

Equity Beta for a Benchmark Australian Water Network Service Provider

A report for Sydney Water

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HoustonKemp.com

Report Author/s

Greg Houston

Brendan Quach

Simon Wheatley

Dale Yeats

Contact Us

Level 40, 161 Castlereagh Street Sydney NSW 2000

Phone: +61 2 8880 4800

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Executive Summary

This report has been prepared at the request of Sydney Water. The context of our report is the regulatory proposal to be submitted to the Independent Pricing and Regulatory Tribunal (IPART) on prices for Sydney Water's water, wastewater, stormwater, trade waste and other ancillary and miscellaneous services for the next regulatory control period, from 1 July 2016 to 30 June 2020 (the next regulatory period).

Our report replicates and extends the analysis previously undertaken by SFG on comparable water utilities in the United Kingdom and North America. Consistent with the approach adopted by SFG, we identify companies classified by Industry Classification Benchmark (ICB) as 'water utilities', listed on the New York, NASDAQ, Toronto, and London exchanges.¹

After removing companies for which financial data were not available, we undertook ten equity beta calculations including:

- long-term equity betas for individual water utilities, using both weekly and monthly returns;
- long-term equally weighted and value-weighted portfolios of water utilities, using both weekly and monthly returns, and
- five and two year, equally weighted and value-weighted portfolios using weekly returns.

In our opinion, there is no single, 'correct' method for calculating the equity beta for a benchmark regulated water utility, and so all statistically robust estimates should be considered in developing a plausible equity beta range.² Figure 1, shows the results of our analysis of the equity betas of UK and North American water utilities.



Figure 1: Results of market estimates of the equity beta for a water utility

¹ Note that in addition to this group we were able to identify four further water utilities in the UK that are no longer listed

² We note that our estimates using 2 years of returns did not produce sufficiently precise equity beta estimates to be relied on to estimate the equity beta for a benchmark water utility.

Figure 1 shows an equity beta range with:

- a lower bound of 0.59, consistent with the median of the individual water utilities using monthly data and approximately the same as the long term equal weighted portfolio using monthly data (0.60); and
- an upper bound of 0.88, consistent with the five year equal weighted portfolio and approximately the same as the mean of the individual water utilities using weekly data (0.87).

Our analysis is strongly supportive of the 0.6 to 0.8 equity beta range previously found by IPART.³

In section 4 of this report we recommend that IPART adopt an equity beta at the top of the plausible range because:

- it would be consistent with IPART's last decision for Sydney Water that set the WACC at the top of the plausible range for Sydney Water;
- the CAPM underestimates the required return on low beta assets with NERA's (2015) study suggesting an equity beta closer to a central value of 1 should be adopted when applying the CAPM. It follows that, where the plausible range is between 0.59 and 0.88 (or 0.6 and 0.9), then adopting an estimate at the top of the range will substantially reduce the risk of underestimating the required return on equity; and
- US regulators routinely adopt allowed returns on equity for water utilities above that which the CAPM would generally estimate – given the "end-result" doctrine adopted in that jurisdiction. This suggests that to the extent regulators are giving weight to the CAPM, they must be choosing equity betas at the top of any plausible range.

We also note that the weight of market evidence on the equity beta of a benchmark water utility does not support the adoption of an equity beta less than 0.7.⁴ Specifically we find that the average of the ten statistically robust beta estimates that are presented in Figure 1 is 0.73. Further we observe that seven of the ten beta estimates are approximately equal to, or above, 0.7.

Finally, we note that the analysis of market betas previously conducted by SFG only considered long-term beta estimates using monthly returns. Our analysis shows that if SFG had considered weekly returns and used more recent data it would have found a materially higher upper bound to the equity beta of a benchmark water utility.

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^{3 3} IPART, Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services | Water – Final; Report, June 2012, page 198.

⁴ We note that IPART in its decision for the Sydney Desalination Plant adopted an equity beta of 0.7, see IPART, *Review of water prices* for Sydney Desalination Plant Pty Limited from 1 July 2012, | Final Report, December 20-11, page 87.

1. Introduction

This report has been prepared at the request of Sydney Water. The context of our report is the regulatory proposal to be submitted to the Independent Pricing and Regulatory Tribunal (IPART) by Sydney Water on 30 June 2015. Sydney Water's submission is the first significant step in the review of prices for Sydney Water's water, wastewater, stormwater, trade waste and other ancillary and miscellaneous services for the next regulatory control period, from 1 July 2016 to 30 June 2020 (the next regulatory period).

Sydney Water has asked us to prepare a report on the current market data in relation to the equity beta, with reference to the data and analyses relied upon by IPART in its decision for the previous regulatory control period. In so doing, we have been asked to assess:

- the methodology previously used to determine the equity beta for Sydney Water;
- whether there are any statistical deficiencies in the data and/or other statistical approaches that may be appropriate;
- the appropriate set of comparable water utilities from the United States, United Kingdom and Canadian financial markets to use in estimating the equity beta; and
- the sensitivity of equity beta estimates to different aggregations of the data, ie, using weekly or monthly
 returns data and the reliance on more recent periods.

Sydney Water has requested that we recommend the appropriate equity beta range for estimating the return on equity for the purpose of its submission to IPART on 30 June 2015. We have also been asked to consider the economic rationale for distilling a point estimate from the equity beta range with reference to:

- any known bias in the SL CAPM;
- international best practice for estimating the return on equity in the context of economic regulation; and
- any other material we believe is relevant to the determination of a point estimate within the equity beta range.

The remainder of our report is structured as follows:

- section 2 sets out the context for this report and the role of the equity beta in estimating the cost of equity;
- section 3 outlines the market evidence of the equity beta for a benchmark water and wastewater business and provides our recommended reasonable range for the equity beta based on the outlined market data; and
- section 4 considers a range of relevant information to inform our recommended point estimate of the equity beta for a benchmark efficient business in the circumstances of Sydney Water.

Our report has three appendices which provide more information on our methodology, comparable companies used in the analyses and the instructions we received from Sydney Water.

2. Context

This section outlines the context of our study and provides a brief explanation of the role of the equity beta in setting the cost of equity for a benchmark water and wastewater business.

2.1 The CAPM and equity beta

The capital asset pricing model (CAPM) developed by Sharpe (1964) and Lintner (1965) is commonly regarded as the first asset pricing theory.⁵

Sharpe and Lintner's insight is that the return that an investor will require on an individual asset will be determined not by how risky that asset would be if held alone, but by how the asset contributes to the risk of the portfolio that the investor holds.

The Sharpe-Lintner CAPM is expressed as the following equation:

$$\mathbf{E}(R_i) = R_f + \beta_i [\mathbf{E}(R_m) - R_f]$$

where		
E(Rj)	=	is the expected return on asset <i>j</i> ;
Rf	=	is the risk-free rate;
eta_j	=	asset <i>j</i> 's equity beta, which measures the contribution of the asset to the risk, measured by standard deviation of return, of the market portfolio; and
E(R _m)	=	the expected return to the market portfolio of risky assets where the difference between the expected return on the market and the risk free rate is colloquially known as the market risk premium.

The CAPM applies the equity beta to scale the market risk premium (MRP) up or down to reflect the asset's risk premium (the premium above the risk free rate) that equity holders would require to hold that particular asset as part of its well-diversified portfolio.

This simple relation between mean return and beta provides market participants and regulators with what, in principle, should be a simple way of estimating a firm's return on equity. In practice, however, applying this theoretical model is more complicated because one cannot observe the return to the market portfolio of all risky assets. The market portfolio of all risky assets includes not only stocks, for which returns are readily observable, but also corporate bonds, real estate and human capital, for which returns are not readily observable.

Because of these difficulties, an empirical version of the CAPM typically estimates the equity beta using published equity market returns using the following equation:

$$\beta_e = \frac{Cov(r_a, r_b)}{Var(r_a)}$$

This formula represents the covariance between the return on the listed stock (r_a) and the return on a broad market index (such as the All Ordinaries in Australia) (r_b), divided by the variance of the return on the broad market index. Data services such as that available from Bloomberg provide historical market prices and dividend information, which allow returns to be calculated.

⁵ Sharpe, William F., Capital asset prices: A theory of market equilibrium under conditions of risk, Journal of Finance 19, 1964, pages.425-442.

Lintner, John, The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets, Review of Economics and Statistics 47, 1965, pages13-37.

It is important to note that the use of a market index that only includes equity assets is a substantial departure from the theory of the CAPM, under which the market portfolio should include all assets. As a result, even if the CAPM model is correct and investors are only concerned with the beta of a stock relative to the market portfolio of all risky assets, there is no reason to believe that an empirical version of the CAPM that uses the return on a equity market index as a proxy for the return to the market portfolio of all risky assets will produce unbiased estimates of the returns that investors require. We discuss the evidence and implications of any potential biases in the CAPM in section 4.1.

Finally, we note that theory does not provide any guidance on the practical estimation of the equity beta from historical market data. In particular, theory provides no direction on the period that returns should be estimated (ie, daily, weekly, monthly or annually) or the period over which beta should be estimated, ie, all available data or more recent data such as the last two or five years.⁶ In our opinion, regard should be had to all statistically robust estimates of the equity beta. With different methods for calculating the equity beta providing a plausible range for a benchmark water business.

