TW HPRM ref: 18/11427

9 February 2018

Mr Joe Dimasi
Office of the Tasmanian Economic Regulator
GPO Box 770
Hobart TAS 7001

Dear Mr Dimasi

Supplementary response to the Tasmanian Economic Regulator's draft report on PSP3

I refer to our response to the Tasmanian Economic Regulator's (TER's) draft report on Price and Service Plan 3 (PSP3) submitted to your office on 25 January 2018 in which we noted our engagement of a third party to undertake a further technical assessment of the TER's report.

This third party review, undertaken by consultant Frontier Economics, is now complete. We asked Frontier Economics to:

- describe the methods for regulatory depreciation and the weighted average cost of capital (WACC) proposed by TasWater in our draft PSP3 submission, and by the TER in its draft determination for PSP3
- outline the merits of TasWater's and the TER's proposed methods with respect to regulatory theory and regulatory precedent in Australia, and
- comment on the extent to which sufficient evidence has been put forward by TasWater and the TER to support their respective positions.

The report supports the approach we proposed in our draft PSP3 submission for regulatory depreciation in so far as this method produces the most accurate estimate of depreciation and best achieves a matching of customers efficiently contributing towards the cost of assets that benefit them. Further, the report also supports our method for calculating the cost of the debt and the risk free rate in the WACC as it is aligns more closely with the debt management approach used by an efficient benchmark firm.

The report is attached for your consideration. We would welcome the opportunity to discuss our response, and Frontier Economics review findings, prior to the formulation of your final report on PSP3.

Yours sincerely

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Encl.

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A review of the method for calculating depreciation and WACC for PSP3

A REPORT PREPARED FOR TASWATER

February 2018

A review of the method for calculating depreciation and WACC for PSP3

Contents

1 Introduction

1.1 Background and overview of task

The Tasmanian Economic Regulator (TER) published its draft determination for Price and Service Plan 3 (PSP3) on 30 November 2017.[1] While TER accepted most of TasWater's proposed expenditure, service standards and policies, it put forward alternative views for calculating regulatory depreciation and the weighted average cost of capital (WACC).

In particular:

- for **depreciation**, TasWater and TER proposed different views with respect to the method for calculating the remaining life for depreciating existing assets. TasWater proposed depreciating each of its assets individually using a line-by-line approach. While TER accepted this approach for new assets, it adopted a weighted average life method for depreciating existing assets; and
- for the **WACC**, TasWater and TER proposed different views with respect to the weight that attributed to 'on-the-day' bond rates and historical bond rates in calculating the debt risk premium and the risk-free rate. TasWater proposed an equal 50-50 weighting, similar to the approach used by IPART, while TER applied a modified version of this approach which placed greater weight on current rates.

In light of this, we have been asked by TasWater to assess the merits of TasWater's and TER's approaches with respect to depreciation and WACC. In particular, we have been asked to:

- describe the methods for depreciation and WACC proposed by TasWater in its initial submission, and by TER in its draft determination, for PSP3;
- outline the merits of TasWater's and TER's proposed methods, with respect to regulatory theory and regulatory precedent in Australia; and
- comment on the extent to which sufficient evidence has been put forward by TasWater and TER to support their respective positions.

In undertaking this task, we have restricted our analysis to the points of divergence between TasWater and TER, as specifically outlined above. As such, we have not assessed any other aspect of TasWater's initial proposal, or TER's draft decision, on depreciation, WACC, or other issues.

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1 Office of the Tasmanian Economic Regulator, *2018 Water and Sewerage Price Investigation Draft Report*, November 2017 (hereafter referred to as the 'TER Draft Report').

1.2 Preparation of report

This report was prepared by Professor Stephen Gray, with assistance from Ehson Shirazi and Dinesh Kumareswaran.

Stephen is Chair of Frontier Economics (Australia), and Professor of Finance at the University of Queensland Business School. He is a leading expert on regulatory and cost of capital issues, and leads Frontier Economics' work on cost of capital and financial economics. He has published widely in leading academic journals, and has advised nearly all regulated businesses in Australia (across industries and jurisdictions) on rate of return matters.

Stephen's work on empirical finance, asset-pricing and corporate finance has been published in leading academic and practitioner journals. Much of this work has led to, or arisen from, consulting projects. At University of Queensland Business School, Stephen teaches a range of award and executive education courses in financial management, asset valuation, and corporate finance. He has Honours degrees in Commerce and Law from the University of Queensland and a PhD in Financial Economics from Stanford University. He has received a number of academic awards including the Prime Minister's Award for University Teacher of the Year in the Economics and Business field in 2002.

1.3 Structure of this report

The remainder of this report is structured as follows:

- **Section 2** sets out a summary of TasWater's and TER's proposed approaches to depreciation for PSP3, and a review of the merits of each approach; and
- **Section 3** sets out a summary of TasWater's and TER's proposed approaches to WACC for PSP3, and a review of the merits of each approach.

2 Regulatory Depreciation

This section sets out our analysis of the approaches adopted by TasWater and TER for calculating the remaining life for depreciating existing assets.

2.1 Overview of TasWater's approach

In its initial submission, TasWater calculated its depreciation allowance by using a 'line-by-line' approach to depreciate its assets. Under this approach, a residual value and residual economic life was specified for each individual asset, and each asset was then depreciated in accordance with the following formula:[2]

$$Regulatory\ depreciation = \frac{Residual\ regulatory\ asset\ value}{Residual\ asset\ life}$$

The depreciation allowance for a given regulatory year was calculated by summing together the individual asset depreciation calculations for that year.

