Report for the Essential Services Commission of South Australia

LRMC - Drinking Water services in SA Final report

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About Sapere Research Group Limited

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Appendices

Glossary

2011/12 Draft LRMC Modelling	Modelling conducted by SA Water in 2011/12 on LRMC — Includes a spreadsheet and a word document
ABS	Australian Bureau of Statistics
ADP	Adelaide Desalination Plant
Adelaide Pipelines	The three pipelines systems that connect the River Murray to Adelaide. These are Swan Reach-Stockwell, Mannum-Adelaide and Murray Bridge-Onkaparinga pipeline systems
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AIC	Average Incremental Cost
Annual Report	SA Water's 2012/13 Annual Report
BIL	Barossa Irrigation Limited — A wholesale customer of SA Water
c/kL	Cents per kilo-litre
CHWN	Critical human water needs
CIE	Centre for International Economics
CPI	Consumer price index
Commission	Essential Services Commission of South Australia
DEWNR	Department of Environment, Water and Natural Resources
ESC Act	*Essential Services Commission Act 2002*
GA	Greater Adelaide
GL	Giga litre = 1000 ML
IBT	Inclining Block Tariff
LRMC	Long run marginal cost
LRMC Area	An set of WIZs for which we have estimated LRMC
LRMC Pricing Paper	The companion paper to this report titled 'LRMC Pricing'
LTP	Long term plan — a plan developed for a water supply region
kL	Kilo Litre
ML	Mega litre = 1000 kL
MLR	Mount Lofty Ranges
NRM Act	*Natural Resources Management Act (2004)*
NRMP	Natural Resources Management Plan
NWI	National Water Initiative

POE	Probability of exceedance
PV	Present value
RBP 2013	SA Water's Regulatory Business Proposal for 2013
Revised Demand Model	The ACIL Tasman demand forecasting model described in section 4 as revised by the CIE
RM	River Murray
RM PWC	River Murray Prescribed Water Course
Sapere	Sapere Research Group
SAAL	South Australian Arid Lands
Turvey Method	The perturbation method to calculating LRMC
WIZ	Water Infrastructure Zone
WIZ WWAS Model	An activity based costing model used by SA Water
WWAS	Wastewater Asset System
SA Government	Government of South Australia
WAP	Water Allocation Plan
WACC	Weighted average cost of capital

Summary

Introduction and background

SA Water provides water and wastewater services to the majority of people in South Australia.

A commonly accepted principle for water usage pricing is that prices should be set with regard to the long run marginal cost (LRMC) of the supply of additional water. Currently SA Water applies uniform state-wide charges for water usage. For residential customers, an inclining block tariff (IBT) structure is used, whereby the charge increases with different levels of water use. The charge for the second tier of the IBT is based on an estimate of LRMC that was made prior to the completion of the Adelaide Desalination Plant (ADP).

The Essential Services Commission of South Australia (Commission) is the economic regulator for essential services in South Australia including the retail services provided by SA Water. The Treasurer has referred to the Commission to inquire into options for pricing reform for drinking water and sewerage retail services provided by SA Water.

To this end, the Commission engaged Sapere Research Group (Sapere) to review and update the LRMC of SA Water drinking water services to customers for the period from 2014/15 through to 2049/50, and in doing so investigate the services areas that might be used to apply location-based pricing.

Estimating LRMC

LRMC is commonly defined as the cost of providing an additional unit assuming all factors of production can be varied. In practice it is estimated as a time-averaged cost of meeting a permanent change in demand. The two key methods commonly used are the Turvey method, which considers the cost to meet a marginal permanent change in forecast demand and the Average Incremental Cost (AIC) method which considers the cost of meeting demand in excess of current demand.

SA Water had previously made estimates of LRMC (most recently using the AIC method). Historical documents suggest that prior to the drought SA Water's estimate of LRMC for the Adelaide region was between the tier 1 (real price ≈$0.55 per kilo-litre (kL)) and tier 2 (≈$1.30 per kL) usage prices applied by SA Water. The current tier 2 usage price is $3.23 per kL.

Regional analysis

SA Water divides the areas of its retail services into 5 regions and, within these regions, 41 Water Infrastructure Zones (WIZs). The marginal cost of supplying to these zones varies due to differences in the sources of water used and the variable costs in transporting the water. Based on these differences, we have proposed 12 areas for estimating LRMC (LRMC Areas) (summarised in Table S3 on page xii).

Due to changes in demand (and to some extent, supply) the marginal cost of supplying to some areas may change over time.

For Greater Adelaide (73 per cent of customers), and a number of other LRMC Areas, the marginal source of supply is currently the River Murray. For areas supplied through the three pipelines used to transport water from the River Murray to Adelaide (the Adelaide Pipelines), SA Water has entitlements which have no other use and the marginal cost is currently just the variable pumping and treatment costs. In these areas, the costs of using the River Murray may increase with demand due to the need to purchase additional River Murray water allocations. Due to a capacity constraint on the Adelaide Pipelines, the Adelaide Desalination Plant (ADP) may need to be used if demand grows sufficiently.

There are no material supply constraints, in the foreseeable future, in most other areas. Some areas where constraints might exist in the future are:

- On Kangaroo Island, growth in demand and concerns over supply may drive the need for significant capital investment.
- In the Eyre peninsular, a desalination plant may need to be built in the south to meet growing demand; however, this is not expected by SA Water to be required for another 25 years.
- In a number of areas (Mount Pleasant, Myponga, Barossa) additional water treatment plant (WTP) capacity may soon be required.

Demand

The pressures on the demand-supply balance discussed above depend significantly on the growth in demand.

SA Water recently engaged ACIL Tasman to develop a model to forecast demand for retail water sales in the state. The Centre for International Economics (CIE) reviewed and slightly revised the model (the Revised Demand Model). The model provides forecasts out to 2020/21.

We have used the model as a basis for forecasting demand; however, we have made some adjustments to the forecasts produced by the model. We have some concerns in using the model, in particular, for the purposes of estimating LRMC. These include:

- If prices are set to reflect LRMC, then prices may fall significantly in the future. In our view there is significant uncertainty in using the model to estimate the effect of price changes. Unfortunately, removing this uncertainty in the short-term will be difficult.
- We would expect the demand from new dwellings to differ (due to the adoption of water efficiency fixtures) from existing dwellings. This is not considered in the model but could be reasonably easily addressed with analysis of billed consumption of new dwellings. We recommend that this be included in future iterations of the model.

LRMC estimates

By combining the forecasts of demand and estimates of the cost of supply sources we have made some estimates of the LRMC by LRMC Area.

Our most substantive analysis has been conducted for water sourced through the Adelaide Pipelines (which is relevant to the Greater Adelaide, Mount Pleasant, Swan Reach to Paskeville, and Yorke areas). The cost of supplying to these areas depends on the total demand via the Adelaide Pipelines, which affects the cost of additional water allocations and the costs of using the ADP.

The likelihood and extent of using the ADP depends on the supply from the Mount Lofty Ranges (MLR) and demand. To model the use of the ADP we have developed a simple probabilistic model that captures the variability in supply from the MLR.

Using this model we have estimated the LRMC for the Greater Adelaide LRMC Area as $0.62 per kL in 2014/15 using the Turvey method and $0.56 per kL using the AIC method. The difference in the results between the methods reflects that the costs of supply increase with growing demand, and that the AIC method puts greater weight on nearer-term costs. In our view the Turvey method is a more accurate representation of the cost of a permanent change in demand. The LRMC will escalate as demand grows resulting in an increasing likelihood of using the ADP. Based on existing demand forecasts we estimate the LRMC will grow by around 1.65 per cent per annum (2.6 per cent for the AIC Method) over the period 2014/15 to 2024/25.

A decomposition of LRMC for this area is summarised in the table below.

Table S1: Decomposition of LRMC for Greater Adelaide in 2014/15

Component	Contribution to LRMC	
	Turvey	AIC
[redacted]		
Total ($/kL)	**$0.62**	**$0.56**

Note: The 'contribution to LRMC' reflects the *likelihood* and cost of each component.

There is some uncertainty over many aspects of the estimate. The key assumptions, and the uncertainty associated with these assumptions, are summarised in Table S2. Of note, the marginal cost of sourcing water from the ADP is of low significance due to the low likelihood of use; but it is of great interest, as it provides (with some qualification) an upper limit to the LRMC for providing water to Greater Adelaide. As the cost is marginal, it only includes the costs that are additional to maintaining the ADP in its no-production state.

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Table S2: Key assumptions

Parameter	Assumption	Reasonable Range	Potential impact	Comment
Change in demand forecast by 2020-21	+30%	+0% to +50%	High	Increase assumed due to a price fall. 0% change possible if there is no price change. Very significant long-run affects are possible.
Long-term growth in demand	0.9%	0.7% to 1.1%	High	Long-term growth will determine need to use the ADP. Difficult to forecast.
MLR supply in light of climate change	Some reduction	Unable to assess	High	Larger reduction would increase need for ADP.
[redacted]				
Adelaide Pipelines capacity (net of wholesale demand)	183 GL/year	180 to 190 GL/year	Low	SA Water has confirmed the constraint. Some uncertainty over future wholesale use.
Discount rate used	SA Water cost of capital	Not assessed	Very low	Changing the discount rate has a small effect on LRMC.

Estimates of the LRMC and plausible ranges, together with estimates of SRMC, for all LRMC Areas are presented in Figure S1 and Table S4 on the following pages. The key assumptions used in determining LRMC for other LRMC Areas are as follows:

- For other areas connected to the Adelaide Pipelines, we have used the Greater Adelaide LRMC and applied an increment to reflect additional pumping and treatment costs.
- For the Eyre region, we have applied an increment on variable costs to the Northern region, based on the possibility of a future capital expansion.
- For Kangaroo Island, the LRMC estimate is based on the usage price that will balance demand and supply given current supply sources. This approach has been adopted due to the very high cost of the next best augmentation.
- For other locations connected to the River Murray, we have used the cost of abstracting water from the River Murray and the estimated pumping and treatment costs from existing information.

- For locations with other local resources, we have no reliable information on the costs of the bulk water resource. Due to the additional cost associated with upgrading or drilling new groundwater bores we assume the long-run costs could be material. While, we understand, there are no foreseeable capacity constraints we have assumed that the LRMC should be no less than the cost for a town connected to the River Murray.

A summary of our LRMC estimates with reasonable lower and upper ranges is shown in Figure S1 below. Of note our upper range estimate, are all below the current tier 2 price. Our best estimate for Greater Adelaide and most other LRMC Areas is for the LRMC to be below $1/kL. The estimates are consistent with estimates that had been made prior to the recent drought.

Table S3: Suggested LRMC Areas

LRMC Areas	Main sources	WIZ codes	Customers (2011/12)	Average consumption billed (kL)	Average variable cost
Greater Adelaide	MLR, River Murray via Adelaide Pipelines, ADP	[redacted]			
Mount Pleasant	As above				
Swan Reach to Paskeville	River Murray via Swan Reach-Stockwell Pipeline				
Yorke	River Murray via Swan Reach-Stockwell Pipeline				
Northern	River Murray via Northern Pipeline, Groundwater				
Eyre (excluding West Coast)	River Murray via Northern Pipeline, Groundwater				
Tailem Bend Keith Pipeline	River Murray via Tailem Bend Keith Pipeline				
River Murray Towns	River Murray via other pipelines				
Myponga	Local resources				
South East	Local groundwater				
Kangaroo Island	Local resources				
Other disconnected	Local groundwater				

Source: WIZ WWASS Model, See Appendix 1 for maps of the zones. Note that there are an additional 5 WIZ codes (07, 11e, 12, 27 and 29) without retail customers.

Table S4: LRMC estimates by LRMC Area

LRMC Area	SRMC ($/ kL)	LRMC estimates ($/kL)			Justification
		Low	Best	Upper	
Greater Adelaide (GA)	[redacted]				Reflects probability of needing to purchase additional permanent allocations from the River Murray and use of the ADP
Mount Pleasant	[redacted]				Modified from GA to account for additional pumping and treatment costs
Swan Reach to Paskeville	[redacted]				Modified from GA to account for additional pumping and treatment costs
Yorke	[redacted]				Modified from GA to account for additional pumping and treatment costs
Northern	[redacted]				Reflects pumping and treatment costs and cost of River Murray water abstraction
Eyre (excluding West Coast)	[redacted]				Reflects future expansion
Tailem Bend Keith Pipeline	[redacted]				Reflects pumping and treatment costs and cost of River Murray water allocations
River Murray Towns	[redacted]				Reflects pumping and treatment costs and cost of River Murray water allocations
Myponga	[redacted]				Reflects existing variable costs plus an allowance for expansion and renewal
South East	[redacted]				Reflects existing variable costs plus an allowance for expansion and renewal
Kangaroo Island	[redacted]				Reflects price required to keep demand at a level to meet supply
Other disconnected	[redacted]				Reflects existing variable costs plus an allowance for expansion and renewal

Source: Sapere analysis.

1. Introduction and background

1.1 Introduction

SA Water is a corporation wholly owned by the Government of South Australia (SA Government) that provides water and wastewater services to the majority of people in South Australia.

