,916	$ 99,223	$ 101,531
	50%	$ 87,301	$ 89,484	$ 91,667	$ 93,849	$ 96,032
	60%	$ 82,302	$ 84,360	$ 86,417	$ 88,475	$ 90,533

As expected, the greater the mix of Junior positions the lower the overall median salary or compensation. And, the higher the bonus the higher this estimated compensation for non-managerial employees as a benchmark for MMWD.

Notice that the Average Covered Payroll of $105,659, I use in the table below, is my estimate of such a figure for non-managerial positions.

Estimated % overpaid in 2022 | Average Covered Payroll | $ 105,659

		Bonus as % of salary				
		0%	2.5%	5.0%	7.5%	10.0%
Junior position %	40%	14.5%	11.7%	9.0%	6.5%	4.1%
	50%	21.0%	18.1%	15.3%	12.6%	10.0%
	60%	28.4%	25.2%	22.3%	19.4%	16.7%

The table above indicates that, as estimated, the non-managerial MMWD staff may be overpaid. The overpayment estimates range from 4.1% to 28.4% depending on the assumptions regarding the percent of junior position and the percent bonus. As mentioned in the earlier part of this analysis, if this issue is directionally accurate, I strongly suspect that the overpayment is concentrated within the junior positions, especially the customer representatives[42].

[41] These receive an equal % mix or allocation within my model.

[42] I have often called MMWD customer representatives throughout my being a customer of the MMWD for several decades. And, the challenge of this job seems substantially lower than for cell phone companies, other utilities, etc. For one thing the customer reps have to deal with issues associated with only 6 bills a year instead of 12. And, the nature of the business is far simpler than a cell phone service (number of plans, etc.).

MMWD Wage Inflation

Let's compare MMWD wage inflation vs. a series from the BLS for employees with a college degree or higher[43].

	Covered payroll per FTE	Wages College +
2015	12.3%	3.2%
2016	2.6%	3.2%
2017	1.9%	3.7%
2018	6.0%	3.3%
2019	-4.1%	3.6%
2020	3.5%	3.8%
2021	2.7%	3.3%
2022	5.4%	4.9%
Source	MMWD	BLS

As shown above, MMWD wages (using Covered payroll per FTE as a proxy) increased a lot faster in 2015 than the BLS national time series for college-educated workers. Afterward, MMWD wage inflation seemed in line with or lower than the mentioned BLS series.

Let's see how the two different series (MMWD vs. BLS) look on an indexed basis with the year 2014 = 100.

	Covered payroll per FTE	Wages College +
2014	100.0	100.0
2015	112.3	103.2
2016	115.3	106.5
2017	117.4	110.4
2018	124.4	114.1
2019	119.3	118.2
2020	123.5	122.7
2021	126.8	126.7
2022	133.6	132.9
Source	MMWD	BLS

[43] Both time series, MMWD and BLS use June 30 as the year end for each fiscal year. I captured the relevant June data within the BLS monthly time series to construct the shown wage inflation time series.

As shown above, on an indexed basis over the fiscal 2014 to 2022 wages rose a bit faster at MMWD vs. the BLS national index. But, notice that a good deal of this growth was front-ended in 2015.

Let's redo this indexation exercise, but this time starting with 2015 as the first year (2015 = 100) instead of 2014. Now, it is apparent that wages rose at a slower pace at MMWD vs. the BLS national series over the 2015 to 2022 fiscal year period.

	Covered payroll per FTE	Wages College +
2015	100.0	100.0
2016	102.6	103.2
2017	104.5	107.0
2018	110.8	110.6
2019	106.2	114.5
2020	109.9	118.9
2021	112.9	122.8
2022	118.9	128.8
Source	MMWD	BLS

Special Section 3: Pension

Pension section introduction

The State public pension system on a nationwide basis is fiscally either stressed or unsustainable. California public pensions are no exception. Any public pension analysis that is based on mathematics readily uncovers that. However, keep in mind that MMWD has no control whatsoever over its related pension liabilities. Any unfavorable analytical findings regarding MMWD pension situations are explicitly not aimed at MMWD Management. Nevertheless, analyzing the fiscal implications of such pensions on MMWD is a critical analytical task given the material long-term fiscal implications.

California Public Employee's Pension Reform Act of 2013 (PEPRA)

Over a decade ago, the California legislature became aware that the State public pension system was fiscally unsustainable. So, they passed PEPRA effective January 1, 2013. Any California public employee hired at that date or later would receive much less generous public pension benefits. The ones hired before 2012 had the more generous pension benefits levels grandfathered.

Below I focus on the main PEPRA items that affect the MMWD.

Public employees hired before 2013 are referred to as Classic Members. The ones hired after 2012, are New Members.

	Classic Member (pre-2013)	New Member (post-2012)	Impact
Benefit rule	2.7% at 55	2.0% at 62; 2.5% at 67	Will help a lot. But, will not resolve long-term fiscal pressure.
Salary cap	?	$136,440 in 2013 dollars adjusted for inflation. About $176,800 in 2023 dollars	The salary cap will have very little impact. Few New Members have salaries that high.
Employee cost sharing	?	Employees are responsible for 50% of their pension costs	Just about no impact. The cost sharing is capped at 8.00% contribution

At MMWD, Classic Members benefit from one of the most generous benefit formulas within the public pension system. It is as high as employees working in safety-related occupations (firefighters, police persons, etc.). Just to understand what it means, a Classic Member who joined MMWD upon graduating from college, could retire at 55 and earn 92% of his salary adjusted for inflation forever.

The basic calculation of his salary replacement rate is:

55 – 21 = 34 years of service.