2.2 Overview of TER's approach

In its draft determination, TER adopted a hybrid approach to calculate regulatory depreciation. This hybrid approach uses TasWater's proposed line-by-line method for new assets (i.e., assets purchased or constructed since 1 July 2009), but adopts a weighted average life method for existing assets (i.e., assets transferred before 1 July 2011).[3]

TER set out several reasons in support of its decision to adopt a different approach for depreciating existing assets. This includes that:[4]

- there was no consistent approach to depreciation amongst regulators, and that there is no precedent to support tracking the depreciation on individual assets;
- a line-by-line approach will add substantial complexity and administrative costs for TasWater and TER;
- retrospectively changing the calculation of regulatory depreciation on existing assets was not considered sound regulatory practice; and
- it was sceptical of the veracity of the data for existing assets, particularly in view of: (a) the lack of knowledge about the condition of assets that were transferred to TasWater in 2009; (b) the high-level nature of the GHD/KPMG review of

2 TasWater, *Draft Price and Service Plan 3 – 1 July 2018 to 30 June 2021*, 30 June 2017, p.109 (hereafter referred to as the 'TasWater Initial Proposal').

3 TER Draft Report, p.144.

4 TER Draft Report, pp. 142-144.

these assets in 2009; and (c) the absence of sufficient condition assessments of the assets post-transfer.

TER's decision means that the depreciation approach applied to existing assets is a continuation of the approach that was applied to these assets under the current regulatory period (PSP2).

2.3 Review of the merits of each approach

2.3.1 Regulatory principles

Efficiency implies recovery of asset cost over its economic life

The overall objective of economic regulation is to ensure that users of a regulated service pay an amount which is commensurate with the efficient cost of providing the service, plus a reasonable return on investments. Each revenue building block must be assessed against this guiding principle.

The depreciation building block is an allowance provided to a regulated business so that capital investors recover the cost of their investment over the economic life of the asset. In order to be consistent with the principle above, the depreciation profile should systematically allocate the cost of an asset over the period that the asset usefully provides services to consumers, in a way that reflects the distribution of benefits provided by the asset over time. In this way, only those consumers that benefit from the services provided by an asset will contribute to the purchase cost of that asset, and this contribution will be in proportion to the benefit they receive.

In practice, application of this principle means that assets should be depreciated over their *economic life*, where the economic life of an asset refers to the period over which the asset is expected to be utilised. A depreciation profile that results in the recovery of an asset's cost over a different period of time will lead to less efficient outcomes. This is because:

- if an asset is depreciated over a period of time that is ***shorter*** than its economic life, this has the effect of unjustifiably bringing forward depreciation, resulting in today's customers paying a greater proportion of the asset's costs than future generations that also benefit from that asset; and
- if an asset is depreciated over a period of time that is ***longer*** than its economic life, this has the effect of unjustifiably deferring depreciation, resulting in future generations of customers paying a greater proportion of the asset's costs to the benefit of today's customers and to the detriment of future customers who are contributing towards the cost of an asset that is no longer in use.

The further a depreciation profile for an asset deviates from the distribution of the benefits received from that asset over time, the further removed prices will be from the efficient level.

Individually tracking each asset is the most accurate method

In our view, TasWater's line-by-line approach to depreciation, which depreciates each asset individually over its economic life, is better aligned with the over-arching objective of economic regulation then the weighted average approach adopted by TER. This is because a depreciation approach that individually tracks each asset is the most accurate method for calculating the actual remaining economic life of an asset (and, as shown above, depreciating an asset according to its actual remaining economic life will lead to more efficient outcomes).

So much has been recognised by the AER:[5]

> The most accurate way of estimating remaining asset lives is to track every asset individually. That is, record each asset added to the RAB and track its value over time.

While the adoption of average asset lives simplifies the calculation of depreciation, it will not give precisely the same value as if each asset was individually tracked and depreciated according to its economic life. This is because assets with a remaining economic life that is less than (greater than) the average will be depreciated over a period that is longer than (shorter than) their remaining economic life. This leads to inefficient prices, with today's customers either subsidising, or being subsidised by, further generations.

In addition, on this issue of intergenerational equity, TER states that:[6]

> … it could be equally argued that applying a line by line approach produces relatively shorter asset lives and therefore higher regulatory depreciation meaning that future customers benefit relative to current customers.

In our view, this statement is inaccurate. A line-by-line approach, calculated using the economic life of each asset, suggests that only those customers that make use of the assets will be the ones that pay for the assets. Intergenerational issues only arise when assets are not depreciated according to their actual economic life, which will occur under TER's proposed weighted average approach.

Response to issues raised by TER

In the following sections, we respond to specific issues that were raised by TER in its draft decision on regulatory depreciation.

(a) Administrative burden

In its draft decision, TER notes as follows:[7]

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5 Australian Economic Regulator, *Preliminary Decision – SA Power Networks Determination 2015−16 to 2019−20 – Attachment 5 – Regulatory Depreciation*, April 2015, p.5-12.

6 TER Draft Report, p.143.

7 TER Draft Report, p.143.

> Applying a line by line approach to almost 260,000 assets would be complex and comes with substantial administrative costs for both TasWater and the Economic Regulator in the event that adjustments have to be made.

In some cases, the cost imposed from applying an overly onerous process may outweigh any potential efficiency benefits attributable to that process. However, this is unlikely to be the case at present, since TasWater have already gathered the data to support the calculation of depreciation at the individual asset level, and undertaken the line-by-line depreciation calculations for each of its assets. In our view, if a regulated business *proposes* a more complex depreciation approach, then it cannot be said that this imposes an overly excessive burden on the business.

Also, from TER's perspective, we note that checking the accuracy of a depreciation model is substantially less burdensome than developing the model. This suggests that an approach proposed by a regulated business will not be overly burdensome for that regulated business or for the regulator, even if it involves further work.

(b) Consistency over time

In its draft decision, TER notes as follows:[8]

> It is not considered sound regulatory practice to retrospectively change the calculation of regulatory depreciation on existing assets.

We agree that excessive or unjustifiable changes in regulatory methodology should be avoided as they will lead to an increase in regulatory risk, and a commensurate increase in the required rate of return (to reflect this higher level of risk).

However, in our view, changes that improve regulatory methodology, or that better contribute to the achievement of regulatory objectives, should be encouraged. This is consistent with best practice regulation, with regulators often reviewing and improving their approaches (e.g., the AER's Better Regulation reform program led to substantive changes to many aspects of its regulatory framework).