2.2 IPART's previous approach to estimating the equity beta

IPART's review of prices for Sydney Water's water, wastewater, stormwater drainage and other services for the period 1 July 2012 to 30 June 2016 (the last regulatory control period) applied the capital asset pricing model (the CAPM) to estimate the return on equity for Sydney Water. Applying the CAPM to estimate the return on equity necessitates estimating the equity beta, which is a measure of the systematic, or undiversifiable, risk faced by a business.

IPART estimated the equity beta range for Sydney Water to be from 0.6 to 0.8. In coming to this estimate, IPART considered advice from its consultants, the Strategic Finance Group (SFG) and Professor Davis, on the appropriate equity beta for Sydney Desalination Plant.

We summarise SFG and Professor Davis's recommendations below and describe IPART's decisions as to the equity beta for Sydney Desalination Plant and Sydney Water, which were informed by these recommendations.

2.3 Recommendations by IPART's experts

In 2011 IPART engaged SFG to prepare a report on the appropriate equity beta for Sydney Desalination Plant.⁷ This report was also used to inform IPART's subsequent decision on the equity beta for Sydney Water for the 2012 to 2016 period. IPART also engaged Professor Ken Davis to peer review SFG's report on the equity beta.

2.3.1 Quantitative Analysis

SFG estimated the equity beta for Sydney Desalination Plant by undertaking ordinary least squares (OLS) regression analyses of excess stock returns for comparable water utilities against excess market returns. SFG applied two approaches to analyse the set of comparable water utilities it identified, ie, SFG:⁸

- 1. treated the estimate of the equity beta from each firm as an independent estimate of the equity beta; and
- 2. compiled an equal-weighted index comprising a portfolio of comparable firms for which there are returns estimates available in each month.

SFG adjusted the resulting estimates of the equity beta to account for bias using an approach based on Vasicek (1973), ie, SFG formed each estimate as a weighted average of an OLS estimate of the equity beta and unity using the standard error of the OLS estimate and an assumption about the prior distribution of

⁶ We note that good statistical practice suggests that any estimate of the equity beta should be over a period sufficient to provide statistically significant estimates of the equity beta.

⁷ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011.

⁸ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 4.

betas to guide its choice of a weight. SFG assumed that mean and standard deviation of the prior distribution were 1 and 0.5.⁹ However, Professor Davis noted that:¹⁰

While the bias-correction adjustment used by SFG does not markedly affect the estimated betas, the rationale for such an adjustment, particularly using a long data sample of specifically chosen water utility stocks is not strong.

SFG also calculated re-geared equity beta estimates to adjust for different levels of leverage in the sample. In particular, SFG estimated the asset beta by stripping out the effect of mean monthly leverage and assumed a debt beta of 0.2.¹¹ Further, SFG removed 20 monthly observations that it considered to be outliers, which improves the precision of its equity beta estimates.¹²

Finally, SFG considered the potential for asymmetric exposure to market risk on the basis that investors will prefer stocks covary highly with market returns during 'up markets' and covary little with market returns during 'down markets'. To this end, SFG separately estimated the equity beta in up markets and in down markets.¹³ However, Professor Davis noted that:¹⁴

It is not clear to me that this approach is warranted

To summarise, SFG presented eight re-geared and bias-corrected beta estimates, ie, SFG:15

- applied four estimation techniques, ie:
 - > firm specific estimates;
 - > estimates derived from an equal-weighted index;
 - > constant market exposure;
 - > asymmetric market exposure;
- using two samples, ie:
 - > outliers included; and
 - > outliers excluded.

Data

SFG applied OLS regression analysis using monthly data on returns from January 1973 to June 2011, ie, a period of 462 months.¹⁶ SFG selected January 1973 to be the starting date because it is the earliest date for which estimates of returns are available. However, Professor Davis notes that:¹⁷

The use of the longer period does not generate markedly different estimates than are obtained from (more commonly used) shorter period estimates.

SFG identified 32 potentially comparable water utilities by searching for companies classified as industry classification benchmark (ICB) subsector 'water utilities' and listed on the New York, NASDAQ, Toronto,

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⁹ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 7 and 8.

¹⁰ Davis, K. "Cost of Capital parameters for Sydney Desalination Plant: By SFG Consulting" An initial review for IPART, August 2011, page 2.

¹¹ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 8 and 9.

¹² SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 15.

¹³ SFG, *Cost of capital parameters for Sydney Desalination plant*, August 2011, pages 11 to 13 and 20 to 21.

¹⁴ Davis, K. "Cost of Capital parameters for Sydney Desalination Plant: By SFG Consulting" An initial review for IPART, August 2011, page 2.

¹⁵ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 18 and 19.

¹⁶ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 10.

¹⁷ Davis, K. "Cost of Capital parameters for Sydney Desalination Plant: By SFG Consulting" An initial review for IPART, August 2011, page 1.

London or Australian exchanges. SFG then eliminated 16 companies that were American Depository Receipts that did not have available returns data or were thinly traded.¹⁸ By means of this approach, SFG identified a sample of 16 comparable companies from the United States (US) and the United Kingdom (UK).¹⁹ The average number of monthly observations across comparators was 294, while the minimum was 38 observations.²⁰

For the purpose of implementing the second approach outlined above, SFG compiled an equal-weighted index of company returns by converting the returns of UK companies and the UK market index to US dollar returns.²¹

Further, SFG constructed an index of market returns using the Datastream Total Market Indices for the US and UK markets, which are large market capitalisation-weighted indices with long time series. SFG then created a weighted index of market returns according to the number of US and UK stocks comprising the sample at each point in time.²²

Results

We present the results of SFG's analysis below.

Figure 2: Re-geared, bias-corrected estimates of the equity beta with outliers removed²³

	Mean of individual firm estimates	Equal-weighted index estimates		
Constant Estimate	0.55	0.52		
Down Market	0.69	0.61		
Up Market	0.38	0.43		

SFG found a relatively greater exposure to market returns during down markets and relatively less exposure to market returns during up markets. On this basis, SFG considered that investors would account for this asymmetry in their required returns and that, at a minimum, investors would price in the risk associated with down markets.²⁴ However, IPART interpreted Professor Davis's advice to be that the equity beta estimates were robust, but the 'down market' equity beta should not be used.²⁵

2.3.2 Internal Consistency

SFG states that the return required by equity holders must be at least equal to the return required by debt holders in the same firm.

¹⁸ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 10.

¹⁹ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 10.

²⁰ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 10.

²¹ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 10.

²² SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 10.

²³ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 19.

²⁴ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 20.

²⁵ Davis, K. Cost of Capital parameters for Sydney Desalination Plant: By SFG Consulting" An initial review for IPART, August 2011, page 3 and 4.

IPART, Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services from 1 July 2012 to 30 June 2016, Final Decision, page 209.

SFG explains that gamma, ie, the value of imputation credits created, allocates the cost of equity into a proportion derived from dividends and capital gains, and a proportion derived from imputation credits. However, non-resident investors earn only the proportion from dividends and capital gains and, so, their return on equity will be lower than that derived by resident investors, who benefit from imputation credits.

SFG calculated that, with a corporate tax rate of 30 per cent and a gamma of 0.4, the proportion of equity returns associated with dividends and capital gains will be 85 per cent. This implies that maintaining internal consistency necessitates an uplift to SFG's beta estimates, ie, to ensure that the return on equity provided to non-resident investors is at least equal to the return on debt.

SFG recommended that:26

If imputation credits were valued at 0.40, our view is that the minimum equity beta would need to increase to 0.74 to ensure that returns from dividends and capital gains were at least equal to returns to debt holders.

2.4 IPART's determination for Sydney Desalination Plant from 1 July 2012

IPART considered the recommendations of both SFG and Professor Davis when determining the equity beta for Sydney Desalination Plant from 1 July 2012. IPART determined gamma to be 0.25 in its determination and went on to state that:

With this gamma, the minimum beta in line with SFG's concept of internal consistency is less than 0.7. This suggests that a beta of 0.7 is consistent with SFG's recommendations. A beta of 0.7 represents a significant premium on SFG's regression estimates of 0.52 and 0.55. SFG's regression estimates in periods of below normal market returns, or "down-market beta", resulted in means of 0.61 and 0.69.

On this basis, IPART determined the equity beta range to be 0.6 to 0.8 and used a point estimate of 0.7.

2.5 IPART's Determination for Sydney Water from 1 July 2012

2.5.1 Sydney Water's Submission

Sydney Water proposed an equity beta of 1.0 for the 1 July 2012 to 30 June 2016 period. In support of an equity beta of 1.0, Sydney Water highlighted that the water services regulatory authority in the United Kingdom, OFWAT, adopted an equity beta of 0.9 for water utilities and stated that:²⁷

Owing to the nature of the water industry in Australia and the regulatory regime, Sydney Water represents a much higher risk business than water in the UK.

Further, Sydney Water highlighted that the AER reduced the equity beta for electricity businesses from 1.0 to 0.8 and stated that Sydney Water faces higher risk, as compared with electricity businesses in Australia.

Sydney Water's consultants, Professor Bob Officer and Dr Steven Bishop (Value Adviser Associates), did not support using comparisons with UK water utilities and electricity businesses to establish an equity beta for Sydney Water, because of the significant differences in regulatory and economic environments. However, Professor Bob Officer and Dr Steven Bishop did support an equity beta range of 0.8 to 1.0 for Sydney Water.²⁸

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²⁶ SFG, Cost of capital parameters for Sydney Desalination plant, August 2011, page 27.