34 x 2.7% = 91.8% replacement rate

If this individual lives till 89, the MMWD will have pretty much fully paid this individual twice, once during his active career, and a second time during his early and long retirement. You don't need to go through the math to figure out that such pension benefit levels are unsustainable. Even the California legislature figured that out. And, that is why they came up with PEPRA.

PEPRA is not enough of a fix to put the whole system and the MMWD on a fiscally sustainable path for several reasons:

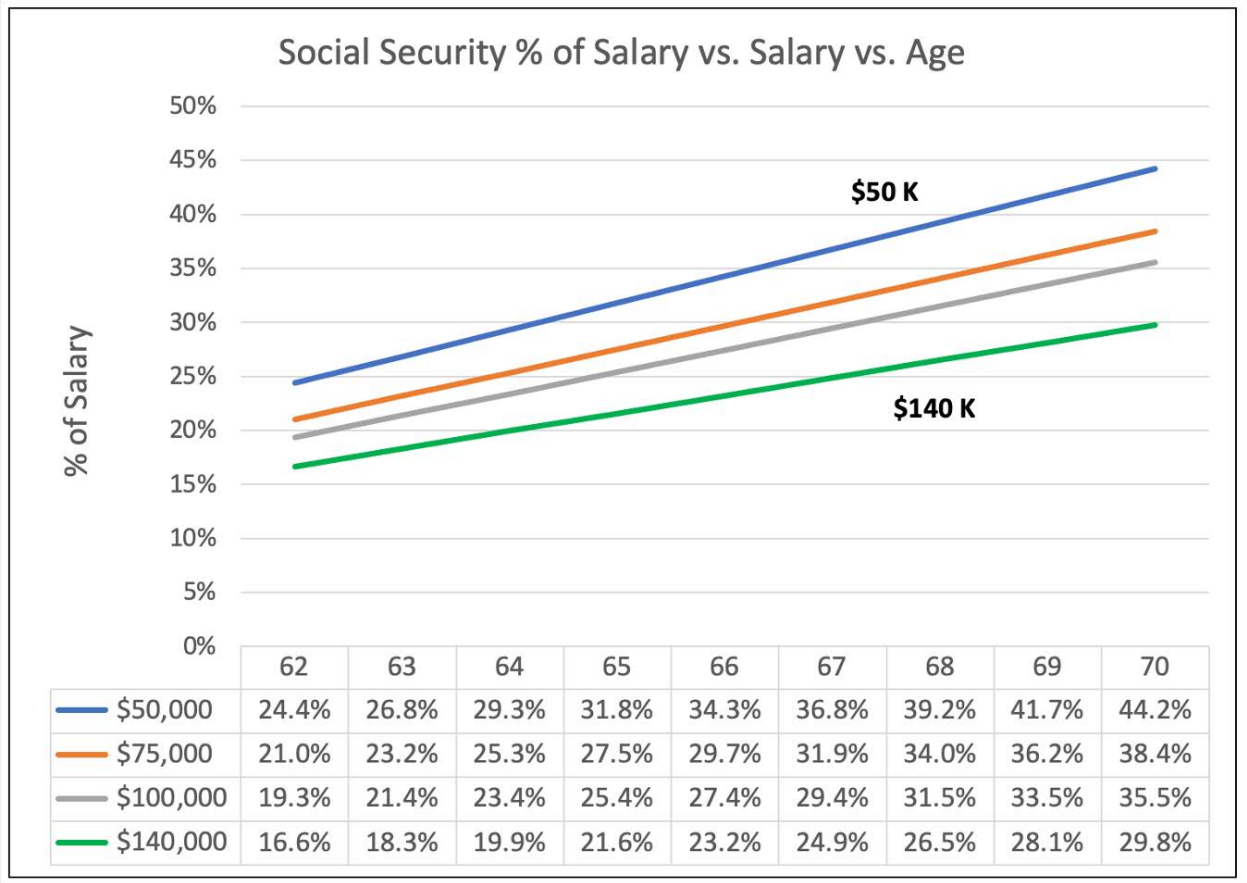
- First, it is a generational solution that will take a very long time to impart its full effect. As of today, 10 years after PEPRA was passed Classic Members still account for 60% of MMWD active employees. And, they probably account for around 90% of pensioners;

- PEPRA did not go far enough to render the system fiscally sustainable. The salary cap, and the 50% cost sharing are ineffective.

- The benefit rule is still extraordinarily generous (fiscally stressful for MMWD). 2% at 62 still means one would get 60% salary replacement after 30 years of service. 2.5% at 67 means someone would get 75% salary replacement after 30 years of service or 87.5% after 35 years of service. By comparison, the majority of employees that are covered by Social Security get a far lower salary replacement rate as disclosed within the following section.