Ultimately, provided that the total return of capital over the life of an asset does not exceed the initial value of the asset (in net present value terms), there are no substantive issues with transitioning from the weighted average approach (applied in PSP2) to a line by line approach in PSP3. Specifically, the proposed change does not involve any double counting or change in the total amount recovered via depreciation allowances; it only changes the timing to better reflect the true asset lives.

(c) Data accuracy

The advantages of individually tracking each asset requires accurate data on both the remaining value and economic life for each asset. The complexity of this task

8 TER Draft Report, p.143.

is the main reason that a line-by-line approach is not typically used by regulators or regulated businesses in other jurisdictions (see below for more information).

We note that TER has questioned the veracity of the data recorded in TasWater's asset register for assets that were transferred to the business.[9] This appears to be a key reason why TER adopted a different approach for existing assets.

In our view, concerns over the accuracy of data should not automatically disqualify the line-by-line approach for depreciating existing assets. Best practice regulatory decision-making would require that TER identify precisely what the data issues are, and then provide TasWater with an opportunity to address those concerns. In the absence of identifying and analysing these issues, it cannot be said with any degree of certainty that TER's proposed weighted average approach will result in a more accurate, and therefore more efficient, outcome.

2.3.2 Regulatory precedent

In general, most regulators and regulated business adopt an approach whereby:

- individual assets are grouped into, and depreciated by, asset classes;
- capital expenditure during a regulatory period is depreciated by using standard asset lives for each asset class – the standard asset life reflects how long assets within that class would physically last had they just been built; and
- assets in the opening RAB are depreciated by using the remaining life for each asset class – this is calculated at the start of the period as a weighted average of the remaining economic life of all individual assets included in each class.

This approach has been applied by IPART, ESCOSA, the ESC, the ERA, the QCA (for pre-1 July 2013 assets), and the AER.[10]

We note that use of weighted average asset lives is an outturn of the availability of data, and the complexity of alternative methods, rather than some objectives-based preference for this methodology over a line-by-line approach. For instance, TER has noted that both the ICRC and QCA use a line-by-line approach for new capex, where more comprehensive asset data is available.[11] However, in both cases, the

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9 TER Draft Report, pp.141-143.

10 IPART, *Review of prices for Sydney Water Corporation From 1 July 2016 to 30 June 2020 – Final Report*, June 2016, pp.127-130; ESCOSA, *SA Water Regulatory Determination 2016 – Final determination*, June 2016, p.133; ESC, *Melbourne Water Price Review 2016 – Final decision*, June 2016, p.58 (note, the ESC approved Melbourne Water's proposal to calculate depreciate for existing assets using average remaining lives); ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, 5 September 2012, p.230; QCA, *SEQ Bulk Water Price Path 2015-18*, March 2015, p.37 (note that the QCA has accepted the depreciation of assets after 1 July 2013 on a line-by-line basis); AER, Final Decision – Ausgrid Distribution Determination 2015−16 to 2018−19 – Attachment 5 – Regulatory Depreciation, April 2015, pp.5.9-5.11.

11 TER Draft Report, pp.137-137.

regulated businesses did not propose using a line-by-line approach for depreciating existing assets, so there was no direct consideration of this issue by the regulator.

The AER's decision for SAPN for the 2015-20 period also illustrates this point. In this case, the AER unequivocally recognised that individual tracking assets was the most accurate approach.[12] The AER ultimately accepted a 'year-by-year' approach to tracking SAPN's assets. Under this approach:[13]

- assets in existence as at 1 July 2010 are to be depreciated by asset class over the remaining lives of those assets approved by the AER in its last determination;
- capital expenditure for each year of 2010-15 is grouped together by asset class, and depreciated separately using the standard asset life.

That is, the capital expenditure of each asset class is tracked as disaggregated yearly categories over time, preserving these discrete categories across multiple regulatory control periods. These separately tracked expenditures can be thought of as asset sub-classes – for instance, the motor vehicle class would be split into sub-classes for 2015 motor vehicles, 2016 motor vehicles, 2017 motor vehicles, etc, and each is depreciated separately using the standard asset life for the motor vehicle class.

We note that the AER's approach with respect to assets existing at 1 July 2010 falls out from the particular economic framework that the AER is required to apply – specifically, NER clause 6.5.5(b)(3), due to which the AER determined that it could not revisit past decisions on remaining asset lives – rather than the exercise of AER discretion.

However, the approach approved for capital expenditure recognises that removal of averaging assets with disparate economic lives (in this case, averaging of old and new assets) will lead to a depreciation profile that better reflects the economic life of the assets.

Importantly, this approach does not involve individual tracking of assets, and so is different to that proposed by TasWater. Assets are still grouped together by asset class, and depreciated in accordance with an average asset life for that class. Despite this, the approach is a recognition of the limitations of the average – its purpose is to avoid combining 1 July 2010 assets with assets from subsequent regulatory control periods, and so reduce the compromises associated with using a single remaining asset life for assets with disparate economic lives.

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12 Australian Economic Regulator, *Preliminary Decision – SA Power Networks Determination 2015−16 to 2019−20 – Attachment 5 – Regulatory Depreciation*, April 2015, p.5-12.

13 Australian Economic Regulator, *Final Decision – SA Power Networks Determination 2015−16 to 2019−20 – Attachment 5 – Regulatory Depreciation*, October 2015, p.5-11.

2.3.3 Summary and conclusions

In our view, the primary criterion for selecting a depreciation method is accuracy – the most accurate estimate will best achieve a matching of customers efficiently contributing towards the cost of assets that benefit them. There appears to be broad agreement that a line-by-line approach to depreciation produces the most accurate estimates.

