Demand Variation Adjustment Mechanism Review

Report for the Essential Services Commission of South Australia — Final Report

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Contents

Summary

Background

The Essential Services Commission of South Australia (Commission) makes pricing determinations for retail drinking water and sewerage services provided by SA Water. The determinations set a maximum revenue (cap) that SA Water can recover through prices, which it sets in conjunction with its owner, the South Australian Government. The South Australian Treasurer's Pricing Orders have required that the determinations

> must include a mechanism which allows for the adjustment of the total revenue which may be derived where the Commission determines there to be a relevant and material variation between forecast and actual rates of water consumption or sewerage connections. The adjustment mechanism must operate on the basis of efficient costs associated with variations in demand, and so as to promote a stable price path for retail services.

The SA Water Regulatory Determination 2020 (SAWRD20) and the prior 2016 determination (SAWRD16) include a drinking water retail sales adjustment mechanism and sewerage retail services mechanism. These estimate a variation in revenue (adjusted for the time value of money), and:

- if a materiality threshold is exceeded (currently 1 per cent of the relevant revenue), then
- 50 per cent of the variation in revenue is returned (for over recovery; or recovered for under recovery) in the subsequent regulatory period.

The current (SAWRD20) mechanisms largely have the effect of adjusting for material variation in average prices, rather than – as specified in the Pricing Order – for material variation in 'water consumption or sewerage connections'. They capture demand variation to the extent that it affects average prices. In this regard, the SAWRD16 mechanisms are more closely aligned with the Pricing Order. Another issue (of lesser significance) is that neither the current nor the 2016 mechanisms account for variations in efficient costs associated with variations in demand.

The variation in drinking water sales can be significant and in SAWRD20 the 2016 mechanism was applied resulting in $18.8 million being deducted from the revenue cap. In contrast, sewerage connections are highly predictable, and it appears unlikely that any variation in the future will be material.

Options for the next determination

Demand variation adjustment mechanisms are common for regulated utilities. They invariably accompany revenue cap regulation (to address the risk of the utility breaching the cap) and frequently accompany price cap regulation.

In designing a mechanism there are several design choices.

The key design issue is how much of the revenue variation due to demand variation is passed through to customers. At one extreme, a pure 'unders and overs' mechanism applies whereby all revenue variation is passed through to customers. At the other extreme the utility bears all the revenue variation risk. This issue can be assessed in terms of costs and benefits, many of which arise when (as

is the case with SA Water) the utility makes a margin on sales (i.e. when prices exceed the costs incurred).

The benefits of passing the revenue variation through to customers include:

- reducing the costs to the utility of cash flow volatility caused by demand variation
- reducing the utility's incentives to under-forecast demand (which leads to higher prices at the beginning of the period) and undertake other activities mid-period to maximise revenue
- providing some risk–management benefits to customers – by returning higher-than-expected expenditure in one regulatory period (e.g. due to lower than expected rainfall) to customers in the subsequent regulatory period.

The costs of passing the revenue variation through to customers include:

- contributing to price volatility between regulatory periods, which can be exacerbated by how the adjustments are implemented in the subsequent period
- reducing the utility's incentives for accurate forecasting and business development (e.g. by providing services to new commercial customers); however, these issues might be separately addressed if considered material.

In summary, it would be preferable to increase the variation in revenue passed to customers if the impact on price volatility is not considered significant. [1] This can be achieved by removing the materiality threshold (which provides little benefit) and increasing the pass-through percentage. Arguably a 100 per cent 'unders and overs' mechanism might apply, whereby all the variation is passed through to customers.

Another key design issue relates to how the variation in revenue is calculated. In this regard, it is preferable that the calculation is made net of variable costs and that it accounts for variation in demand by pricing tier to ensure that all the effects of demand variation are captured. I also recommend excluding revenue variation due to demand restrictions, as it is more efficient that the revenue be recovered through contemporary price changes to encourage water conservation.

Mechanisms can also vary in how the adjustment is implemented, including when the adjustment is made and how it is modified in subsequent period prices; however, there does not appear any reason to change the current settings.

[1] For the SAWRD16 period, the variation between forecast and actual water sales (in present value terms) – and thus the potential variation on prices – was around 1.5 per cent. Sewerage connections can be forecast with high accuracy and accordingly any adjustment should be very small.

1 Introduction

As part of the SA Water Regulatory Determination 2020 (SAWRD20),[2] the Essential Services Commission of South Australia (Commission) sets a four-year revenue value for SA Water that is subject to demand variation adjustment mechanisms for the retail sales of drinking water and sewerage services. These mechanisms aim to adjust revenue values in the subsequent regulatory period, to account for any material differences between forecast and actual demand during the current period. This process aims to share demand risk between SA Water and its customers. The mechanisms are included in the regulatory determination to be consistent with requirements set out in the South Australian Treasurer's Pricing Order.

The demand adjustment mechanism takes the form of a formula to be exercised at the end of the period. If a material difference in revenue is calculated due to demand variation, then half of that difference is incorporated in the revenue caps to apply in the next period. A demand adjustment mechanism was included in both SAWRD20 and the previous determination (SA Water Regulatory Determination 2016, SAWRD16).

This project aims to review the current mechanisms and make recommendations for mechanisms for the next determination. The project scope and how these elements are addressed in the report is provided in Table 1.

The rest of this report is structured as follows.

- Section 2 provides a background.
- Section 3 examines the current and prior demand variation adjustment mechanisms.
- Section 4 considers and assesses the design options of the demand variation adjustment mechanism. This includes a consideration of mechanisms applied elsewhere.
- Section 5 concludes.

[2] Essential Services Commission of South Australia (2020a).

Table 1: Project scope and how addressed in the repot

Requirement.	Section
The report is to:	
• note from a legal standpoint why the mechanism is in place	3.1
• outline how the current demand adjustment mechanism operates	3.1 and 3.2
• explain the advantages and limitations of the current mechanism	3.1 and 3.2
• compare the current mechanism to the previous one (in SAWRD16)	3.1.2 (Water) 3.2.2 (Sewerage)
• summarise how other regulatory jurisdictions tend to handle demand risk	3.3 and Appendix B
• make recommendations on potential approaches to treat demand risk for SAWRD24 to meet requirements under the Pricing Order (which could include current or alternative mechanisms).	5 (summary)
The report should include:	
• a discussion of who bears risk under the current mechanism and to what extent and why	3.1 and 3.2
• an explanation for why the sharing of risk between SA Water and its customers may (or may not) be equal depending on certain circumstances	4.2
• a comparison of empirical differences between how the current and previous mechanisms operate (including sensitivity analysis that demonstrates the potential impact from various outcomes).	3.1.2 (Water) 3.2.2 (Sewerage) Appendix A
The report:	
• must set out the Consultant's assessment and recommendation	5
• …with a clear description of the evidence used for reaching conclusions	4
• should discuss any limitations in the Consultant's analysis and findings	Embedded in each section.

2 Background

2.1 The economic regulation of SA Water

The South Australian Water Corporation (SA Water) is a statutory corporation operating as a business enterprise 'with the principal responsibility of providing water and sewerage services for the benefit of the people and economy of the State'.[3] It is a monopoly provider of retail drinking water and sewerage services to the majority (about 95 percent) of the South Australian population.

The Commission regulates the retail services provided by SA Water. Its overall approach to regulating SA Water aims to protect the long-term interests of South Australian consumers with respect to the price, quality and reliability of services. The Commission's regulatory approach involves setting a price determination for a four-year regulatory period. SAWRD20 covers the period 1 July 2020 – 30 June 2024. This report also considers the prior determination (SAWRD16), which covered the period 1 July 2016 – 30 June 2020. Key extracts from the determinations relevant to this project are provided in Appendix C.

The Commission requires SA Water to set prices to ensure the revenue recovered during the regulatory period does not exceed revenue caps that are specified for drinking water retail services and sewerage retail services.[4] However, the determination allows SA Water to recover additional revenue where actual demand exceeds forecast demand via demand variation adjustment mechanisms for the two services.

2.2 The requirement for a demand variation adjustment mechanism

The demand variation adjustment mechanisms are developed to comply with the 2020 Pricing Order[5] issued by the Treasurer, which specifies that (para. 5.5):[6]

> The determination must include a mechanism which allows for the adjustment of the total revenue which may be derived where the Commission determines there to be a relevant and material variation between forecast and actual rates of water consumption or sewerage connections. The adjustment mechanism must operate on the basis of efficient

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3 *South Australian Water Corporation Act 1994*.

4 In SAWRD20, the revenue caps (expressed as a present value at 1 July 2020, in dollars of December 2018) are $2,541.2 million for DWRS and $1,215.0 million for SRS.

5 *Water Industry Act 2012* (Section 35) Pricing Order for the Regulatory Period 1 July 2020 - 30 June 2024. Available at https://www.treasury.sa.gov.au/economy,-taxes-and-rebates/economic-regulation.

6 The Pricing Order also includes other revenue adjustment mechanisms. Clause 5.6 states "[t]he determination must include a mechanism which allows for the adjustment of the total revenue which may be derived where the Commission determines appropriate as a result of the occurrence of an event beyond the control of SA Water which has or will have a material impact on the cost of provision of a drinking water retail service or a sewerage retail service during the regulatory period. The adjustment mechanism must operate on the basis of efficient costs attributable to the event, and so as to promote a stable price path for retail services."

costs associated with variations in demand, and so as to promote a stable price path for retail services.

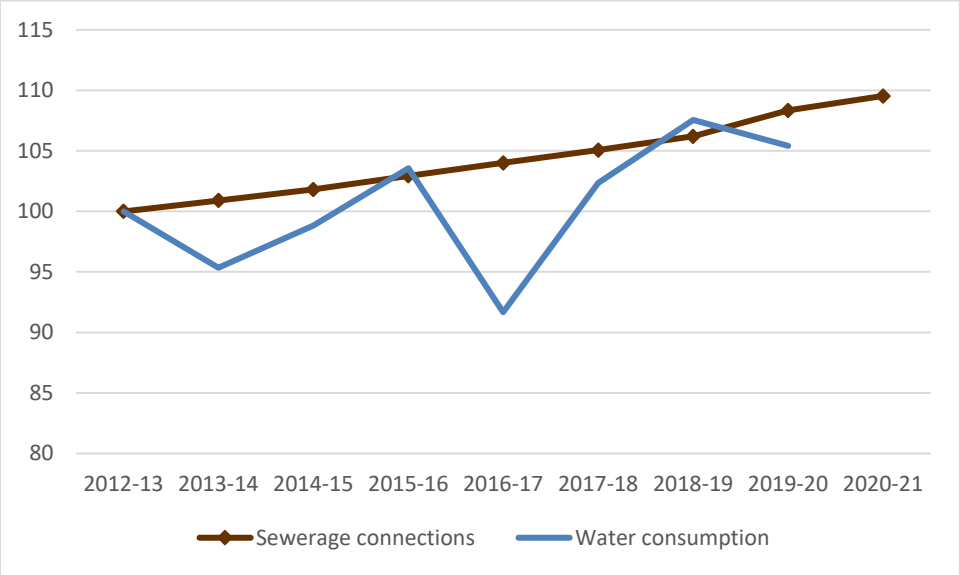
An identical set of requirements for a demand variation adjustment mechanism were specified in the 2016 Pricing Order for SAWRD16.

2.3 The demand for, and pricing of, SA Water's retail drinking water and sewerage services

The historic variation in water consumption and sewerage connections is show in Figure 1 below. Annual water consumption (water sales) can vary significantly, which consequently results in significant variation in the drinking water retail sales revenue.

In contrast, the number of sewerage connections is highly predictable. The annual growth in connections has been a consistent 1.1 per cent per year since 2015–16, excluding 2019–20 due to a one-off change. *Prima facie*, this lack of variation raises the question as to whether a demand variation mechanism is required for sewerage connections.

Figure 1: Changes in the water consumption and sewerage connections (indexed to 2012–13)



Source: Sapere analysis of SA Water data.
Note: Water consumption is based on water sales. The growth in sewerage connections in 2019-20 was abnormally high due to a one-off change related to the subdivision process.