The Essential Services Commission of South Australia (Commission) is the economic regulator for essential services in South Australia including the water and wastewater services provided by SA Water.

Sapere Research Group (Sapere) has been engaged by to review and update the long run marginal cost (LRMC) of SA Water's cost of supplying drinking water services to customers for the period from 2014/15 through to 2049/50. The scope of this report is described in Box 1 below.

The rest of this report is structured as follows.

- Section 2 outlines the concepts underpinning LRMC and the analytical framework adopted for the purposes of this project.
- Section 3 conducts a regional analysis.
- Section 4 reviews existing demand forecasts.
- Section 5 analyses the costs of providing drinking water services and presents LRMC estimates.
- Section 6 concludes and discusses some considerations in using LRMC estimates for pricing.

Box 1: Scope of works

The Commission is seeking advice to review and update the LRMC of SA Water's cost of supplying drinking water services to customers for the period from 2014/15 through to 2049/50.

In particular, the Commission is seeking advice on the following:

- A review of the range of applicable LRMC methodologies and a recommendation as to the preferred approach to be adopted for the purposes of setting SA Water's drinking water usage charges;
- To assist the Commission in examining the benefits of moving from the current statewide pricing regime to location-based pricing, the consultant should assess the most appropriate service area to be used for developing an LRMC value or values, having regard to cost differences between regions. The Commission has requested regional cost data from SA Water which will form an input into this element of the study;
- An assessment of the reasonableness of the cost estimates and demand forecasts provided by SA Water to the Commission for the purposes of calculating LRMCs and a risk assessment associated with those estimates;
- The estimation of an LRMC value (or values) for SA Water's drinking water services on an infrastructure zone/customer service area basis or other basis using the preferred methodology (or methodologies); and
- Where it may not be possible to obtain reliable estimates to underpin the LRMC for a particular zone/service area, an alternative methodology should be provided that provides a forward-looking cost measure of the supply of water reflecting an incremental change in demand.

A robust estimate of the LRMC should reflect all variable costs, future infrastructure costs arising from the level of predicted water use, and provision for environmental and other externalities. The estimate of the LRMC of water should be a forward-looking cost measure, reflecting the incremental change in demand, assuming all factors of supply can be varied.

Consideration should be given to developing LRMC estimates assuming the presence of existing infrastructure in SA based on the current available technologies and current costs, thereby forming a proxy of the long-term cost of investing in new assets.

1.2 Background

1.2.1 The Commission

Until recently, the Commission's role in water pricing was limited; primarily focused on reviewing the SA Government's price setting process having regard to certain pricing principles enunciated by the Council of Australian Governments (CoAG) in 1994 as well as through the National Water Initiative (NWI) in 2004.

Due to recent reforms, the Commission's role is becoming more substantive. On 1 January 2012, the *Water Industry Act 2012* (Water Industry Act) commenced empowering the Commission under the *Essential Services Commission Act 2002* (the ESC Act) to make a determination that regulates prices, conditions relating to prices, and price-fixing factors for water retail services.

The Commission made its first independent revenue determination for SA Water in May 2013, setting maximum allowed revenues for drinking water and sewerage retail services for the three year period from 1 July 2013 to 30 June 2016. For this period SA Water sets specific prices but those prices must comply with the average revenue caps in the Commission's revenue determination.

For future periods the Commission may set prices for drinking water services. For this purpose, the Commission needs to understand the marginal costs of providing the services delivered.

At the time of writing there are other related reforms being considered. In September 2012 the Treasurer of South Australia referred to the Commission an Inquiry into pricing reform for drinking water and sewerage retail services provided by SA Water. This inquiry is investigating a number of related matters.

In performing its functions, the Commission is guided by its ESC Act. Section 6 of the ESC Act requires that with regard to all its functions the Commission must have as its primary objective the '***protection of the long-term interests of South Australian consumers with respect to the price, quality and reliability of essential services.***'

1.2.2 Drinking water services provided by SA Water

SA Water provides drinking water to the majority of South Australians across the state. The drinking water services provided by SA Water can be thought of as being:

- the connection to the SA Water networks, and
- the provision of drinking water.

Drinking water for the most part can be thought of as a single commodity with uniform characteristics. With some qualification,[1] SA Water provides its retail water customers with a

[1] The quality of drinking water can vary by locations and there are current pressures to improve water quality in some locations.

single uniform drinking water service[2] that is well defined[3] and does not vary by location or over time.[4]

One additional dimension to the drinking water service provided by SA Water relates to water security, which we define as the continued availability of drinking water at reasonable prices. Although related to the provision of water services, for the purposes of pricing, water security may be considered an additional service. This is because (as consistent with our definition) following a negative supply shock, consumers may expect prices to be maintained at 'reasonable' levels and other measures are used to manage the demand-supply balance. For example, in South Australia (as elsewhere), during the recent drought, restrictions on water use were applied.

The scope of this report is on the LRMC of the provision of drinking water; that is the LRMC of volume of water demanded.

In theory, it might be possible to consider the LRMC of the other services. However, in practice there are issues in measuring LRMC for these other services and pricing based on LRMC:

- With regards to connections; the cost of providing an additional connection is very location dependent.
- With regards to water security; there is no clear measure of security that is provided and no existing explicit charge for water security.

2 The other (non-drinking) water services provided by SA Water are out of scope of this report.

3 For example, there are strict externally determined water quality standards.

4 However, drinking water guidelines can, and do, vary over time.

2. Long run marginal cost

2.1 About LRMC

A commonly accepted principle for water usage pricing, established in NWI Commission pricing principles,[5] is that prices should be set with 'regard to the long run marginal cost [LRMC] of the supply of additional water'.

LRMC is commonly defined as the cost of providing an additional unit, assuming all factors of production can be varied. It differs from the short run marginal cost (SRMC), which is the marginal cost assuming that some capital investment (or other factor of production) is fixed.[6]

As with marginal cost, LRMC and SRMC are forward looking cost concepts; that is the costs that are sunk (i.e. incurred or committed to) are not included in the calculation. Also (as noted in the scope) LRMC should include provision for environmental and other externalities; that is costs and benefits borne by other parties (to SA Water and the consumers of drinking water).[7]

Pricing with regard to LRMC has been advocated to ensure that prices provide an efficient signal for usage over the long-term. If prices were set at SRMC then prices may vary greatly depending on the capacity available.

However, there are costs as well as benefits to using LRMC as a basis for pricing. While in theory, LRMC is calculated using the assumption that all factors of production can be varied, in practice, once built a facility cannot be resized to meet changing demand. Because demand is dynamic (typically growing over time), the capital program will rarely be optimal for a level of demand. To account for the dynamic nature of demand, LRMC is estimated as the time-averaged cost of meeting a permanent change in demand into the future. This has important implications for this work.

- First, LRMC may be above or below marginal cost (which is generally SRMC) and, therefore, prices set at LRMC may discourage efficient behaviour in the short-run.
- Second, LRMC pricing dampens, but does not eliminate, the variability associated with SRMC prices. Estimates of LRMC will rise as new capacity investments draw close and fall once investments are committed.
- Third, there is often uncertainty as to future demand and costs. Therefore prices set at LRMC may prove to be too low or too high.

Given these factors there are often trade-offs in how LRMC is determined and how prices are set with regards to LRMC.

5 http://www.environment.gov.au/water/publications/action/nwi-pricing-principles.html.

6 This sub-section provides a brief overview of LRMC and pricing based on LRMC. See a companion paper (the LRMC Pricing Paper) for further information.

7 It is appropriate that provision for externalities be included in estimating LRMC, so as to ensure that the prices set with reference to LRMC encourage efficient use of the resource.

2.2 Methods and issues in estimating LRMC

The methods to estimating LRMC are described in a companion paper (LRMC Pricing Paper). The two key methods used are:[8]

- the Turvey (perturbation) method, and
- Average Incremental Cost (AIC) method.

Both these methods involve estimating LRMC by dividing the present value (PV) of future expenditure to service demand growth by a similar measure (a PV) of the demand growth. In effect, the two methods differ in the baseline that is used from which to measure changes in demand. For the Turvey method, the baseline used is the forecast demand. For the AIC method the baseline is the current level of demand.

The two methods may produce very similar results. The Turvey and AIC methods will produce different results when the cost of meeting new demand is changing over-time. In effect, the AIC method places greater weight on the marginal costs of meeting demand in the short-term than does the Turvey method. There are also practical differences. By focussing on marginal changes, the Turvey method is simpler to use to identify the impact of a single service when there are multiple drivers of cost.

Estimation of LRMC is generally undertaken by separately estimating marginal operating costs and capital costs.[9] Marginal operating costs are generally relatively straight forward to estimate as they tend not to vary substantially with demand. Estimating capital costs is more challenging due to the lumpy nature of investments.

2.3 Approach adopted in this paper

In this paper we have employed a building-block approach to estimating LRMC, whereby we have separately estimated the LRMC of different components (i.e. the building blocks) of providing drinking water services. This approach improves transparency and enables estimation of common cost components that are applicable across multiple locations.

For components (e.g. variable treatment costs) that we do not expect to vary substantially (over time or with demand) we have estimated marginal costs based on historical data that has been supplied.

For components (e.g. the cost of bulk water) where significant capital investment may be required, or where the marginal costs are expected to vary with demand, we have employed the LRMC methods that are described above. The main results have been presented using the Turvey method, but we have also made estimates made using the AIC method. The Turvey method is used because it more accurately measures the marginal cost of a permanent change in demand.[10]

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8 As discussed in the LRMC Pricing Paper, different terminology is used in other industries but essentially the same key methods are used.

9 Often a distinction is made between long run marginal operating costs and long run marginal capital costs.

10 See the LRMC Pricing Paper for a more detailed discussion of the how the AIC and Turvey methods differ.

We have estimated future costs over a period of 25 years; this is consistent with the period that SA Water uses for its long-term forecasts.

Estimates have been presented in terms of dollars per kilo-litre ($/kL) or cents per kL (c/kL).[11] All estimates are based in 2013/2014 price levels. To calculate present values, we apply a discount rate equal to SA Water's real pre-tax weighted average cost of capital (WACC). The Commission calculated this to be 5.06 per cent (as at 30 April 2013) for the 2013/14 - 2015/16 Revenue Determination period.[12]

Where possible, information has been sourced from, and key assumptions reviewed with, SA Water. However, for many cost components, information was not available. In such situations, we have attempted to supplement the information received from SA Water using external sources. When doing so we have typically rounded costs to increments of 5 c/kL. We expect that the estimates may be refined with improved information over time.

2.4 SA Water pricing and prior estimates of LRMC

2.4.1 Charging approach

The costs of providing drinking water services are recovered by direct charges on customers and charges and payments made by property developers. The key charges and payments relevant to this study are:[13]

- two customer charges
  - a quarterly charge based on water usage, and
  - a fixed charge based on the connection, and
- payments by developers, which include direct payments for water infrastructure and augmentation charges, which are charges paid by developers to SA Water as a contribution to infrastructure costs.

Residential water usage is charged using inclining block tariff (IBT) structure whereby the usage charge increases with different tiers of water usage.

As is common, the broad pricing approach is: for developers to pay (by direct payment of by augmentation charge paid to SA Water) for local infrastructure costs; to set usage charges to encourage efficient use of water; and, to set fixed charges at a level to ensure overall recovery of SA Water costs.

While not directly in scope of this report, payments made by developers are of interest. The direct payments made by, and augmentation charges imposed on, developers are of interest

11 We have adopted the approach of presenting cost components in terms of c/kL, and summary costs in $/kL.

12 ESCOSA (2013) section 9.

13 There are a variety of other charges primarily for administrative matters.

as they can be used to signal differences in the cost of providing water services by location and in doing so reduce the need for other location based charges. SA Water's policy on developer payments and augmentation charges is summarised in Box 2 below.

Box 2: Developer payments and augmentation charges

Extract from SA Water Fact Sheet on Augmentation Charges

Where SA Water reticulated water supply and/or wastewater services are required, the developers fund and construct the mains within the development.

Occasionally the existing adjacent water and/or wastewater infrastructure may not have sufficient capacity to cope with serving the newly created allotments. When this occurs the developer is also required to meet the cost of the upgrade work that will provide additional capacity to specifically serve the development.

When the development is part of a large area where further development will occur, rather than only consider what upgrade work is required for each specific development, a broader approach is taken by determining what upgrade work is required to serve the total area. To recover the cost of the upgrade works for the whole area from several developers, an Augmentation charge is established.

How is the augmentation charge calculated?

The charge is based upon the cost of providing the required infrastructure to a defined area where land is being developed. When the infrastructure work that is required has been defined, a charge based upon the cost of the work and the size of the area, or the number of potential allotments that can be served is established.

As an example, augmentation work may consist of:

- The duplication of a water main.
- Additional water storage capacity.
- A sewage pumping station.
- Construction of larger diameter sewers.

These services can be staged or delayed until the existing infrastructure is no longer able to serve the level of development that has taken place.