We accept that it is possible for administrative cost and complexity to outweigh the benefits of using a more accurate approach. Therefore, the trade-off between accuracy and cost/complexity must be performed on a case-by-case basis. The primary objective of accuracy should only be sacrificed if there is clear evidence that the benefits are outweighed by other considerations. In our view, this is unlikely to be the case at present, since TasWater has already gathered the data to support the calculation of depreciation at the individual asset level, and undertaken the line-by-line depreciation calculations for each of its assets.

3 Weighted Average Cost of Capital

Sections 3.1 to 3.3 below set out our analysis of the approaches adopted by TasWater and TER for calculating the allowed return on debt. The return on debt is calculated as the sum of the debt risk premium, the risk-free rate and debt issuance costs. The analysis presented in this section apply equally to the calculation of both the debt risk premium and the risk-free rate components. We do not consider debt issuance costs in this report.

Section 3.4 discusses briefly the method for determining the risk-free rate to be used in the calculation of the return on equity allowance.

3.1 Overview of TasWater's approach to the return on debt

TasWater's approach for determining the debt risk premium (DRP) was to:[14]

- compute a long-term (historical average) estimate of the DRP, measured using the 10-year average of corporate bond yields;[15]
- compute a short-term (current) estimate of the DRP, measured using an 'on-the-day' approach, or the 40-day average of corporate bond yields;[16]
- take a weighted average of the long-term and short-term estimates, where each component receives an equal 50 per cent weight.

TasWater proposed broadly the same approach to determine the risk-free rate, but with Commonwealth government bond yields.[17]

The rationale for considering both historical and current estimates of the cost of debt is that it attempts to balance two objectives:

- *reflect actual debt financing practices of efficient and prudent firms* – the historical cost of debt (approximated using a 10-year average) reflects the benchmark firm's outstanding cost of debt, based on its efficient and prudent financing strategy. This is because infrastructure businesses (which typically have substantial debt portfolios) tend to stagger the issuance of debt to reduce refinancing risk, and

14 TasWater Initial Proposal, pp.284-293.

15 This 10-year historical average is computed using monthly debt premium data published by the RBA, and by averaging over each of the 120 months from January 2008 to December 2017, inclusive.

16 This current estimate of the DRP is computed by averaging debt premium data published by the RBA for the months November 2017 and December 2017.

17 The current estimate of the risk-free rate was calculated by averaging daily yields on Commonwealth Government Securities (published by the RBA) over the 40 business days to (and including) 29 December 2017.

may be unlikely, or unable, to fully hedge the interest rate risk on this debt so that it aligns with a current (on-the-day) cost of debt at the start of a regulatory period. Regulators have generally found this to be an efficient response to managing refinancing risk as it would result in a relatively small proportion of the firm's debt maturing each year.

- *provide appropriate price signals for efficient future investment* – a benchmark efficient firm might also be expected to be exposed to the prevailing spot rate because: (a) new capital expenditure would have to be financed at the prevailing rate; and (b) an efficient firm might maintain an amount of spot exposure such that it can lock in a fixed rate from time to time when it considers market conditions to be favourable. Setting the cost of debt allowance in line with this cost could provide an efficient price signal to a firm when it is deciding whether to expand capacity or make other investment decisions.

Using some combination of these two approaches takes account of their different merits. A 50-50 approach, as proposed by TasWater, effectively gives equal weight to both objectives. This weighting scheme is the same default approach applied by IPART.

3.2 Overview of TER's approach to the return on debt allowance

In its draft decision, TER agrees that a combination of current and historical rates is appropriate. It notes that:[18]

- current rates 'theoretically present the most efficient expected cost of debt'; and
- historical rates reflect that a benchmark firm has 'an efficient debt financing and risk management policy and such a policy would be based on issuing debt at different points in time with a staggered maturity profile.'

TER also notes that 'incorporating a historical component in the cost of debt is beneficial in that it may reduce the volatility in the WACC, which in turn may lead to less price volatility.'[19]

However, TER considered that historical rates are over-represented in TasWater's (50-50 weighting) approach. As such, TER developed an alternative approach that placed greater weight on the current (on-the-day) rate. In doing so, TER noted:[20]

18 TER Draft Report, p.151.

19 TER Draft Report, p.151.

20 TER Draft Report, p.152.

> The Economic Regulator concluded that a cost of debt methodology that incorporates some degree of historical rates but is predominately weighted towards current market rates would provide regulated businesses with the appropriate signals regarding the need to make efficient investment decisions.

TER's approach for calculating the risk-free rate applies the following steps (note that the same approach was used to determine the debt risk premium, but with the Reserve Bank of Australia's monthly corporate credit swap data instead):[21]

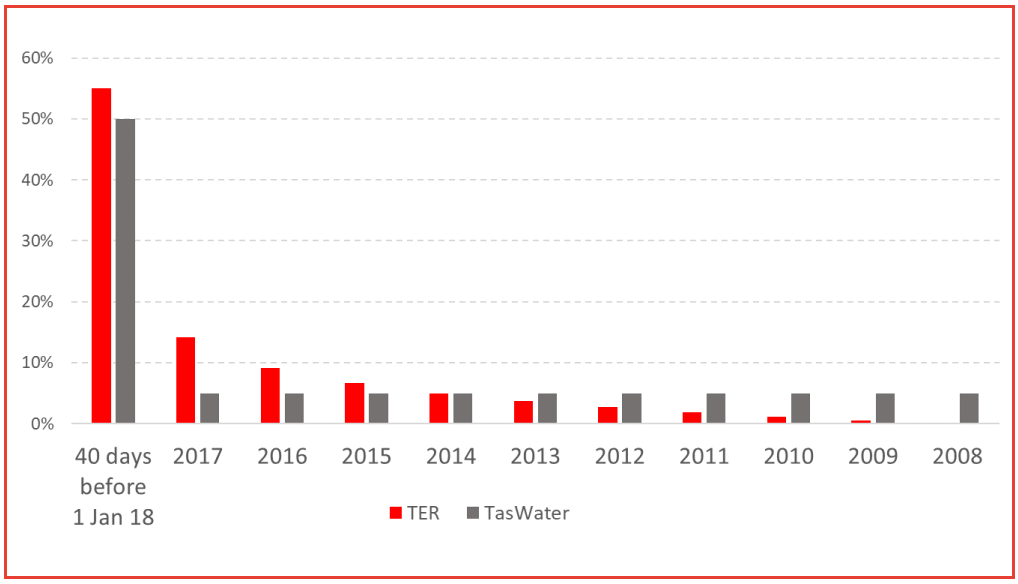
1. calculate the 40-trading day average of 10-year Commonwealth Government Securities (CGS);
2. calculate the daily average of the last nine, eight, seven, six, five, four, three, two, one year of yields on the 10-year CGS used in step 1;
3. calculate the average of the value in step 1 and the values in step 2; and
4. calculate the midpoint of the values calculated in steps 1 and 3.