²⁷ Sydney Water, Sydney Water submission to IPART's Review of prices for Sydney Water Corporation's water, sewerage, stormwater and other services, 16 September 2011, page 86.

²⁸ Sydney Water, Sydney Water submission to IPART's Review of prices for Sydney Water Corporation's water, sewerage, stormwater and other services, 16 September 2011, page 87 and 88.

2.5.2 IPART's final decision

IPART's determination of the equity beta for Sydney Water for 2012 to 2016 reflected that for Sydney Desalination Plant in that it considered the recommendations of SFG and Professor Davis and determined the equity beta range to be 0.6 to 0.8. In so doing, IPART stated that:²⁹

The empirical estimates suggested that the water utility industry beta has a mean of 0.52 to 0.55. SFG preferred to consider a downmarket beta, this is only calculated when the market's returns are lower than the risk free rate, which has a mean of 0.61 to 0.69. Professor Davis's peer review of the SFG advice concluded that the beta estimates were robust, although he recommended that we do not use the downmarket beta.

Further, we note that IPART's estimated WACC range was 4.0% to 5.6% but it adopted a point estimate of 5.6%. This implies an equity beta value of 0.8.

²⁹ IPART, *Review of prices for Sydney Water Corporation's water, sewerage, drainage and other services*, Final Decision, March 2012, page 209.

3. Equity Beta – Range Estimate

In this section we first briefly describe the data we have assessed to estimate the equity beta for a benchmark water utility. Section 3.2 sets out the results of our analysis of the equity betas of individual companies using both long term weekly and monthly data. Section 3.3, tabulates the estimated equity betas of portfolios of comparable water and wastewater businesses using:

- both equally weighted and value-weighted portfolios;
- weekly and monthly data; and
- different estimation periods

Section 3.4 outlines the differences between our analysis and that analysis previously undertaken by SFG. Finally, section 3.5 sets out our recommended equity beta range for a benchmark efficient water utility.

3.1 Data

3.1.1 Comparable companies

We identified comparable water utilities by searching the Bloomberg database for companies that:

- are listed on the New York, NASDAQ, Toronto, London and Australian exchanges; and
- are classified as Industry Classification Benchmark (ICB) subsector 'water utilities'.

We identified 32 potentially comparable water utilities that satisfied these criteria. Further, to this set we added three companies that SFG identified as meeting these criteria when it undertook its analysis in 2011, along with three water utilities from the United Kingdom of which we are aware, but are no longer listed. A description of each of these companies is set out in Appendix A2.

We downloaded daily data for these 38 potentially comparable water utilities for the longest period available on Bloomberg, with the earliest observation in July 1980 and the most recent observation in March 2015.

For each of these companies we reviewed the business description available on the Bloomberg database and company websites to assess the degree to which it is comparable to a benchmark water utility. Further, where appropriate, we undertook additional research by means of a desktop search. A description of each of these companies is set out in Appendix A2.

In our preferred portfolio we eliminated 21 companies from the list of 38 identified potential water utilities. The reasons for eliminating companies included that:

- they operated in developing countries;
- they derived a material proportion of revenue from activities other than the provision of water and wastewater distribution services; or
- there were no publically available financial data for the utilities.

We note that four of the companies we eliminated were included in the set of comparable water utilities used by SFG to estimate the equity beta. No portfolio exhibited signs of thin-trading.

We therefore identified 16 comparable water utilities from the United States, Canada and the United Kingdom. However, for the purpose of comparing our results with those derived by SFG, we present the results of three sets of comparable companies. Specifically:

• set 1 comprises the water utilities used by SFG to estimate the equity beta.

- set 2 comprises the water utilities used by SFG but excludes the water utilities that we identified as not being sufficiently comparable to a benchmark water utility; and
- set 3 is our preferred set and comprises the same water utilities as set 2 with an additional five water utilities that we consider to be sufficiently comparable to a benchmark efficient water utility.

Table 1 below shows the water utilities that comprise these three sets.

Table 1Sets of water utilities for which we present results

	Company	Set 1	Set 2	Set 3
1	American States Water	\checkmark	\checkmark	\checkmark
2	American Water Works	\checkmark	\checkmark	\checkmark
3	Aqua America	\checkmark	×	×
4	Artesian Resources	\checkmark	\checkmark	\checkmark
5	Cadiz	\checkmark	×	×
6	California Water Services	\checkmark	\checkmark	\checkmark
7	Connecticut Water	\checkmark	\checkmark	\checkmark
8	Consolidated Water	\checkmark	×	×
9	Middlesex Water	\checkmark	\checkmark	\checkmark
10	Northumbrian Water Group	\checkmark	\checkmark	\checkmark
11	Pennichuck	\checkmark	\checkmark	\checkmark
12	Pennon Group	\checkmark	×	×
13	Severn Trent	\checkmark	\checkmark	\checkmark
14	SJW Corporation	\checkmark	\checkmark	\checkmark
15	United Utilities Group	\checkmark	\checkmark	\checkmark
16	York Water	\checkmark	\checkmark	\checkmark
17	Dee Valley Group	×	×	\checkmark
18	GWR Global Water Resources	×	×	\checkmark
19	AWG Parent Company	×	×	\checkmark
20	Kelda Group	×	×	✓
21	Thames Water	×	×	\checkmark

Table 2 below provides further information on the companies that comprise the three sets displayed above.

Table 2Water utilities used to comprise sets

Firm	Ticker	Data Availability Leverage (per cent)		Mkt. cap. (US \$m)					
	North American utilities								
American States Water	AWR	Feb 1988 – Mar 2015	18.8	960					
American Water Works	AWK	Apr 2008 – Mar 2015	51.3	5,628					
Aqua America	WTR	Jul 1980 – Mar 2015	19.5	2,880					
Artesian Resources	ARTNA	Apr 1994 – Mar 2015	41.1	115					
Cadiz	CDZI	Nov 1988 – Mar 2015	60.3	75					
California Water Service	CWT	Feb 1985 – Mar 2015	20.3	1,011					
Connecticut Water Service	CTWS	Feb 1985 – Mar 2015	29.2	209					
Consolidated Water	CWCO	Jun 1995 – Mar 2015	-9.5	182					
Middlesex Water	MSEX	May 1985 – Mar 2015	28.9	229					
Pennichuck	PNNW	Aug 1992 – Jan 2012	29.0	93					
SJW	SJW	Jul 1980 – Mar 2015	18.0	849					
York Water	YORW	Apr 1994 – Mar 2015	23.4	218					
GWR Global Water Resources	GWR	Dec 2010 – Mar 2015	-0.1	36					
		UK utilities							
Northumbrian Water	NWG	May 2003 – Oct 2011	61.4	1,322					
Pennon Group	PNN	Jul 1990 – Mar 2015	32.2	2,466					
Severn Trent	SVT	Jul 1991 – Mar 2015	50.2	2,392					
United Utilities Group	UUG	Jul 1990 – Mar 2015	49.5	4,403					
Dee Valley Group Parent Co	DVW	Dec 1994 – Mar 2015	38.3	44					
Thames Water	101	July 1990 – Feb 2001	23.3	2,606					
Kelda Group	KEL	July 1991 - Feb 2008	39.6	2,110					
AWG Parent Company	AWG	July 1991 - Dec 2006	57.4	960					

Table 2 shows that we identified fewer water utilities from the United Kingdom – however, the water utilities in the United Kingdom are typically much larger than those in North America on the basis of market capitalisation.

3.1.2 Market indices

On the basis that the comparable companies we identified are domiciled in the United States, Canada and the United Kingdom, we use the FTSE all share index³⁰ for the United Kingdom and the MSCI North American Index³¹ for the United States and Canada.

³⁰ The FTSE all-share index is a capitalisation weighted index comprised of the FTSE 350 and the FTSE SmallCap indices. Its Bloomberg ticker is 'ASX Index'.

³¹ The MSCI North American index is a free-float weighted index with the Bloomberg ticker 'MXNA Index'.

3.2 Results of individual water utilities

Table 3 below presents individual beta estimates for the individual companies that comprise the three sets we analyse.

	Weekly data		Monthly	data				
	Estimate Std. Err.		Estimate	Std. Err.				
	North American utilities							
American States Water	1.14	0.11	0.62	0.19				
American Water Works	0.58	0.10	0.38	0.14				
Aqua America	0.97	0.12	0.29	0.23				
Artesian Resources	0.34	0.09	0.45	0.13				
Cadiz	1.09	0.18	0.95	0.28				
California Water Service	1.10	0.10	0.64	0.20				
Connecticut Water Service	0.78	0.12	0.44	0.14				
Consolidated Water	2.01	0.31	2.75	0.58				
Middlesex Water	0.79	0.10	0.59	0.13				
Pennichuck	0.32	0.15	0.32	0.24				
WLS	1.39	0.12	1.07	0.19				
York Water	0.73	0.12	0.45	0.24				
GWR Global Water Resources	2.48	0.93	1.31	1.54				
Mean	1.06		0.75					
Median	0.88		0.52					
		UK utilities						
Northumbrian Water	0.57	0.10	0.20	0.12				
Pennon Group	0.80	0.10	0.71	0.17				
Severn Trent	0.65	0.09	0.49	0.14				
United Utilities Group	0.76	0.07	0.66	0.13				
Dee Valley Group Parent Co	0.10	004	-0.02	0.15				
Thames Water	0.77	0.29	0.88	0.46				
Kelda Group	0.65	0.16	0.79	0.25				
AWG Parent Company	0.32	0.13	0.51	0.19				
Mean	0.58		0.53					
Median	0.70		0.58					

Table 3 Individual beta estimates using a long term estimation period

We highlight two notable inferences from Table 3, ie:

- water utilities in the United Kingdom generally have a lower equity beta, as compared with their North American counterparts; and
- the equity beta estimate for almost all companies is higher when weekly data is used rather than monthly data.