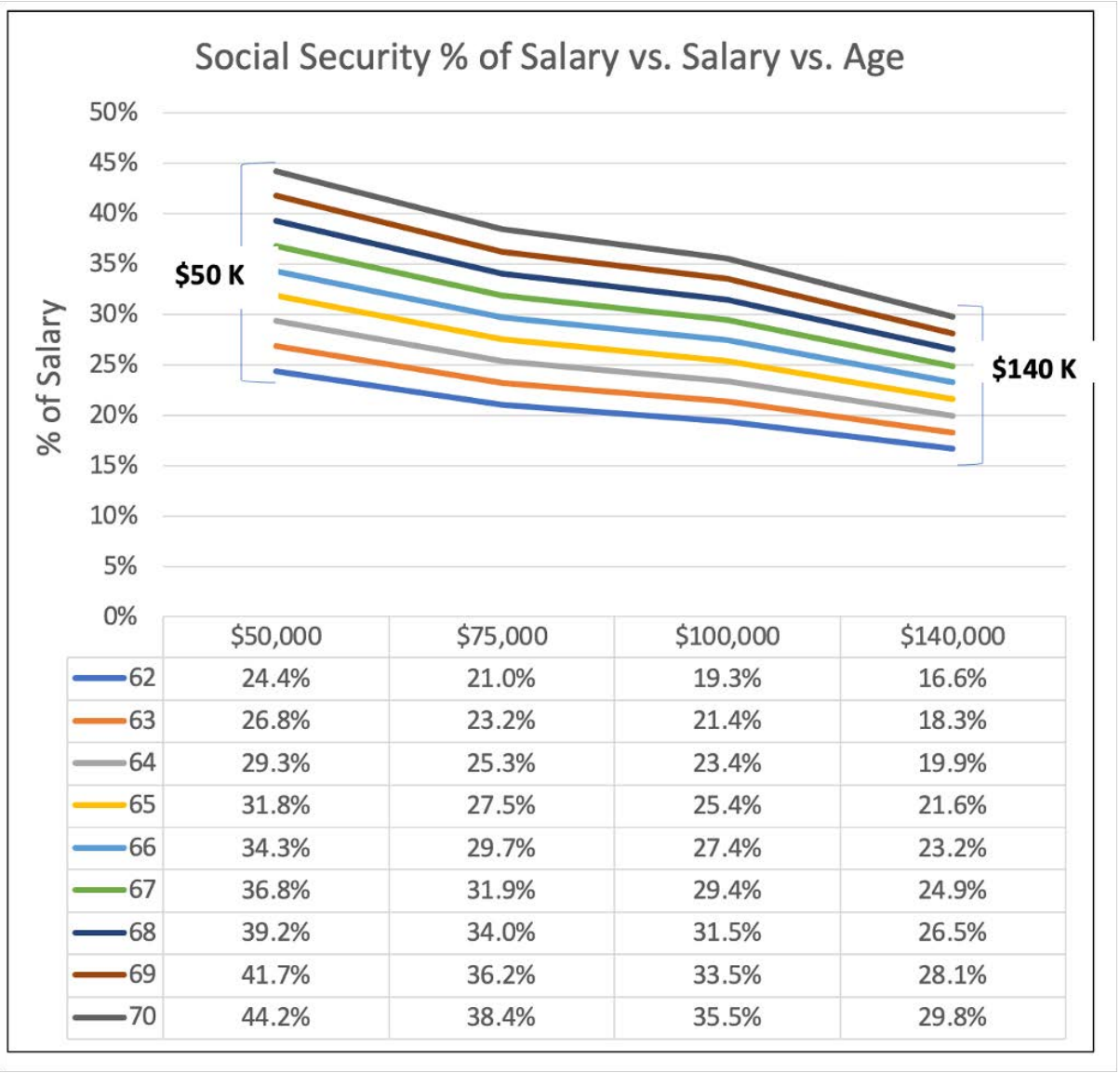
CALPERS pensions vs. Social Security salary replacement rate

As shown within the graph below, Social Security salary replacement rates are a lot lower than CALPERS pensions.



	62	63	64	65	66	67	68	69	70
$50,000	24.4%	26.8%	29.3%	31.8%	34.3%	36.8%	39.2%	41.7%	44.2%
$75,000	21.0%	23.2%	25.3%	27.5%	29.7%	31.9%	34.0%	36.2%	38.4%
$100,000	19.3%	21.4%	23.4%	25.4%	27.4%	29.4%	31.5%	33.5%	35.5%
$140,000	16.6%	18.3%	19.9%	21.6%	23.2%	24.9%	26.5%	28.1%	29.8%

See below another way to look at the same data.



	$50,000	$75,000	$100,000	$140,000
62	24.4%	21.0%	19.3%	16.6%
63	26.8%	23.2%	21.4%	18.3%
64	29.3%	25.3%	23.4%	19.9%
65	31.8%	27.5%	25.4%	21.6%
66	34.3%	29.7%	27.4%	23.2%
67	36.8%	31.9%	29.4%	24.9%
68	39.2%	34.0%	31.5%	26.5%
69	41.7%	36.2%	33.5%	28.1%
70	44.2%	38.4%	35.5%	29.8%

Within the Social Security System, a 62 year old making $100,000 would get a salary replacement rate of only 19.3%, at MMWD as a New Member, he could get 75% to 87.5% (using the mentioned examples). And, as we speak the Social Security Trust Fund running out by the mid 2030s has become again front page news.

Within the tables below see additional comparisons between the CALPERS pensions replacement rates for New Members vs. Social Security.

CALPERS. Service 30 - 35 years		
Age	Service	Replacement
62	30	60.0%
63	31	65.1%
64	32	70.4%
65	33	75.9%
66	34	81.6%
67	35	87.5%

Social Security % of Salary Replacement				
	Salary			
Age	$ 50,000	$ 75,000	$ 100,000	$ 140,000
62	24.4%	21.0%	19.3%	16.6%
63	26.8%	23.2%	21.4%	18.3%
64	29.3%	25.3%	23.4%	19.9%
65	31.8%	27.5%	25.4%	21.6%
66	34.3%	29.7%	27.4%	23.2%
67	36.8%	31.9%	29.4%	24.9%

CALPERS. Service 35 - 40 years		
Age	Service	Replacement
62	35	70.0%
63	36	75.6%
64	37	81.4%
65	38	87.4%
66	39	93.6%
67	40	100.0%

Social Security % of Salary Replacement				
	Salary			
Age	$ 50,000	$ 75,000	$ 100,000	$ 140,000
62	24.4%	21.0%	19.3%	16.6%
63	26.8%	23.2%	21.4%	18.3%
64	29.3%	25.3%	23.4%	19.9%
65	31.8%	27.5%	25.4%	21.6%
66	34.3%	29.7%	27.4%	23.2%
67	36.8%	31.9%	29.4%	24.9%

As depicted, this California public pension system is a fiscal implosion for municipalities. In essence, it transfers the equivalent of all Social Security liabilities from the Federal Government onto the public employer (MMWD). And, given their very high salary replacement rates these public pension liabilities are about 3 times the size of their respective Social Security equivalent.