A summary of current pricing is provided in Table 2 below. The prices are set by SA Water in conjunction with its owner, the South Australian Government. The pricing of SA Water's retail drinking water services is an important consideration for this report. Of most significance is that SA Water applies an inclining block tariff structure for residential water usage whereby prices increase once a customer's usage passes different tier thresholds. A key implication is that demand variation affects the average price, which also contributes to the revenue variation.

Table 2: Key SA Water prices from 1 July 2022

	Residential	Commercial & Non-residential
Drinking water retail services		
Fixed water ($ per quarter)	$68.6	$68.6
Usage charge per kL		$2.806 (no tiers apply)
Tier 1 (First 0.3836kL)	$1.966	
Tier 2 (0.3836 to 1.4247 kL)	$2.806	
Tier 3 (Over 1.4247kL)	$3.04	
Sewerage retail services		
Metro (per $1000 of property value)	$0.20225	$0.2685
Country (per $1000 of property value)	$0.30275	$0.41575
Minimum fixed	$73.5	$73.5

Notes: There are exceptions and additions to the above. These include:

- For commercial customers, a charge per $1000 of property value greater than $10 million
- Several community concessions, including on water usage rates and sewerage connections
- Special rates for other customer types including car parks
- Other miscellaneous fees and charges (see SA Water 2021).

Source: SA Water Pricing Schedule Rates and Sales 2021-22 1 July 2021, available at https://www.sawater.com.au/my-account/water-and-sewerage-prices/water-prices.

3 The revenue adjustment mechanisms

3.1 The drinking water retail services (DWRS) adjustment mechanism

3.1.1 The current (SAWRD20) DWRS mechanism

The current demand adjustment mechanism for drinking water retail services (DWRS) revenue[7] involves calculation of an adjustment amount. This amount is subtracted from the maximum DWRS revenue determined for the subsequent price determination, thereby affecting the prices and customer bills charged in the subsequent regulatory period.

The formula for the adjustment amount (see Box 1 below) is based on the difference between actual DWRS sales revenue and a notional DWRS sales revenue (hereafter the demand variation revenue). The adjustment amount is 50 per cent of the difference if the difference is at least 1 per cent of the notional revenue and zero otherwise. For example, if actual revenue exceeds notional revenue (i.e. SA Water over-recovers) by $30 million and this amount is more than 1 per cent of the notional revenue, then $15 million will be subtracted from the maximum DWRS revenue in the next regulatory determination. Similarly, if the difference is negative $30 million, then $15 million would be added to maximum DWRS revenue in the next determination.

Box 1: The formula for DWRS revenue adjustment amount in SAWRD20

The DWRS revenue adjustment amount (RA_D) is described in SAWRD20 by the following formula

$RA_D = 0.5 \times (A_D - N_D)$ if $|A_D/N_D - 1| \geq 1\%$ (otherwise zero)[8] , where

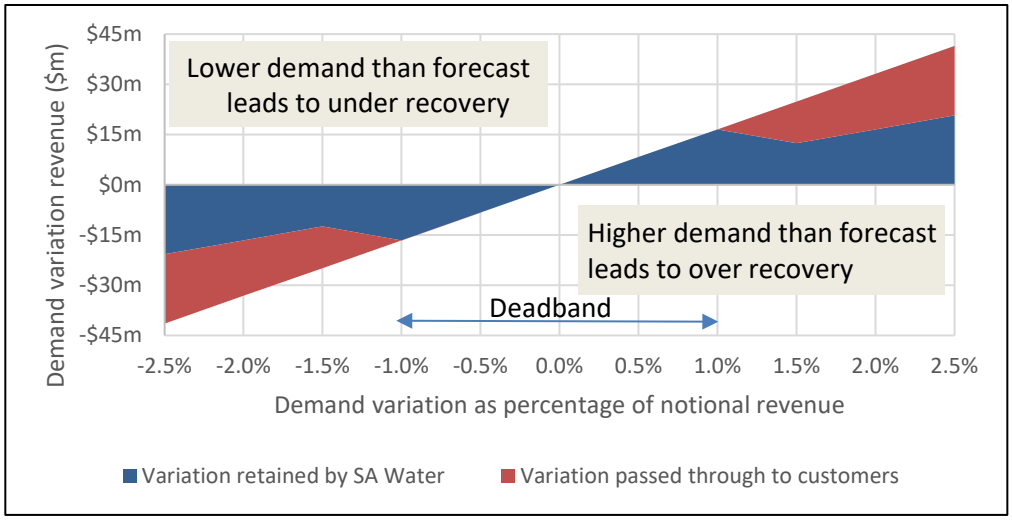
- A_D is the actual DWRS sales (i.e. usage) revenue
- N_D is the notional DWRS sales revenue received if forecast prices were applied to actual demand.

The sharing of the variation revenue and how this varies as a percentage of the notional revenue is shown in Figure 2 below. Due to the 1 per cent materiality threshold, there is deadband (between -1% and 1%) in which SA Water retains all the demand variation in revenue. For larger variations, SA Water shares the revenue variation with customers. Due to the deadband, the amount of revenue variation retained by SA Water is less when the variation is between 1 and 2 per cent of notional revenue than when it is just below 1 per cent of notional revenue.

[7] The mechanism is described in clause 2.4 in the SAWRD20 Price Determination.

[8] Expressed as a present value as of 1 July 2020, in dollars of December 2018 for the regulatory period.

Figure 2: Example of how the variation in revenue is shared between SA Water and customers



The revenue amounts are calculated in real[9] present value terms (applying discount rates that are specified set out in the determination). The term sales revenue is explained in the Commission's 'Final Determination: Statement of reasons' (p. 50) as referring to usage revenue.[10] Consequently, the DWRS demand adjustment is independent of other DWRS revenue,[11] notably fixed charges which are around one-third of DWRS revenue.

Due to how notional revenue is defined in SAWRD20,[12] the revenue variation is, in effect, largely a measure of revenue variation due to price rather than due to demand. In SAWRD20, the variation in revenue is calculated as the difference between:

- actual revenue – based on actual demand and actual prices, and
- notional revenue – based on actual demand and forecast prices.

As actual and notional revenue are based on actual demand volume, any adjustment relies on a variation between actual and forecast usage prices.

9 The SAWRD20 Price Determination (clause 2.3.2) states that "… the Commission will deflate actual drinking water retail services revenues in each regulatory year to revenues in dollars of December 2018 using the change in March to March Consumer Price Index, All Groups Index Number (weighted average of eight capital cities) published by the Australian Bureau of Statistics for each relevant year, as a proxy for the December to December change in Consumer Price Index for that year."

10 Essential Services Commission of South Australia (2020b).

11 The SAWRD20 Price Determination defines drinking water retail services as 'retail services constituted by the sale and supply of water of a quality fit for human consumption' that are not 'excluded retail services', which are standard and non-standard connection services (including developer services), trade waste services, non-domestic hauled waste services, easement extinguishment and encumbrance services, hydrant and fire plug services, meter services, or network analysis and audit services.

12 Clause 2.4.2 (ii) (ii) of the SAWRD20 Price Determination defines the notional DWRS sales revenue as "that would have been received during the regulatory period if forecast [DWRS] sales prices applied … were applied to actual [DWRS] demand".

Nevertheless, the current mechanism, picks up some variation in demand due to how 'prices' are measured. Although SA Water's has an inclining block tariff structure for water usage prices,[13] an average water usage price has been used in applying the mechanism.[14] Due to the inclining block tariff structure, a variation in demand will typically cause a variation in the average usage price. Because the variation in water consumed is greater[15] in the higher tiers than in the lower tiers (e.g. due to variation in weather and watering needs), an increase in demand will typically lead to an increase in the usage price and contribute to the increase in the usage revenue.[16] How this variation impacts the average price is illustrated in Box 2 below.

Box 2: The impact of demand variation in average prices

The table below provides an example of how demand variation affects prices and total revenues, when there is an inclining block tariff. The table shows the different prices and volumes by pricing tier for a single year. In the hypothetical example, actual demand falls in the higher tiers (by 40% for tier 3 and 10% in tier 2) due to increased rainfall that reduces demand by larger users. In total usage is 6.2 per cent less than forecast. However, the impact on revenue is more significant (-7.3% less). Although no prices have changed, the average price is 1.3 per cent lower than forecast.

	Price per kL	**Volume GL**			**Revenue $m**		
		Forecast	Actual	% change	Forecast	Actual	% change
Tier 1	$1.85	80	80	0%	148.0	148.0	0%
Tier 2	$2.64	101	90.9	-10%	266.6	240.0	-10%
Tier 3	$2.86	5	3	-40%	14.3	8.6	-40%
Other	$1.54	8	8	0%	12.3	12.3	0%
Concessions				0%	-8.0	-8.0	0%
Total		**194**	**181.9**	**-6.2%**	**433.3**	**400.9**	**-7.3%**
Average price per kL					$2.23	$ 2.20	-1.3%

Of note, SAWRD20 states that the notional revenue is the revenue received if '[forecast prices] were applied to [actual] demand as specified in the Forecast Schedule in Part 5 of this determination.' However, Part 5 only refers to forecast demand and does not refer to forecast prices or actual demand. This wording may reflect that forecast demand is required to determine forecast (average)

[13] Whereby the price varies by tier. See Table 2 on page 5.

[14] As described in section 3.1.2.1, the average usage price was used when applying the similar SAWRD16 mechanism.

[15] Evidence for this is shown in Figure 3 on page 26.

[16] The inclusion of this revenue variation is consistent with the Commission's SAWRD20 statement of reasons (page 50) which emphasises that variation in sales revenue is excluded when "…SA Water changes the balance between fixed and variable drinking water prices…" on the basis that "…it was not caused by a variation in demand".

prices, but it may reflect that it was *intended* that notional revenue was based on forecast prices and *forecast* demand.

An empirical example of the application of the SAWRD20 mechanism is provided in Appendix A. The example is useful for illustrating the sharing of revenue variation due to demand variation under the current mechanism.

3.1.2 The SAWRD16 DWRS mechanism

The DWRS demand adjustment mechanism for SAWRD16 is summarised in Box 3 below. An empirical example of its application and comparison with the SAWRD20 mechanism is provided in Appendix A. The 2016 mechanism is like the current mechanism; but there are some important differences.

First, the notional DWRS revenue (N_D) is calculated based on the actual prices applied to forecast demand (as opposed to forecast prices applied to actual demand). Accordingly, the SAWRD16 mechanism is based on revenue variation due to variation in demand (as opposed to variation in price, as in SAWRD20). Of note, as in SAWRD20, the mechanism is based on average demand (across pricing tiers), and thus does not directly adjust for variation in the average price caused by variation in demand by pricing tier.

Second, the demand adjustment mechanism is based on the variation in the total DWRS revenue – an amount that includes sales and non-sales (i.e. non-usage) revenue.[17] This affects the materiality test (i.e. whether actual revenue varies from notional revenue by more than 1 per cent) and consequently the size of the deadband. As DWRS total revenue is greater than DWRS usage revenue, the deadband (as percentage of usage revenue) is larger in the 2016 mechanism than in the 2020 mechanism.[18] Of note, this does not affect the calculation of the adjustments outside of the deadband, as both the notional value and the actual value include the *actual* non-sales revenue.

Third, the demand adjustment mechanism is bundled with an additional adjustment (R_D) that arises if actual DWRS revenue would have exceeded the maximum DWRS revenue if not for the demand (usage volume) variation. This additional adjustment involves a return of 100 per cent of any positive variation in revenue not captured by the demand variation adjustment formula. This includes any additional revenue from an increase in the average price due to a variation in demand.

As a result of these differences, the 2016 mechanism will capture more of the variation in revenue due to demand variation than the current mechanism. This is because the current mechanism only captures variation in demand due to variation in price (which stems from a variation in demand on the inclining block tariff). This is illustrated in the empirical example that is provided in Appendix A.

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[17] The move in SAWRD20 toward the use of sales (usage) revenue, rather than including non-usage revenue, was explained in the Commission's SAWRD20 statement of reasons (p. 50). It stated that it accepted SA Water's proposal for the mechanism to apply only to usage revenues, as this approach was considered to be more consistent with the the requirements of the Pricing Order, which requires the mechanism to address any '… material variation between forecast and actual rates of *consumption*' [emphasis added].

[18] DWRS usage is around two-thirds of total DWRS revenue.