We note that SFG's analysis used only monthly data and so Table 3 suggests that SFG's estimates of the equity beta may have been higher had it undertaken further analyses using weekly data.

Table 4Summary statistics for individual beta estimates by set

	Weekly data	Monthly data
	Меа	an
North American utilities	1.06	0.75
UK utilities	0.58	0.53
All utilities	0.87	0.69
	Medi	an
North American utilities	0.88	0.52
UK utilities	0.70	0.58
All utilities	0.77	0.59

Table 4 summaries the results of individual company equity beta estimates and highlights that:

- the mean of all 21 water utilities ranges from 0.69 to 0.87 using monthly and weekly data, respectively; and
- the median of all 21 water utilities ranges from 0.59 to 0.77 using monthly and weekly data, respectively.

3.3 Results of portfolios of water utilities

Table 5 below presents equity beta estimates from the three sets of companies using equal weighted and value-weighted portfolios with weekly and monthly data for different time periods.

Table 5		Regeared portfolio equity beta estimates								
		25 ye (Weekly	ars data)	25 yea (Monthly	ars ⁄ data)	Five ye (Weekly	ears data)	Two Ye (Weekly	ears data)	
	Portfolio		Std.		Std.		Std.		Std.	
	weighting	Estimate	error	Estimate	error	Estimate	error	Estimate	error	
Set 1	Equal	0.89	0.07	0.76	0.10	1.10	0.10	1.22	0.18	
Sel I	Value	0.90	0.11	0.65	0.11	0.80	0.08	0.91	0.20	
Set 2	Equal	0.78	0.07	0.61	0.09	0.88	0.09	1.04	0.19	
Set 2	Value	0.84	0.11	0.64	0.10	0.74	0.09	0.88	0.21	
Sot 2	Equal	0.77	0.07	0.60	0.09	0.88	0.09	1.04	0.19	
Set 3	Value	0.76	0.11	0.64	0.10	0.74	0.09	0.87	0.21	

We note that estimating the equity beta using an equal weighted portfolio of the companies in Set 1 with a 25-year estimation period and monthly data gives rise to an equity beta estimate of 0.76, which is higher than that estimated by SFG (ie, 0.52) derived using used data going back to 1973.

In the following sections we draw inferences from the various approaches to estimating the equity beta, as presented in Table 5 above.

Estimation Period

We estimate the equity beta using two year, five-year and 25-year estimation periods. In contrast, SFG's estimation period was from January 1973 to June 2011, ie, approximately 39 years. Table 2 shows that the Bloomberg database has limited data available prior to 1990 for a number of the companies we identified.

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The longest period estimation period we therefore use is 25 years. Professor Davis noted in his review of SFG's analysis that:32

The use of the longer period does not generate markedly different estimates than are obtained from (more commonly used) shorter period estimates.

We note that using a five-year estimation period gives rise to a higher estimate of the equity beta, as compared with a 25-year estimation period. Further, a two year estimation period gives even higher estimates as compared with a five or 25-year estimation period. It follows that our analysis does not support a similar conclusion as Professor Davis, with our beta estimates using the most recent 2 and 5 year periods substantially higher than the equity beta estimates we generated from 25 years of returns. There are a number of potential reasons that our analysis differs from that found from SFG, including:

- the fact that the market index that we use in our portfolio analysis combines the North American and London markets, rather than the US and London markets;
- the fact that our data begin in 1990 and end in 2015 whereas SFG's data begin in 1973 and end in 2011. •

The standard error increases materially when a two-year estimation period is used, because there are only 104 weekly observations in two years. Consequently, we give relatively more weight to the more precise estimates arising from a 25-year and five-year estimation period.

Data frequency

We estimate the equity beta using both monthly and weekly data whereas, in contrast, SFG estimated the equity beta using only monthly data. We note that the use of weekly data generally gives rise to more precise estimates, because of the increased number of observations.

This is supported by the evidence presented in Table 3, which shows that the standard error of individual equity beta estimates declines materially when weekly, rather than monthly, data are used. Table 4 shows that weekly data give rise to higher estimates of the individual equity beta, with the average and median beta estimates being 0.18 higher than those estimated using monthly data.

Further, Table 5 shows that, in all portfolios, the use of monthly data results in lower beta estimates than using weekly data. Consequently, had SFG considered weekly data in addition to monthly data it would likely have found a materially higher upper bound for the equity beta of a regulated water utility.

Weighting

We estimate the equity beta using both equally weighted and value-weighted portfolios whereas, in contrast, SFG used only an equal weighted portfolio.

Table 5 shows that an equal weighted portfolio gives rise to higher estimates of the equity beta, as compared with a value-weighted portfolio. This result is unsurprising given that Table 3 shows that water utilities from the United Kingdom, while relatively fewer in number:

- are generally much larger than their counterparts in the United States; and
- have lower individual equity betas than their counterparts in the United States.

In our opinion, estimates from both equally weighted and value-weighted portfolios should be considered when estimating the equity beta range.

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³² Davis, K. "Cost of Capital parameters for Sydney Desalination Plant: By SFG Consulting" An initial review for IPART, August 2011, page 1.

3.3.1 Companies comprising the portfolio

We estimate the equity beta using three different portfolios of comparable companies, ie:

- Set 1 comprises the water utilities used by SFG to estimate the equity beta.
- Set 2 comprises the SFG water utilities, but excludes those that we identified as not being sufficiently comparable to a benchmark water utility; and
- Set 3 is our preferred set and comprises the same water utilities as Set 2, but with an additional five companies not identified by SFG but which we consider to be sufficiently comparable to a benchmark efficient water utility.

In contrast to the portfolio of water utilities used by SFG, our preferred portfolio, ie, Set 3:

- excludes four water utilities that we consider not to be sufficiently comparable to a benchmark efficient water utility;
- includes two additional water utilities that we identified by means of the same search criteria applied by SFG; and
- includes three additional water utilities from the United Kingdom that are no longer listed.

In Appendix A1, we review the comparability of the water utilities we identified by means of our search.

The reasons for our endorsement of portfolio estimates containing Set 3 companies are set out above. However, we note that Table 5 shows that our preferred portfolio of water utilities gives rise to lower estimates of the equity beta over a 25-year assessment period, as compared with that used by SFG, ie, Set 1.

3.4 Previous SFG analysis

Our study finds a substantially wider range of beta estimates than that reported by SFG for listed UK and North American water utilities. Our findings differ because:

- different data sets are used, with our estimates relying on daily data provided by Bloomberg data service starting at February 1985, while the SFG data set contained monthly returns from 1973;
- we consider beta estimates generated from both weekly and monthly returns, whereas SFG only considered monthly returns;
- we consider both long term and more recent beta estimates, whereas SFG focused on long term beta estimates; and
- we examine both equally weighted and valued weighted portfolios, whereas in contrast SFG only considered equal weighted portfolios.

Our study examines a more comprehensive set of beta estimates than that produced by SFG, a consequence of which is that:

- using weekly returns persistently results in higher beta estimates than monthly returns; and
- regard to more recent market data results in statistically robust higher beta estimates than those calculated from long term returns.

Nevertheless, our analysis is intentionally conservative in that we have constructed portfolios that:

- exclude a number of companies that were included in the SFG study, on the basis that they are not sufficiently comparable to Sydney Water, which results in lower beta estimates, as evidenced by the lower equity beta estimates produced from portfolio 2 as compared to portfolio 1; and
- include a number of comparable companies that were not considered by SFG, which again results in lower beta estimates, as evidence by those produced from portfolio 3 compared to portfolio 1.

3.5 Recommended range

In our opinion, the equity beta range should be determined by giving relatively greater weight to the estimates derived from:

- both the mean and median estimates of beta from individual water utilities; and
- both an equally weighted and value-weighted portfolio for Set 3 using both a 25-year estimation period with monthly and weekly data, and a five-year estimation period with weekly data.

Figure 3 illustrates our quantitative analysis that supports an equity beta range with:

- an upper bound of 0.88, consistent with the five year equal weighted portfolio and approximately the same as the mean of the individual water utilities using weekly data (0.87); and
- a lower bound of 0.59, consistent with the median of the individual water utilities using monthly data and approximately the same as the long term equal weighted portfolio using monthly data (0.60).



Figure 3: Results of market estimates of the equity beta for a water utility

We note that our study is strongly supportive of the 0.6 to 0.8 equity beta range previously found by IPART.³³

^{33 33} IPART, Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services | Water – Final; Report, June 2012, page 198.

4. Equity Beta - Point Estimate

This section sets out our recommended equity beta point estimate from within that range we identify in section 3.