The US still has a tremendous borrowing capacity to plug whatever fiscal holes social entitlements represent. By contrast, the MMWD has as we speak just about no incremental borrowing capacity to withstand this prospective and ongoing fiscal burden. The MMWD is pressed for time to raise rates just to break even.

Employees in the private sector are financially responsible for funding much of their retirement. Social Security is, as depicted, just a small component of overall retirement income. They fund their retirement by using 401Ks, IRA, Roth IRA, etc.

Meanwhile, public employees bear little responsibility for funding their retirement besides making small contributions to their plans that are in line with private employees' contributions to Social Security. Yet, public employees can avail themselves of all the same financial instruments to boost their retirement income (401Ks, IRAs).

The far thriftier Social Security system is still not deemed fiscally sustainable, and it will only go on thanks to massive prospective borrowings from the US Government. The MMWD does not have the luxury of relying on US Debt to support its pension plan liabilities.

How CALPERS and other pension plans game pension liabilities math

The higher the discount rate one uses to discount the estimated pension liabilities over time, the lower the present value of such pension liabilities.

The discount rate is equal to the pension fund investment portfolio's expected rate of return. So, the higher that estimated return is the lower the present value of pension liabilities that municipalities have to record on their books.

In theory, there is nothing wrong with the above. But here is how CALPERS games such calculations resulting in underestimating pension liabilities:

- First, they use an expected rate of return that is too high;
- Second, they use a discount rate that is higher than their expected rate of return.

This gaming does not convey the true fiscal stress imparted by pension liabilities. The pension claims from beneficiaries are not going away. And, the chronic misinforming (using discount rates that are too high) can lead to abrupt adjustments to avoid a pension fund insolvency (unable to pay pension claims).

Within my analysis, I will adjust pension liabilities using more realistic discount rates. This makes an enormous difference when figuring out CALPERS pension liabilities on MMWD's books.

CALPERS

This is the largest MMWD pension plan. Let's review its actuarial investment assumptions that determine the discount rate CALPERS uses to estimate the present value of MMWD pension liabilities. The data within this section came from Footnote 7 in the 2022 Annual Report.

CALPERS investment assumptions			
		Real return	
Asset class	Mix	Yr 1 - 10	Yr 11 +
Global equity	50%	4.80%	5.98%
Fixed Income	28%	1.00%	2.62%
Private Equity	8%	6.30%	7.23%
Real Assets	13%	3.75%	4.93%
Liquidity	1.0%	0.00%	-0.92%
	100%	3.67%	4.93%
Inflation		2.00%	2.92%
Nominal return		5.67%	7.85%
Discount rate		7.15%	7.15%
Gap		1.48%	-0.70%

CALPERS investment assumptions include an investment mix tilted towards equities (Global equity + Private Equity = 58% of total investment mix). The next columns disclose annual real return assumptions over the next 10 years and beyond the next 10 years. Notice that the beyond next 10 years assumptions appear really aggressive. Annual real returns of 6% for Global equity and a7.2% for Private Equity seem very high. The latter would entail that CALPERS doubles its investment value in real terms in just a decade[44].

Next, you add their inflation assumptions to arrive at nominal returns[45]. Then, you compare the resulting nominal returns with the CALPERS discount rate of 7.15% to discount the pension liabilities to derive the present value of such liabilities. Notice that this discount rate is 1.48 percentage points higher than the nominal return over the next 10 years.

In order to conduct sensitivity analysis of the present value of CALPERS pension liabilities on MMWD's balance sheet I focus on the 5.67% nominal return that appears far more realistic than the 7.15% one. The mentioned 5.67% nominal return aligns well with Vanguard's return expectation of a 60%/40% (Equities/Bonds) portfolio of domestic and international securities aggregated within relevant indices.

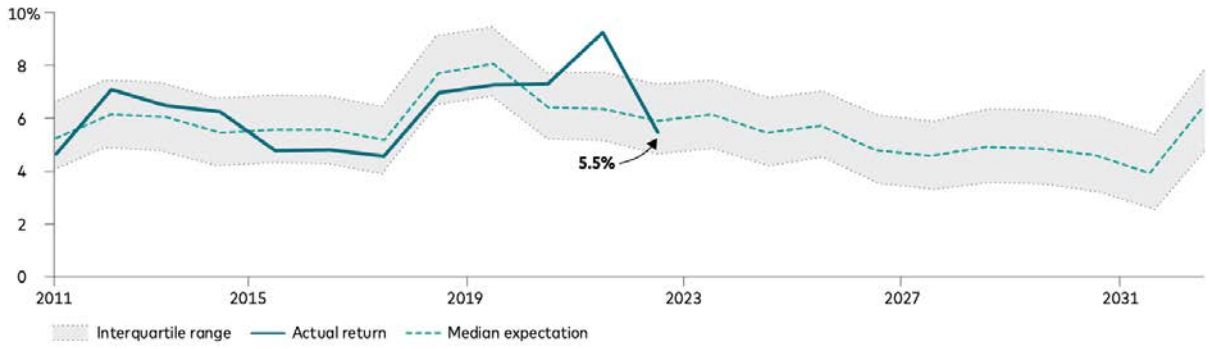
[44] You can figure that out just using the rule of 72. 72/7.2 = 10 years for an investment to double in value given a 7.2% annual return.