We understand that the application of steps 1 and 2 produces 10 different values – an average of the 40-day yield, and an average of yields for the past 9 years, and the past 8 years, and the past 7 years, and so on until the past 1 year. An average of these 10 observations is taken in step 3, and then step 4 calculates the midpoint between this average, and the average of the 40-day yield.

This approach results in a time-weighted average of bond yields that places greater weight on rates for more recent periods than older rates. These weights are set out in Figure 1 below.

21 TER Draft Report, p.152.

Figure 1 – Comparison of bond weights applied by TER and TasWater



Source: Frontier Economics analysis.

Note: This chart represents our understanding of the weights applied by TasWater and TER to bond yields in calculating the cost of debt. The '40 days before 1 Jan 18' column reflects: (a) for the risk-free rate, the average of daily yields on Commonwealth Government Securities over the 40 business days to (and including) 29 December 2017; and (b) for the DRP, the average of debt premium data for the months November 2017 and December 2017. Each of the remaining columns represents an average of monthly bond yield data for the corresponding calendar year. For example, the '2017' column reflects: (a) for the risk-free rate, the average of monthly yields on Commonwealth Government Securities over the 12 months from January 2017 to December 2017 (inclusive); and (b) for the DRP, the average of debt premium data over the 12 months from January 2017 to December 2017 (inclusive).

3.3 Review of the merits of each approach

3.3.1 Regulatory principles

A historical trailing average better reflects efficient costs

As a guiding principle, regulatory frameworks should operate to do least harm to the incentives that businesses operating in a workably competitive market would otherwise face, thereby encouraging prudent and efficient behaviour.

In relation to the cost of debt, this principle suggests that the regulatory framework should encourage businesses to adopt the debt raising strategies of a prudent and efficient provider of services using long-lived infrastructure assets. A regulatory framework can best achieve this by setting the regulatory WACC in a way that is consistent with such a debt raising and management strategy.

For financing long-lived infrastructure assets, the debt raising approach that would be observed in competitive markets is likely to include:

- *the issuance of longer term debt* – firms generally seek to finance long-lived assets with longer maturity debt to reduce debt refinancing risk; and
- *the periodic issuance of tranches of debt* (as opposed to raising debt all at once) – this also allows firms to spread their refinancing risk over time and thereby lower overall risk.

We agree with the conclusion reached by both TasWater and TER that the 10-year staggered maturity approach represents an appropriate regulatory benchmark to the long-term debt component. We consider this conclusion is uncontroversial, as many other regulators have reached similar conclusions.[22]

Given that the benchmark efficient approach is to issue 10-year debt on a staggered maturity basis, the benchmark efficient cost would be replicated by updating the regulatory allowance every year. This is because (approximately) 10 per cent of the relevant debt pool would mature each year, and be refinanced at the current rate. The relevant trailing average, and consequently the benchmark efficient cost, will therefore change each regulatory year. It follows that updating this component of the return on debt on an annual basis would produce a regulatory allowance that more accurately reflects the benchmark efficient cost of debt.

The preferred way of achieving this outcome would be to adopt a trailing average methodology that involves the annual updating of the WACC on the basis of a rolling average of the cost of debt. The AER has recently moved to such a trailing average approach, whereby the allowed return on debt will be an equally weighted (with weights equal to 0.1) average of the prevailing rates in the previous ten years.[23] The AER adopted this policy to be consistent with its requirement to have regard to the return on debt of a benchmark efficient firm, and in recognition of the fact that regulated businesses tend to periodically issue long-term debt.

To put this plainly, to accept the principle that regulated firms stagger the issuance of their debt portfolio is to also recognise that a trailing average approach (being an approach based entirely on historical rates) will be most consistent with efficient outcomes. This should therefore be the starting point for any regulatory analysis.

Trade-offs from adopting an alternative cost of debt approach

In determining the allowed return on debt, a regulator may choose to balance the objective of reflecting the actual debt financing practices of efficient and prudent firms, with the objective of providing appropriate price signals for efficient future investment. Since future debt is raised at current rates, promotion of this second objective will lead to a cost of debt that gives some weight to current rates.

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22 Including the AER, ESC, ESCOSA, IPART and ERA.

23 AER, *Better Regulation – Rate of Return Guideline*, December 2013, p.4.

Both TasWater and TER's proposed approaches fall within this category, but differ with respect to the proportion of weight attributed to current and historical rates. TasWater adopts a 50-50 weighting, and hence weights each objective equally, while TER places relatively more weight on current rates.

By contrast, the AER approach is to apply 100% weight on the trailing average approach on the basis that (a) the amount of new investment is likely to be small relative to the existing asset base, and (b) 10% of its trailing average allowance is already set equal to the prevailing rate.

The approach of balancing current and future rates gives rise to several important trade-offs. In general, the more weight placed on current rates (vis-à-vis historical rates):

- the more removed prices will be from the level commensurate with an efficient debt management approach;
- the greater the potential for material differences between the actual and allowed cost of debt;
- the greater the refinancing risk for the business; and
- the greater the level of revenue (and so price) volatility between regulatory periods.