In Sydney Water's last determination, IPART adopted an equity beta at the top of the range:³⁴

Due to current market uncertainty and historically low parameter estimates we decided an appropriate point estimate for the WACC is the upper bound of our range

Market conditions have not markedly improved since IPART's last decision and the prevailing risk free rates are substantially lower than those recorded in 2012. Accordingly, IPART's previously stated reasons for adopting an equity beta at the top of the range remain valid.

In addition, for the reasons set out below we believe there is substantial, credible evidence for IPART to adopt an equity beta value at the top of its equity beta range.

4.1 Market data

We have generated a range of equity beta estimates for a benchmark water and wastewater utility, using available market data on UK and North American water utilities.

Figure 4, reproduces those estimates and notes that the average of the 10 separate beta estimates is 0.73. Further, Figure 4 also highlights:

- six of the equity beta estimates are over 0.7;
- three of the equity beta estimates are below 0.7; and
- one of the estimates is close to 0.7 (ie, 0.69 for the mean of all water utilities using monthly returns).

³⁴ IPART, Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services | Water – Final; Report, June 2012, page 198.



Figure 4: Results of market estimates of the equity beta for a water utility

4.2 Known CAPM biases

Although the CAPM is an intuitive and simple financial model, it has been known for more than 40 years that empirical versions of the CAPM tend to underestimate the returns to low-beta assets, a phenomenon that is colloquially referred to as the low beta bias. By way of example, Mehrling (2005) notes that:³⁵

'The very first [Wells Fargo] conference was held in August 1969 at the University of Rochester in New York State ... The focus of the first Wells Fargo conference was on empirical tests of the CAPM ... the most significant output of the first conference was the paper of Fischer Black, Michael Jensen, and Myron Scholes (BJS), titled "The Capital Asset Pricing Model: Some Empirical Tests," eventually published in 1972. ... One important consequence of the BJS tests was to confirm earlier suggestions that low-beta stocks tend to have higher returns and high-beta stocks tend to have lower returns than the theory predicts.'

However, the low-beta bias observed in the CAPM does not necessarily invalidate the model, because the empirical version of the CAPM typically employed departs from the theoretical version.

We explain the theoretical underpinning of the CAPM in Section 2.1 and note that the SL CAPM predicts that there should a positive linear relation between the expected returns to assets and their betas computed relative to the market portfolio of *all risky assets*. However, the empirical version of the CAPM, including that applied by IPART, measures the risk of an asset relative to a portfolio of stocks, whose value constitutes a relatively small proportion of the value of all risky assets. Therefore, the return to a portfolio of stocks may not be a good proxy for the return to the market portfolio of all risky assets.

³⁵ Mehrling, P., *Fischer Black and the revolutionary idea of finance*, Wiley, 2005, pages 104-105.

There is a substantial body of work from reputable sources in both the United States and Australia that indicate that the CAPM will underestimate the returns to low-beta assets. Most recently, NERA (2015)³⁶ assesses the empirical performance of the CAPM using monthly data from January 1969 to December 2013 for Australian stocks, drawn from SIRCA's Share Price and Price Relative (SPPR) database.³⁷

NERA (2015) uses in-sample and out-sample tests to examine whether there is evidence against the restrictions imposed by the CAPM. In-sample tests use the full sample of data whereas, in contrast, out-sample tests split the full sample of data up.

On the basis of the in-sample tests, NERA (2015) finds that: 38

... the evidence indicates that the SL CAPM significantly underestimates the returns generated by low-beta portfolios and overestimates the returns generated by high-beta portfolios. In other words, the model has a low-beta bias.

and that: 39

The evidence is particularly strong for low-beta portfolios – the SL CAPM underestimates the returns to the five lowest-beta portfolios by around three to five per cent per annum. Thus the evidence against the model is both economically and statistically significant.

Similarly, the out-of-sample tests indicate that the SL CAPM underestimates the returns to low beta portfolios.⁴⁰ Moreover, NERA (2015) also tests a 'naïve' model that states that the mean returns to all equities are the same and finds that it cannot reject the hypothesis that such a model generates unbiased estimates.

This evidence indicates that an equity beta closer to a central value of 1 should be adopted when applying the CAPM. It also suggests that the need to set a point estimate for the equity beta at the top of a range increases when that equity beta range is substantially less than 1. Consequently, if IPART maintains that the equity beta range for a Sydney Water is between 0.6 and 0.8, then NERA's (2015) study suggests that the risk of underestimating the required return on equity is substantially greater if one were to adopt an equity beta at the bottom of its range as opposed to choosing a point estimate at the top of its range.

4.3 US regulatory decisions

US regulators tend not to use a single financial model such as the CAPM but, rather, case law has resulted in regulators adopting the "end-result" doctrine, which was developed from the *Hope* case⁴¹ and has long since been embraced by US regulators. This doctrine states that:⁴²

It is the result reached and the impact of the rate order rather than the method or theory employed that is controlling. Potential infirmities inherent in the methods used are of secondary importance, according to this doctrine. This is a reassuring assertion, given the stringency and surrealism of the assumptions that frequently characterize the financial models and theories employed in the determination of a fair return.

Under such an approach the paramount consideration is the empirical validity of the model outcomes, assessed by reference to the *allowed rate of return objective*. Implicitly, a model would not be excluded from consideration simply because of a perceived theoretical deficiency.

³⁶ NERA, *Empirical Performance of Sharpe-Lintner and Black CAPMs*, February 2015.

³⁷ NERA, *Empirical Performance of Sharpe-Lintner and Black CAPMs*, February 2015, page 21.

³⁸ NERA, *Empirical Performance of Sharpe-Lintner and Black CAPMs*, February 2015, page ii.

³⁹ NERA, *Empirical Performance of Sharpe-Lintner and Black CAPMs*, February 2015, page 27.

⁴⁰ NERA, *Empirical Performance of Sharpe-Lintner and Black CAPMs*, February 2015, page 38.

⁴¹ Federal Power Commission v Hope Natural Gas Company, 320 U.S. 391 (1944)

⁴² Morin, R., New Regulatory Finance, Public Utilities Reports, Inc., Vienna, Virginia, 2006, page 14

On this basis, US regulators have consistently allowed water utilities to earn a return on equity that is substantially higher than that suggested by the CAPM. In other words, US regulators have implicitly found that the cost of equity estimates provided by the CAPM understate a fair return.

4.3.1 Allowed rate of return for water utilities in the United States

Table 6 below illustrates the allowed rate of return for regulated water utilities in the United States presented in the March edition of the AUS utility report.

Table 6Allowed rate of return for regulated water utilities in the United States

	Allowed Return on Equity	Equity beta range	Implied MRP lower bound	Implied MRP upper bound
American States Water Co. (NYSE-AWR)	9.99	0.62-1.14	7.06	12.98
American Water Works Co., Inc. (NYSE-AWK)	9.75	0.38-0.58	13.47	20.55
Aqua America, Inc. (NYSE-WTR)	9.83	0.29-0.97	8.13	27.21
Artesian Resources Corp. (NDQ-ARTNA)	10.00	0.34-0.45	17.91	13.71
California Water Service Group (NYSE-CWT)	9.99	0.64-1.10	7.32	12.58
Connecticut Water Service, Inc. (NDQ-CTWS)	9.63	0.44-0.78	9.86	17.48
Middlesex Water Company (NDQ-MSEX)	9.75	0.59-0.79	9.89	13.24
SJW Corporation (NYSE-SJW)	9.99	1.07-1.39	5.79	7.52
Average	9.87	0.55-0.90	8.81	14.42

Table 6 shows that the prevailing allowed rate of return for the regulated US water utilities covered in the AUS utility report was, on average, 9.87 per cent in March 2015. Table 6 also sets out the equity beta we have calculated for each firm using weekly and monthly data. On the basis that the prevailing risk free rate for the week ending 27 March 2015 was equal to 1.94 per cent for 10 year Treasury bonds, it is possible to calculate an implied prevailing market risk premium associated which each decision.

The final two columns of Table 6 calculate the implied MRP associated with each rate of return. Table 6, demonstrates that the average MRP for the US market implied by these decision is between 8.81 and 14.42per cent. This is clearly substantially higher than any recognised estimates of the US market equity premium; for example, Damodaran has recently estimated that the US MRP is in the order of 6 per cent.⁴³

The only plausible explanation is that US regulators have allowed water utilities a return on equity above what the CAPM would generally estimate. Setting a return on equity that is substantially above those estimated by the CAPM is, in our opinion, reasonable given the known limitations of the CAPM.

4.4 Conclusion

In this section we highlighted that the CAPM is widely known to underestimate the return on low beta stocks. The NERA (2015) report highlights that in Australia one can reject that the returns of low beta companies is less than those of the market generally. NERA uses both in-sample and out-sample tests and finds that the CAPM underestimates the returns required on low beta stocks and over-estimates the returns required on

⁴³ Damodaran, A. Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2015 Edition, March 2015, estimates that the implied market risk premium in the United States as at 1 January 2015 is equal to 5.78 per cent. While the historical arithmetic average 6.11 per cent.

high beta stocks. This study strongly suggests an equity beta closer to a central value of 1 should be adopted when applying the CAPM.

In section 3 of this report we find that market estimates of the equity beta for a benchmark water utility range between 0.59 and 0.88. The known biases associated with the CAPM strongly suggest that adopting a point estimate at the top of this range will lessen the risk of setting a return on equity below that required by equity investors.