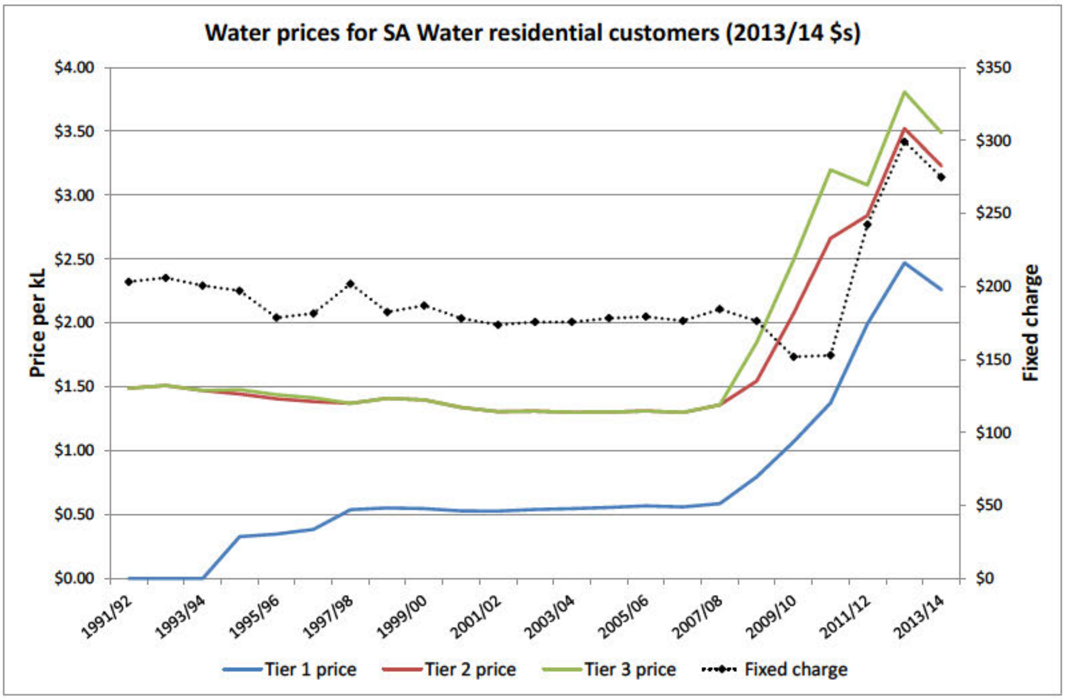
Source: SA Water Augmentation Charges Fact Sheet.[14]

2.4.2 Historical pricing at SA Water

The water prices charged in prior years provide an important context, in part because they are based on LRMC. Figure 1 shows, in real terms, how residential water prices have changed over time.

14 http://www.sawater.com.au/NR/rdonlyres/8CCE6A79-A809-415F-866C-700DB0C6212A/0/Augmentation.pdf. Accessed, 7 December 2013.

Figure 1: Residential Water Prices



Source: DF007 Water Pricing History, Current prices from SA Water website
Note: Nominal prices have been adjusted to 2013/14 prices using the consumer price index (CPI) for Adelaide (all groups). The tier levels have changed over time: the start of the Tier 2 level was initially set at 136 kL per year and is currently 30 kL per quarter (i.e. equivalent to 120 kL per year). Prior to 1994/95, the Tier 1 price was zero; that is, residential customers received a free allocation of water.

As illustrated in Figure 1, since 2006/07 the real price per kL of water has risen significantly by $1.66 (303%) for tier 1, $1.89 (149%) for tier 2 and $2.15 (169%) for tier 3. Demand has changed significantly during this time as well.

Historically, the setting of SA Water prices has been the responsibility of the Minister for Water Security (or other relevant minister) within the SA Government (the owner of SA Water).

Some explanation for the pricing can be found from the Transparency Statements that were released by the SA Government. In the inaugural 2004-05 Transparency Statement Part A, the SA Government reported that issues of efficient resource pricing were considered. [15] The statements suggested that the LRMC were (in 2013/14 prices) in-between the tier 1 (around $0.55 per kL) and tier 2 (around $1.30 per kL) prices. Specifically that:

> '[…] the lower first tier usage charge is justified on the basis of general affordability of an essential service, rather than economic efficiency' (page 34-35).

15 Specifically including 'average incremental operating costs, such as chemicals and electricity, the opportunity cost of drawing water from the Murray, projected augmentation costs and an estimate of externalities.' 2004-05 Transparency Statement Part A, (page 34)

'[…] the present top tier per kl charge exceeds LRMC plus proxy for environmental externalities.' (page 56).

In later statements views on the LRMC were modified, to reflect (it appears) the risk that sources other than the River Murray would be required. Selective quotes from the Transparency Statements are provided in Box 3 below. These include successive estimates of LRMC (in in 2008-09 dollars) based on expansions of the ADP of:

- around $1.90 per kL in the 2008-09 Transparency Statement, and
- $2.30 per kL in 2009-10 Transparency Statement.

We have also been supplied with a Draft LRMC model and paper prepared by SA Water in 2011/12 (the 2011/12 Draft LRMC Modelling). This contains some useful information and assumptions that we have adopted where we lack other information.

Box 3: History of statements made on LRMC for SA Water's drinking water services

2005-06 Transparency Statement Part A, page 48

"In 2005-06 the view was expressed that the 'the second, higher tier, is consistent with current preliminary estimates of SA Water's Adelaide LRMC."

2006-07 Transparency Statement Part A, page 32

"[…] the second tier is consistent with the upper end of the range of current preliminary estimates for the LRMC of supply to Northern Adelaide."

2007-08 Transparency Statement Part A, page 29

"LRMC is difficult to quantify and is contingent on assumptions about sourcing of future supplies, and in particular whether these will be from the River Murray, less traditional potential potable water substitutes such as storm-water reuse and effluent recycling or alternatively desalination. The latter of these might imply LRMC higher than the current second water usage tier. However, on the basis that desalination is not required to meet future Adelaide water requirements in the near term, the current second tier water usage price is reasonably consistent with the upper end of the range of indicative estimates for LRMC, including water resource costs, for South Australia's primary urban water demands."

2008-09 Transparency Statement Part A, page 37

"The unfolding severity of the current drought and the Government's new water security initiatives have caused SA Water to significantly revise its previous estimates of LRMC. Beyond the water security initiatives already announced, additional water supplies for South Australia are more likely to be sourced by an expansion of the proposed Adelaide desalination plant (e.g. from 50GL per annum to 100GL per annum), rather than by expanded water trading in the Murray-Darling Basin. This would lead to an estimated LRMC of around $1.90 per kL."

2009-10 Transparency Statement Part A, page 29-30

SA Water has estimated LRMC based on Average Incremental Cost, i.e.

$$\text{LRMC(Average Incremental Cost)} = \frac{\textit{Net Present Value Investment Program}}{\textit{NPV Output from Capacity Expansion}}$$

The estimate of LRMC is based on the following assumptions:

- capital costs of $640 million (in 2007-08 dollars) (numerator);

- operating costs of $60 million (numerator);
- a plant life of 25 years (numerator);
- residual plant value of 25% of the initial capital cost ($160 million) (numerator);
- WACC of 6% pre-tax real (both numerator and denominator);
- plant operating capacity of 100% for the first two years (denominator and numerator through variable portion of operating costs); and
- plant operating capacity of about 75% thereafter (denominator and numerator through variable portion of operating costs).

Based on these assumptions LRMC is estimated to be about $2.30 per kL in 2008-09 dollars, or $2.35 per kL in 2009-10 dollars.

Source: Transparency statement – Part A, 2009-10 water & wastewater (pages 29-30).

3. Regional analysis

The LRMC of providing drinking water services depends heavily on the balance between demand and supply which can vary significantly by location. This section outlines the areas serviced by SA Water, the supply sources and the pressures on the demand supply balance. The information is based on a number of sources including SA Water's 2013 Regulatory Business Proposal (RBP 2013) and accompanying documents.

3.1 Areas serviced by SA Water

For the purpose of supplying retail water services, SA Water divides water supply into 5 regions and, within these, 41 zones. These regions, and the key infrastructure in the regions, are summarised in Figure 2. As reflected in the figure, there is a great deal of connectivity between the regions; with pipelines connecting most of the population to the River Murray.

SA Water does not provide retail drinking water services to all communities. These other communities include communities in the Alinytjara Wilurara region in the far west of the state (where SA Water manages infrastructure but is not a provider of water services) and many townships in the far north (where SA Water only supplies a small number of townships).

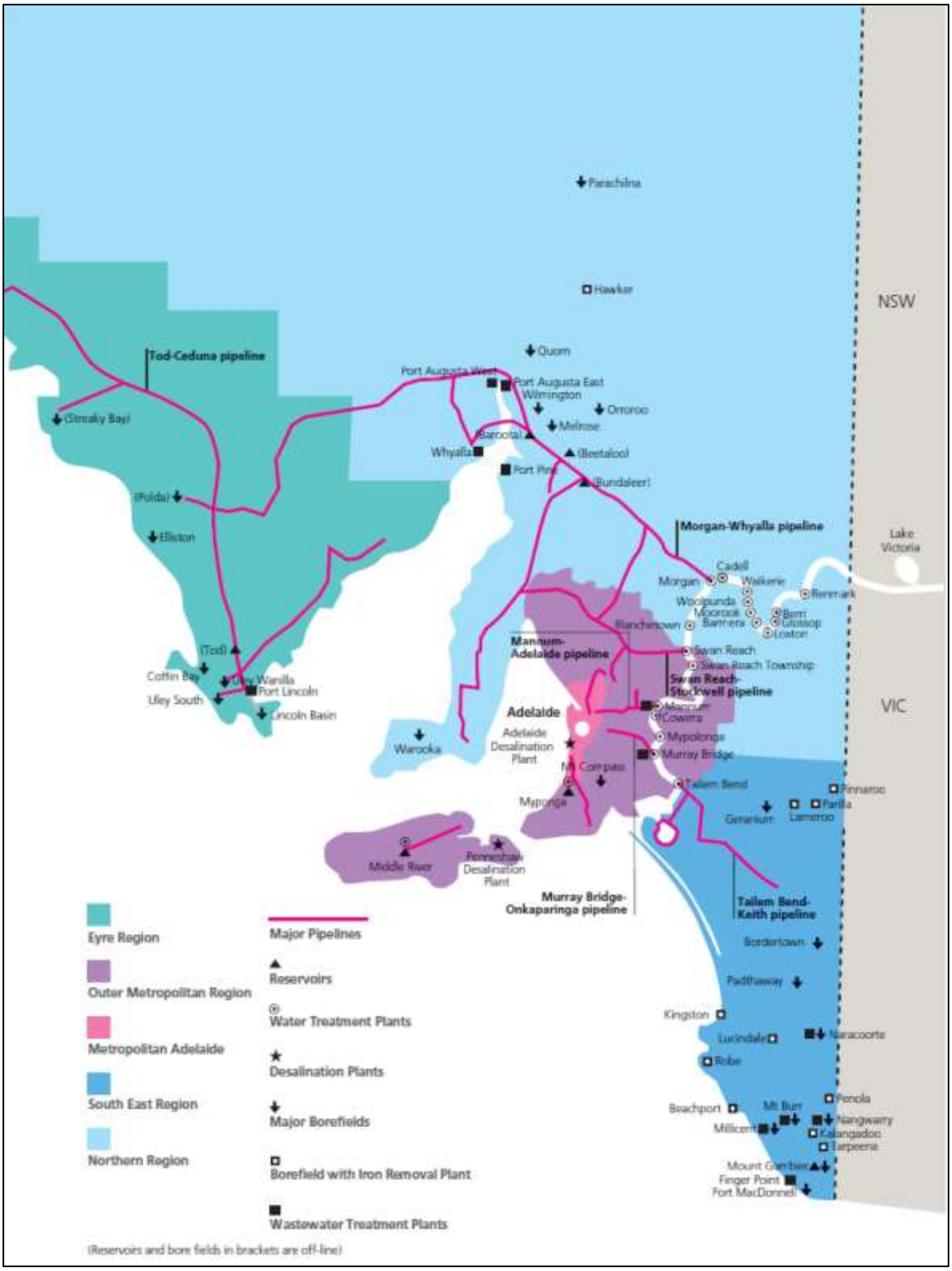
Key statistics for the different regions is summarised in Table 1 below. Of note, the Adelaide and surrounding regions (encompassing the Metro and Outer metro regions) represents 84 per cent of all customers and 78 per cent of volumetric demand.

Table 1: Summary data by region (2011/12)

[redacted]

Source: WIZ WWAS Model (2011/12); excludes a wholesale service known as the BIL Zone and 4 other zones without retail customers.

Figure 2: SA Water Infrastructure



Source: SA Water Infrastructure Summary

3.2 Supply sources

3.2.1 Overview

The majority of water supplied in South Australia has been derived from natural sources including the River Murray, the Mount Lofty Ranges (MLR) and a number of surface and groundwater systems. The regulatory framework for water resource management in South Australia, including water trading, is established through the *Natural Resources Management Act 2004* (NRM Act).

The NRM Act establishes eight regions (NRM Regions) across South Australia and regional boards responsible for developing a Natural Resources Management Plan (NRMP) for its region. The eight NRM Regions and the SA Water regions they refer to are described in Table 2 below.