[45] 5.67% for the next 10 years and 7.85% for beyond 10 years.

FIGURE II-2

Returns on a 60/40 balanced portfolio are now more in line with our view from 10 years ago

10-year annualized returns



Notes: The chart shows the actual 10-year annualized return of a 60/40 stock/bond portfolio compared with the VCMM forecast for the same portfolio made 10 years earlier. For example, the 2011 data point at the beginning of the chart shows the actual return for the 10-year period 2001–2011 (solid line) compared with the 10-year return forecast made in 2001 (dotted line). After 2022, the dotted line is extended to show how our forecasts made between 2013 and 2022 (ending between 2023 and 2032) are evolving. The interquartile range represents the area between the 25th and 75th percentile of the return distribution. The portfolio is 36% U.S. stocks, 24% international stocks, 28% U.S. bonds, and 12% international bonds. See the Appendix section titled "Indexes for VCMM simulations" for further details on asset classes.

Source: Vanguard calculations, as of September 30, 2022.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of September 30, 2022. Results from the model may vary with each use and over time.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

As disclosed below, using CALPERS own discount rate of 7.15%, the present value of CALPERS pension plans on MMWD's books is $75.4 million. Within the Annual Report disclosure, it indicates that if the discount rate was reduced from 7.15% to 6.15%, the present value of the pension liabilities would increase to $109.9 million. Using the same elasticity of the change in PV subject to a 1 percentage drop in discount rate, I estimate that with a discount rate of 5.67%, the PV of CALPERS pension liabilities on MMWD's books would reach $126.4 million.

CALPERS pension liability Sensitivity Analysis

Discount rate	Pension liability
5.67%	126,449,912
6.15%	109,900,361
7.15%	75,422,129

Using CALPERS 5.67% nominal return, I estimate that CALPERS may have underestimated the related pension liabilities on MMWD's books by over $50 million ($126.4 million vs. $75.4 million). Using CALPERS own calculation (reducing their discount rate from 7.15% to 6.15%), with much certainty we can state that CALPERS has underestimated the pension liabilities by at least $35 million ($109.9 million vs. $75.4 million).

Other Post Employment Benefit (OPEB)

Besides CALPERS, MMWD have other post employment benefits. But they are much smaller. Reviewing OPEB's investment assumptions, they are more transparent and conservative than CALPERS. The overall OPEB nominal return at 5.74% is aligned with Vanguard's expected return for a fairly similar 60/40 portfolio.

OPEB investment assumptions		
Asset class	Mix	Real return
Global equity	59%	4.56%
Fixed Income	25%	0.78%
TIPS	5%	-0.08%
Commodities	3%	1.22%
REITs	8%	4.06%
	100%	3.24%
Inflation		2.50%
Nominal return		5.74%
Discount rate		6.25%
Gap		0.51%

Notice that OPEB's discount rate at 6.25% is about half a percent higher than the expected nominal return. Those two should be equal. But the mentioned difference is much lower than at CALPERS. Conducting sensitivity analysis gives us figures far smaller than at CALPERS.

OPEB liability Sensitivity Analysis	
Discount rate	Liability
5.74%	10,408,715
5.25%	13,498,852
6.25%	7,228,281

Using OPEB nominal return of 5.74% as a discount rate, I estimate that OPEB may have underestimated its related pension liabilities on MMWD's books by only about $3 million (($10.4 million vs. $7.2 million). On a relative scale that is a trivial difference vs. the $35 to $50 million observed with the CALPERs pension liabilities.

A basic pension model to understand pension math

Let's focus on one single employee and work through the funding of his benefits. The objective of the model is to uncover how much the employer contribution has to be for a pension scheme to pencil out.

For simplification, I will make one main assumption:

1) His salary is in 2023 dollars. And, over his entire active career his yearly raises and promotions will equal the inflation rate.

The above assumption facilitates the building of a very transparent pension plan.

Below are the other quantitative assumptions included in the model (cells in yellow are inputs we can change.

Assumptions	
Salary	$100,000
Years of service	20
Years in retirement	20
Per year	2.7%
% of income	54.0%
Employe contribution	7.50%
Real rate of return	3.70%

Describing the input box above…

The employee makes $100,000.
He works for 20 years.
He spends 20 years in retirement collecting his pension.
He is a Classic Member, so his benefit formula is 2.7% per years of service.
The resulting salary replacement rate is: 2.7% x 20 years = 54.0%.
His employee contribution is 7.50%. This is the actual current employee contribution that has been effective for several of the most recent years. Remember, per PEPRA this contribution can't exceed 8.00%. So, we are pretty close from maxed out on this one assumption.
The real rate of return on the pension plan portfolio is 3.70%.

Don't worry much about these specific assumptions because the resulting model will allow us to sensitize them.

The first thing to figure out is what is the present value of such a pension at the time the pension years start.

PV of pension at time pension start	
Annual	$54,000
Real rate	3.70%
Term in years	20
PV of pension	$753,765

So, you have an annuity of 20 payments of $54,000 discounted by the real rate of 3.70%. The resulting present value as shown is $753,765.

The next step is to figure out how much the employee will have contributed towards this pension.

Future value of employee contribution at time pension starts	
Employee contr. p.a.	$7,500
Real rate	3.70%
Term in years	20
FV of contribution	$216,510

So, the employee contributes 7.5% of his $100,000 salary towards his pension. That results in annual contribution of $7,500 over 20 years. Using a real rate of return of 3.70%, indicates that in 20 years, his contributions will be worth $216,510 by the time he retires.

Next, we have to figure out what is the employer contribution to make this pension scheme work.