In section 4.3 we demonstrate that the regulated returns on equity for US water utilities are substantially greater than that estimated by the CAPM. In our opinion, these US regulatory decisions implicitly acknowledge the CAPM's known limitations and strongly suggest that one should adopt a point estimate at the top of any known equity beta range.

Finally, we note that our analysis of equity betas of UK and North American water utilities highlights that the average of the 10 separate beta estimates is 0.73 and:

- six of the equity beta estimates are over 0.7;
- three of the equity beta estimates are below 0.7; and
- one of the estimates is close to 0.7 (ie, 0.69 for the mean of all water utilities using monthly returns)

In light of this evidence, we recommend that Sydney Water adopt an equity beta at the top of the reasonable range.

A1. Methodology

In this appendix we describe our approach to estimating the equity beta range. Although we use a number of different methodologies, each is consistent in that it estimates the equity beta using an OLS regression of stock returns against market returns. To this end, we identified comparable water utilities in the United States, Canada and the United Kingdom, which we discuss in more detail in section 3.1 of this report.

A1.1 Individual estimates and portfolios

We analyse the comparable water utilities using three approaches, ie:

- 1. by treating the equity beta estimate for each comparable water utility as an individual observation;
- 2. by compiling an equal weighted portfolio of comparable water utilities; and
- 3. by compiling a value-weighted portfolio of comparable water utilities.

In the first approach, we regress the returns of each company against the return on the market in which it is domiciled and so derive an equity beta estimate and an associated standard error for each company. We then compute the mean and median estimates of the group. It is easier, however, to assess the significance of mean estimates of beta by forming portfolios. So we also compile equally weighted and value-weighted portfolios of the comparable companies.

For the purpose of implementing the second and third approaches we downloaded from Bloomberg data for non-United States companies and indices in United States dollars.

In the second approach, we compile a portfolio comprising, at each point in time, the companies for which data is available, where each company has an equal weight in the portfolio. The return to this portfolio of water utilities is regressed against the return to a joint market index that combines the North American and UK market indices. This joint market index is weighted, at each point in time, by the number of UK and North American companies contained in the portfolio of water utilities.

The third approach is similar to the second approach; however, the weights used to compile the portfolio and joint market index are determined on the basis of market capitalisation. Specifically, we compile a portfolio of water utilities, at each point in time, which is weighted by the market capitalisation of the water utilities at the start of each period. Similarly, the weights for the joint market index, at each point in time, are determined by the market capitalisation of UK and North American water utilities that comprising the portfolio of water utilities.

The primary difference between the equal weight and value-weighted portfolios is that UK water utilities are given relatively more weight, since all four of the UK firms are large water utilities.

A1.2 Adjustments

The comparable water utilities we identified were financed using different proportions of debt and equity. However, the level of a company's financial leverage has implications as to its exposure to systematic risks, and so we re-levered our beta estimates to reflect the benchmark leverage used to weight the amount of debt and equity finance in IPART's cost of capital calculation in the 2009 decision, ie, all beta estimates are re-leveraged to 60 percent debt.⁴⁴

⁴⁴ Where a comparable firm has a gearing ratio different from the assumed benchmark, the observed beta of the comparable firm is relevered using the re-leverage formula adopted by the AER. See: AER, *Electricity transmission and distribution network service providers - Review of the weighted average cost of capital (WACC) parameters: Final Decision*, May 2009, pages 265-267.

A1.3 Data frequency and estimation period

We downloaded daily price data from Bloomberg and converted these price data to weekly and monthly returns. We note that using weekly data increases the precision of estimates, as compared with using monthly data.

Further, we also estimate the equity beta using different estimation periods. We note that while using a longer estimation period increases the number of observations, it also increases the likelihood that a company's risk profile has recently changed. Consequently, we have calculated the equity betas using a sample period that includes:

- all available data for the individual company estimates;
- data from July 1990 for our analysis of equally weighted and value-weighted portfolios;
- data from March 2010 to March 2015 (ie, the last 5-years) for our analysis of equally weighted and valueweighted portfolios; and
- data from March 2013 to March 2015 (ie, the last 2-years) for our analysis of equally weighted and valueweighted portfolios.

A1.4 Summary

To summarise, we calculate regeared estimates of the equity beta using:

- individual stock estimates as well as equal weighted and value-weighted portfolios;
- weekly and monthly data, although for the shorter periods (ie, 2- and 5-years) we only rely on weekly data due to the imprecision of estimates using monthly data over these short periods; and
- a range of estimation periods including approximately 25 years, the most recent 5 years and the most recent 2 years.



A2. Company Descriptions

A2.1 Water utilities included in SFG group of comparable companies

SFG estimation of the equity beta for the Sydney Desalination Plant (SDP) examined the market returns of 16 water companies. In this appendix we provide a brief description of each of the companies. Furthermore we provide our reasons for excluding a company from our preferred group of comparable water businesses.

A2.1.1 American States Water Co

American States Water Company has two subsidiaries; Golden State Water Company and American States Utility Services.

In 2013, Golden State Water Company generated revenues of \$320 million by providing water and wastewater services to approximately 257,000 customers in California. American States Utility Services generated revenues of \$114 million by providing water and wastewater services to 457,000 personnel and families on military bases throughout the United States.

Golden State Water Company is also involved in electric utilities, which contributed 8% of the Group's revenues in 2013.⁴⁵

In our opinion, American States Water is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.2 American Water Works Co Inc

American Water Works Company, now known as American Water,⁴⁶ is a water and wastewater company that serves approximately 15 million people in the United States and Canada.⁴⁷

In our opinion, American Water Works is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.3 Aqua America Inc

Aqua America Inc provides water and wastewater services to approximately 14 million people in the United States. The company has made around 200 acquisitions in the last ten years in accordance with its 'aggressive growth-through-acquisition' strategy.⁴⁸

The substantial acquisition activity of Aqua America raises questions as to the extent that market beta estimates for this company capture the underlying risk of owning and operating a water and wastewater businesses as opposed to the growth through acquisition strategy. In our opinion, Aqua America should be removed from the group of comparable companies used to estimate Sydney Water's equity beta.

Our analysis, highlights that the removal of Aqua America from the portfolio of comparable companies, results in lower equity beta estimates.

⁴⁵ American States Water Company. (2013). Annual Report. p.2.

⁴⁶ American Water website, <http://pr.amwater.com/Company/history.cfm>, viewed on 12 March 2015.

⁴⁷ American Water website, <http://www.amwater.com/About-Us/page22960.html>, viewed on 12 March 2015.

⁴⁸ Aqua America Inc website, < http://ir.aquaamerica.com/>, viewed on 12 March 2015.

A2.1.4 Artesian Resources Corp

Artesian Resources Corporation provides water utility services to more than 80,000 customers in Delaware through its subsidiary Artesian Water Company Inc. The company offers a number of related services such as consulting, but its primary water provision business accounts for around 90% of revenue.⁴⁹

In our opinion, Artesian Resources Corporation is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.5 Cadiz Inc

Cadiz Inc. is a renewable resources company that purchases land and develops technologies with the view to addressing California's future energy and water requirements. It holds over 70 square miles of property with water resources and potential for clean energy projects.⁵⁰

In our opinion, Cadiz Inc is not an appropriate comparator company for Sydney Water because it is not a provider of water and wastewater distribution services. Consequently we have removed Cadiz Inc from our preferred group of companies used to estimate the equity beta for Sydney Water.

We note that our analysis highlights that the removal of Cadiz Inc from the portfolio of comparable companies, results in lower equity beta estimates.

A2.1.6 California Water Service Grp

California Water Service Group consists of six subsidiaries which collectively provide water and wastewater services to 2 million people in western United States.⁵¹

In our opinion, California Water Service Group is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.7 Connecticut Water Svc Inc

Connecticut Water Service Inc. provides water utility services to around 300,000 people in Connecticut through its subsidiary, Connecticut Water.⁵²

In our opinion, Connecticut Water Service is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.8 Middlesex Water Co

Middlesex Water Company provides a range of water, wastewater and related services in New Jersey and Delaware. It is primarily involved in the regulated collection, treatment, distribution, and selling of water.⁵³ Other operations such as the non-regulated contracts for maintenance and operation of water and wastewater systems accounted for around 13% of revenue in 2013.⁵⁴

In our opinion, Middlesex Water Company is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

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⁴⁹ Artesian Water Company website, < http://www.artesianwater.com/about-artesian>, viewed on 12 March 2015

⁵⁰ Cadiz Inc. website, < http://cadizinc.com/investor-relations/>, viewed on 12 March 2015.

⁵¹ California Water Service Group website, < https://www.calwatergroup.com/> viewed on 12 March 2015.

⁵²Connecticut Water website, <http://www.ctwater.com/Home/About%20Us/Who%20We%20Are>, viewed on 12 March 2015.

⁵³Middlesex Water Company website, <http://www.middlesexwater.com/family/middlesex-water-company>, viewed on 12 March 2015.