Box 3: Formulaic representation of the SAWRD16 DWRS revenue adjustment mechanism

The DWRS revenue adjustment amount (RA_D) is described in SAWRD16 by the following formula[19]

$$RA_D = V_D + R_D,$$

Where

- $V_D = 0.5*(A_D – N_D)$ if $|A_D/N_D -1| \geq 1\%$ (otherwise zero)
- R_D = maximum of ($N_D – M_D$) and zero
- A_D is the actual DWRS revenue received during the regulatory period
- N_D is the notional DWRS revenue received if actual prices were applied to forecast demand
- R_D is the revenue adjustment that arises if actual DWRS revenue exceeds the maximum revenue other than as a result of a demand variation
- M_D is the maximum DWRS revenue as specified in the determination.

Of note, it ($N_D – M_D$) can be expressed as:

- $A_D – M_D$ (the difference between actual and maximum DWRS revenue), *less*
- $A_D – N_D$ (the variation attributable to changes in demand)

3.1.2.1 Implementation of the SAWRD16 Demand revenue adjustment

The 2016 mechanism was applied in determining a revenue adjustment for inclusion in the revenue cap set out in SAWRD20. Table 3 below shows the calculations incorporated in SA Water's drinking water retail services revenue adjustment statement.

The calculation differs to the SAWRD16 Price Determination formula in terms of the treatment of costs. As shown in the table, the adjustment is based on the 'Variance attributable to demand net of costs'. These costs are recorded in the spreadsheet as the 'Total additional costs incurred due to variance in demand ($M)' and are calculated to be $2.2 million. However, this adjustment for costs is not consistent with the revenue adjustment mechanism as described in the SAWRD16 Price Determination. The implication is that SA Water's revenue allowance in the 2020–24 period is overstated by $1.1 million. While this adjustment for costs was not in line with the mechanism described in the SAWRD16 Price Determination, it is aligned with wording in the Pricing Order.[20] This is discussed in section 4.4.1.

Also, the formula contained in the revenue adjustment statement that tests the materiality of the variance uses 4-year revenue cap (M_D) as a denominator rather than the notional revenue (N_D) in accordance with SAWRD16.

[19] It is described in the SAWRD16 Price Determination (clause 2.3).

[20] The 2016 Pricing Order stated that "…[t]he adjustment mechanism must operate on the basis of efficient costs associated with variations in demand, and so as to promote a stable price at for retail services".

Table 3: SAWRD16 DWRS Demand revenue adjustment statement

Item	Amount	Note
4-year revenue cap	$2,841.3m	M_D
Total regulated revenue [Actual DWRS revenue]	$2,851.1m	A_D
Regulated revenue - adjusted for demand [Notional Revenue]	$2,811.3m	N_D
Variance attributable to demand	$39.8 m	A_D - N_D
Total additional costs incurred due to variance in demand	$2.2m	Costs (C)
Variance attributable to demand net of costs	$37.6m	A_D - N_D – C
Adjustment in RD20 for demand	-$18.8m	$-V_D = (A_D – N_D – C)/2$

Source: Unless stated values are measured as a present value at 1 July 16 in real $ Dec 2014. Text and values copied from the workbook "Revenue compliance for RD16 - updated for Dec2020 billings" (tab: "Water Live").

3.2 The sewerage retail services (SRS) adjustment mechanism

3.2.1 The current (SAWRD20) SRS mechanism

The current demand variation adjustment mechanism for sewerage retail services (SRS) revenue is described in clause 2.8 in SAWRD20 and summarised in Box 4 below.

As with the drinking water, the adjustment is based on the difference between actual revenue and a notional revenue based on actual demand and forecast prices.[21] If the difference is greater than 1 per cent of the notional revenue, then 50 per cent of the difference will be deducted from the subsequent revenue adjustment amount. The notional SRS revenue is revenue that would have been received if forecast SRS prices were applied to actual SRS connections.[22]

There is no definition of what is meant by SRS 'prices'. SRS charges are primarily based on rate per $1000 of property value, which varies by location (metro or country) and by customer type (residential,

[21] The notional SRS revenue that would have been received during the regulatory period if forecast SRS prices applied by SA Water during the regulatory period were applied to actual SRS connections as specified in the determination.

[22] Specifically, clause 2.8.2 (ii) (ii) of the SAWRD16 Price Determination states "N_S (expressed as a present value at 1 July 2020, in dollars of December 2018) is the notional sewerage retail services revenue that would have been received during the regulatory period if forecast sewerage retail services prices applied by SA Water during the regulatory period were applied to actual sewerage retail services connections as specified in the Forecast Schedule in Part 5 of this determination."

commercial, non-residential).[23] An average rate per connection was used in preparing the sewerage retail services revenue adjustment statement.

Box 4: Formulaic representation of the current SRS revenue adjustment mechanism

The SRS revenue adjustment amount (RA_S) is described in SAWRD20 by the following formula

$RA_S = 0.5 \times (A_S - N_S)$ if $|A_S / N_S - 1| \geq 1\%$ (otherwise zero)[24] , where

- A_S is the actual SRS revenue
- N_S is the notional SRS revenue received if forecast prices were applied to actual demand.

3.2.2 The prior (SAWRD16) SRS mechanism

The 2016 SRS demand variation adjustment mechanism differed to the current mechanism in how the notional SRS revenue was calculated. In 2016 it was based on what would have been received if actual prices were applied to forecast SRS connections (as specified in the determination).

The 2016 determination also included a non-demand variation adjustment that only applies if it is positive; that is, when SA Water over recovers SRS revenue for reasons other than variation in the number of connections.

Box 5: Formulaic representation of the SAWRD16 DWRS revenue adjustment mechanism

The SRS revenue adjustment amount (RA_S) is described in SAWRD16 by the following formula

$RA_S = V_S + R_S$, where

- V_S is the sewerage demand variation revenue adjustment
  $= 0.5 \times (A_S - N_S)$ if $|A_S / N_S - 1| \geq 1\%$ (otherwise zero)[25]
- R_S = maximum of $(N_S - M_S)$ and zero
- A_S is the actual SRS revenue received during the regulatory period
- N_S is the notional SRS revenue received if actual prices were applied to forecast demand
- R_S is the revenue adjustment that arises if actual SRS revenue exceeds the maximum revenue other than as a result of a demand variation
- M_S is the maximum SRS revenue as specified in the determination.

Of note, $(N_S - M_S)$ can be expressed as:

- $A_S - M_S$ (the difference between actual and maximum SRS revenue), *less*
- $A_S - N_S$ (the variation attributable to changes in demand)

[23] Minimum fixed charges apply. Community concession customers are charged per water closet (per toilet). See https://www.sawater.com.au/my-account/water-and-sewerage-prices/water-prices.

[24] Expressed as a present value as of 1 July 2020, in dollars of December 2018 for the regulatory period.

[25] Expressed as a present value as of 1 July 2020, in dollars of December 2018 for the regulatory period.

The mechanism was applied in the sewerage retail services revenue adjustment statement submitted for use in SAWRD20. The key calculations are included in Table 4 below. The sewerage demand variation revenue adjustment was not material; however, a $4.5 million adjustment was included due to 'other than demand' variation.

Table 4: SAWRD16 SRS Demand revenue adjustment

Item	Amount	Note
4-year revenue cap	$1,188.1m	M_S
Total Actual SRS regulated revenue	$1,189.8m	A_S
Notional SWS Revenue – adjusted for demand	$1,192.6m	N_S
Variance attributable to demand	-$2.82m	$A_S – N_S$
… as a % of notional revenue	-0.24%	A_S / N_S -1
Demand variance revenue adjustment	$0m	V_S = 0 as (A_S / N_S -1)<1%
Other revenue adjustment	$4.5m	R_S = max ($N_S – M_S$,0)
Total revenue adjustment	**$4.5m**	**$RA_S = V_S + R_S$**

Source: Unless stated values are measured as a present value at 1 July 16 in real $ Dec 2014. Text and values copied from the workbook "Revenue compliance for RD16 - updated for Dec2020 billings" (tab: "Sewerage Live").

3.3 Alignment of the mechanisms with the Pricing Order

The current mechanisms do not align well with the requirements of the Pricing Order. There are two key issues.

First, the current mechanism adjusts for material variation in prices, rather than – as specified in the Pricing Order – for material variation in 'water consumption or sewerage connections'. As discussed in Box 2 on page 8, due the inclining block tariff structure, a variation in water consumption will likely cause a variation in the average water price; but the effect will be limited.

In this regard, the 2016 mechanisms are more aligned with the (then 2016) Pricing Order in that the adjustment was based on variations in water consumption and sewerage connections. However, the 2016 mechanism only considered the total variation in demand and not the variation in demand at different price levels. That is:

- for water consumption, the 2016 mechanism did not consider demand variation by tier, which attract different rates
- for sewerage connections, the 2016 mechanism did not consider variation by customer type, who pay different rates.

This issue was mitigated in the 2016 mechanisms by the 'other revenue' adjustments, which account for upward variation not covered by the demand adjustment mechanisms. However, these other revenue adjustments have a different structure. They adjust for 100 per cent of any positive variation (i.e. over-recovery) and zero per cent of any downward variation (i.e. under-recovery).

Second, the 2020 (& 2016) Pricing Order (para. 5.5) specifies that the 'adjustment mechanism must operate on the basis of efficient costs associated with variations in demand'. I assume this to mean that the mechanism should *account* for variation in the efficient costs associated with variations in demand. However, the 2020 and 2016 mechanisms, as described in the determinations, do not include consideration of variation in efficient costs associated with variations in demand. Nevertheless, as noted above, the recent application of demand adjustment mechanism included an adjustment for variation in costs.

4 A future demand variation adjustment mechanism

4.1 Overview

In this section I consider options, and make recommendations, for the demand adjustment mechanism for the next determination. I begin by considering the approaches to managing revenue risk and then the design issues relating to:

- the extent that revenue variation is passed through to customers
- how revenue variation is measured
- how the mechanism is administered.

4.2 Approaches to managing demand variation revenue risk

The approaches to manage demand variation risk are commonly considered in conjunction with the form of price control, which may be categorised as:

- a revenue cap, whereby – as is the case of SA Water – the utility can set prices but is limited by the maximum revenue it may receive in a regulatory period
- a price cap on each of the regulated services
- a hybrid price and revenue cap, which contain elements of both a price and revenue cap.

Variation in demand creates an issue for the application of the revenue cap. In the absence of any accommodation for demand variation, the utility faces an asymmetric risk, whereby if demand:

- is lower than expected, it earns less than its revenue cap
- is higher than expected, it risks breaching the revenue cap and being penalised in a future determination.

This risk is costly for the utility and ultimately undesirable for customers as it would encourage the utility to set higher prices to limit the downside risk of low demand.

To address this risk, revenue cap regulation is invariably accompanied by an 'unders and overs' mechanism, whereby some or all of the variance between forecast and actual revenue goes into an account and included as an adjustment in a subsequent regulatory period. The demand variation adjustment mechanism that applies to SA Water is a form of an unders-and-overs mechanism that specifically relates to variation in revenue associated with variation in demand. [26]

[26] Revenue risk can also be managed through review 'triggers', whereby, prior to the next scheduled review, a regulated firm can trigger a regulatory review to have elements of its revenues and costs reconsidered in the event of an unfavourable outcome. To manage the risk associated with variation in costs, cost pass-throughs are often applied, whereby specifically identified costs beyond the firm's control are passed through to customers in the subsequent regulatory period. For example, under SAWRD20 Price Determination (clause

Under a price cap – in contrast to a revenue cap – a demand variation mechanism is not required to address the asymmetric risk faced by the utility. In such cases, the key value of the mechanism is to address the cash flow volatility risk faced by firms and to mitigate the utility's incentive to inflate prices by under-forecasting demand.

Demand variation mechanisms can vary in terms of a range of characteristics, which I categorise as:

- the revenue covered, including whether:
    - the mechanism is limited to variation in revenue due to demand variation
    - the revenue is adjusted for variation in costs associated with variation in demand
- the level of risk sharing, which is primarily defined by the:
    - deadband – the threshold level of variation below which no adjustment is made
    - proportion of variation in revenue passed through to customers
- how it is administered, including:
    - when the adjustment is made
    - whether limits are placed on the price variation caused by adjustments
    - whether the regulator had discretion in applying the adjustment
    - how calculations are made, for example, how adjustments are made for inflation.