Table 2: NRM Regions

NRM Region	Description	Corresponding SA Water region(s)
Adelaide and MLR	Covers nearly a million hectares and includes almost 80 per cent of South Australia's population, as well as highly productive areas with reliable rainfall that make a substantial contribution to the state's agriculture.	Metro & Outer metro
Alinytjara Wilurara	A diverse and arid landscape covering a quarter of South Australia - a quarter of a million sq km with 340 km of coastline	Northern & Eyre
Eyre Peninsula	An area of more than 55 000 sq km and supports a population of 55 000 people	Eyre
Kangaroo Island	An area of 4370 sq km. It has 457 km of coastline and supports a population of more than 4000 people, the majority of whom live in Kingscote.	Outer Metro
Northern and Yorke	Covers an area of about 3 780 000 ha and comprises the Yorke Peninsula, the Lower North, Mid North and Upper North and southern Flinders Ranges	Northern
South Australian Arid Lands (SAAL)	Covers 538 000 sq km, almost 55 per cent of the state.	Northern
South Australian Murray Darling	Covers 70 000 sq km or about 7 per cent of South Australia.	Outer Metro and Northern

NRM Region	Description	Corresponding SA Water region(s)
Basin		
South East	Includes the State Marine Waters, covers about 28 000 sq km of South Australia and supports a population of 65 000 people across seven local government areas.	South East

Source: Descriptions from http://www.nrm.gov.au/about/nrm/regions/sa.html (accessed 11 December 2013).

Where there are competing demands on a limited water resource, the water resource will be prescribed under the NRM Act. Prescription of a resource requires that the NRM Region board develops a Water Allocation Plan (WAP) to describe how water is allocated.

The majority of prescribed resources in South Australia are fully allocated; however, those licensed to extract water can generally obtain additional water allocations via temporary transfers (also known as seasonal transfers) and permanent water transfers. In the case of the River Murray, interstate transfers (to and from South Australia) are also possible between licensees.

The SA Government has conferred licences and allocations under the NRM Act to SA Water, often with limitations as to how the water allocation may be used. SA Water has also purchased additional permanent entitlements and temporary allocations. Where trading occurs it is possible to value the water allocations, however as noted in the SA Water's Annual Reports an estimate of the fair value of many water licences cannot be determined because of the lack of active markets.

In 2009, the SA Government released *Water for Good*, a strategy and plan for managing water security in South Australia. A key commitment of the plan is the development of detailed water demand and supply plans for every region. To date, demand and supply statements have been developed relating to selected NRM Regions being Alinytjara Wilurara; Eyre Peninsula; Kangaroo Island; Northern and Yorke and the SAAL.

3.2.2 Key water resources

Mount Lofty Ranges (MLR)

Water sourced from the MLR is the primary water source used to service Adelaide and its surrounds. This is a relatively inexpensive source of water but by itself is insufficient to meet demand. Between 10 and 90 per cent of Adelaide's mains water supply is met by the MLR storages.

SA Water has a licence to extract 143 GL per annum from the MLR for the sole purpose of public water supply. However, the water supplied depends on availability. SA Water has conducted analysis of historical inflows to the MLR.[16] Key findings from this analysis include that the inflows have fallen in recent years; in particular that the median inflow is:

- 165 GL/annum when measured over the 117 years on record
- 143 GL/ annum when measured over 30 years (1982/83 – 2011/12), and
- 113 GL/ annum when measured over 10 years (2002/03 – 2011/12).

The amount SA Water draws from the MLR is reduced by water lost to spillage, evaporation and environmental flows. SA Water's analysis notes that the relationship between the inflows into the MLR and the associated River Murray pumping is very dependent on the timing of inflows due to the risk reservoirs overflowing and water being lost as spill. Due to limited storage capacity, the risk of water being lost to spill increases with higher inflows and conversely less water is spilt when inflows are low. The report estimates the 30 GL/ annum difference in inflows between using the 30 year sequence above and the 10 year sequence equates to roughly 15GL/a of additional pumping from the River Murray for 2015/16.

A condition of SA Water's water licence for the Western Mount Lofty Ranges includes that some water is released for environmental flows. The water licence states:[17]

> "The licensee will participate in an environmental flow trial as agreed between the parties, with the objectives of establishing timing, frequency, duration and governance of environmental flows up to 16.5 gigalitres/annum as defined under the water allocation plan and having regard to water availability from natural inflows."

In 2010, the Department for Water released a study titled the 'Potential Impact on Water Resource Availability in the Mount Lofty Ranges due to Climate Change' (Heneker and Cresswell, 2010). The study (hereafter the MLR Climate Change Study) estimated the available water that may be drawn from the MLR under different scenarios taking into account the different factors above including spillage, evaporation and environmental flows. The MLR Climate Change Study (which was completed in 2008) estimated under the main climate change scenario (known as A2) that the bulk water available from the MLR would fall from a current mean of 102.5 GL to 66.5 GL per annum in the period 2035 to 2065.

A revision of the study is underway and is due to be completed sometime over the next year. Until that time, the MLR Climate Change Study provides the best estimate of the supply that would be available from the MLR.

River Murray

The River Murray has been use to supply to over 90 per cent of SA Water's customers. In recent years, the volumes supplied from the River Murray have ranged from around 90 GL (2010-11) to 223 GL (2006-07).[18]

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16 Provided in 'OX0049-A Summary - Water Demand and Source of Supply Assumptions.docx'.

17 Source: SAWI105-107.

18 Source: SA Water Annual Reports.

SA Water has water licences to extract water from the River Murray issued to it by the SA Government under the NRM Act. These include 'Metropolitan Adelaide' and 'Country Towns' licences with conditions that reflect caps made under agreement by the Murray–Darling Basin Ministerial Council. Under the agreement, the SA Government must ensure that diversions from the River Murray within South Australia for water supply purposes:[19]

- delivered to Metropolitan Adelaide and associated country areas through the Swan Reach-Stockwell, Mannum-Adelaide and Murray Bridge-Onkaparinga pipeline systems, do not exceed a total diversion of 650 GL over any period of 5 years;
- for Country Towns do not exceed 50 GL per year.

There are some limitations to SA Water's diversions from the River Murray. During a drought, SA Water's licences may be restricted. For example, due to drought conditions in 2008-09 the Country Towns allocation was restricted to 31 GL/annum and the Metropolitan Adelaide allocation was restricted to an annual extraction of 150 GL.

Drought conditions may restrict the volume of water that can physically be abstracted from the River Murray; however, under the *Water Act 2007* (s. 86A), critical human water needs (CHWN)[20] are given priority over other uses and, in effect, SA Water is not limited to the water it can abstract from the River Murray so long as there are sufficient flows.

SA Water's Metropolitan Adelaide licence is non-tradeable; therefore there is no opportunity cost of using the entitlement for other purposes; that is while SA Water uses less than its entitlement, the effective marginal cost of abstraction is zero.

If SA Water seeks to abstract more from the River Murray than conferred under the licences, it can do so, but must purchases the necessary allocations.

SA Water has purchased a series of permanent tradable rights to water from the Murray Darling system. The rights include rights held in South Australia, Victoria and NSW. SA Water's 2012/13 Annual Report (page 15) notes that 'The allocations made to these water rights are able to be transferred within the Southern Murray Darling Basin including South Australia.' In addition to the permanent water rights SA Water has been granted by the SA Government approval to purchase seasonal (i.e. temporary) water allocations for critical human needs.

There is a very small risk that the River Murray water quality is not suitable for drinking. This may be due to a number of reasons including salinity issues stemming from the mouth of the river. It is feasible that salinity issues prevent the abstraction of water from one or more of the River Murray pipelines servicing Adelaide.

There are also pipeline capacity constraints. The effective capacity of three pipelines servicing the Adelaide region (Swan Reach-Stockwell, Mannum-Adelaide and Murray Bridge-Onkaparinga pipelines, hereafter the Adelaide Pipelines) may provide up to 190 GL /

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19 Source: Review of the Operation of the Cap: Overview Report of the Murray-Darling Basin Commission, August 2000.

20 CHWN are as 'the needs for a minimum amount of water […] required to meet core human consumption needs in urban and rural areas […]'. Water Act 2007 (s. 86A).

annum.[21] The pipelines are also used to supply water to a wholesale customer (Barossa Irrigation Limited, BIL). The demand by the wholesale customer is relevant as increases the opportunity cost of using the pipeline.

For the metropolitan Adelaide region, the River Murray is a more expensive source of water than the MLR due to the cost of pumping.

Adelaide Desalination Plant (ADP)

The ADP has potential to provide 100 GL per annum of water, over 50 per cent of South Australian current water needs. Given the interconnection of the network, the ADP can, in effect be used to make more supply available to all zones connected to the River Murray that are west of the River Murray. Furthermore, by reducing demands on the River Murray, using the ADP can increase water available for any town that draws water from the River Murray.

The ADP is a relatively expensive source of water, and following the proving period it is expected that the ADP will not be required for some time.

Other sources

The other water sources used by SA Water include ground water, surface water, desalination and recycled water. The SA Government has issued water licences to SA Water under the NRM Act for a number of other water resources in regions around South Australia.

Groundwater is the most significant of these other resources and it is the primary resource in many parts of the state. Like surface water, the availability of groundwater is climate dependent. Furthermore, the full extent of a groundwater resource is often not known. Groundwater is used close to where it is extracted. The quality of groundwater varies significantly with some sources unfit for drinking unless desalinated. Demand and supply pressures and options

The availability of water sources to meet current and future demands has been analysed in the water demand and supply statements conducted by NRM Region and SA Water's long term plans (LTPs). In some regions, plans (or demand and supply statements) have yet to be developed (e.g. the South East); however, these appear to be regions were water resources are relatively abundant.

The plans have identified a few areas supplied by SA Water (including the Eyre Peninsula, Kangaroo Island and the Yorke Peninsula) where there is a risk that additional supply will be required. Furthermore changes in demand and supply may result in a change in the mix of resources being used to service Adelaide.

Areas serviced by the Adelaide Pipelines

Metropolitan Adelaide and associated country areas that draw from the River Murray through the Swan Reach-Stockwell, Mannum-Adelaide and Murray Bridge-Onkaparinga

21 The capacity constraint based on correspondence with SA Water dated 12 December 2013.

pipelines (the Adelaide Pipelines) represent 75 per cent of SA Water volume supplied to retail customers.[22]

An increase in demand (coupled with falls in the supply from the MLR) will result in an increasing marginal cost of supply as a result of SA Water:

- needing to pump at times when electricity costs are high
- purchasing additional water allocations from the River Murray (in excess of the Metropolitan Licence), and
- needing to use the ADP to supplement supplies, due to capacity constraints in the Adelaide Pipelines preventing additional use of water from the River Murray.

Eyre Peninsula

For the Eyre Peninsula, the NRM supply and demand statement[23] forecasts that demand for drinking water only, on the basis of population growth, will exceed supply by 2020/21. SA Water's current predictions are that additional water will not be needed until 2038.

In its 2008 LTP for the region, SA Water identified a number of options (including estimated capital costs) to meet this growth in demand. These are: [24]

- a desalination plant on the north-west coast (possibly at Ceduna or Penong)
- a desalination plant on the south coast (possibly at Cathedral Rocks)
- further expansion of the Iron Knob-Kimba pipeline to transfer additional water
- a pipeline from Whyalla to supply the East coast
- improvements to Tod Reservoir to improve quality in future: water currently non-potable, and
- new borefields (increased use of groundwater).

We understand that the south coast desalination plant is the current preferred option.[25]

Kangaroo Island

On Kangaroo Island, SA Water provides drinking water services to around 2,000 customers. Customers are serviced by two independent water supply systems:

- Middle River (or Kingscote) — 355 ML billed consumption in 2012/13, and
- Penneshaw — 43 ML billed consumption in 2012/13.[26]

In its 2009 LTP for Kangaroo Island, SA Water forecast that demand would exceed the Middle River supply in 2013/14 and outlined a number of augmentation options. These options including desalination plants, water storages and a dam and ranged in cost from

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22 Source: WIZ WWAS Model (average of 5 years to 2012/13). [Drinking Water Workbook, WIZ Analysis]

23 SA Department for Water, 2013, Eyre Peninsula Supply and Demand Statement Annual Review 2012 (p. 4).

24 SA Water, 2008, Eyre Peninsula Long Term Plan.

25 Verbal advice received from SA Water [12 December 2013].

26 Source: WIZ WWAS Model (average of 5 years to 2012/13). [Drinking Water Workbook, WIZ Analysis]

around $50 million (lower estimate for large treated water storage) to $150 million (upper estimate for new large dam).[27]

However, billed consumption has fallen 20 per cent since 2008/09.[28] More recently, SA Water has identified that the next augmentation for the Middle River supply system would be a storage upgrade, which would provide an additional 65 ML/ year. SA Water has advised that 'modelling of the demand/supply scenario forecasts indicate this project may not be required until 2045' but that the 'high degree of variability in demands and resource availability requires that SA Water continually monitor the changes in the Kingscote [Middle River] water supply.'[29]

Yorke Peninsula

The Yorke Peninsula receives 95 percent of its supply from the River Murray. SA Water's 2012 LTP Annual Review for the Yorke Peninsula identified a future constraint in the Warren – Bundaleer Junction; however, SA Water has since advised that there is no longer constraint in the foreseeable future.[30]

Other areas

There are no foreseeable water supply issues in other areas of the state.