⁵⁴ Middlesex Water Company. (2013). Annual Report. pp. 61-62

A2.1.9 Pennon Group Plc

Pennon Group has two major subsidiaries; South West Water Limited and Viridor Limited. South West Water Limited provides water and wastewater services for several counties in southern England, while Viridor Limited is a major UK recycling, renewable energy and waste management business.⁵⁵ In 2014, approximately 40 per cent of the Group's revenue was generated by South West Water, the remaining 60 per cent is generated from recycling, renewable energy and waste management.⁵⁶

In our opinion, Pennon is not an appropriate comparator company for Sydney Water because a minority of its revenue is derived from the provision of water and wastewater distribution services. We note that the removal of Pennon from the portfolio of comparable companies, results in lower equity beta estimates.

A2.1.10 Severn Trent PLC

Severn Trent PLC has two subsidiaries; Severn Trent Water and Severn Trent Services.

Severn Trent Water is a water and wastewater utilities provider that around 4.2 million households and business in the United Kingdom.⁵⁷ Over 80% of group revenue was contributed by Severn Trent Water in 2014.⁵⁸

Severn Trent Services provides water treatment products and operating services to large customers in a number of countries worldwide.⁵⁹

In our opinion, Severn Trent PLC is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.11 SJW Corp

SJW Corp has a number of subsidiaries. The largest of these, San Jose Water Company, is a water utility serving over 1 million people in San Jose.⁶⁰

SJW Corp also holds real estate and provides non-regulated services such as maintenance and backflow testing to other utilities. These other operations are relatively minor, as regulated water utility services contributed approximately 95% of group revenue in 2013.⁶¹

In our opinion, SJW Corp is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.12 United Utilities Group Plc

United Utilities provides water and wastewater services to approximately 7 million people in north-western England⁶².

Although the company has other operations overseas and investment properties, the vast majority of the group's profit is derived from its regulated UK water business.⁶³

⁵⁵ Pennon Group website, <http://www.pennon-group.co.uk/about-us>, viewed on 12 March 2015.

⁵⁶ Pennon Group. (2013). Annual Report. pp. 2-5.

⁵⁷ Severn Trent PLC website. < http://www.severntrent.com/about/our-companies/severn-trent-services>, viewed on 12 March 2015.

⁵⁸ Severn Trent PLC. (2014). Annual Report. pp. 2-3.

⁵⁹ Severn Trent Services website, < https://www.severntrentservices.com/>, viewed on 12 March 2015.

⁶⁰ San Jose Water Company website, < http://www.sjwater.com/about_us/>, viewed on 12 March 2015.

⁶¹ SJW Corp. (2013). Annual Report. p.61.

⁶² United Utilities website, < http://corporate.unitedutilities.com/what-we-do.aspx>, viewed on 12 March 2015.

⁶³ United Utilities Group PLC. (2014). Annual Report. p.2.

In our opinion, United Utilities is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.13 York Water Co

York Water Company impounds, purifies and distributes water throughout York, Pennsylvania. The Company's present average daily consumption is approximately 70 million litres.⁶⁴

In our opinion, York Water is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.14 Consolidated Water Co

Consolidated Water Company is involved in designing, building, operating and financing reverse osmosis desalination plants and distribution systems in the Caribbean.⁶⁵

In our opinion, Consolidated Water Company is not an appropriate comparator company for Sydney Water because its primary business is not the provision of water and wastewater distribution services. We note that the removal of Consolidated Water Company from the portfolio of comparable companies, results in lower equity beta estimates.

A2.1.15 Northumbrian Water Group

Northumbrian Water Group contains a number of companies. The principal subsidiary, Northumbrian Water Limited, provides water and wastewater services to 4.5 million and 1.8 million people in the United Kingdom respectively.⁶⁶ Collectively, Northumbrian Water Limited and other water and waste water contracts provided approximately 98% of the Group's revenue in 2012.⁶⁷

In our opinion, the Northumbrian Water Group is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.1.16 Pennichuck Corporation

Pennichuck Corporation is primarily involved in the collection, storage, treatment and distribution of water in New Hampshire. Through its five wholly owned subsidiaries, the company also offers a number of non-regulated contract services and has some real estate holdings. Regulated water utility revenues constituted 93% the group's revenues in 2010.⁶⁸

In our opinion, the Pennichuck Corporation is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water.

A2.2 Water utilities not identified by ICB and not included in the SFG comparable list

We have identified three further water companies that were not include in SFG's list of comparable companies because they are not currently listed as water utilities by UCB. The reason that these companies are not identified as water utilities by ICB is that they are no longer listed.

⁶⁴ York Water Company website, <https://www.yorkwater.com/about>, viewed on 12 March 2015.

⁶⁵ Consolidated Water Company website, <http://www.cwco.com/>, viewed on 12 March 2015.

⁶⁶ Northumbrian Water Group website, <http://www.nwg.co.uk/Aboutus.aspx>, viewed on 12 March 2015.

⁶⁷ Northumbrian Water Group. (2012). Annual Report. p.46.

⁶⁸ Pennichuck Corporation website, http://www.pennichuck.com/about_us.php, viewed on 12 March 2015.

A2.2.1 Thames Water Ltd

Thames Water provides potable water services across London and Thames Valley to 9 million customers and wastewater services to 15 million customers.⁶⁹ Thames Water was listed on the London Stock Exchange between July 1990 and February 2001 when it was acquired by the German utility RWE.

In our opinion, Thames Water is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water – although we note that Thames Water will only influence our long term beta estimates.

A2.2.2 Anglian Water Group

Anglian Water Group is the parent company of Anglian Water. Anglian Water provides water and wastewater service over an area that stretches from Humber north of Grimsby, to the Thames estuary and then from Buckinghamshire to Lowestoft on the east coast of England.⁷⁰ Anglian Water Group was listed on the London Stock Exchange from July 1991 to December 2006.

In our opinion, the Anglian Water Group is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water – although we note that Anglian Water Group will only influence our long term beta estimates.

A2.2.3 Kelda Group

Kelda Group was originally known as Yorkshire water plc, and was one of the regional water companies privatised in 1989.⁷¹ Yorkshire Water manages the collection, treatment and distribution of water and wastewater in the Yorkshire region. Kelda was listed on the London Stock Exchange from July 1991 to February 2008 following its acquisition by the global infrastructure fund, Saltaire Water.

In our opinion, the Kelda Group is an appropriate comparator company that should be included in the group of companies used to estimate the equity beta for Sydney Water – although we note that Kelda Group will only influence our long term beta estimates.

A2.3 Water utilities identified by ICB but not included in the SFG comparable list but included in our group of preferable companies

A2.3.1 Dee Valley Group PLC

Dee Valley Group PLC is the holding company for its sole trading subsidiary, Dee Valley Water PLC. Dee Valley Water PLC purifies and supplies water to approximately 258,000 customers in Wales and England.⁷² It supplies 23 million tonnes of water per year over an area of 831 square kilometres.⁷³

A2.3.2 GWR Global Water Resources Corp

GWR Global Water Resources Corp. owns and operates water, wastewater and recycled water utilities in Arizona. Water services accounted for more than half of the company's revenue in 2012 and 2013, while water, wastewater and recycled water services collectively accounted for approximately 95% of the 33 million USD of revenue in 2013.⁷⁴

⁶⁹ Thames Water website, http://thameswater.co.uk/.

⁷⁰ Anglian Water website, http://anglianwater.co.uk/.

⁷¹ Kelda Group website, http://keldgroup.co.uk/.

⁷² Dee Valley Water PLC website, http://www.deevalleygroup.com/ viewed on 12 March 2015.

⁷³ Dee Valley Water PLC website, <http://www.deevalleywater.co.uk/article.php?id=43> viewed on 12 March 2015.

⁷⁴ GWR Global Water Resources Corp. (2013). Annual Report. p.34.

A2.4 Companies identified by ICB but not included in the SFG comparable list or our group of preferable water utilities

These companies have been excluded from our group of comparable companies because they either do not provide water and wastewater distribution services or there is no publically available financial data.

A2.4.1 Armadale Capital PLC

Armadale Capital Plc is developing a portfolio of investments in African natural resources. Current investments include major stakes in gold mining, mine drainage and coal briquetting operations.⁷⁵

A2.4.2 Bioshaft Water Technology

Bioshaft Water Technology specialises in the design and manufacture of wastewater treatment plants for the removal of water soluble organic compounds.⁷⁶

A2.4.3 Bioteq Environmental Tech INC

BioteQ Environmental Technologies, Inc. treats mine impacted wastewater and hydrometallurgical waste streams.⁷⁷

A2.4.4 Blue Planet Research & Technology

This company is no longer active and its business entity status has been permanently revoked.⁷⁸ It was an environmental science and technology company that assisted in the design and manufacture of systems to treat contaminated water.⁷⁹

A2.4.5 California-Michigan Land & WTR CO

In 1963, the California Public Utilities Commission authorized The California-Michigan Land and Water Company to sell its water system and properties to the East Pasadena Water Company, a wholly-owned subsidiary. East Pasadena Water Company now serves water to approximately 2,900 service connections.⁸⁰

A2.4.6 Cypress Energy Partners LP

Cypress Energy Partners, L.P. provides saltwater disposal and other water services oil, natural gas and trucking companies. The company also provides independent pipeline inspection services to other companies including public utilities.⁸¹

A2.4.7 Holiday Gulf Homes INC

Holiday-Gulf Homes provides water, garbage, and lighting services in Florida and also rents out commercial buildings.⁸²

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⁷⁵ Armadale Capital PLC website, <http://www.arma.dalecapitalplc.com/>, viewed on 12 March 2015.