Yearly employer contribution	
Total contribution	$537,254
Real rate	-3.70%
Term in years	20
Yearly contribution	$18,339
" as % salary	18.3%

By the time the employee retires, the employer would have to gather funds equal to:

$753,765 - $216,510 = $537,254

He would have in this case 20 years to do that. And, earning a real rate of return he could discount the required contribution stream by 3.70%. This results in a yearly contribution of $18,339 or 18.3% of salary[46].

Next, let's sensitize, the employee years in retirement and years of service to observe how the employer contribution as % of salary moves. I run the calculation twice. The first time I use the 2.7% benefit formula applicable to the Classic Members. The second time I use the 2.0% New Member benefit formula for employees who joined MMWD after 2012.

[46] Using the negative real rate of return seems a bit counterintuitive. To explain it, let's pretend the real rate is 0%. So, in this case the employer would have to contribute per year: $537,254/20 = $26,863. But, because the employer earns a real rate of return, he can discount this annual contribution stream by 3.7%.

Calculations with the 2.7% formula.

Employer annual contribution as % of salary				
Benefit form.	2.7%			
			Years in retirement	
		15	20	25
	10	18.3%	24.2%	29.1%
Years of	15	15.8%	21.1%	25.6%
service	20	13.5%	18.3%	22.3%
	25	11.4%	15.8%	19.3%
	30	9.5%	13.4%	16.6%

Calculations with the 2.0% formula.

Employer annual contribution as % of salary				
Benefit form.	2.0%			
			Years in retirement	
		15	20	25
	10	11.6%	16.0%	19.6%
Years of	15	9.8%	13.7%	17.0%
service	20	8.1%	11.7%	14.6%
	25	6.6%	9.8%	12.4%
	30	5.1%	8.0%	10.4%

Next, let's sensitize the employee years in retirement vs. the real rate of return used.

Calculations with the 2.7% formula.

Employer annual contribution as % of salary				
Benefit form.	2.7%			
			Years in retirement	
		15	20	25
	2.00%	21.0%	28.7%	35.7%
Real rate	2.25%	19.7%	27.0%	33.4%
of return	2.50%	18.6%	25.3%	31.2%
	2.75%	17.4%	23.7%	29.2%
	3.00%	16.3%	22.2%	27.2%
	3.25%	15.3%	20.8%	25.4%
	3.50%	14.3%	19.4%	23.7%
	3.75%	13.4%	18.1%	22.0%
	4.00%	12.4%	16.9%	20.5%
	4.25%	11.6%	15.7%	19.0%
	4.50%	10.7%	14.6%	17.6%

Calculations with the 2.0% formula.

Employer annual contribution as % of salary				
Benefit form.	2.0%			
			Years in retirement	
		15	20	25
	2.00%	13.6%	19.3%	24.5%
Real rate	2.25%	12.7%	18.0%	22.8%
of return	2.50%	11.8%	16.8%	21.2%
	2.75%	11.0%	15.6%	19.7%
	3.00%	10.2%	14.5%	18.2%
	3.25%	9.4%	13.4%	16.9%
	3.50%	8.7%	12.4%	15.6%
	3.75%	8.0%	11.5%	14.4%
	4.00%	7.3%	10.6%	13.3%
	4.25%	6.7%	9.7%	12.2%
	4.50%	6.1%	8.9%	11.2%

As shown above, the calculated annual employer contribution is often under 20% when using the 2.7% formula and under 15% when using the 2.0%. As depicted, this does not seem that fiscally onerous.

However, keep in mind this is only the first half of the story. The second half is the MMWD active employee population vs. the MMWD pensioners.

MMWD pensioner vs active employee multiple

The table below shows the number of active employees and pensioners at MMWD since fiscal 2015 until fiscal 2022. As shown, while the number of active employees has not risen between 2015 and 2022, the number of pensioners has increased by over 25% from 289 to 362 during that same period. Pensioner numbers has risen by a compounded annual growth rate (CAGR) of 3.3% during this period.

	Active	Pensioner	Pensioner to Active
2015	227	289	1.27
2016	238	292	1.23
2017	236	306	1.30
2018	232	314	1.35
2019	228	329	1.44
2020	228	343	1.50
2021	227	353	1.56
2022	226	362	1.60
CAGR	0%	3.3%	

Notice within the table above the far right column showing the pensioner to active employee multiple. It has risen rapidly since 2015 from 1.27 to 1.60. Let's see how this multiple would increase over time given different pensioner CAGRs.

	Pensioner/Active multiple						
		2025	2030	2035	2040	2045	2050
	1.0%	1.65	1.73	1.82	1.92	2.01	2.12
Pensioner	1.5%	1.67	1.80	1.94	2.09	2.26	2.43
growth p.a.	2.0%	1.70	1.88	2.07	2.29	2.53	2.79
or CAGR	2.5%	1.72	1.95	2.21	2.50	2.83	3.20
	3.0%	1.75	2.03	2.35	2.73	3.16	3.66
	3.3%	1.77	2.08	2.44	2.87	3.38	3.98

The colored tiering reflects a level of fiscal stress imparted on MMWD as this pensioner to active employee multiple rises and increases pension liabilities burden. Notice that none of the above scenarios are pessimistic. Indeed, the worst case scenario is that the pensioner numbers keep on growing at the current annual rate of 3.3% as they have over the 2015 to 2022 period.

Using the CAGR of 3.3%, where pensioners numbers keep on growing at the current rate, we can see that this pensioner to employee multiple would reach over…

2 times by 2030 (just 7 years away),
3 times by 2043
4 times by 2050.