3.3 Areas for estimating LRMC

The appropriate grouping of locations for estimating LRMC ultimately depends on the extent of variation in the LRMC by location. Across zones, where there is minimal variation in LRMC, there is minimal benefit to a variation in pricing.

Variation in LRMC will predominantly relate to differences in the sources of water used and the marginal variable costs (including those of pumping and treatment costs) in using these sources (see section 5.3 for a discussion of other costs). This subsection considers the variations in the marginal variable costs of supplying water by location.

Marginal variable costs of using water sources

Unfortunately, SA Water is not able to provide information on the marginal costs of using its existing water sources.

SA Water has been able to provide information on incurred fixed[31] and variable costs by WIZ coupled with data on consumption and numbers of customers. The source of this

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27 The augmentation options are outlined by SA Water in 'SA Water, 2009 Kangaroo Island Long Term Plan (p. 45, figure 17)'. Costs are nominal. Note: we do not have the details and have based the cost estimates on the figure in the plan.

28 Source: WIZ WWAS analysis.

29 Source: SA Water unpublished communication [SAWI104].

30 Source: SA Water verbal advice [12 December 2013].

31 The WIZ WWAS Model data on fixed costs is of little use to this study as the costs include distribution network costs which are very significant and only very loosely related to volume consumed.

information, referred to as the WIZ WWAS Model,[32] is a fully allocated activity based costing model of SA Water's actual costs. The WIZ WWAS Model is of some use as it can be used to calculate average variable costs, which may provide some guide as to marginal costs and differences in marginal costs by location.

The variable costs identified in the WIZ WWAS Model are primarily electricity costs and chemical costs. These account for only 6 per cent of total costs.

The average electricity costs, by zone provide an indication of the pumping costs to different zones; however care is required. Marginal costs are likely to be greater than average costs because the averages will include water from nearby locations (e.g. water from the MLR) and water pumped at times which electricity costs are low.[33] At the margin, water is more likely to be pumped further distances (e.g. for Adelaide from the River Murray) and at times when pumping costs are higher.

Suggested LRMC Areas

Based on variation in the supply sources (discussed in previous sections) and variation in the variable costs, a preliminary set of LRMC groups of the WIZs has been identified. These, including a summary of the average variable costs from the WIS WWAS Model, are described in Table 3 below. Maps of the WIZs are provided in Appendix 1.
As can be seen in the table, there is reasonable variation in the variable costs which might justify differential pricing. Of note:

- We expect the marginal variable cost for the Greater Adelaide region to significantly higher than the average ([redacted]).
- [redacted]
- [redacted]
- There are 5 'other' zones that are not connected to each other. We have grouped these into one area, for no other reason than that they are small.

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32 WWAS refers to Wastewater Asset System.

33 For example, in a discussion on pumping along the Morgan-Whyalla Pipelines SA Water report (Unpublished document [CX0110 report]) 'Because the major operating cost for the Morgan system is the electricity to pump water along the Morgan-Whyalla Pipelines, every effort is made to maximise pumping during the low electricity tariff period, and minimise the amount of pumping that occurs during the high tariff period of the day and week. Since there is very little storage capacity, the treatment plant also needs to operate during the low tariff times, to match the pumping rate. Therefore, Morgan WTP generally operates only at night during the week, and on weekends, and is shut down during the day.'

34 We understand that this is due to the higher elevation of the Mount Pleasant zone.

Table 3: Suggested LRMC Areas

LRMC Areas	Main sources	WIZ codes	Customers (2011/12)	Average consumption (2011/12, kL)	Average variable cost ($/kL)
Greater Adelaide	MLR, River Murray via Adelaide Pipelines, ADP	[redacted]			
Mount Pleasant	River Murray via Adelaide Pipelines				
Swan Reach to Paskeville	River Murray via Swan Reach-Stockwell Pipeline				
Yorke	River Murray via Swan Reach-Stockwell Pipeline				
Northern	River Murray via Northern Pipeline, Groundwater				
Eyre (excluding West Coast)	River Murray via Northern Pipeline, Groundwater				
Tailem Bend Keith Pipeline	River Murray via Tailem Bend Keith Pipeline				
River Murray Towns	River Murray via other pipelines				
Myponga	Local resources				
South East	Local groundwater				
Kangaroo Island	Local resources				
Other disconnected	Local groundwater				

Notes: Source is the WIZ WWAS Model. Customer numbers were not provided for 2012/13. The average variable cost is the calculated over 2008/09 to 2012/13. Note that there are an additional 5 WIZ codes (07, 11e, 12, 27 and 29) without retail customers.

4. Demand

4.1 Introduction and overview

The demand for a service can be an important component of the estimation of LRMC. Growth in demand can drive the need for new capacity investment and result in the use of higher costs resources, thereby increasing operating costs.

As discussed, in the previous section, there are a number of areas where a changing demand/supply balance has potential implications for marginal costs. These relate to:

- increased demand in the Greater Adelaide (combined with potentially lower supply from the MLR) resulting in SA Water needing to rely on additional water allocations from the River Murray and ultimately the ADP, and
- the potential need for additional supply capacity on Kangaroo Island and the Eyre Peninsular

This section reviews SA Water's estimates of demand for drinking water that it supplies. In doing so, there are a number of important considerations.

First, demand for LRMC pricing purposes is challenging because the demand for water depends on the price of water and thus there is circularity in estimating demand for purposes of LRMC. Demand depends on usage pricing, which is set with regard to LRMC, which in turn may depend on demand.

Second, the timing of demand can be important; that is, some costs (e.g. expansion of transport infrastructure) may be driven by peak-demand requirements, while for other costs annual average demand is required.

Third, the location of demand change can also be important as some costs, particularly relating to capacity constraints, are dependent on where demand growth occurs.

4.2 SA Water estimates of demand

SA Water has conducted a number of forecasts of drinking water demand. These include:

- a long-term model of state-wide demand developed by ACIL Tasman for SA Water as part of the RBP 2013 and subsequently refined by the Centre for International Economics (CIE), and
- estimates of location specific demand contained within regional LTPs and other documents.

An overview of the ACIL Tasman model is provided in Box 4 below. As part of the revenue determination process, the Commission engaged the CIE to conduct a review of the ACIL Tasman model (CIE 2013). CIE concluded that the 'approach to forecasting demand was generally sound' (page 3). CIE recommended a number of technical modifications which they incorporated into a revised version of the ACIL Tasman demand forecast model (the Revised Demand Model). Of particular relevance to this review, these included:

- modification of the price elasticities, and

- allowance for less than complete bounce back in demand following the drought.

The Revised Demand Model is the most recent and most comprehensive forecast of future demand. There are, however, some practical limitations to using it for calculating LRMC. The forecast is for annual billed consumption on a state-wide basis up until 2020-21. For the purpose of calculating LRMC, it is necessary to estimate the volume supplied (which may differ from billed)[35] by location and to estimate demand for a longer-time period.

Nevertheless, the Revised Demand Model appears to be the most useful basis for forecasting projections of future water demand for the purpose of LRMC. The location specific demand estimates contained within the regional LTPs and other documents are useful complementary documents.

Box 4: An overview ACIL Tasman's State-wide model

As part of the RBP 2013, SA Water presented a long-term model of drinking water demand developed by ACIL Tasman.

The ACIL Tasman model estimates demand on a state-wide level based on forecasts of property type and average demand by customer type. Specifically, the forecast was estimated as the sum of residential, commercial and other non-residential demand, where:

- Residential demand was forecast as residential customer numbers times average demand per residential customer
- Commercial demand was forecast as commercial customer numbers times average demand per commercial customer, and
- Other non-residential demand was forecast using a model of total demand by these customers.

The residential category refers to customers on residential land. The commercial category refers to wholesale and retail trade, professional services and other businesses. ACIL Tasman describes the non-residential category as a catch-all classification that includes primary producers, miners and other uses.

Forecasts of average demand were based on a model developed by ACIL Tasman. For this model ACIL Tasman examined a number of drivers of average demand by customer type, settling on:

- for residential customers price, temperature, water restriction levels,
- for commercial customers price, temperature, water restriction levels and gross state product.

In applying the model a number of key assumptions were made. For the model of average demand the forecasts the assumed that:

- weather conditions will return to the long term average (the median of observations

35 To convert water supplied to water billed ACIL Tasman applies an assumption for water that is non-revenue.

between 1977-78 and 2010-11),

- GSP growth in the short-term would match forecasts prepared by the South Australian Department of Treasury and Finance and after that the average growth rate of GSP over the period 1991 to 2011, and
- usage prices would not change significantly in real terms to the 2012-13 prices.

For estimating residential and commercial customer numbers, ACIL Tasman constructed models based on residential population (for residential customers) and gross state product (for commercial customers). For forecasts of the residential population ACIL Tasman considered alternative population growth projections (low, medium and high scenarios) provided by the Australian Bureau of Statistics (ABS) and the South Australian Department of Planning and Local Government. There is a material difference between the projections; over the period 2011 to 2021 the average annual population growth projected by the ABS was 0.93% per annum versus 1.1% per annum by the SA Government. ACIL Tasman chose the ABS projections on the basis that they were more consistent with recent growth. ACIL Tasman forecast customer growth

Source: Sapere review of ACIL Tasman (2012).

4.3 Using the Revised Demand Model to forecast demand

In our opinion, the broad approach adopted in the Revised Demand Model — of forecasting demand based on a model of average demand by customer type — is reasonable. As we would expect, the model has attempted to control for the key drivers of demand including weather, price and use of restrictions.[36]

We have concerns in using the Revised Demand Model for forecasting long-term demand and using it for the purposes of estimating LRMC. Two key issues relate to:

- the impact of price changes, and
- the effect of trends in water efficiency and water use.

4.3.1 Issues in applying the model

Effect of price

The effect of price is of significant importance for this review. As was discussed in section 3.3, prior to the recent drought, estimates of LRMC were significantly less than current prices. It is therefore necessary to consider the effect of a large fall in price on demand. If a large fall in the usage price occurred, the price-induced change in demand may be very significant.

[36] As noted in their report ACIL Tasman (2012), ACIL Tasman examined a number of potential drivers of water demand and include in their model drivers that were found to be significant and useful to the model.

The extent of the demand response depends critically on assumptions as to the price elasticity of demand.[37] In developing the original demand model, ACIL Tasman estimated price elasticities for residential, commercial and non-residential segments (see Box 4 for definitions) using a number of regression models. They also undertook a literature review and concluded it was appropriate to modify the elasticities they estimate to be consistent with the literature. In constructing the Revised ACIL Model, the CIE modified the regression models and re-estimated the price elasticities. They concluded on price elasticities that were very similar values to what ACIL had originally used.[38]

The uncertainty associated with these estimates should be recognised. There are substantial challenges in estimating prices elasticities. Key challenges, all of which are highly relevant to the estimates made by ACIL Tasman and the CIE, include the following:

- The price elasticity of demand will depend significantly on the time period being considered. All else being equal demand will be more responsive to price over a longer time period. It is generally recognised that price changes will have a lagged effect on demand; that is, demand will respond to price changes made in previous periods. The models used to estimate elasticities did not take into account the lagged effect of price changes on demand.
- Price changes are often correlated with other initiatives and factors that influence demand. This makes it difficult to both a) separately identify the impact of historical price changes and other initiatives; and b) forecast the impact of future changes. A related issue is that the impacts of price may be diluted due to other forced changes. For example, the net effect of a price increase will be less following a demand management program that encourages uptake of water efficiency programs.
- The response to price changes will depend on how price are structured and price changes are communicated. The price signal to consumers will be diluted if they are not made aware of how prices are likely to change over time. The impact of the price signal may also be diluted by the use of an inclining block tariff structure.

Despite these challenges, the price elasticities of demand in Revised Demand Model are broadly consistent with the literature for estimates of the long-run price elasticity of demand. Some comment and qualification is appropriate:

- Responsiveness to price changes may be slow in the medium term due to the impact of recent demand management measures that have reduced price responsiveness. For example, the price elasticity used in the Revised Demand Model (-0.28) is similar to the long-run price elasticity estimated by Abrams et al (2012) for houses that had not participated in water efficiency programs. The price elasticity estimated by Abrams et al (2012) was much lower for houses that had participated in water efficiency programs and much smaller for units.
- The long-run price elasticity for the non-residential category appears relatively low when compared to the price elasticity of the residential category, particularly given the

[37] The price elasticity of demand is a measure of a percentage change in demand in response to a percentage change in price.

[38] Specifically they estimated price elasticities of demand for residential, commercial and non-residential customers as -0.2885 (residential), -0.2781 (commercial), -0.2317 (non-residential).

literature suggests that the long-run price elasticity for non-residential customer is higher than that for residential customers.[39]

In aggregate the price elasticity measures used in the Revised Demand Model appear reasonable for estimating the influence of prices over the very long-term. The weighted average price elasticity is around -0.27, which is consistent with our interpretation of the literature.