In our view, the magnitude of these problems will be enhanced under the approach used by TER since it places relatively more weight on current rates than TasWater's approach. To be clear, in comparison to the approach adopted by TasWater, TER's approach will:

- result in *less efficient prices*, since the return on debt allowance is further removed from the financing costs of a benchmark efficient firm, which in turn may lead to inefficient consumption and investment decisions;
- *increase the risk that the actual cost of debt does not match its allowed cost of debt*, leading to (potentially) large cash flow mismatches, which in turn could deter efficient investment;
- *increase refinancing risk*, or the risk that in order to match its actual cost of debt as closely as possible to the regulatory allowance TasWater would need to refinance a substantial portion of its debt portfolio in periods of high/rising interest rates, such that the return on debt allowance will be insufficient to cover the cost of the higher interest rate on the new loan; and
- result in *larger jumps in the WACC* allowance from one period to the next, which increases revenue volatility, and may lead to price shocks for customers.

We find that TasWater's approach, which places greater weight on historical rates, will better reflect the efficient cost of debt, and therefore should be preferred over the approach adopted by TER.

We discuss each of the above issues in further detail below.

(a) Efficiency

The more weight placed on current bond rates, the more the cost of debt diverges from the historical trailing average, and the further removed the allowance will be from the debt financing costs of an efficient firm. That is, promoting efficient price signals for future investment by setting a cost of debt that reflects expected future bond rates comes at the cost of establishing an allowance that will not reflect the financing costs of a benchmark efficient firm.

TER's approach, which places relatively more weight on current bond rates, will be further removed from the competitive paradigm than the approach adopted by TasWater.

(b) Differences between actual and allowed cost of debt

Application of an approach other than a trailing average approach will mean that a regulated business will not be able to exactly match either the cost of the current portion of its debt portfolio, or the historical portion of its debt portfolio, to the regulatory allowance. This is because the allowance is locked in for the duration of the regulatory period, but the actual cost of debt changes as market conditions change.

Any resulting differences between the business' actual cost of debt and the allowed cost of debt can result in (potentially) large cash flow mismatches that the business (and ultimately shareholders) will absorb. Mismatches of this kind may risk the financial viability of the firm and lead to over/underinvestment, depending on whether the mismatches are positive or negative.

Relevantly, this risk arises under both TER's and TasWater's approaches, but will be heightened under the former (i.e., TER's approach is likely to result in a larger difference between TasWater's actual and allowed cost of debt). To see this, we note that TER's approach places relatively greater weight on current rates, with the implication that its cost of debt will be further removed from the historical trailing average then the cost of debt determined under TasWater's approach.

Further, in calculating the historical component of the cost of debt allowance, TER places *diminishing* weight on bond yields over time. As discussed further below, this is inconsistent with the expected financing practice of an efficient firm operating under a staggered debt approach (since such a firm would be expected to manage its risk by refinancing a relatively equal portion of its debt in each year). TasWater's calculation of the historical debt component, which effectively assumes that the business refinances an equal portion of its debt each year, is consistent with this outcome, and therefore will more closely reflect the actual financing practice of an efficient firm.

(c) Refinancing risk

A competitive firm seeks to reduce its refinancing risk. As such, if one combination of historical and current rates introduces greater refinancing risk than a different approach, it may be argued that the first approach is further removed from the efficient outcome that would occur in workably competitive industries.

In the regulatory context, an efficient and prudent business would try to match its actual cost of debt to the regulated rate. An efficient business trying to match its actual cost of debt to TER's allowance would need to refinance its debt portfolio to align with the weightings ascribed by TER, and reflected in Figure 1 above.

Under this approach, if TasWater sought to match its actual cost of debt as closely as possible to the regulatory allowance, it will have to refinance 60 per cent of its whole debt portfolio at the start of the regulatory period.[24] Refinancing in this way would expose TasWater to material refinancing risk at the start of each regulatory period. Put another way, this approach is implicitly consistent with a debt raising strategy whereby a firm reissues the majority of its debt in a single tranche, and so inconsistent with the principle that a prudent business would choose to spread its refinancing risk by reissuing smaller portions of its debt on a periodic basis. This approach is therefore a deviation from best practice debt management, and will likely lead to an overall increase in the cost of debt.

A 50-50 weighting, as proposed by TasWater, would also create some refinancing risk (vis-à-vis a trailing average approach). However, the magnitude of this risk is smaller than under TER's approach, since it implies that a smaller amount (50 per cent) of debt will be re-issued at the start of the period.

(d) Revenue and price volatility

In general, a volatile revenue allowance is undesirable because it can lead to price shocks for customers (since customers have no way of hedging against volatility in water prices).

Since TER's cost of debt allowance is more heavily weighted towards the 'on-the-day' approach, the allowance (and, consequently, prices) will be more volatile from one regulatory period to the next. Setting the cost of debt at the prevailing rate can lead to large jumps in the WACC due to market conditions. These jumps are a creation of the regulatory framework rather than a reflection of the costs an efficient benchmark firm would incur. Such disconnect may lead to firms adopting debt hedging strategies that are designed to manage the regulatory risks, rather than the fundamental market-related risks.

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24 We understand that TasWater refinances approximately 10 per cent of its debt portfolio per year. In accordance with this assumption, and the distribution of weight in Figure 1, at the start of the next regulatory period, TasWater will be required to refinance 55 per cent of its debt at the current rate, and 5 per cent at the 1-year average.

TasWater's 50-50 weighting will also lead to some volatility, but because half the allowance represents a 10-year historical average, which changes more slowly over time than the 'on-the-day' allowance, the approach would be less volatile than the approach TER is proposing.

No justification for different weights on historical bond yields

As noted above, businesses tend to stagger the maturity of their loans such that only a small portion of their total debt becomes due at any time. This allows a business to manage the risk that it is unable to refinance a large proportion of its debt at a given time at a reasonable cost.

Consistent with the notion, it is reasonable to assume that an efficient and prudent business would seek to re-finance its debt in relatively equal tranches, since to do otherwise would add further refinancing risk. For instance, in each year of a 10-year cycle, the firm might refinance 10 per cent of its debt requirements by issuing a 10-year fixed rate bond.[25] A firm that chooses to refinance a substantially larger portion of its debt in a given year will bear the risk that bond yields in that year are particularly unfavourable.