Using a more optimistic assumption that the pensioner CAGR drops to 2.0% going forward, the mentioned multiple would still rise to…

2 times by 2034

2.75 times by 2050 (that is just one single generation away).

Remember our basic pension model, if a pension fund was not fully funded by the first employee, and now each employee has to support two pensioners (multiple of 2.00), MMWD contribution per active employee probably has to double.

Just revisiting this set of baseline scenarios using the 2.7% formula and a mentioned multiple of 2.00 within the table on the right.

						Pensioner/Employee mu	2.00			
Employer annual contribution as % of salary						**Employer annual contribution as % of salary**				
Benefit form.	**2.7%**					**Benefit form**	**18.3%**			
			Years in retirement						**Years in retirement**	
		15	20	25				15	20	25
	10	18.3%	24.2%	29.1%			10	36.5%	48.3%	58.2%
Years of	15	15.8%	21.1%	25.6%		**Years of**	15	31.6%	42.3%	51.2%
service	20	13.5%	18.3%	22.3%		**service**	20	27.1%	36.7%	44.7%
	25	11.4%	15.8%	19.3%			25	22.9%	31.5%	38.7%
	30	9.5%	13.4%	16.6%			30	19.0%	26.7%	33.2%

As we speak, the current multiple as of fiscal 2022 is 1.60. We also know that the vast majority of pensioners are Classic Members (2.7% formula). Let's see what that looks like.

Pensioner/Employee mu	1.60	**Benefit**	**2.7%**
Employer annual contribution as % of salary			
Benefit form	**18.3%**		
		Years in retirement	
	15	20	25
10	29.2%	38.7%	46.5%
Years of 15	25.3%	33.8%	40.9%
service 20	21.7%	29.3%	35.7%
25	18.3%	25.2%	31.0%
30	15.2%	21.4%	26.5%

As we shall soon see, the above table gives us a fairly realistic range of potential contemporary MMWD employer contributions.

Population mix Classic vs. New Members

Among active employees

Among pensioners

Among active employees, Classic Members decreased from 100% of employee counts in 2012 to 60% in 2022. Inversely, New Members under PEPRA increased from 0% in 2012 to 40% in 2022. At this current pace, Classic Members will drop to 0% and New Members under PEPRA will increase to 100% in 2037.

Among pensioners, the shift from Classic Members to New Members will be a lot slower. We estimate that Classic Members still make between 80% to 100% of the MMWD pensioner population. In 2022.

Using the low end estimate of 80%, and using the same decline of 4 percentage points a year as in the Classic Member active employee percentage, Classic Member pensioners would still represent…

over 50% of pensioners in 2029
over 30% of pensioners in 2034
20% of pensioners in 2037
0% of pensioners in 2042

Going through the same estimation but now using a figure of 100% in 2022, the attrition of such Classic Member pensioners would still represent …

over 50% of pensioners in 2034
over 30% of pensioners in 2039
20% of pensioners in 2042
0% of pensioners in 2047

The high-end estimate of Classic Member pensioners representing 100% of the pensioner population in 2022 is probably more realistic. There are probably not that many MMWD employees who joined since 2013 and retired by 2022.

MMWD employer contribution as a % of payroll

You can find the following table within the 2022 Annual Report.

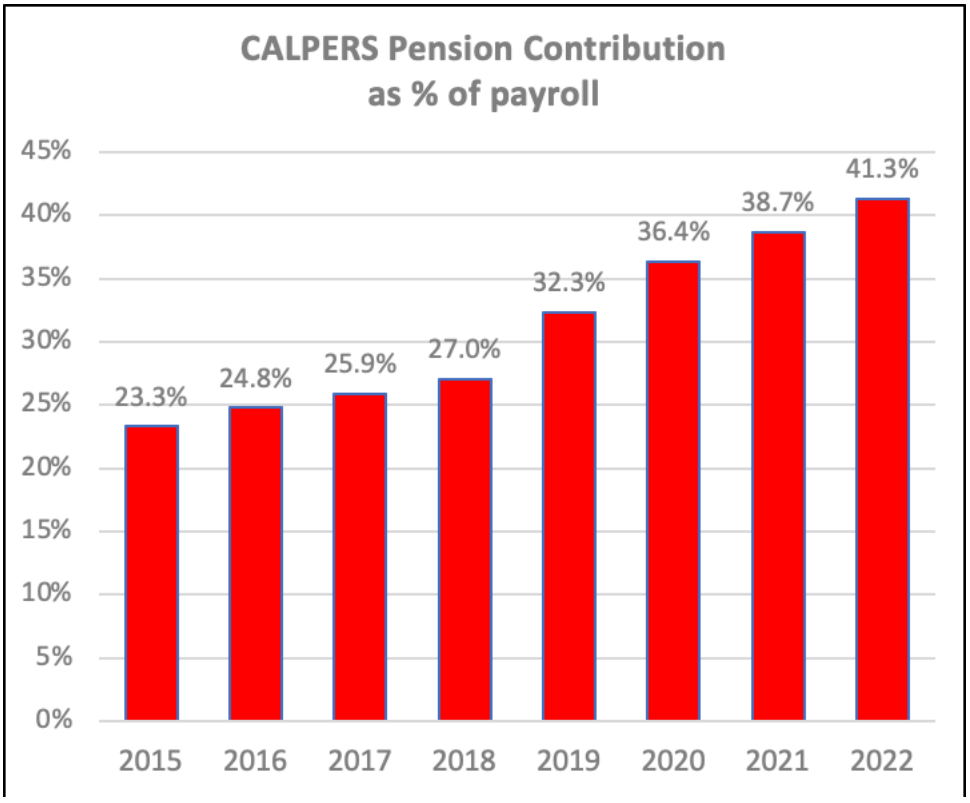
SCHEDULE OF CONTRIBUTIONS
Miscellaneous Plan - Agent Multiple-Employer Defined Pension Plan
Last 10 Years*