⁷⁶ Bioshaft Water Technology website, <http://www.bioshaft.com/new/newsite/>, viewed on 12 March 2015.

⁷⁷ BioteQ Environmental Technologies website, <http://www.bioshaft.com/new/newsite/>, viewed on 12 March 2015.

⁷⁸ Nevada Secretary of State website, <http://nvsos.gov/sosentitysearch/CorpDetails.aspx?lx8nvq=j3A0SNQEszJ7EeiL1CpdGw%253d%253d&nt7=0>, viewed on 12 March 2015.

⁷⁹ Bloomberg L.P. Company Description for Blue Planet Research & Technology. Retrieved 12 March 2015 from Bloomberg database.

⁸⁰ East Pasadena Water Company website, < http://www.epwater.com/#!about/cipy>, viewed on 12 March 2015.

⁸¹ Cypress Energy Partners, L.P website, http://www.cypressenergy.com/, viewed on 12 March 2015.

⁸² Bloomberg L.P. Company Description for Holiday-Gulf Homes Inc. Retrieved 12 March 2015 from Bloomberg database.

A2.4.8 Modern Water PLC

Modern Water develops, installs and operates membrane technologies for treating waste water.83

A2.4.9 New England Service CO

New England Service Company is predominantly involved with the operation, management and financing of water and wastewater utilities. Wholly-owned subsidiaries of the Company collectively provide water to around 8000 customers in the United States.⁸⁴

The Company also provides other services such as backflow device testing and certification. Utility revenues represented approximately 90% of total group revenues in 2013.⁸⁵

A2.4.10 New Horizon Group Inc

No information was found for New Horizon Group Inc. According to Bloomberg L.P., there was also no available information as of October 2008.⁸⁶

A2.4.11 Pawnee Energy LTD

Pawnee Energy Limited is an oil exploration company that is looking to acquire, explore and develop oil resources in the United States.⁸⁷ Until recently, it was known as Island Sky Australia Limited⁸⁸ and distributed small consumer machines that condensed potable water from the air.⁸⁹

A2.4.12 Pure Cycle Corp

Pure Cycle Corporation is a vertically integrated provides water and wastewater services to companies in Colorado.⁹⁰

A large proportion of revenues in 2013 and 2014 were generated from farming operations, a component of the business that did not exist prior to 2013. Additionally, in recent years the supply of water for industrial purposes such as fracking has become a much larger contributor to revenue than commercial or on-site water supply. The company has only one wastewater customer, which results in fluctuations in demand for wastewater services and hence revenue.⁹¹

Pure Cycle Corporation had total revenues of \$264,100 and \$205,000 in 2010 and 2004 respectively.^{92,93}

A2.4.13 Rocky Mountain Intl LTD

Rocky Mountain International manufactures bottled water and is also involved in garment manufacturing and fitness products.⁹⁴

⁸⁵ New England Service Company. (2013). Annual Report. p.4.

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⁸³ Modern Water PLC website, <http://www.modernwater.com/about-us>, viewed on 12 March 2015.

⁸⁴ New England Service Co website, < http://newenglandservicecompany.com/about-us/company-overview>, viewed on 12 March 2015.

⁸⁶ Bloomberg L.P. Company Description for New Horizon Group Inc. Retrieved 12 March 2015 from Bloomberg database.

⁸⁷ Pawnee Energy Ltd website, < http://www.pawneeenergy.com.au/>, viewed on 12 March 2015.

⁸⁸ Pawnee Energy Ltd website, < http://www.pawneeenergy.com.au/>, viewed on 12 March 2015.

⁸⁹ Island Sky Corporation website, <http://www.islandsky.com/>, viewed on 12 March 2015.

⁹⁰ Pure Cycle Corporation website, http://www.purecyclewater.com/about-us.html, viewed on 12 March 2015/

⁹¹ Pure Cycle Corporation. (2014). Annual Report. p. 38.

⁹² Pure Cycle Corporation. (2010). Annual Report. p. 20.

⁹³ Pure Cycle Corporation. (2006). Annual Report. p. 2.

⁹⁴ Bloomberg L.P. Company Description for Rocky Mountain International. Retrieved 12 March 2015 from Bloomberg database.

A2.4.14 STW Resources Holding Corp

STW Resources Holding Corp is an integrated provider of water remediation services with a focus on oil and gas operations. It is also involved in desalination and municipal applications.⁹⁵

A2.4.15 Torrington Water Co

The Torrington Water Company is a regulated public water utility that provides services about 36,000 people, in 5 towns in Connecticut.⁹⁶

A2.4.16 Water Bonds Plc

Water Bonds invests in companies, technologies and facilities in the advanced water treatment sector. Water Bonds is primarily interested in investments that enable the sustainable, cost effective and reliable supply of water.⁹⁷

A2.4.17 West Virginia Water Co

West Virginia American Water Company, previously known as West Virginia Water Company,⁹⁸ provides water and waste water services to the customers in West Virginia.⁹⁹ West Virginia American Water is a subsidiary of American Water.¹⁰⁰

⁹⁵ STW Resources website, < http://www.stwresources.com/>, viewed on 12 March 2015.

⁹⁶ Torrington Water Company website, < http://www.torringtonwater.com/TWCaboutus.html>, viewed on 12 March 2015.

⁹⁷ Water Bonds PLC website, < http://www.waterbonds.co.uk/company>, viewed on 12 March 2015.

⁹⁸ Public Service Commission of West Virginia. (1987). West Virginia Water Company. Accessed online at http://www.psc.state.wv.us/scripts/orders/ViewDocument.cfm?CaseActivityID=28961&Source=Archives>, viewed on 12 March 2015.

⁹⁹ Bloomberg L.P. Company Description for West Virginia Water Company. Retrieved 12 March 2015 from Bloomberg database.

¹⁰⁰ American Water website, <http://www.amwater.com/about-us/our-subsidiaries.html>, viewed on 12 March 2015.

A3. Letter of Instruction

Sydney WATER

14 May 2015

Mr Greg Houston HoustonKemp Economist 161 Castlereagh Street Sydney NSW 2000

Reference: 2015/00000472

IPART's review of prices for Sydney Water Corporation from 2016-20 (PR16) – the equity beta

Dear Mr Houston

Following our recent discussions, Sydney Water would like to engage HoustonKemp Economists (HoustonKemp) to provide an expert report on the equity beta parameter used in the calculation of the cost of equity. We will use your report as part of our submission to IPART's review of prices for Sydney Water's water, wastewater, stormwater, trade waste and other ancillary and miscellaneous services from 1 July 2016 (PR16).

1 Background

The Independent Pricing and Regulatory Tribunal Act 1992 requires IPART to have regard to the appropriate rate of return when making price determinations. IPART will apply the Sharpe-Lintner CAPM (SL CAPM) to estimate the appropriate return on equity for Sydney Water from 1 July 2016 to 30 June 2020. The application of the SL CAPM requires an estimate of the systematic risk faced by Sydney Water represented by the equity beta in the model.

IPART determined an equity beta range of 0.6 to 0.8 in the 2012 price determination, and applied a mid-point value of 0.7, on the basis of advice received from its consultants, Strategic Finance Group (SFG) and Professor Ken Davis. SFG estimated the equity beta by applying ordinary least squares (OLS) regression to analyse a historical series of returns for companies from the United Kingdom and the United States, which was then peer reviewed by Professor Davis.

2 Scope of Work

We request that HoustonKemp prepares an expert report on the equity beta for a benchmark efficient business in the circumstances of Sydney Water. We are likely to attach the report to Sydney Water's PR16 submission due to IPART on 30 June 2015.

The report should assess current market data on the equity beta with reference to the data and analyses relied upon by IPART for the 2012 determination. In so doing, we request that HoustonKemp assesses:

the methodology previously used to determine the equity beta for Sydney Water



- whether there are any statistical deficiencies in the data and/or other statistical approaches that may be appropriate
- the appropriate set of comparable water utilities from the United States, United Kingdom and Canadian financial markets to use in estimating the equity beta
- the sensitivity of equity beta estimates to different aggregations of the data, ie, using daily, weekly, monthly or yearly returns data.

We request that, on the basis of this analysis, HoustonKemp recommends an appropriate equity beta range for Sydney Water for estimating the return on equity for the purpose of its submission to PR16. Further, HoustonKemp should consider the economic rationale for distilling a point estimate from the equity beta range with reference to:

- any known bias in the SL CAPM
- international best practice for estimating the return on equity in the context of economic regulation
- any other material you believe is relevant to the determination of a point estimate within the equity beta range.

3 Material to be relied on

In undertaking its analysis HoustonKemp should rely on the following documents:

- IPART, Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services from 1 July 2012 to 30 June 2016, Final Report, June 2012
- SFG, Cost of capital parameters for Sydney Desalination plant, August 2011
- Davis, K. "Cost of Capital parameters for Sydney Desalination Plant: By SFG Consulting" An initial review for IPART, August 2011.

5 Time frame

HoustonKemp's expert report should be finalised by 29 May 2015.

6 Contact

will be the day to day contact for HoustonKemp. You can contact by phone on the second or by email at the second of the second o

contact if you have any questions regarding the preparation of your report.

Yours sincerely

Dr Kris Funston Manager, Competition and Regulation



Level 40, 161 Castlereagh Street Sydney NSW 2000 Phone: +61 2 8880 4800

HoustonKemp.com