It follows that, for the cost of debt to reflect prudent debt management practices, the historical component should be determined by equally weighting yields in each of the historical years included in its calculation. Over a 10-year cycle, this would be equivalent to placing a 10 per cent weight on the average of yields in each of the preceding 10 years.

The weights applied by TER and TasWater are illustrated in Figure 1, and set out in more detail in Table 1 below.

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25 We also note that it may be efficient for some firms to issue debt with maturity beyond 10 years, and that a number of Australian infrastructure firms have recently done that. It may also be efficient for some firms to refinance, say 20% of their debt requirements every two years rather than 10% every year. That is, different firms may adopt different variations of an efficient debt management strategy, depending on their different characteristics and circumstances. Thus, the 10-year staggered maturity approach should be considered to be a generic benchmark for regulatory purposes and not a declaration that any firm that deviates form it is behaving inefficiently or imprudently. That is, the 10-year staggered maturity approach should be considered to be broadly consistent with how an efficient firm would manage its long-term debt portfolio, recognizing that individual firms may depart from that precise approach, given their particular characteristics and circumstances.

Table 1 – Summary of TER's and TasWater's debt weighting methodology

Period	TER	TasWater
40days before 1 Jan 18	55.00%	50.00%
2017	14.14%	5.00%
2016	9.14%	5.00%
2015	6.64%	5.00%
2014	4.98%	5.00%
2013	3.73%	5.00%
2012	2.73%	5.00%
2011	1.89%	5.00%
2010	1.18%	5.00%
2009	0.56%	5.00%
2008	-	5.00%

Source: Frontier Economics analysis.

The table shows that the approach adopted by TasWater matches the staggered maturity debt profile that infrastructure businesses tend to employ. The historical component of TasWater's cost of debt is determined as a simple 10-year average of historical bond yields, which effectively means that yields in each year of the preceding 10 years are given equal (5 per cent) weight.

In contrast, TER's approach is specifically designed to place diminishing weight on historical yields – that is, yields from 9 years ago are given less weight than yields from 8 years ago, which are given less weight than yields from 7 years ago, and so on. This approach assumes that a benchmark business is, over time, refinancing an increasingly larger portion of its debt portfolio. This is unlikely to be the case since this approach is inconsistent with standard prudent debt management practices.

Ultimately, TasWater's approach, which calculates the historical component of the cost of debt by equally weighting yields in each of the historical years included in its calculation, will better reflect the efficient staggered maturity approach, and therefore should be preferred over the approach adopted by TER.

3.3.2 Regulatory precedent

A summary of the approaches used by other regulators to estimate the cost of debt is set out below.

Table 2 – Approaches used by other regulators in estimating the cost of debt

Regulator	Description of approach
AER	10-year trailing average
ERA	10-year trailing average for DRP, 'on-the-day' approach for risk-free rate
IPART	Midpoint of the current cost of debt (using 40-day average) and the historical cost of debt (using 10-year historical average)
ESC	10-year trailing average
ESCOSA	10-year trailing average
QCA	'On-the-day' approach
ICRC	'On-the-day' approach

Sources: AER, *Better Regulation – Rate of Return Guideline*, December 2013, p.4; ERA, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020, Appendix 4*, 30 June 2016, p. 142; IPART, *Review of our WACC Method – Issues Paper Research*, July 2017, p.23; ESC, *Melbourne Water Price Review 2016 – Final decision*, June 2016, p.50; ESCOSA, *SA Water Regulatory Determination 2016 – Final Determination*, June 2016, p.117-118; QCA, Final decision – Trailing Average Cost of Debt, April 2015, pp. ii-iii; ICRC, *Draft Report – Regulated Water and Sewerage Services Prices 2018–23 - Report 11 of 2017*, December 2017, pp.86-87.

As can be seen, most regulators in Australia place at least 50 per cent, if not 100 per cent, weight on historical rates in calculating the regulated cost of debt. While some regulators, notably the QCA and ICRC, set the cost of debt with reference to the 'on-the-day' rate, the weight of regulatory precedent is overwhelmingly against this approach.

In addition, the Table shows that the debt weighting methodology adopted by TER has not been used by any other regulator in Australia. That is, no regulator has determined the cost of debt by placing diminishing weight on historical yields. Rather, all other regulators have determined the cost of debt by equally weighting yields in each historical year included in its calculation,[26] which is consistent with the view that an efficient firm would seek to re-finance its debt in equal tranches.

Based on these observations, we find that TasWater's approach is more in line with regulatory precedent in Australia then the approach adopted by TER since:

- it places greater emphasis on historical rates (vis-à-vis current rates); and
- it places equal weight on yields in each historical year included in its calculation.

26 This is also true for the QCA and ICRC even though they adopt the 'on-the-day' approach since they are effectively applying 'equal' weights of 0 per cent to historical yields.

3.3.3 Summary and recommendations

Our view is that there is clear evidence of infrastructure businesses adopting debt management practices that are consistent with the trailing average regulatory allowance. A trailing average allowance therefore achieves the objective of equating the regulatory allowance to the efficient cost of debt.

We also recognise that the regulatory objective in relation to new investment is to set the regulatory allowance equal to the cost of new finance, and consequently that some weighting on prevailing rates would achieve that objective – depending on the amount of new investment relative to the existing asset base.

We note that TasWater and TER differ in their weighting of current and historical rates in calculating the cost of debt. Our view is that the TasWater scheme should be adopted because it is consistent with the efficient cost of debt managed under an efficient staggered maturity approach.