Fiscal Year Ended June 30	2015	2016	2017	2018	2019	2020	2021	2022
Actuarially determined contribution	$5,315,722	$5,725,637	$5,991,703	$6,623,291	$7,629,171	$8,724,104	$9,641,185	$10,385,744
Contributions in relation to the actuarially determined contributions	(5,315,722)	(5,725,637)	(5,991,703)	(6,623,291)	(7,629,171)	(8,724,104)	(9,641,185)	(10,385,744)
Contribution deficiency (excess)	$0	$0	$0	$0	$0	$0	$0	$0
Covered payroll	$22,791,661	$23,093,818	$23,117,501	$24,500,232	$23,591,969	$23,991,638	$24,743,973	$25,147,674
Contributions as a percentage of covered payroll	23.32%	24.79%	25.92%	27.03%	32.34%	36.36%	38.96%	41.30%

As shown above, MMWD pension plan contributions rose from $5.3 million or 23.3% of covered payroll in 2015 and nearly doubled to $10.4 million and 41.3% of payroll in 2022. Notice that 41.3% of payroll in 2022 falls within the high end of the range we had developed in our pension model earlier.

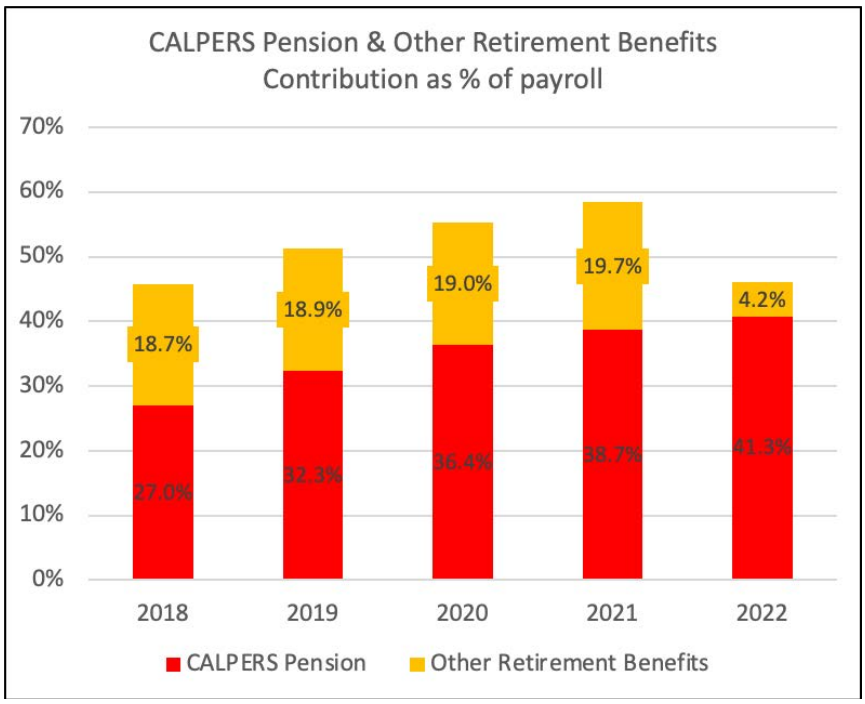
Pensioner/Employee mu		1.60	Benefit	2.7%
Employer annual contribution as % of salary				
Benefit form	**18.3%**			
			Years in retirement	
		15	20	25
	10	29.2%	38.7%	46.5%
Years of	15	25.3%	33.8%	40.9%
service	20	21.7%	29.3%	35.7%
	25	18.3%	25.2%	31.0%
	30	15.2%	21.4%	26.5%

Below I am just graphing the actual MMWD contribution in % shown within the table included in the 2022 Annual Report.



However, MMWD makes greater contributions than the one shown above when you include the MMWD contributions made to fund other pension employee benefits (OPEB). When you

include both the CALPERS pension and OPEB contribution, you get the following aggregate contributions.



Notice how the OPEB contribution level was very small in 2022 at only 4.2% of covered payroll vs. between 18% and 20% for all preceding years. We expect such improvement to be related to temporary favorable movements in the underlying valuation of the pension investment portfolio funding the OPEB.

Within the next fiscal year or two, it is most likely that the contribution to OEB will rise back again to the 18% to 20% range of covered payroll. And, at such time aggregated contributions will most likely rise over 60% of covered payroll. They had already reached 58.4% during fiscal 2021.

Keep in mind that based on my more realistic market rate of return assumptions, the CALPERS pension liabilities were grossly underestimated (by about $50 million). Combining that with an ever rising pensioner to employee multiple that will put upward pressure on the mentioned contributions as a % of payroll, and you have the making of an ongoing fiscal crisis.

MMWD ongoing financial stress due to pension

The mentioned pension contributions will soon reach 60% of payroll. And, they will likely keep on rising.

CALPERS pension plans contributions have risen from 23.3% of payroll in 2015 to 41.3% in 2022. That is an increase of 18 percentage points in just 7 years.

If they increase at the same pace, they would reach 100% of payroll in 23 years (one single generation). If they keep rising at half the historical rate, they would reach 100% of payroll in 46 years (two generations).

If we add the near 20% of payroll earmarked for OPEB, and rerun the same scenarios to figure when pension contributions would reach 100% of payroll (keeping OPEB constant at 20%), we get that overall pension related contributions would reach 100% of payroll within only 15 years. If CALPERs pension contributions would increase at half the speed of historical rate, overall contributions would reach 100% within 30 years.

As a reminder, pension liabilities are not under the control of the MMWD.