Using the elasticity measures, indicative estimates of the effect of changes can be estimated. For example, the Revised Demand Model[40] suggests that a fall in the usage price to the level it was prior to the drought (in 2006-07) would induce a 30 per cent increase in demand over the baseline forecast; equivalent to an additional 59 GL per annum by 2020-21. There are, however, challenges in using the Revised Demand Model to estimate the effect of price changes. These include issues relating to the period over which the demand change occurs, the baseline price from which to measure changes and the extent to which the model is adequately picking up other trends. These issues are discussed in section 5.2.1 in our discussion on demand for Greater Adelaide.

There are also other challenges in applying price elasticities to forecast demand in the future. For example, the price elasticity of demand in the future will also depend on community attitudes to water, which may be influenced by Government policy. Unfortunately there does not appear to be any easy reasonable way to reduce the uncertainty as to the impact of future price changes. Rather, it is perhaps better to recognise the uncertainty and estimate LRMC based on different demand scenarios.

Trends in water use and water efficiency

Another key issue (closely related to price) is the trend in water use and water efficiency. A key risk is that the changes in price have masked the impact of changes in water efficiency.[41] Part of the reduction in demand in recent times will be from the increased use of more water efficient devices (e.g. dual flush toilets). Once installed, these devices will continue to contribute to lower water use regardless of changes in price. A reduction in price may reduce the rate of further take-up of the devices, but would not prompt removal of such devices.

We expect the effect of water efficient devices will continue to increase independent of price. We would expect that there may be future reductions in average water use due to installation of more efficient (than the installed average) devices in new developments and renovations of existing developments. This may be due to improvements in technology and/or government programs that support the adoption of such programs; factors which are independent of price.

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39 A useful summary of previously estimated residential and non-residential price elasticities of demand can be found in ACIL Tasman (2012, section 6.6). The price elasticities for non-residential demand (Table 9) are generally much larger in magnitude that those for residential demand (Table 8).

40 For all analysis we have used the Revised Demand Model (i.e. the CIE modified version of the ACIL Tasman model).

41 ACIL Tasman attempted to model the effect of the uptake of water efficient devices by examination of number of rebates paid for water saving devices; however they found that 'number of rebates issued did not improve the models' ACIL Tasman (2012, p. 36).

An indicative estimate of the effect of water efficiency in new dwellings can be obtained from other jurisdictions. Lower Murray (a Victorian water utility) recently assumed that new properties would consume 80 per cent of the volumes of existing properties because new properties tend to be smaller and have more water efficient gardens and appliances.[42]

To model the effect of greater use of water efficient devices, we recommend that in the future the forecasting model be modified to estimate the average water usage of new dwellings separately to existing dwellings. This modification of approach would require some additional analysis of water usage by age of dwelling, but would provide greater accuracy as to the effect of new dwellings.

Permanent improvements in water efficiency will be reflected in all new houses and existing houses.

4.3.2 Sources of uncertainty in the forecast

As recognised by ACIL Tasman, there are a number of important sources of uncertainty in the demand forecasts; in particular, the extent to which consumer demand would bounce-back following the removal of restrictions. As the end of the drought becomes more distant, the extent of bounce-back effect will be revealed.

There are many other significant uncertainties. Demand will depend significantly on a number of other factors that are difficult to forecast. These include:

1. community attitudes to water use
2. changes in water use technology, and
3. the influence of Government policy.

We see little value now in further research to reduce these sources of uncertainty but recommend that these (and the impact of price and water efficiency as discussed above) continue to be monitored.

4.3.3 Regional forecasts

For the purposes of estimating LRMC it is sometimes necessary to consider the demand in specific regions. Some capital costs will be location and time specific. Thus for example, the capacity expansion of a water treatment plant will be driven by peak demand requirements that occur in a particular location.

The SA Government[43] published population projection by region. These projections can be used in conjunction with the Revised Demand Model forecast to produce growth estimates by region.

42 Lower Murray Water, Part A Urban Water Plan 2013/14 to 2017/18, September 2012. Available from http://www.esc.vic.gov.au/.

43 Department of Planning and Local Government, Government of South Australia, (2010).

5. Estimates of LRMC

5.1 Introduction and overview

This section estimates LRMC for the different LRMC Areas we identified in section 3.3.

The majority of the section examines the LRMC associated with bulk supply sources and the variable costs of using these supply sources. In section 5.3 we elaborate on other costs associated with water supply, including fixed and semi-variable costs associated with water treatment, pumping, distribution and reticulation costs.

5.2 Approach and assumptions by LRMC Area

5.2.1 Greater Adelaide

For Greater Adelaide, the River Murray will be the marginal bulk water source until the ADP is required. The costs of drawing water from the River Murray may also change with demand due to changes in pumping costs and due to the need for SA Water to purchase additional water.

The LRMC of the bulk water supply for Greater Adelaide can be categorised as comprising:

- the costs of abstracting from the River Murray, including:
  - the pumping and treatment costs, and
  - the costs of additional River Murray water allocations (in excess of the Metropolitan Licence), and
- the costs of using the ADP to supplement supplies when insufficient water can be drawn from the River Murray.

Whether each of these cost components is incurred depends on demand (and available local supply). In effect, there are three supply scenarios which reflect that whether the marginal supply is:

1. water pumped from the River Murray without the need for additional water allocations
2. water pumped from the River Murray with the need for additional water allocations, or
3. water supplied from the ADP.

Our estimate of the LRMC needs to reflect the both quantum of costs and the likelihood/timing that each of the scenarios will occur. To do so we consider (below):

- the marginal costs associated with each scenario, and
- the timing and likelihood of each scenario occurring.

Marginal costs of different scenarios

Pumping and treatment costs

[redacted]

[redacted]

[redacted]

[redacted]

We have assumed that these costs will, in real terms, be stable over the medium to long-term. A medium term forecast of the electricity prices for South Australia can be found in forecasts prepared for the Australian Energy Market Operator (AEMO).[45] The most recent forecast is for real electricity prices for businesses in South Australia to grow at an annual rate of 0.3 per cent over the period 2013–14 to 2022–23 (with some significant variations during this period).[46] However, this forecast includes the effect of the carbon pricing scheme implemented on 1 July 2012, which the federal government is seeking to remove. The Australian Energy Market Commission (AEMC) estimates that by 2015/16, carbon pricing mechanism will contribute to around 2 per cent of the representative market offer price, which is similar in effect to the growth rate of the AEMO forecast.[47] We have therefore assumed that removal of this carbon pricing scheme would largely offset the growth in prices forecast in the medium term.

[redacted]

44 Source: SA Water unpublished information [SA Water response to Sapere Assumptions #2].

45 Source: National and state economic forecasts to 2034-35, A report for the Australian Energy Market Operator (AEMO) by National Institute of Economic and Industry Research (NIEIR), available at www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report-2013/NEFR-Supplementary-Information-2013.

46 AEMO (2013, page 5-22).

47 The AEMC estimate that in 2012/13 the cost of the carbon pricing mechanism made up around 7 per cent of the representative market offer price but this (under the existing legislation) will fall by 2015/16, primarily due to the move from a fixed carbon price to a floating price (AEMC 2013, page 206).

48 The average chemical costs for the Metro region in the three years to 2010/11 were 5 c/kL. They have fallen subsequently, but this may be due to greater use of the ADP.

[redacted]

Cost of additional water allocations

SA Water's bulk water licence to extract from the River Murray for Metropolitan Adelaide (650 GL over any period of 5 years referred to in section 3.2.2) exceeds current needs (the demand for the region net of the water received from the MLR).[49] The conditions of the licence are such that the water cannot be used for any other purpose. In effect, while SA Water uses less than this allocation, SA Water's opportunity cost of abstracting water from the River Murray is limited to the Natural Resource Management levies (NRM Levies) it pays. These NRM Levies (discussed in section 5.3.3) are 1.7 c/kL for SA Water's bulk water licences.

If SA Water needs to draw additional water (in excess of its cap) from the River Murray, it may do so by purchasing additional water allocations through temporary or permanent water trades.

The cost of future purchases of River Murray allocations can be estimated based on the price of water allocations.

The National Water Commission (2012) reported the average prices of water allocations traded through the River Murray Prescribed Water Course (PWC). Average prices during 2011-12 in the River Murray PWC were $26/ML (2.6 c/kL) for temporary water allocations. The average price for permanent water allocations was $1768/ML,[50] which, when annuitized over a 25 year period using SA Water's discount rate, is equivalent to 12.6 c/kL each year. The NRM levies for these water allocations are lower; they are 0.55 c/kL.

We assume that SA Water will be in greater need of additional River Murray water during periods when water is relatively scarce and the cost of temporary allocations will be higher. Regardless, for the purposes of estimating LRMC, we assume a permanent water allocation price is appropriate given that the basis of measuring LRMC is a permanent change in demand. For our modelling, we have assumed the cost of permanent allocations will be 13 c/kL. [51] We also make an adjustment for the NRM levies.

Although SA Water is currently using less than its cap (and will continue to do so in the immediate future), there are some arguments for including some allowance for the cost of water allocations while SA Water uses less than its cap. These are: [52]

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49 Source: SA Water unpublished document ['OX0049-A Summary - Water Demand and Source of Supply Assumptions.docx'].

50 This price is a slightly higher, but broadly consistent with, assumptions in the 2011-12 Draft LRMC Modelling; which included the note that "Current price $1.3m for 1GL of permanent Water from the River Murray. Therefore, around $130,000 for 1GL pa. Higher price applies for temporary water. Price will increase by 2040-41."

51 Rounded up from the 12.6 c/kL.

52 We also consider it possible that the basis of SA Water's licence to the River Murray will be reviewed and modified (due to a modification to the Murray Darling Basin Agreement).

- There is an environmental benefit to not abstracting from the River Murray; however, this may be reflected in the difference in the NRM levies.
- The restriction on use may reflect community attitudes towards using water from the River Murray.
- SA Water currently owns a number of permanent allocations, which we would expect to increase as demand increases, and
- There is no restriction[53] on how SA Water uses its country licence and, due to the interconnectivity in the Northern Region, SA Water has some flexibility in supplying water to some locations using the country licence or using water that could also be used to supply the Greater Adelaide area.

Costs of using the ADP

An estimate of the marginal cost of using the ADP is necessary for estimating the cost of the scenario where insufficient water can be supplied from the MLR and through the Adelaide Pipelines. To estimate the marginal cost, we have examined information provided by SA Water in the response to the RBP 2013 on the cost of operating the ADP. We have considered three cost components being:

- start-up costs; that is the cost of moving the ADP from a standby-state to an operating state in which it produces water
- the variable costs of producing water, and
- the costs of maintenance and replacement.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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53 Source: Verbal advice provided by SA Water [on 12 December 2013].

54 Source: SA Water unpublished document [SAWI147].

55 This is based on SA Water's opex forecasts submitted for ADP on the basis of mothballing the plant for one year (2016). (Source: SA Water unpublished document [OX0029-A, Opex costs of the ADP]).

56 Source: SA Water unpublished document [OX0029-E ADP].

[redacted]

[redacted]

[redacted]

[redacted]

The timing of scenarios

The timing of the above scenarios depends on Greater Adelaide demand and the supply of water from the MLR. As demand grows, or MLR supply falls, there is an increasing likelihood that SA Water will need to purchase additional River Murray water allocations and that the capacity of the Adelaide Pipelines will be reached.

Demand

As is discussed in section 4, there is significant uncertainty as to the level of future demand. The Revised Demand Model was developed primarily to estimate demand to end of the revenue determination period (i.e. 30 June 2016) during which there would be no substantial changes to prices. To estimate demand beyond this time, we have used the forecast of the Revised Demand Model as a foundation and made additional assumptions regarding:

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57 We understand that other maintenance costs are not driven by water usage. Source: SA Water verbal advice [on 31 January 2014].

58 The annuitized costs have been estimated by discounting 15% of the $513m by 25 years (at the WACC) and dividing by annual level of usage. It is not clear what reduction in volume (from 100% of capacity) is required to achieve the cost savings. If a 100 GL is used the annuitized cost is 2 c/kL. If 30 GL is used the annuitized cost is 5 c/kL. [See Drinking Water Workbook: Tab, ADP analysis]

- the impact of a price change, should price be set with regard to LRMC
- long-term growth in demand beyond 2020-21
- the demand in the Greater Adelaide region, and
- the relationship between bulk and billed water consumption.

We have assumed that, consistent with the estimates of LRMC (presented later, in section 5.4) in this report, that the water usage price will fall once the current determination period has expired (i.e. from 2016/17). The potential impact on demand could be significant. The Revised Demand Model (which uses an elasticity of around -0.28) suggests that the reduction in price from the current tier 2 price of $3.23 per kL to a price of $0.60 per kL would induce a 57 per cent increase in demand.[59]

However, we expect the change in demand following a price fall to be smaller than implied by the Revised Demand Model. There are a number of factors.