3.4 Approach to estimating the risk-free rate used in the calculation of the return on equity allowance

TasWater and TER both estimate the return on equity allowance using the Capital Asset Pricing Model (CAPM). The CAPM requires three input parameters: the risk-free rate, the equity beta and the market risk premium (MRP):

- The risk-free rate (as in the cost of debt allowance) represents the expected return on a riskless asset;
- The equity beta is a measure of non-diversifiable risk associated with the investment; and
- The MRP represents the return over and above the risk-free rate that an investor in a perfectly diversified asset can expect to earn.

We understand that TasWater uses the same estimate of the risk-free rate to estimate both the return on debt allowance and the return on equity allowance. Likewise, TER uses its preferred estimate of the risk-free rate to estimate the return on debt allowance and the return on equity allowance.

We have been asked by TasWater to comment on whether TasWater's estimate of the risk-free rate, or TER's estimate of the risk-free rate, produces the most appropriate return on equity allowance.

3.4.1 The ideal regulatory approach

In addressing this question, our starting point is the well-accepted regulatory principle that the return on equity allowance should reflect as closely as possible the best estimate of the return required by equity investors in the regulated business. This required return cannot be observed directly, so it must be estimated.

We note that it is well accepted in finance theory, and by finance practitioners, that whilst the individual input parameters used to estimate the return on equity (e.g., the risk-free rate, the MRP) can vary significantly as market conditions change over time, the overall required return on equity remains more stable over time. This is because unless the fundamental risk profile (and, in particular, the non-diversifiable risk) of the investment changes significantly, the return required by equity investors tends to remain fairly stable. Further, there is evidence that the risk-free rate and the MRP tend to move in opposite directions.[27] This means that as the risk-free rate falls, the MRP will tend to increase (although not necessarily in a one-for-one fashion) such that the overall return on equity remains fairly stable.

With this in mind, and noting that the regulatory task is to derive a return on equity allowance that best matches the return required by equity investors in the regulated business, our view is that a good estimate of the return on equity will be one that remains more stable over time (relative to the volatility that might be observed in the individual risk-free rate and MRP parameters).

In practice, this means that the risk-free rate and the MRP should be estimated and combined together in a consistent way. For example:

- If the MRP is estimated using only forward-looking, prevailing market evidence (for example, using the Dividend Growth Model), then the risk-free rate (for the purposes of computing the return on equity allowance) should be estimated consistently using forward-looking, prevailing market evidence (i.e., using an 'on-the-day' rate). For example, this is the approach that IPART takes when deriving a 'current' estimate of the return on equity.
- If, however, the MRP is estimated using only historical market returns data, then the risk-free rate (for the purposes of calculating the return on equity allowance) should be estimated consistently using a relatively long historical average of returns data. For example, this is the approach that IPART takes when deriving an 'historical' estimate of the return on equity.

Both of these approaches will tend to produce relatively similar, stable and reasonable return on equity estimates. For example:

- A return on equity estimate derived using an on-the-day risk-free rate and a forward-looking MRP will tend to be stable because both these parameter estimates will reflect prevailing market conditions. For example, in the calculations performed by IPART, as the risk-free rate falls, the MRP estimate tends to rise (and vice versa), so the overall return on equity estimate remains relatively stable over time.

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27 See, for example: IPART, Review of our WACC method, Issues Paper, July 2017, pp. 16-7. IPART presents statistical evidence of a negative correlation between the risk-free rate and the MRP.

- A return on equity estimate derived using a long historical average of risk-free rates and a MRP estimated using a long historical average of market returns will also remain fairly stable over time. This is because by using long historical averages to estimate both these parameters, each will change only slowly over time, and the resulting return on equity will, consequently, change slowly over time as well.

Mixing and matching risk-free rate and MRP estimates derived using current and historical data can result in implausible regulatory outcomes. For instance, combining an on-the-day risk-free rate estimate with a MRP derived using only long historical averages of market returns would result in a return on equity allowance that moves perfectly in line with fluctuations in government bond yields. This is because the MRP estimate (typically derived using more than 130 years of returns data) will remain effectively constant from one year to the next. However, the on-the-day risk-free rate will fluctuate significantly from year to year as the prevailing government bond yield varies. A largely fixed MRP, combined with a very volatile risk-free rate, will result in the overall return on equity changing in line with government bond yields.

A well-known instance of such an approach producing implausible outcomes occurred during the peak of the Global Financial Crisis (GFC), in late 2009. During that time, when the market risk rose to unprecedented levels, Australian government bond yields fell to historic lows as capital flooded away from risky assets into safe government bonds, driving down the yields on those securities. Under the approach used by most Australian regulators at that time—combining the on-the-day risk-free rate with an effectively fixed MRP (derived using a very long history of market returns)—the return on equity allowance for regulated businesses *fell* sharply as government bond yields tumbled. This was an implausible outcome since it was evident that equity investors were demanding *higher*, not *lower*, returns during the peak of the GFC.

3.4.2 Does TasWater's approach produce a more appropriate estimate of the risk-free rate than TER's?

Turning now to the question of whether TasWater's or TER's approach to estimating the risk-free rate is most appropriate, we note that TasWater proposed (and TER has accepted) a MRP estimate of 6.5% — in line with the MRP allowed by the AER for regulated energy networks in Tasmania. The AER's approach is to give primary weight to long-run historical average returns when estimating the MRP. As a consequence, the AER's estimate of the MRP remains essentially fixed over time. In fact, the AER has applied the same MRP estimate of 6.5% in every regulatory decision since 2013, even as prevailing market rates have fluctuated significantly over the same period and it has never adopted an MRP outside the narrow range of 6.0 to 6.5%.

Given that the MRP estimate accepted by TER is unlikely to change materially over time, our view is that the most appropriate method for determining the risk-free rate is to take a relatively long historical average (say 10 years or more) of government bond yields.

As explained in the preceding sections, TER estimates a time-weighted risk-free rate that favours prevailing rates over historical rates. As a result, TER's approach places less weight on historical returns than does TasWater's. Since TasWater's method is, in our view, closer to the ideal estimation approach than is TER's, we conclude that TasWater's approach to estimating the risk-free rate (for the purposes of determining the return on equity allowance) is more appropriate than is TER's.

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