A summary of the demand adjustment mechanisms for other water utilities in Australia and England and Wales is provided in Table 5 below (additional detail provided in Appendix B). As shown in the table:

- in most other jurisdictions, price caps are used as the primary form of price control
- the size of the deadband varies, from no deadband in some cases to a large deadband in others
- 100 per cent pass through of variation (above the deadband) to the customer is common.

Revenue caps coupled with 'unders and overs' mechanisms to account for demand variation are also common in many other regulated industries, including rail and energy networks. Examples of these are also provided in Appendix B.

Also, as noted in Appendix B, some jurisdictions have or have recommended special arrangements for drought:

- IPART has introduced a drought price for Sydney Water and Hunter Water, designed to recover the loss of revenue and additional costs incurred during drought
- The Queensland Competition Authority (QCA) recommended a Drought allowance mechanism, which could be applied during the regulatory period to limit Seqwater's exposure to drought related risks.

2.10), SA Water may submit to the Commission for approval a pass-through event revenue adjustment for a material financial impact due to an event that "could not otherwise have been reasonably practicably controlled or substantially mitigated by SA Water".

Table 5: Adjustment mechanisms used for other water utilities

Location, entity	Form of price control	Revenue covered	Sharing	Administrative [i]
ACT, Icon Water	Price cap	Water usage (sales) revenue	100% above 6% deadband	
NSW, Sydney Water, Hunter Water, Central Coast	Price cap	Water sales revenue (no adjustment for costs)	100% above 5% deadband	Applied at end of regulatory period
Queensland,[ii] SEQ Water	Price cap	All revenue	100%	End-of-period adjustment. Potential for an in-period adjustment during drought
Tasmania, TasWater	Price cap	No mechanism applies. TasWater bears demand risk		
Victoria,[iii] Yarra Valley Water	Price cap	All regulated service revenue net of bulk charges	100% with no deadband	Limit on price increase of 2%
Western Australia	No economic regulation applies. A 2016 inquiry recommended an adjustment for material variation in costs			
England and Wales	Price cap	All revenue (excluding bioresources). Additional mechanism for developer services activities	100% with no deadband	Applies in period. Financial penalty for material forecasting inaccuracy

Notes: i) In all cases the adjustment calculated was made in present value terms using the regulatory rate of capital; however, there were some differences in adjusting for inflation.
ii) In Queensland, the regulator has no role in monitoring or regulating urban retail water.
iii) The Victorian Essential Services Commission provides the water business with discretion as to the form of price control and how risks are managed. Most businesses do not have an adjustment mechanism for variations in demand or revenue.

4.3 On the allocation of revenue risk

The key function of a demand variation adjustment is that it changes how the revenue variation risk associated with demand variation is allocated between the utility and the customer. This subsection considers this allocation from the perspective of:

- the regulated utility

- customers, and
- the utility's incentives.

The subsection concludes with a consideration of the levers to change the allocation and a summary recommendation as to the extent of risk allocation.

4.3.1 The regulated utility's perspective on revenue risk

4.3.1.1 Pricing and the financial impact of demand variation

The financial impact of demand variation to a utility (or any firm) depends on how prices are set. If prices are set to the marginal cost of supply, then a variation in demand would have an equal impact on revenues and costs and, consequently, the utility would be indifferent to a change in demand.

Setting prices to marginal cost ('marginal cost pricing') is often considered a 'golden rule' for efficient utility price setting;[27] however, it is rarely achieved. In water it is common to set usage prices to the long run marginal cost (LRMC) of supply, which in practice is estimated from forecasts of the costs of meeting a future increment in demand over a long period. LRMC will tend to be greater that the costs incurred in a regulatory period as it incorporates the incremental capital costs of augmenting supply in the future.

In the case of SA Water, water usage prices are higher than LRMC[28] and significantly higher than the true marginal cost. The revenue adjustment statement submitted for use in SAWRD20 estimated that in 2018-19 the variable cost (which, in absence of augmentation, approximates the marginal cost) was $0.22 per kL and the average usage price was $2.94 per kL. Based on this analysis, SA Water receives an average margin of 93 per cent ($2.72 per kL).[29] I have no information on the equivalent margin for sewerage services.

Due to the gap between price and marginal cost, from SA Water's perspective demand variation can have a significant financial impact.[30]

4.3.1.2 The nature and costs of cash flow volatility

The revenue adjustment mechanism may be considered a means of helping to mitigate the cost of cash flow volatility to SA Water. However, I expect this benefit to SA Water to be limited.

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[27] A price set at marginal cost encourages efficient use of a service by encouraging consumption only when private benefits are at least the cost of supply. As quoted by Kahn (1988, p. 65), "[t]he central policy prescription of microeconomics is the equation of price and marginal cost. If economic theory is to have any relevance to public utility pricing, that is the point at which the inquiry must begin."

[28] I estimated the LRMC for provision of water by SA Water to be less than $0.65 in 2014/15 for the Greater Adelaide Area. See Tooth and Hefter (2013).

[29] Furthermore, as illustrated in Figure 3 on page 23, much of the demand variation occurs in the top pricing tier (current price $3.04 per kL).

[30] Of note, a pricing structure that reduces the gap between price and marginal cost, would be consistent with National Water Initiative pricing principles and would encourage a more efficient use of drinking water.

The nature of the risk is an important consideration. It is common to distinguish between diversifiable and non-diversifiable (systematic)[31] risk. As is common for regulated utilities in Australia and elsewhere, SA Water's regulated cost of capital is determined using the capital asset pricing model (CAPM), which compensates investors for the level of non-diversifiable risk. The use of this approach implies there is no additional need to for an adjustment mechanism to manage SA Water's financial exposure for non-diversifiable risks.[32]

Regardless, the volatility of SA Water's cash flows, primarily relate to variation in demand due to variation in weather, which should be considered a diversifiable risk. In theory through diversification the cost of such volatility should be minimal; however, there is common acceptance[33] and some empirical evidence[34] that costs can be material for a range of reasons.[35] For SA Water, I expect that the costs of cashflow volatility are largely associated with the additional financing costs[36] and internal management[37] issues and are material but not overly significant.

It is unclear as to the extent that a demand sharing adjustment mechanism reduces the cost. If 100 per cent of the variation in present value was passed to customers via the adjustment then, *prima facie*, SA Water (and its owner, the South Australian Government) would be indifferent to the variation. However, in practice, for SA Water (and its owner) to be indifferent it would need to be able to invest any excess funds (or finance any shortfall) at the discount rate (the WACC) used in calculating the adjustment. Given the short-term nature and uncertain timing[38] of the funding this may not be realistic. Rather, we might expect, that the true cost of financing to be higher and the return on additional funds received to be lower.

4.3.2 The customer perspective on revenue risk

From the customer perspective, the demand variation adjustment mechanism has two major effects.

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31 The non-diversifiable risks are those that are correlated with the risk of the overall market.

32 For a more elaborate discussion on the use of CAPM and risk sharing see QCA (2012). As they state "[c]learly, an unders-and-overs account that eliminates variance in the firm's revenues is fundamentally inconsistent with the concept of providing a risk-adjusted rate of return with respect to that component of the firm's returns."

33 For example, a 2004 survey of financial professors found the vast majority agreed that "managing financial risk was an effective way for companies to build shareholder value" (Smithson & Simkins, 2005, p. 8).

34 For example, there is evidence that cash-flow volatility reduces firm value (Rountree et al., 2008), increases corporate bond yield spreads (Douglas et al., 2016) and is associated with a higher cost of debt (Minton & Schrand, 1999)

35 The potential inefficiency of managing risks that they cannot control is given as a reason for cost passthroughs (QCA 2012, section 4.2).

36 Firms require internal finance to undertake ongoing operations and to pay for capital expenditure. Volatility results in firms having to: access external finance at a higher cost than internal finance; build up larger cash reserves (which has an opportunity cost); or defer or not-undertake investments because of the expense of the additional cashflow.

37 A common concern is that managers may have an incentive to reduce risk more than shareholders, which results in agency costs (Aretz et al., 2007, pp. 437–438).

38 The timing is uncertain as, for example, a variation in cash flow in one year may be offset, or compounded, by a variation in the following year.

First, the revenue demand variation adjustment mechanism can contribute to bill and price volatility. For example, under a 50 per cent sharing rule, in present value terms, a 4 per cent over-recovery of drinking water revenue from customers in one regulatory period will lead to approximately[39] a 2 per cent reduction in the following regulatory period and consequently a 6 per cent change in average drinking water bills. In nominal terms, the bill volatility can be greater still.

The volatility for individual customers caused by the adjustment mechanism will depend on how prices are changed and their level of consumption. For example, a common pricing approach is to set usage prices at a level to encourage efficient use and set the fixed connection charge to recover the remaining revenue. Under this approach the adjustment would only apply to the fixed connection charge (i.e. rates revenues). As rates revenue is around one-third of total water revenue, under this approach, a 6 per cent reduction in rates will be required to achieve a 2 per cent reduction in drinking water revenue. In response to an adjustment, SA Water could also reduce its water prices, or change the pricing tier threshold levels.

There is limited data to assess the extent of price and bill volatility that may occur. Some historical data is shown in Table 6 below.

Table 6: Variation in water demand and related revenue by financial year (FY)

	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY17 to FY20
Actual demand (GL)	193	184	191	200	177	198	208	204	786
Annual change %		*-5%*	*4%*	*5%*	*-11%*	*12%*	*5%*	*-2%*	
Forecast demand					190	191	193	195	769
Variation to forecast %					*-7%*	*3%*	*8%*	*5%*	*2.3%*
Actual water sales $m – real 2014	626	544	562	590	480	543	572	558	2,152
Water sales forecast $m – real 2014					534	540	548	559	2,181
Variation to forecast %					-10%	0%	5%	0%	-1.3%
Variation to forecast in present value terms %									-1.5%

Source: SAWRD16 drinking water retail services revenue adjustment statement. Note: values have not been discounted.

As shown in the table, the variation in the volume of water demand can be significant. In the last regulatory period, year-on-year variation has ranged from -11 per cent to +12 per cent and the annual variation between actual and forecast has ranged from -7 per cent to +8 per cent. However, over the regulatory period the actual volume variation to forecast is relatively small (2.3%). The variation in the revenues received in any one year can be more significant because (due to the inclining block tariff) the demand variation also causes a variation in the average price. Nevertheless,

[39] The average bill variation will be slightly less, due to customer growth.

over the regulatory period the variation of actual revenue to forecast is only -1.3 per cent, which when discounting is applied is -1.5 per cent.

I do not have the forecast data for the 2013–2016 regulatory period; nevertheless, the volume data for this period appears relatively stable. This data – albeit limited – suggests that the price volatility caused by a variation adjustment may not be a significant issue.

Second, the adjustment mechanism can help to manage the financial risk of customers by providing an offset to bill variations due to variations in demand. The variation in demand will typically be a result of weather which affects the demand for outdoor use. For example, low rainfall drives customers to use more water to maintain their gardens. In such case, the revenue adjustment in the following regulatory period helps offset the financial impact on customers who paid more to maintain their garden. Similarly, higher rainfall means that customers can maintain their garden at a lower cost and can afford an adjustment in the following period. In this way the revenue adjustment mechanism helps to manage customers' financial risk in achieving their desired outcome. In effect, rather than *sharing the risk*, the revenue adjustment mechanism is managing the financial risk for both SA Water and the customer base. This perspective provides a rationale for a higher level of risk sharing.[40]

There are, however, limitations to this risk management benefit for customers. Due to the delay in adjustment and the churn in the customer base, customers who benefit from lower bills in one period, may differ to those who paid higher bills in another. SA Water could potentially mitigate this issue by modifying prices mid-regulatory period. Furthermore, the discount rate that applies is likely to differ to the discount rate that used by the customer base.

From the customers' perspective, there are also distributional considerations. Consider, for example, that periods of higher rainfall benefit people with large gardens who typically have higher water needs. If the adjustment is implemented through a change in fixed charges,[41] the under-recovery will be financed by all customers.[42] This issue could be mitigated by SA Water by applying the adjustment to higher water users, for example, by modifying the threshold levels for Tier 2 and 3 prices (or modifying the Tier 2 and Tier 3 prices).