- We expect that price to have a lagged effect on demand, particularly for the non-residential sector. This lagged effect of price on demand is not captured in in the Revised Demand Model.[60] An implication is that the appropriate baseline from which to measure a price change may be lower than that the current price.
- In the short-medium term, changes in demand may be muted as a result of recent decisions to install water efficient devices. In effect, many of the long-run decisions that households could make in response to price changes were made during the drought. As found by Abrams et al. (2012), the price responsiveness of household who have installed water efficient devices is much lower than that of other households.
- We expect that there are some longer term trends in demand — due to changes in water use and penetration of water efficiency devices — that are not captured in the Revised Demand Model.

In light of these considerations, we have assumed a 30 per cent (one-off) increase in demand, over that forecast by the Revised Demand Model (with a reasonable range being 20 to 50 per cent). This is equivalent to the result that the Revised Demand Model would predict given a price fall to the tier 2 price that existed in 2006/07 ($1.26 per kL). To reflect that the impact of a price change on demand will not be instantaneous,[61] we have assumed the uplift in demand will be smoothed over the 5 year period to 2020-21.[62]

We have estimated demand beyond 2020-21 with reference to forecasts of the population growth. The medium forecast for the population for the Greater Adelaide region implies an

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59 Note, when price changes are large it is not appropriate to simply apply the elasticity to the percentage price change because the percentage difference will depend significantly on the baseline used. The difference between the LRMC estimate and the Tier 2 price is 81 per cent when measured as reduction from the Tier 2 price, and 438 per cent when measured as an increase from LRMC estimate.

60 We note that the Revised Demand Model incorporated a lagged effect regarding the removal of restrictions.

61 The ACIL Demand Model did not model the short and long-term effects on price changes.

62 The length of period over which the demand uplift is smoothed is not material to the results. The 5 year period was selected because we consider it a period of reasonable length that also coincides with the period over which the Revised Demand Model is estimated.

average growth rate of around 0.9 per cent per annum.[63] This growth may differ to the growth in the demand for water. There are a number of considerations:

- Changes in household size. All else being equal, a reduction in household size would result in an increase in per capita demand for water.
- Changes in dwellings. New dwellings are more water efficient than existing dwellings. Furthermore, new dwellings tend be on smaller block sizes and are more likely to be apartments.
- Changes in non-residential use. Trends elsewhere (e.g. in Sydney)[64] suggest that non-residential demand for water is falling due to increased water efficiency and a shift from manufacturing to a service-based economy.
- A usage-price set with regard to LRMC will rise over time with demand, thereby discouraging further increases in demand.

The factors above include reasons why the demand growth rate may be higher or lower than the population growth rate. We expect it is most likely that, over the long-term, per-capita demand for water will fall, and therefore the growth in demand for water will be less than the population growth. However, it is possible for demand to grow significantly. On balance of these factors, and given the uncertainty, for the purposes of modelling we have used the 0.9 per cent growth measure.

We have assumed the demand in the zones (WIZs) serviced by the Adelaide Pipelines will be 75 per cent of total demand. This is based on these zones' share of billed retail consumption in 2012/13.

Consistent with the analysis in the Revised Demand Model, we have made the assumption that there is a supply loss of 12.6 per cent; that is, billed water consumption will be 12.6 per cent less than bulk water supplied.

Supply from the MLR and use of the ADP

To estimate the water available from the MLR, we have relied on the MLR Climate Change Study (Heneker and Cresswell, 2010). The study provides estimates of the available bulk supply from the MLR under two climate change scenarios (known as A2 and B2).[65] The report estimates the bulk supply available from the MLR, having allowed for climate variation, spillage, evaporation and environmental flows.

The main results of the report are presented in terms of the A2 scenario, which the report notes is (p. 4) 'at the higher end of emissions scenarios'. For the A2 scenario, and the current conditions, the results presented include a summary of the distribution. The summary includes probability-of-exceedance (POE) values for a limited number of POE values (10%, 25%, 50%, 75% and 90%).

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63 Based on Department of Planning and Local Government, Government of South Australia, 2010. Population Projections for South Australia and Statistical Divisions, 2006-36, December 2010 release. (Medium Projection Series).

64 See for example, 'Sydney Water - Submission to IPART 2012 pricing determination. (section 7.3).

65 The climate change scenarios were developed by the Intergovernmental Panel on Climate Change (Nakicenovic and Swart, 2000).

To use the results, we have constructed two tables (POE Tables), for the A2 scenario and the current conditions, that estimate the POE for each volume (in units of GL) to be supplied by the MLR.[66] Our key assumptions are as follows:

- We use a linear extrapolation of the summary distribution provided in the study's report to determine a POE for each volume. We have assumed the supply from the MLR will be no less than 15 GL per year — this is on the basis that we would expect the tail end of the distribution to flatten and that, in case of an extreme drought, environmental flows would be reduced below the target measures. We have also assumed, consistent with the SA Water's licence conditions, the maximum supply from the MLR is 148 GL.
- We have assumed that distributions by catchments are perfectly correlated.
- We have assumed evaporation is constant (at 17 GL per year) — this is consistent with results supplied in the report.
- To estimate the distribution for any particular year we have taken extrapolated the results from the current conditions, which are assumed to represent 2008 (when the analysis of the study was completed), and results from the A2 climate conditions, which are assumed to represent 2050. For example, the results for the year 2029/30 are assume to fall midway between the results for the current conditions and the A2 climate conditions.

We do not make any explicit adjustment to allow for sharing of supply between years (which would reduce volatility). However, there is also some volatility in demand (which may be negatively correlated with supply). In effect, we have assumed these two factors offset each other.

We have used the information to estimate the likelihood of using, and the extent of use of the ADP, as follows:

- For each year, we have estimated the bulk demand to be supplied that needs to be met from the MLR or the ADP; that is, the volume that cannot be supplied from the River Murray. This increases over time as bulk demand increases. It is calculated as bulk demand by the areas supplied via the Adelaide Pipelines less the capacity constraint of pumping water from the River Murray through the Adelaide Pipelines. This capacity constraint is assumed to be 190 GL less an amount (7 GL per annum)[67] to allow for consumption by wholesale customers.
- Using the POE Tables described above, we estimate the probability that the MLR cannot supply the remaining demand and therefore that the ADP must be used. We use the same tables to estimate the *expected* volume that would be supplied from the ADP.

Purchase of additional permanent water allocations

We have assumed that SA Water will purchase additional permanent River Murray water allocations, once the expected demand from the River Murray through the Adelaide Pipelines exceeds 100 GL per annum.[68] This is consistent with an assumption included in

66 [See Drinking Water Workbook, Tab: MLR Supply].

67 Estimate based on historical water use [source: WIZ WASS Model].

68 Up to a limit of 90 GL; as there is no value in water allocations that exceed the pipeline capacity.

Draft 2011-12 LRMC Modelling conducted by SA Water. The expected demand on the River Murray has been calculated as the bulk demand less the expected supply from the MLR and ADP.

Other scenarios for use of the ADP

The scenario described above is that the ADP will be used when there is a limit on the capacity constraint on the Adelaide Pipelines. There are two other scenarios under which the ADP may be used. These are as follows:

- Scenario 1: Fall in River Murray quality

  We understand that the ADP may be used should the quality of the River Murray water fall significantly. We understand that the likelihood of this event occurring is very small and not materially related to the amount of water that is drawn by SA Water from the River Murray. We have therefore assumed that a permanent change in demand will not change the likelihood of this scenario.

  The costs of operating the ADP in this scenario, when used, will depend on the level of demand. A higher level of demand will increase the demand on the ADP. This in turn will increase the overall average costs of supply.

  However, given the low probability of this scenario, we have assumed this cost to be negligible.

- Scenario 2: Severe drought — minimum flows not available from River Murray

  Another scenario under which the ADP might be used is when the River Murray flows are so low that water cannot be abstracted. While, there were some concerns this risk might have eventuated during the recent drought, we understand this risk to be very small. Furthermore, the likelihood of this event is not materially impacted by SA Water use of River Murray water.

  We have therefore assumed a permanent change in demand will not materially change the expected costs of this scenario.

Results and discussion

Using the assumptions above, increases in demand will result in:

- additional pumping and treatment costs from obtaining water from the River Murray
- additional purchase of permanent allocations (once the total median expected demand from the River Murray exceeds 100 GL per year), and
- an increase in the use of the ADP (once the capacity constraint on drawing water from the River Murray is reached).

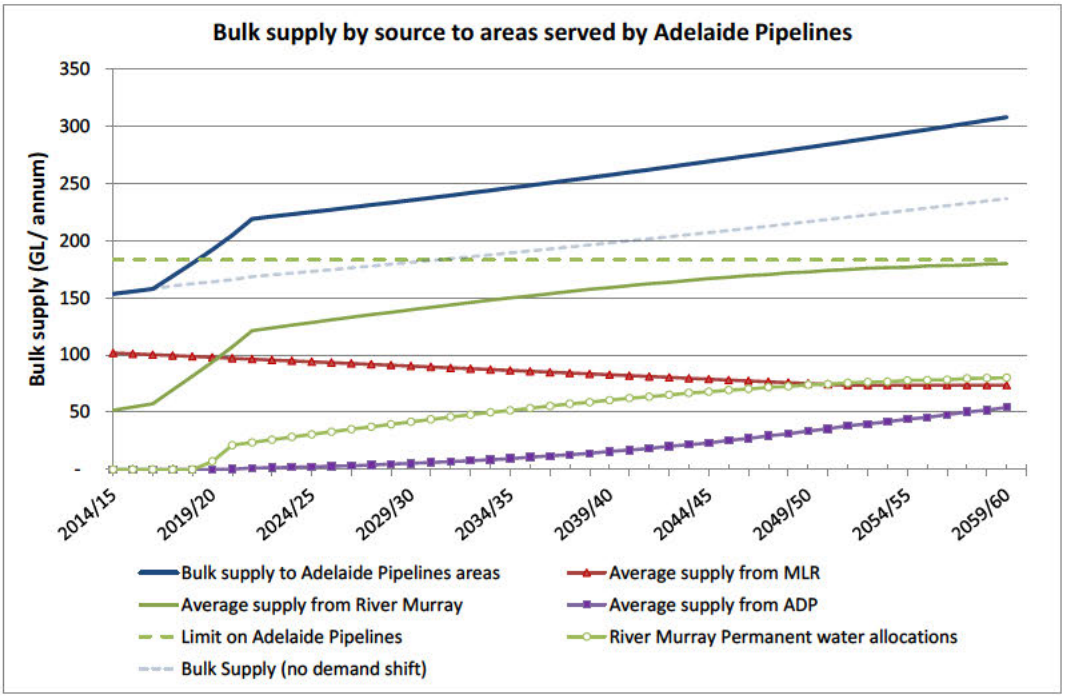
The forecast change by supply source over time is illustrated in Figure 3 below. As illustrated it is forecast that:

- bulk supply to the areas serviced by the Adelaide Pipelines increases rapidly for a few years following a price fall in 2015/16, and then steadily grows, eventually doubling by 2059/60
- average supply from the MLR declines steadily over time

- the use of the River Murray continues to grow until the capacity limit is reached around 2041
- the volume of permanent water allocations continues to rise steadily until the pipeline capacity limit is reached, and
- the expected supply from the ADP increases steadily over time as demand grows; note, expected supply from the ADP begins to grow while there still is average capacity, due to the variability of flows from the MLR.

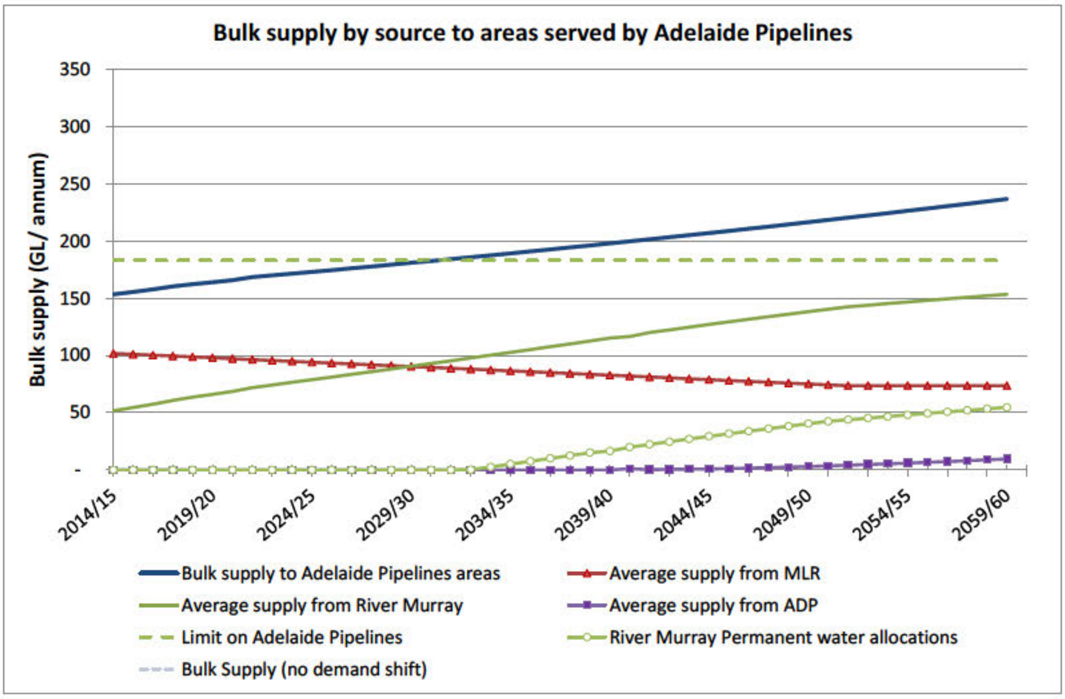
The forecast, assuming no price change is shown in Figure 4 below. Under this scenario, the average supply from the ADP is minimal until 2050.