The above argument for a greater level of risk sharing, does not apply to a drought situation where customer demand is restricted. In such a case, it would be preferable to address the revenue gap with adjusting prices mid-period to offset the effect of reduced demand due to restrictions (while providing additional financial incentives to reduce water consumption).

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40 A counter to the above argument is that customer utility (i.e. wellbeing) may also be lower during wet times (due to a general preference for drier weather).

41 Changing the Tier 1 price or the Tier 1 quantity level would have a similar effect.

42 Similarly, it is generally the case that landlords pay fixed charges and renters pay usage charges. Thus, over recovery due to higher-than-expected usage may be paid for by renters to the benefit of landlords (and vice-versa). This may not be a material factor, to the extent renters have lower usage.

4.3.3 Incentives

4.3.3.1 Incentives to manage revenue variation

A demand variation mechanism can affect a utility's financial incentives when – as is the case of SA Water – it makes a margin on its sales (i.e. when prices are above marginal cost).

Under forecasting demand

SA Water has a financial incentive to under-forecast usage demand, as this will have the effect of pushing-up prices.[43]

This incentive issue is mitigated by the extent the variation in revenue is passed through to customers. The mitigation is currently limited because of limits to the risk sharing (by the materiality band and the 50 per cent sharing parameter) and because the current mechanism only applies to a variation in prices. The materiality band means that SA Water could benefit by an over recovery of $17.6 million (present value as at 1 July 2020 in 2018 dollars) before any risk sharing mechanism would apply. As illustrated in Table 7 (page 35), under the current mechanism, the extent of risk sharing is small.

Managing demand

A demand-variation adjustment mechanism can affect SA Water's incentives to undertake water demand management activities during a regulatory period. Once prices are set, in the absence of a demand-variation adjustment mechanism, SA Water has a disincentive to encourage water conservation (rather it has an incentive to encourage water use).[44] This is not necessarily a material issue given that the high water-usage prices (set above the marginal cost of supply) give consumers excessive (i.e. higher-than-optimal incentives) to conserve water.

Similarly, the sharing of revenue variation with customers, can reduce SA Water's incentives to invest in business development. This is discussed in section 4.4.4.2.

Mid-period pricing

While SAWRD20 and SAWRD16 include clauses[45] that SA Water must set prices to ensure revenues do not exceed the maximum revenues set by the Commission, SA Water has, in the absence of any adjustment mechanisms, asymmetric incentives to increase prices mid-period. This is because in the absence of an offsetting mechanism, SA Water has an incentive to raise prices mid-period in response to updated revenue forecasts of under-recovery, but no financial incentive to reduce prices in response to higher-than-expected demand forecasts.

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[43] SA Water's sets its prices to recover its maximum allowable revenue. The prices (for at least some services) depend on the forecast demand. The lower the demand forecast the higher the prices required so that the expected revenue recovered equals the maximum allowable revenue.

[44] I note that SA Water provides online advice on efficient water use (https://www.sawater.com.au/my-home/saving-water/in-your-home).

[45] Clause 2.2.1 for drinking water and clause 2.6.1 for sewerage (in both the SAWRD20 and SAWRD16 Price Determinations).

The revenue adjustment mechanisms can affect SA Water's incentives to modify pricing mid-regulatory period. The SAWRD20 revenue adjustment mechanism explicitly targets variation in prices. However, for drinking water, the variation is focussed just on water usage and does not affect SA Water's incentive to adjust connection charges. The SAWRD16 included an 'other revenue adjustment mechanism', which would prevent SA Water from exceeding its maximum revenue through pricing.

4.3.3.2 Incentives for accurate forecasting

A demand-variation adjustment mechanism can affect SA Water's incentives for accurate forecasting by sharing the risk associated with an inaccuracy. As noted in section 4.2, to encourage more accurate forecasting by water utilities in England and Wales, the regulator (Ofwat) includes a revenue forecast incentive (RFI), whereby it penalises utilities when their actual revenue differs from the forecast by more than a set percentage. Such an incentive mechanism might be considered; however, it is not feasible to consider within the scope of this project whether such a change would be worthwhile.

4.3.4 Changing the allocation of revenue risk

The extent of risk sharing between SA Water and the customers is determined by:

- the deadband created by a threshold below which there is no pass through to customer (currently ±1 per cent of revenue)
- the risk sharing parameter that determines how much of revenue variation is passed through to customers (currently 50 per cent).

The use of the deadband is consistent with the Pricing Order, which specifies that an adjustment when there is *material variation*. Nevertheless, it useful to consider the need for a deadband and its optimal size.

There do not appear to be any material administrative costs associated with a different sized dead-band and there does not appear any other administrative reason against a much smaller (or nil) dead-band. Regardless of the size, the same calculations occur and there is negligible effort associated with incorporating the adjustment into the next regulatory period.

The size of the deadband has only a small effect on pricing volatility as it does not affect the size of the largest adjustments, but rather whether small adjustments will be made. For example, a reduction in the current 1 per cent dead-band to 0.5 per cent would not affect the adjustment when the variation is more than 1 per cent.

There are benefits to a small dead-band A smaller deadband also increases benefits of the demand variation adjustment in terms of:

- managing the financial risk to SA Water
- managing the financial risk to SA Water's customers
- addressing SA Water's incentives for under forecasting demand and underinvesting in water conservation.

The current deadband (of ±1 per cent) is small compared to that used in other jurisdictions.[46] Nevertheless, there appears no material benefit to retaining the deadband other than consistency with the Pricing Order, which refers to a material variation.

In contrast, there are pros and cons of changing the risk sharing parameter. A higher rate of sharing increases the benefits of the risk adjustment mechanism (associated with the financial risk management and improved incentives). However, a higher rate of sharing also leads to greater volatility of prices and bills across regulatory periods.

4.3.5 Summary and recommendations for revenue risk allocation

In summary, there are benefits and costs of passing revenue variation through to customers.

- The benefits relate to:
    - reducing the costs to the utility of cash flow volatility caused by demand variation
    - reducing the utility's incentives to under-forecast demand (which leads to higher prices) and undertake other activities mid-period to maximise revenue
    - providing some risk–management benefits to customers.
- The costs relate to:
    - contributing to price volatility between regulatory periods, which can be exacerbated by how the adjustments are implemented in the subsequent period.
    - reducing the utility's incentives for accurate forecasting and business development; however, these issues might be separately addressed if considered material.

If the additional cost of the price volatility is not considered significant, then it would be preferable to increase the variation in revenue passed through to customers. This can be achieved by removing the 1 per cent threshold (if deemed consistent with the Pricing Order) and increasing the pass-through percentage. Arguably, a 100 per cent 'unders and overs' mechanism might apply, whereby all the revenue variation due to demand variation is passed through to customers.

4.4 The variation in revenue to be considered

4.4.1 Adjustment for costs

The current mechanism does not include any adjustment for costs incurred during the regulatory period due to variations in demand. I expect the modification would be reasonably straight forward to undertake and would provide several benefits. This could involve:

- SA Water determining the marginal cost (per-unit costs incurred during the regulatory period) of services, for drinking water with respect to water volume and for sewerage with respect to provision of the number of connections
- A modification to the adjustment mechanism formula whereby the revenue is replaced with the net revenue.

[46] For example, a 5 per cent deadband is applied to water businesses in NSW.

It should not be a material burden to SA Water, as SA Water should already be estimating the marginal cost of supply for pricing and general management purposes. As noted in section 3.1.2.1, SA Water estimated these costs when applying the 2016 mechanism for DWRS services. The benefits include that it would:

- more accurately reflect the risk faced on SA Water
- reduce the level of adjustment, thereby reducing the volatility of prices in the subsequent period
- be more consistent with the Pricing Order (clause 5.5 as discussed in section 3.3).

In considering the above, I recommend that revenue variation be measured net of costs.

Note, there is a separate, but related issue, of how the risk of cost-variation should be managed. For example, during an extended dry period that drives higher demand, SA Water may incur higher supply costs, for example, associated with the use of the desalination plant.

4.4.2 Use of average prices

The metric used to measure demand in the current (and prior) DWRS mechanism is the total water use aggregated across each of the different pricing tiers. However, the variation in volume by pricing tier can be substantial (see Figure 3). Because the variation in demand is greater at higher price-tiers, higher demand leads to a higher average price and vice-versa. Consequently, a revenue-variation based on total demand and the average price will understate the magnitude of the revenue variation.

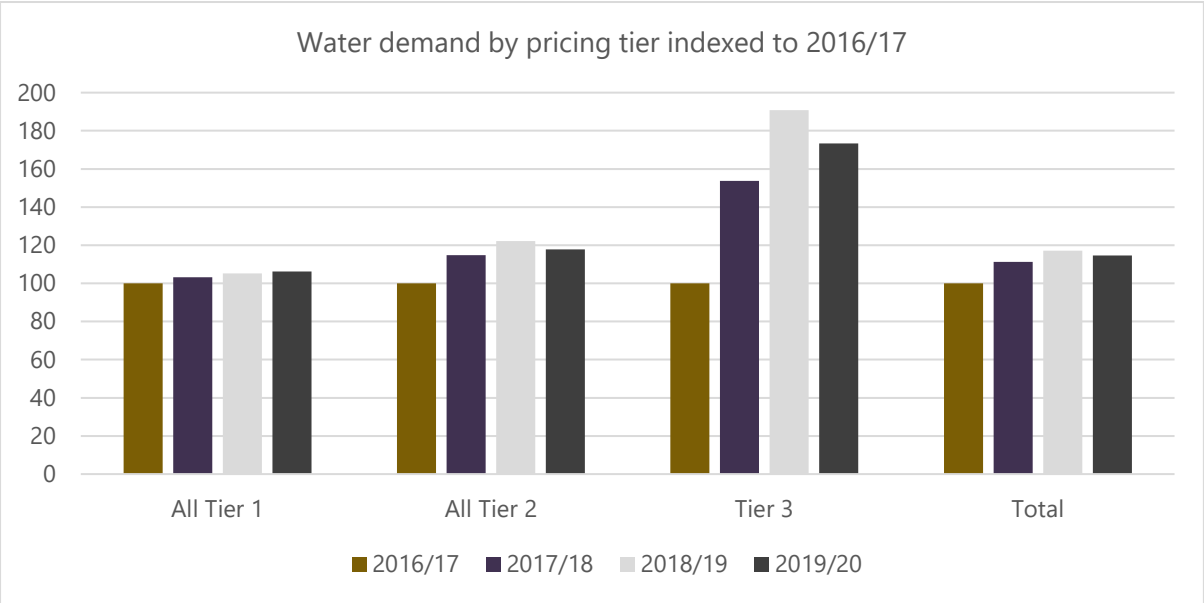
This issue could be addressed or mitigated in several ways.

- The most accurate approach would involve measuring actual and forecast demand volume by pricing tariff band and calculating notional revenue using the forecast prices by tariff band.
- Alternative approaches would involve using an estimate of the average price of the variation in water-demand. For example, if 90 per cent of the variation in water demand is in Tier 3 and 10 per cent in Tier 2, then the average price used could be estimated as 90 per cent of the actual Tier 3 price and 10 per cent of the Tier 2 price. A slightly simpler approach is to use a price based on actual price multiplied by a pre-determined adjustment factor (specified in the determination) to reflect that the demand variation occurs at a higher level.

The sewerage connection charges also vary (by property value and property type) and consequently demand variation could also cause variation in the average charge. However, this appears unlikely to be a material issue because connection numbers can be forecast with reasonable accuracy[47] and because demand variation need not lead to a change in the average charge. Consequently, I do not recommend a change in how the variation in SRS revenue is measured.

[47] I note that the annual growth has been a consistent 1.1 per cent since 2015/16 (excluding 2019/20 for which there was a correction).

Figure 3: Water demand variation by pricing tier in SAWRD16 period



Source: Sapere analysis on SA Water data.

4.4.3 Actual or forecast prices

The variation in revenue calculation caused by demand can be based on actual or forecast prices (or conceivably a combination).

- Actual prices can be used (as in SAWRD16) by comparing actual revenue (which is based on actual prices and demand) with a notional revenue based on actual prices and forecast demand.
- Forecast prices can be used by comparing a notional actual revenue based on forecast prices and actual demand and forecast revenue (based on forecast prices and forecast demand).

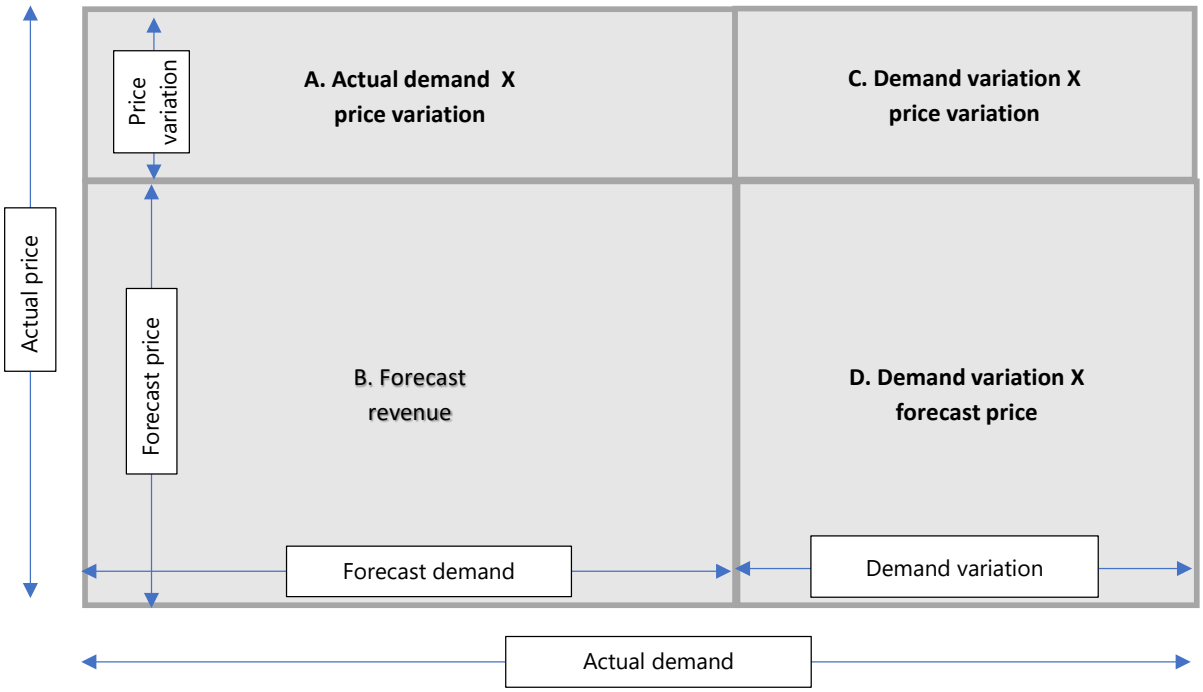
The figure below illustrates the difference. In this example illustration, Actual revenue (the sum of all boxes) is greater than Forecast revenue (box B) due to a positive demand variation and a positive price variation.

- If actual prices are used, then the revenue variation is Actual revenue (A+B+C+D) – Notional revenue (A + B) = C + D
- If forecast prices are used, then the revenue variation is the Notional actual revenue (B +D) – Forecast revenue (B) = D

Thus, the difference between the two approaches is the variation in prices multiplied by the variation in demand. Arguments for the actual price approach are that it captures more of the revenue variation due to demand variation and may be simpler to implement. Another argument for the actual price approach is that it makes some adjustment for the variation in demand on average prices; however, as discussed in the previous sub-section, this issue can be addressed separately.

Considering the above, I recommend retaining the approach adopted in SAWRD16, which is based on actual prices.

Figure 4: Variation between actual and forecast revenue



4.4.4 Special cases of demand variation

4.4.4.1 Restrictions

Drought is a special situation, whereby demand is low due to the restrictions imposed. A demand revenue adjustment made after a drought, while offsetting SA Water's fall in revenue, would be an additional burden imposed on customers.

A preferable alternative is for SA Water (and its owner, the South Australian Government) to increase pricing during a drought to offset the reduced demand (as well as provide incentives for water conservation).[48] To encourage the use of this option, the demand adjustment mechanism could be designed to exclude reductions in demand that occurred during drought.

Considering the above, I recommend the demand variation adjustment does not include variation in demand when water restrictions are imposed.

4.4.4.2 Business development

Some demand variation is within SA Water's control because it relates to business development. SA Water can potentially increase water sales through expansion in the locations serviced or the acquisition of new commercial customers.

The demand variation adjustment mechanism has the effect of reducing SA Water's incentives to expand its water sales. To the extent that the deadband and/or the 50 per cent sharing rule is

[48] This approach is adopted by IPART, as noted in Section 4.2.

preserved, SA Water would continue to receive some financial incentive. Under a 100 per cent pass through to consumers, SA Water's incentive for business development would be removed.

It would appear possible to address this loss of incentive. An option is to exclude sales growth associated from business development when calculating the demand variation (or only including a partial[49] pass-through to customers). However, this appears administratively complex and would increase SA Water's incentive to under-forecast the additional water sales it is likely to achieve. An alternative to address the later issue would be to allow SA Water to apply to the Commission on a case-by-case basis to retain some of the additional margin or establish a separate mechanism to encourage business development.

Considering the above, I do not recommend the demand variation adjustment formula include an adjustment/carve-out for business development.

4.4.4.3 Adjustments for weather correction

A possible option would be to design the adjustment mechanism to only adjust for variation in demand due to forecast weather. This could potentially be achieved through use of a weather-correction demand forecast model, which isolates the demand variation.

The key advantage of such an approach is that it would protect SA Water from demand variation due to weather, which is out of its control, but not from variation due to other factors (e.g. extent of water conservation activity and sales to customers) which are within its control.

There are, however, several downsides. It would be administratively difficult to implement. There is a risk that the model would not be accurate, with the risk of SA Water taking on demand variation and additional variation in prices in the next regulatory period. It would also be challenging to account for demand variation during drought if restrictions are imposed.

4.5 How the mechanism is applied

As noted in section 4.2, there are variations in how revenue adjustment mechanisms are applied in other jurisdictions and sectors.

These variations include

- how calculations are made, for example, how adjustments are made for inflation and the time value of money
- when the adjustment is made (i.e. at the end of the regulatory period, or annually)
- whether the regulator has discretion in applying the adjustment

[49] This argument, and the level of sharing, is consistent with the views of other regulators for profit making activities from non-core services. For example, IPART when discussing non-regulated revenue states "[s]haring the revenue encourages the utilities to pursue non-regulated revenue while ensuring customers also benefit from the arrangements because they pay for the assets. In the past we have typically applied a 50:50 sharing ratio of the revenue." See IPART (2020, p. 253).

- how the adjustments flow through to prices (including whether there are limits placed on the annual price variation).

Regarding each of these:

- There appears no reason to modify the current approach for adjusting for inflation and time value of money.
- There appears no compelling need for the regulator to have discretion in applying the formula.
- Under the revenue cap approach, it is only appropriate that the adjustment be applied in the subsequent period, as SA Water can make price adjustments mid-regulatory period.
- Under a revenue cap approach, SA Water (in conjunction with its owner, the South Australian Government) will determine how the adjustments flow through to price changes.

In summary, there appears no reason to change how the revenue adjustment mechanism is applied.

5 Conclusions, options, and recommendations

Mechanisms to adjust for revenue variation due to demand variation were included in both the SAWRD20 and SAWRD16 Price Determinations. The SAWRD16 mechanisms are preferred to the current mechanisms, as the current mechanisms largely have the effect of adjusting for price rather than demand variation. Nevertheless, there are a variety of other improvements to the mechanisms that could be made.

The key design issue is how much of the revenue variation (due to demand variation) is passed through to customers. At one extreme, a pure 'unders and overs' mechanism applies whereby all revenue variation is passed to customers. At the other extreme the utility bears all the revenue variation risk. This issue can be assessed in terms of costs and benefits, many of which arise when (as is the case with SA Water) the utility makes a margin on sales (i.e. when prices exceed the costs incurred).

The benefits of passing revenue variation through to customers include:

- reducing the costs to the utility of cash flow volatility caused by demand variation
- reducing the utility's incentives to under-forecast demand (which leads to higher prices at the beginning of the period) and undertake other activities mid-period to maximise revenue
- providing some risk–management benefits to customers – by returning higher-than-expected expenditure in one regulatory period (e.g. due to lower than expected rainfall) to customers in the subsequent regulatory period.

The costs of passing the revenue variation through to customers include:

- contributing to price volatility between regulatory periods, which can be exacerbated by how the adjustments are implemented in the subsequent period
- reducing the utility's incentives for accurate forecasting and business development (e.g. by providing services to new commercial customers); however, these issues might be separately addressed if considered material.

In summary, it would be preferable to increase the variation in revenue passed to customers if the impact on price volatility is not considered significant. Based on historic data, the potential impact on price volatility does not appear large. Nevertheless, there is a trade-off, against which I do not have the information to make a firm recommendation.

The variation in revenue passed to customers can be increased by removing the materiality threshold (which provides little benefit) and increasing the pass-through percentage. Arguably a 100 per cent 'unders and overs' mechanism might apply, whereby all the variation is passed through to customers.

Another key design issue relates to how the variation in revenue is calculated. In this regard, it is preferable that the calculation is made net of variable costs and that it accounts for variation in demand by pricing tier to ensure that all the effects of demand variation are captured. I also recommend excluding revenue variation due to demand restrictions, as it more efficient that the revenue be recovered through contemporary price changes to encourage water conservation.

Mechanisms can also vary in how the adjustment is implemented, including when the adjustment is made and how it is modifies prices in subsequent periods; however, there does not appear any reason to change the current settings.

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Appendix A Empirical example of the mechanisms

The SAWRD20 mechanism

An example of applying the current drinking water retails sales (DWRS) mechanism is provided in Table 7 below. The table includes the discount factors from SAWRD20, SA Water's forecasts, and hypothetical data used for illustration purposes.

Table 7: Illustration of the SAWRD20 demand variation mechanism

	2020-21	2021-22	2022-23	2023-24	Present value*
Current forecast**					
Discount factor	0.9839	0.95344	0.92558	0.89997	
a) Forecast usage volume – GL	194.0	194.5	195.0	195.5	732.8
b) Forecast DWRS sales revenue – $m	439.9	440.8	441.4	442	1,659.4
c) Implied forecast usage price [= b / a]	*$2.27*	*$2.27*	*$2.26*	*$2.26*	*$2.26*
Hypothetical data and calculations					
d) Actual usage volume – GL	205.0	205.0	205.0	205.0	771.4
e) Actual DWRS sales revenue – $m ($A_D$)	472.9	472.3	471.4	470.5	1,775.4
f) Actual average usage price [= e / d]	*$2.31*	*$2.30*	*$2.30*	*$2.30*	*$2.30*
g) Notional DWRS sales revenue – $m ($N_D$) [= c x d]	464.8	464.6	464.0	463.5	1,746.9
h) $A_D – N_D$ in $m [= e – g = e – c x d]	8.1	7.7	7.4	7.0	28.4
i) Materiality test ($A_D – N_D$) / N_D [= h / g]					*1.63%*
j) Revenue adjustment RA_D $m =0.5 x ($A_D – N_D$) if $\|A_D/N_D -1\| \geq 1\%$ [= 0.5 x *i*]					14.2
k) Adjustment as % of DWRS sales revenue					*0.8%*
l) Adjustment as % of change in DWRS sales revenue [=j / (e – b)]					*12.3%*
Variation percentages					
m) in DWRS sales revenue [=e / b – 1]	*7.5%*	*7.1%*	*6.8%*	*6.4%*	*7.0%*
n) in GL demand [= d / a – 1]	*5.7%*	*5.4%*	*5.1%*	*4.9%*	*5.3%*
o) in usage price [= f / c -1]	*1.7%*	*1.7%*	*1.6%*	*1.5%*	*1.6%*

Note: * Present value is the sum product of the yearly values and discount factors. The italicised values (the usage prices and percentages) are calculated according to the formula in the first column. The 'present value' formula is applied to water volume to enable comparison between forecast and actual volumes over time. Source: data provided by the Commission.

In this example, actual sales (i.e. usage) revenue (row e) is higher than forecast usage revenue (row b), due to:

- actual demand (row d) being higher than the forecast demand (row a)
- actual average prices (row f) being higher than forecast average prices (row c).[50]

The DWRS revenue adjustment amount (row j) – which will be subtracted from the maximum DWRS revenues determined for subsequent price determination – is calculated as $14.2 million. This is half the difference (row h) between Actual DWRS sales revenue (A_D, row e) and the Notional DWRS sales revenue (N_D, row g). This difference is considered material as it is at least one percent (row i) of the Notional revenue. The Notional DWRS sales revenue is calculated as actual usage volume (row d) multiplied by forecast prices (row c). Of note, the adjustment amount is independent of non-usage DWRS revenue.

The example is useful for illustrating the sharing of risk under the current mechanism. The revenue adjustment equates to just 12.3% of the variation in DWRS sales revenue. This is equivalent to 0.8% of forecast DWRS sales revenue, which is significantly less than the 7% variation (row m) between actual and forecast DWRS sales revenue. The reason for the difference is that most of the variation in DWRS usage revenue (row e *less* row b) was due to changes in the volume (see row n) rather than changes in the average price (row o).

If the formula was based on an equal share of differences between actual and forecast DWRS usage revenue the adjustment would have been significantly greater. Specifically, it would have been $58m (~4.1 times greater) based on DWRS usage revenue.[51]

The SAWRD16 Mechanism

The SAWRD16 mechanism is illustrated in Table 8, which applies the mechanism to the same data used in Table 7. If the 2016 mechanism was used, the Demand variation revenue adjustment (V_D, row l) would be $44.5m, which is significantly higher than the comparable adjustment under the current mechanism (row j in Table 7). This is because the variation in demand volume (row n in Table 7), which is the basis of the 2016 mechanism, is significantly greater than the variation in prices (row o in Table 7) which is the basis of the 2020 mechanism.[52]

More generally I expect that the 2016 mechanism to lead to a larger adjustment than the current mechanism. This is because I expect that the variation due to price (which stems from a variation in demand on the inclining block tariff) to be smaller than the variation due to demand.

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[50] This is consistent with the inclining block tariff structure whereby higher demand will generally lead to a higher average usage price.

[51] Equal to half the differences between $1,775.4m (row e) and $1,659.4 (row b).

[52] This also means that the Notional Revenue (N_D, row F) is significantly lower than the Notional Revenue using current mechanism (row g in Table 7).

The table also includes the additional non-demand adjustment (R_D) calculated as $31.6m (row J), which is based on the difference of the Notional Revenue and Maximum DWRS revenue (M_D).[53] This adjustment reflects:

- the variation in DWRS other revenue, and
- the variation in DWRS usage revenue not due to changes in demand.[54]

Of note, this additional non-demand adjustment only applies if it is positive; that is, as an adjustment when SA Water over recovers.[55] In summary, using this example, the size of the revenue adjustment will be significantly larger using the SAWRD16 revenue adjustment mechanism.

Table 8: Application of the 2016 mechanism to the hypothetical example used in Table 3

	FY21	FY22	FY23	FY24	Present value*
A) Forecast usage volume – GL	194.0	194.5	195.0	195.5	732.8
Forecast DWRS sales revenue – $m	439.9	440.8	441.4	442	1,659.4
Forecast DWRS other revenue – $m	233.5	232.6	234.7	237.2	882.2
B) Forecast DWRS revenue – $m ($M_D$)	673.4	673.4	676.1	679.2	2,541.6
C) Actual average usage price	*$2.31*	*$2.30*	*$2.30*	*$2.30*	*$2.30*
Actual DWRS sales revenue – $m	472.9	472.3	471.4	470.5	1,775.4
Actual DWRS other revenue – $m	232.5	234.6	237.7	238.2	886.8
E) Actual DWRS revenue – $m ($A_D$)	705.4	706.9	709.1	708.7	2,662.2
F) Notional DWRS revenue – $m ($N_D$) [= A x C + D]	680.0	682.7	686.1	686.9	2,573.2
G) A_D – N_D in $m [= E – F = E – A x C]	25.4	24.2	23.0	21.8	88.9
H) Materiality test (A_D – N_D) / N_D [= G / F]					*3.46%*
I) Demand variation revenue adjustment ($m) V_D [= 0.5 x G if |H|≥1%]					44.5
J) Other revenue adjustment ($m) R_D [=max(E – B,0)]					31.6
K) DWRS revenue adjustment amount $RA_D = V_D + R_D$ [= I +J]					76.1

Note: Lower case letters in formula refer to the rows in Table 7.

53 The Maximum DWRS revenue (MD) is the present value of the Forecast DWRS revenue (i.e. $2,541.6m).

54 This variation may be indirectly due to changes in demand, because under an inclining block tariff structure, changes in demand will generally lead to a change in price.

55 SAWRD16 Price Determination (Clause 2.3.2 (b)) states that this revenue adjustment arises if actual DWRS revenue exceeds the maximum DWRS revenue other than as a result of a demand variation and equals the maximum of (N_D – M_D) and zero.

Appendix B Experience in other jurisdictions

Overview

A summary of the approaches in other selected jurisdictions and sectors is provided in Table 9 below.

Table 9: Form of regulation

Regulator	Utility sector	Form of regulation
Independent Competition and Regulatory Commission – ACT	Water and waste	Price cap
Independent Pricing and Regulatory Tribunal – NSW	Urban water and waste	Price cap
	Rural bulk water (WaterNSW)	Price caps
Essential Services Commission of Victoria	Water	Choice of price, revenue, hybrid price and revenue, and tariff-basket caps
Office of the Tasmanian Economic Regulator	Water	Price cap
Queensland Competition Authority	Water	Hybrid price and revenue cap
	Port	Revenue cap
	Rail	Revenue cap
Australian Energy Regulator	Electricity – Transmission, Distribution	Revenue cap
	Gas – Transmission, Distribution	Price cap
Australian Competition and Consumer Commission	Post	Price cap
	Rail	Revenue cap
	Telecoms (NBN)	Price control with revenue cap

Source: Adapted from Sydney Water (2021).

Water utility regulation

Australian Capital Territory (ACT)

For the current determination for Icon Water, the Independent Competition and Regulatory Commission (ICRC) Final Report[56] includes individual price caps for water and sewerage services and provision for a demand volatility adjustment.

The key features of the demand volatility adjustment are:

- It is based on the variation in revenue of water usage charges (tier 1 and tier 2 charges)
- A 6 per cent deadband applies (adjusted where necessary for any approved pass-through amounts)
- A nominal weighted average cost of capital (WACC) is used
- There is no mention of an adjustment for variable supply costs.

New South Wales (NSW)

The NSW Independent Pricing and Regulatory Tribunal (IPART) regulates water prices for metropolitan water utilities in NSW. The primary form of regulation for water and sewerage services is individual price caps.

IPART has introduced and applied a demand volatility adjustment mechanism (DVAM) that attempts to account for differences between actual water sales and water demand forecasts to several water businesses it regulates, including Sydney Water, Hunter Water and Central Coast Water.[57] For each of these businesses, IPART applies price-caps and has a DVAM with a ±5 per cent deadband.

IPART is currently reviewing its regulation of water businesses.[58] A draft report was recently released but did not refer to demand variation adjustment.

Central Coast Water

In a recently published draft review[59] of Central Coast Council water prices, IPART chose to apply a DVAM that was established as part of a 2019 Determination. The DVAM was introduced in the 2013 Determination initially with a deadband of ±10 per cent. This was lowered to ±5 per cent in the 2019 Determination.

Also notable is that:

- the Central Coast Council had to apply to IPART for an adjustment for a recovery of revenue

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56 See Clause 13 (e) (p. 20) of ICRC (2018).

57 Of note, an IPART pricing determination cannot bind a future Tribunal decision and thus IPART determinations can only recommend an adjustment be applied in future regulatory periods.

58 https://www.ipart.nsw.gov.au/Home/Industries/Water/Reviews/Metro-Pricing/How-we-regulate-the-water-businesses

59 IPART (2022, pp. 12–13)

- a key reason for a reduction in water sales was the community response to water savings campaigns and restrictions
- IPART chose not to apply the adjustment to the final year of the regulatory period (2021-22) as actual sales had yet to be recorded
- the adjustment was calculated in present value terms using the real pre-tax WACC from the regulatory determination.

Sydney Water

The DVAM for Sydney Water and its application is described in IPART's (2020) Final Report of prices for Sydney Water.[60] In 2020, IPART applied the DVAM, which led to revenue being returned to customers over the 2020 determination period.

In addition to the DVAM, IPART introduced a drought water usage price – a higher usage price during drought, which is designed to recover Sydney Water's additional drought costs (e.g. of implementing restrictions), and to account for the effect of water restrictions on demand.

The key features of the Sydney Water's DVAM are that:

- it has a deadband of ±5 per cent
- it is based on four years of water sales, lagged by one year from the determination, so that it is based on actual water sales data
- to account for the drought usage price, IPART has decided to calculate the DVAM by comparing actual water sales to a 'composite water-sales forecast', which accounts for drought and non-drought pricing periods.

Of note, IPART do not publicly specify a formula for the DVAM.

Hunter Water

The DVAM for Hunter Water is described in IPART's (2020) Final Report of prices for Hunter Water.[61]

The DVAM is like that proposed for Sydney Water. As with Sydney Water, IPART introduced a drought water usage price to recover costs and revenue during drought.

WaterNSW

WaterNSW (the merger of State Water and the Sydney Catchment Authority) is NSW's bulk water supplier. In additional to providing water to Greater Sydney (the main client being Sydney Water), it provides water infrastructure services to rural areas in 13 valleys in NSW.

In the rural valleys, WaterNSW is highly exposed to revenue risks. Its costs are largely fixed but a substantial amount of its revenue comes from usage charges. In 2014, the then-regulator (the Australian Competition and Consumer Commission, ACCC) introduced an 'unders and overs mechanism' to manage the volatility risk. Concerned that the unders and overs mechanism did not adequately address the volatility issue (and contributed to price volatility), WaterNSW obtained an

[60] See IPART (2020).

[61] See IPART (2020a, Section 3.2).

insurance product to protect its revenue stream and sought to recover the cost of the insurance via regulated charges.

Queensland

The Queensland Competition Authority (QCA) currently have no role in monitoring or regulating urban retail water. In 2014, the QCA recommended a long-term regulatory framework for south-east Queensland (SEQ); however, the framework has not been adopted.

In the 2014 framework the QCA recommended an unders and overs mechanism for urban water retailers to assist them in managing any shortfalls or surpluses in revenues over time (to be recovered on a revenue-neutral basis).

The QCA investigates and recommends bulk water prices in SEQ at the request of the Queensland Government. In a recent report on SEQ Water's Bulk Water Prices for the Queensland Government, (QCA 2022, p. 61) noted several mechanisms that limit Seqwater's exposure to risk:

> Revenue protection mechanism—Seqwater is guaranteed to recover its allowable revenue from the previous regulatory period. This occurs through an end-of-period adjustment, through which it will either recoup any under-recovery, or return any over-recovery, of revenue. Such a mechanism removes Seqwater's exposure to the risk that forecast water consumption may not materialise.
> ...
>
> Drought allowance mechanism—subject to government consideration, the drought allowance could be applied during the regulatory period, should Seqwater be operating at or below the 'drought response' trigger. This could limit Seqwater's exposure to drought related risks.

Western Australia

There is no economic regulation of water utilities in Western Australia.

The Economic Regulation Authority of Western Australia conducted an inquiry[62] in 2016, which it recommended an adjustment for material variation in costs but did not make a recommendation regarding variations in demand.

Tasmania – TasWater

The price determinations made by the Office of the Tasmanian Economic Regulator (OTTER) to date have not included a revenue adjustment mechanism for demand variation; that is, TasWater bears the revenue risk of any revenue variation.

The draft determination (OTTER 2022, p. 141) states:

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[62] Economic Regulation Authority (2016).

> Prices may be adjusted during the regulatory period only if there has been a material change in TasWater's costs due to new or amended legislative requirements or a tax event (as defined in the Pricing Regulations).
>
> …
>
> All other variations between forecasts and actual outcomes over the fourth regulatory period will, therefore, need to be managed by TasWater, including any differences between forecast and actual CPI.
>
> The next (fifth) price determination investigation will review any differences between forecast and actual outcomes that occurred during the fourth regulatory period and recommend appropriate actions to account for those variations.

Victoria

In Victoria, the Essential Services Commission of Victoria (ESCV) provides water businesses with discretion as to the form of price control and how risks are managed.

The ESCV's latest guidance (ESCV, 2021) states that utilities must specify any proposed price adjustment mechanisms to apply and has specified criteria for evaluating the mechanisms. They state that they will consider:

- the extent to which the event is outside the business's control and poses a significant risk of cost changes during the period
- the extent to which the nominated event is uncertain in its impacts and timing
- whether it is reasonable that customers should bear risk associated with the nominated event
- the impact of the nominated event on efficiency incentives for the water business
- the ability for the business to otherwise manage the risk and cost impact posed by the event – for example, in its form of price control, tariff structures or approach to contracting.

The 2018 price determinations included common mechanisms that allow for prices to adjust for: uncertain or unforeseen events; differences between forecast and actual desalination costs (covering desalination security payments and the cost of any water ordered); a 'pass through' of changes in some costs (such as taxes) during the regulatory period; and annual changes to the benchmark cost of debt.

Most businesses do not have an adjustment mechanism for variations in demand or revenue. An exception is Yarra Valley Water, which has a revenue cap adjustment mechanism. The key features of the mechanism are:[63]

- it adjusts for variations in all regulated service revenue
- it adjusts for variations in bulk charges to Yarra Valley Water
- adjustments are made on an annual basis within the regulatory period

[63] See ESCV (2018).

- where the revenue cap adjustment is positive (excess revenue to be returned to customers), the weighted average of all scheduled price increases is limited to 2.0% in real terms (with any additional shortfall to carried for subsequent years)
- price changes as a result of a revenue cap adjustment may be applied to any or all of the revenue cap services.

England and Wales

Ofwat regulates water and wastewater companies in England and Wales. For the most recent price review (PR19) Ofwat included two adjustment mechanisms:[64]

- a revenue forecasting incentive (RFI), which applies to most revenue (excluding bioresources)
- a developer services revenue adjustment mechanism (DSRA) relating to the activities required to connect new developments (or previously unconnected premises) to a water or wastewater network

The RFI is a symmetric revenue adjustment applied in-period to reconcile any revenue under or over-recovery in an earlier year. The adjustments are modified to account for the time value of money. Where differences between actual and allowed revenues are greater than 2%, the RFI applies a financial penalty.

DSRA is a reconciliation related to developer services to ensure companies' allowed revenue reflects the actual number of new connections. The allowed revenue adjustments are calculated as the sum of:

- the difference between actual and forecast new properties by year
- multiplied by a unit rate relevant to the service
- adjusted for the time value of money.

Other sectors

Revenue caps accompanied by 'unders and overs' schemes are common in other regulated utilities. Two examples from rail and electricity networks are provided below.

Rail – Aurizon Network

Aurizon Network manages Australia's largest coal export rail network, the central Queensland coal network.

As noted by the QCA:[65]

> Aurizon Network operates under a revenue cap regime, where any over or under-recovery of its approved revenues in any given year is returned (recouped) through a reference tariff adjustment two years later (revenue adjustment amounts).

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64 For details see Ofwat (2017).

65 https://www.qca.org.au/project/aurizon-network/2016-access-undertaking-ut4/revenue-adjustment-amounts/

Electricity – South Australia Power Networks (SA Power Networks)

SA Power Networks is South Australia's sole electricity distributor. It builds, maintains and upgrades the poles, wires and substations that deliver power to homes and businesses in the state.

SA Power Networks are regulated by the Australian Energy Regulator (AER) under a revenue cap coupled with an unders and overs mechanism, which is applied each year. In a recent submission it describes the regulator approach as follows[66]

> The AER decided … for SA Power Networks for the 2020–25 RCP, that our [services] are to continue to be regulated via a revenue cap form of control. Under a revenue cap form of control, the AER sets the total allowed revenue (or annual revenue requirement) for each regulatory year of the 2020–25 RCP. SA Power Networks must comply with the revenue cap by forecasting sales for the next regulatory year and setting prices so the expected revenue is equal to or less than the total revenue allowed. At the end of each regulatory year, SA Power Networks will report actual differences to the AER and any over or under recovery is deducted from or added to the total revenue in future regulatory years.

[66] SA Power Networks (2019).

Appendix C Extracts from SAWRD20 and SAWRD16

This appendix includes the key clauses from SAWRD20 and SAWRD16 Price Determinations that are relevant to this report

Key clauses from SAWRD20

2.2.2 Where actual drinking water retail services demand exceeds forecast drinking water retail services demand, SA Water may recover drinking water retail services revenues in excess of the maximum drinking water retail services revenues specified in clause 2.2.1, in the amount calculated under clause 2.4.2 as the sales revenue adjustment amount (RA_D).

2.4 Drinking water retail services revenue adjustment mechanism

2.4.1 Prior to the commencement of the subsequent regulatory period, the Commission will calculate a drinking water retail services sales revenue adjustment amount (RA_D), which will be subtracted from the maximum drinking water retail services revenues determined as part of the subsequent price determination.

2.4.2 RA_D will be calculated as follows (and expressed as a present value at 1 July 2020, in dollars of December 2018):

RAD equals:

(i) $0.5*(A_D - N_D)$, where A_D (as defined in subclause (i) below) differs from N_D (as defined in subclause (ii) below) by one percent or more, or alternatively

(ii) zero, where A_D (as defined below in subclause (i) below) differs from N_D (as defined in subclause (ii) below) by less than one percent,

(i) A_D (expressed as a present value at 1 July 2020, in dollars of December 2018) is the actual drinking water retail services sales revenue received during the regulatory period, and

(ii) N_D (expressed as a present value at 1 July 2020, in dollars of December 2018) is the notional drinking water retail services sales revenue that would have been received during the regulatory period if forecast drinking water retail services sales prices applied by SA Water during the regulatory period were applied to actual drinking water retail services demand as specified in the Forecast Schedule in Part 5 of this determination.

2.4.3 For the purposes of clause 2.2 and clause 2.4:

(a) actual drinking water retail services demand is drinking water retail services demand to be submitted by SA Water by 30 April 2024 based on actual drinking water retail services demand up to 31 March 2024 and SA Water's best estimate of drinking water retail services demand for the period between 1 April 2024 to 30 June 2024 (inclusive).

(b) actual drinking water retail services sales revenue is drinking water retail services revenue to be submitted by SA Water by 30 April 2024 based on actual drinking water retail services sales revenue up to 31 December 2023 and SA Water's best estimate of drinking water retail services revenue for the period 1 January 2024 to 30 June 2024.

2.8 Sewerage retail services revenue adjustment mechanism

2.8.1 Prior to the commencement of the subsequent regulatory period, the Commission will calculate a sewerage retail services revenue adjustment amount (RA_S), which will be subtracted from the

maximum sewerage retail services revenues determined as part of the subsequent price determination.

2.8.2 RA_S will be calculated as follows (and expressed as a present value at 1 July 2020, in dollars of December 2018):

RA_S equals:

(i) $0.5*(A_S - N_S)$, where A_S (as defined in subclause (i) below) differs from N_S (as defined in subclause (ii) below) by one percent or more, or alternatively

(ii) zero, where A_S (as defined in subclause (i) below) differs from N_S (as defined in subclause (ii) below) by less than one percent,

(i) A_S (expressed as a present value at 1 July 2020, in dollars of December 2018) is the actual sewerage retail services revenue received during the regulatory period, and

(ii) N_S (expressed as a present value at 1 July 2020, in dollars of December 2018) is the notional sewerage retail services revenue that would have been received during the regulatory period if forecast sewerage retail services prices applied by SA Water during the regulatory period were applied to actual sewerage retail services connections as specified in the Forecast Schedule in Part 5 of this determination.

2.8.3 For the purposes of clause 2.6 and clause 2.7:

(a) actual sewerage retail services connections is the number of sewerage retail services connections to be submitted by SA Water by 30 April 2024 based on actual sewerage retail services connections up to 31 March 2024 and SA Water's best estimate of sewerage retail services connections for the period 1 April 2024 to 30 June 2024.

(b) actual sewerage retail services revenue is sewerage retail services revenue to be submitted by SA Water by 30 April 2024 based on actual sewerage retail services revenue up to 31 December 2023 and SA Water's best estimate of sewerage retail services revenue for the period 1 January 2024 to 30 June 2024.

5.1 Forecast demand

5.1.1 For the purposes of clause 2.4 and 2.8 of this price determination, the forecast level of drinking water retail service demand (expressed in total GL) and sewerage retail service demand (expressed in number of connections) in each regulatory year is as submitted by SA Water in writing by 31 August 2020 and subsequently approved by the Commission.

Key clauses from SAWRD16

2.2.2 Where actual drinking water retail services demand exceeds forecast drinking water retail services demand, SA Water may recover drinking water retail services revenues in excess of the maximum drinking water retail services revenues specified in clause 2.2.1, in the amount calculated under clause 2.3.2 as the revenue adjustment amount (RA_D).

2.3 Drinking water retail services revenue adjustment mechanism

2.3.1 Prior to the commencement of the subsequent regulatory period, the Commission will calculate a drinking water retail services revenue adjustment amount (RA_D), which will be subtracted from the maximum drinking water retail services revenues determined as part of the subsequent price determination.

2.3.2 RA_D will be calculated as follows (and expressed as a present value at 1 July 2016, in dollars of December 2014):

$RA_D = V_D + R_D$, where

(a) V_D (expressed as a present value at 1 July 2016, in dollars of December 2014) is the drinking water demand variation revenue adjustment and equals:

(i) $0.5*(A_D - N_D)$, where A_D differs from N_D by one percent or more

(ii) zero, where A_D differs from N_D by less than one percent

(b) R_D (expressed as a present value at 1 July 2016, in dollars of December 2014) is the revenue adjustment that arises if actual drinking water retail services revenue during the regulatory period exceeds the maximum drinking water retail services revenue as specified in clause 2.2.1 other than as a result of a demand variation and equals the maximum of $(N_D - M_D)$ and zero.

(c) A_D (expressed as a present value at 1 July 2016, in dollars of December 2014) is the actual drinking water retail services revenue received during the regulatory period.

(d) N_D (expressed as a present value at 1 July 2016, in dollars of December 2014) is the notional drinking water retail services revenue that would have been received during the regulatory period if actual drinking water retail services prices applied by SA Water during the regulatory period were applied to forecast drinking water retail services demand as specified in the Forecast Schedule in Part 5 of this determination.

(e) M_D is the maximum drinking water retail services revenues for the regulatory period, as specified in clause 2.2.1

2.3.3 For the purposes of clause 2.2 and clause 2.3:

(a) actual drinking water retail services demand is drinking water retail services demand to be submitted by SA Water by 30 April 2020 based on actual drinking water retail services demand up to 31 December 2019 and SA Water's best estimate of drinking water retail services demand for the period 1 January 2020 to 30 June 2020.

(b) actual drinking water retail services revenue is drinking water retail services revenue to be submitted by SA Water by 30 April 2020 based on actual drinking water retail services revenue up to 31 December 2019 and SA Water's best estimate of drinking water retail services revenue for the period 1 January 2020 to 30 June 2020.

2.5 Drinking water retail services revenue adjustment statement

2.5.1 By a date and in a manner and form specified by the Commission in writing, SA Water must submit to the Commission a drinking water retail services revenue adjustment statement in relation to the regulatory period, which must include (without limitation):

(a) actual revenues attributable to the sale and supply of drinking water retail services for each regulatory year during the period 1 July 2016 to 30 June 2019

(b) estimated revenues attributable to the sale and supply of drinking water retail services for the period 1 July 2019 to 30 June 2020

(c) actual demand for drinking water retail services for each regulatory year during the period 1 July 2016 to 30 June 2019, and

(d) estimated demand for drinking water retail services for the period 1 July 2019 to 30 June 2020.

5.1 Forecast demand

5.1.1 For the purposes of clause 2.3 of this price determination, the forecast level of drinking water retail service demand in each regulatory year is as follows:

	2016-17	2017-18	2018-19	2019-20
Total (GL)	190.1	191.4	192.9	194.5

5.1.2 For the purposes of clause 2.7 of this price determination, the forecast level of sewerage retail service demand (expressed in number of connections) in each regulatory year is as follows:

	2016-17	2017-18	2018-19	2019-20
Total (connections as at 31 December each year)	597,345	604,513	611,767	619,109

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