Figure 3: Forecast supply to areas Adelaide Pipelines supply areas



Source: Sapere analysis [Sapere Drinking Water Workbook]

Figure 4: Forecast Greater Adelaide Supply by Source (no price change)



Source: Sapere analysis [Sapere Drinking Water Workbook]

We have calculated the LRMC using both the Turvey and AIC methods. The resulting LRMC for Greater Adelaide is:[69]

- using the Turvey method $0.62 per kL in 2014/15 and $0.73 per kL in 2024/25
- using the AIC method $0.56 per kL in 2014/15 and $0.73 per kL in 2024/25.

The difference in the results between the two methods, and the increase in the LRMC estimate over time, reflects that increasing cost of supplying water as demand increases.

[redacted]

[redacted]

69 Details of estimates for future years are available. [See Drinking Water Workbook, Grtr Adelaide LRMC].

70 The qualification is that in the long term the long-term the ADP capacity could be exceeded.

Table 4: Decomposition of LRMC for Greater Adelaide in 2014/15

Component	Contribution to LRMC	
	Turvey	AIC
[redacted]		
Total ($/kL)	**$0.62**	**$0.56**

Note: The 'contribution to LRMC' reflects the *likelihood* and cost of each component.

5.2.2 Other areas supplied via the Adelaide Pipelines

For the other areas supplied via the Adelaide Pipelines (Mount Pleasant, Swan Reach to Paskeville and Yorke) the costs will be identical to those of the Greater Adelaide area with the exception of additional pumping and water treatment costs.

In the absence of information on marginal costs we have made some estimates largely relying on the historical average variable costs captured in the WIZ WWAS Model (refer to Table 3 on page 22). Our assumptions and justifications for these estimates are as follows:

- [redacted]

For the Mount Pleasant LRMC Area there is an additional potential cost associated with an upgrade to a WTP. The SA Water long term Capital plan identifies $20 million for upgrading the Mount Pleasant WTP. We have assumed that the upgrade of the WTP is independent of water use (for example, due to the need to service new developments). If so then the costs of the WTP would not be driven by usage and should not be included in the LRMC estimate. If, however, the need for the WTP is due to a restriction in capacity then, given the small

71 The variable chemical costs captured in the WIZ WWAS Model for Swan Reach to Paskeville appear unreasonably small, and so we have estimated differences in variable costs based on differences in electricity costs only.

population on Mount Pleasant (<1000 customers), it is very likely to be more efficient to encourage a reduction in demand to avoid the need for the upgrade. In such case, the appropriate LRMC for Mount Pleasant would be the price to dampen demand sufficiently to avoid building the WTP; and therefore likely to be significantly higher than the estimates provided.

5.2.3 Northern region

For the Northern region there does not appear to be any potential supply constraint in the foreseeable future. As SA Water is not restricted in how it uses its country licence we assume that the LRMC for this region should include the River Murray abstraction costs (the costs of permanent water allocations and NRM levies) plus an allowance for marginal pumping and treatment costs.

[redacted]

We have also included, consistent with the other areas, an allowance for additional long-run pumping and treatment costs.

5.2.4 Eyre peninsular

For the Eyre peninsular, there is a potential resource constraint that is expected to result in a significant incremental investment around 2038. SA Water has provided additional detail on the proposed desalination plant to address this constraint. SA Water advised that:[72]

- In 2009 it was announced that the southern Eyre Peninsula Desalination plant cost was to be in the order of $150-$200 million for a 2.5 GL/annum plant.
- [redacted].
- The timing for this plant is dependent on both future demand and SA Water's allocation from the Southern basins.

Unfortunately, there is insufficient information on demand to estimate LRMC using a Turvey or AIC method approach; however, an indicative estimate may be obtained from annuitized unit cost of the investments. [redacted]

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72 Source: SA Water unpublished document [SAWI103. No additional information has been provided at this time].

73 The unit cost is simply the annuitized cost per kL assuming the plant is operating at capacity. As noted in the LRMC Pricing Paper, the unit costs may approximate the average value of LRMC over a long time period.

No further information has been provided on the operating costs (including pumping and treatment costs) associated with the desalination options. [redacted]

5.2.5 Tailem Bend Keith Pipeline and River Murray Towns

The zones included in Tailem Bend Keith Pipeline and River Murray Towns are connected to the River Murray by pipelines that do not have apparent capacity constraints.

[redacted]

- [redacted]
- [redacted]

We have also included an allowance for additional long-run pumping and treatment costs consistent with the other areas.

5.2.6 Kangaroo Island

As discussed in section 3.2.2, the pressure on the demand/supply balance on Kangaroo Island has changed in recent years. In 2009, SA Water had expected an augmentation would be required in the near future; however, SA Water's current forecast is that an augmentation will not be until 2045, a time well outside the planning period.

The change between 2009 and today may, in large part, be due to the change in water usage prices[74] and demand management activities. Billed consumption fell 20 per cent between 2008/09 and 2012/13. If water usage prices were to fall, demand would increase and potentially there would again be pressure on the demand/supply balance.

[redacted] [redacted]

74 The Tier 2 usage price more than doubled between 2008/09 and 2013/14.

75 Based expected life of 25 years. Due to system losses, the annuitized cost per kL of water billed would be higher.

[redacted]

A guide to this LRMC is the pre-drought price on Kangaroo Island. If prices were to fall to pre-drought prices, we would expect average demand to increase, but to a level less than before the drought due to improved water efficiency. However total demand may be similar to pre-drought levels due to an increase in customers (rising by 1 per cent per annum).

[redacted]

5.2.7 South East, Myponga and other locations

For locations with other local resources, we have received no reliable information on LRMC. Due to the cost associated with obtaining water allocations and upgrading, or drilling new, groundwater bores, we assume the long-run marginal costs could be material. While no foreseeable capacity constraints have been identified, we have assumed that the LRMC of servicing these locations should be no less than the cost of a town connected to the River Murray.

In the absence of other information, we have assumed that in addition to the long-run costs of pumping and treatment, the LRMC for the costs of bulk supply would be:

- [redacted]
- [redacted]

[redacted]

SRMC estimates have been obtained from the information on variable costs.

5.3 Other costs

5.3.1 Long-run pumping and water treatment costs

In addition to the variable electricity and chemical costs, there will be other costs associated with pumping and treatment including:

- semi-variable costs such as costs associated with maintenance (e.g. additional pumping increases the frequency of maintenance) and operating costs (e.g. additional pumping may result in extended pumping hours), and
- capital costs associated with capacity expansion and renewal, where required.

Not all of the costs of water treatment and pumping will be, even over the long-term, related to volume. For example, water usage may affect the size of WTP facility that is required and drive the need for increased maintenance and renewal, but the need for a WTP may be independent of the level of water consumption.

To gain an indicative estimate of the volumetric driven long run costs of pumping and treatment we examined estimates of water treatment and pumping projects. A useful example is the set of estimates prepared for the Board of the Adelaide and Mt Lofty Ranges NRMC for treatment of Torrens Lake.[76] The set of estimates included estimates for 20 ML per day and 50 ML per day plants (including pumping facilities).

The annuitized unit costs for treatment and pumping are summarised in Table 5 below for two different treatment options. These costs will include a small amount of variable electricity costs and variable treatment costs that have been considered elsewhere.

Table 5: Example annuitized per unit pumping and treatment costs (c/kl)

	Capital costs		Operating costs		Total costs	
	Opt. 1	Opt. 2	Opt. 1	Opt. 2	Opt. 1	Opt. 2
20 ML/day	**24**	**32**	**10**	**12**	**34**	**44**
Pumping	2	2	1	1	3	3
Treatment	23	30	9	11	31	41
50 ML/day	**15**	**20**	**7**	**9**	**22**	**29**
Pumping	1	1	1	1	2	2
Treatment	14	19	6	8	20	27
Increasing from 20 to 50 ML/day	**9**	**12**	**5**	**7**	**14**	**19**
Pumping	1	1	1	1	1	1
Treatment	9	11	4	7	13	18

Note: Sapere analysis [Drinking Water Workbook: Tab WTP and Pumping] on Torrens Lake treatment options.

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76 See water treatment reports available at: http://www.amlrnrm.sa.gov.au/Water/Surfacewater/Waterwaysintheregion/TorrensTaskForce.aspx. Downloaded 10 December 2013.

The results in the table provide a guide as to the long-run costs of treatment and pumping. Where WTPs and pumping facilities have been established and have sufficient capacity, the marginal costs of water treatment will, in the medium term, be the variable and semi-variable costs [redacted]. However, over the long-term the pumping and treatment assets will need to be renewed and so it is appropriate to consider the usage contribution to capital costs. If a facility was required regardless of volume, then the unit costs associated with increasing from 20 to 50 ML/day may provide the best guide as to volumetric capital costs. If new facilities are required the capital costs associated with the different sized plants would be a better guide.

There is some information to suggest that increases in demand are driving the need for augmentation of WTP capacity. The capacity of WTPs was reviewed recently by Tonkin Consulting (2011). They identified a number of plants in established areas which were approaching capacity and would need to be upgraded to meet growth in the near future. These are:

- Barossa WTP; anticipated upgrade between 2016 and 2023
- Mount Pleasant WTP; anticipated upgrade towards the end of the planning period, and
- Myponga WTP; anticipated upgrade between 2013 and 2032.

Unfortunately, there is limited information on the cost of expanding the capacity in these areas. The SA Water long term Capital plan identifies $20 million each for the Barossa and Mount Pleasant WTPs. Given the significance of the capital expenditure required to service WTPs in the small communities it is appropriate that the cost be included in a LRMC pricing signal.

In consideration of the above factors we make the following assumptions.

- To account for capital and long-run operating costs of pumping and water treatment an additional 15 c/kL is added to the LRMC of all LRMC Areas. This amount is in the middle of the range of the capital costs presented in Table 5.
- Given the upcoming need for capital expansion, a further 5 c/kL is added to the LRMC estimate for the Myponga.
- As discussed in section 5.2.2, we have made the assumption that the planned WTP upgrade for the Mount Pleasant area will not be affected by the water usage of Mount Pleasant customers. For this reason we have assumed that no special adjustment should be made for Mount Pleasant.

5.3.2 Distribution and reticulation costs

In general the cost of distribution and reticulation is driven by the number of connections and only loosely related to water demand; that is, an increase or reduction in water demand will generally have very little impact on distribution and reticulation costs. This is because at the time of installation the marginal cost of greater distribution pipeline capacity is relatively very small.

The costs of other distribution infrastructure such as local storage and pumping infrastructure may be more closely correlated to expected demand volumes, but still with this infrastructure we expect there to be significant economies of scale. Empirical research on economies of scale in the water industry supports this assumption. Broadly the empirical evidence suggests a cost elasticity of in the order of 0.5; that is a 10 per cent increase in volume can be achieved with a 5 per cent increase in cost.[77]

Another factor to consider is that due to recent falls in average demand the network infrastructure in most established areas may have some excess capacity.

Given the considerations above, we have assumed the LRMC for distribution network costs to be negligible and assumed that the other long-term costs associated with pumping and treatment are reflected in our estimates for pumping and treatment considered earlier.

5.3.3 Other external costs

There are a number of potential externalities to water use. These include:

1. the environmental impact of using a bulk water source
2. externalities associated with water transport and treatment, and
3. externalities associated with water use.

In evaluating these externalities care is required to ensure that only external costs and benefits are considered. For example, the environmental costs can be internalised through a number of policy instruments; for example, the cost of additional water allocation from the River Murray reflects the cap imposed on abstracting water from the River Murray.

The environmental impact of using a bulk water source

Abstraction of water from a water source may, through depletion of the resource, impose an environmental cost. Often such environmental impacts are managed by limiting the water that may be abstracted; in which case, the environmental impact cost would be reflected in the price paid for water allocations.

In some other situations, SA Water has water allocations that cannot be used for another purpose. These include the River Murray Metropolitan water licence allocation and the allocations in other areas for where there is no active market for water allocations. In these situations, the environmental cost may be addressed through application of a volumetric based levy.

SA Water pays a number of levies (known as NRM levies) for water abstracted from a number of prescribed resources. In 2013/14, the levies are \$17.40 per ML (1.74 c/kL) for use of the River Murray Metropolitan licence and prescribed resources in the Mallee area (in the South East Region) and \$5.35 to \$5.55 per ML (≈0.55 c/kL) for other resources and River Murray entitlements. We have included these levies in the cost of water resource abstraction.

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[77] ACIL Tasman (2007) provides a useful review of evidence on economies of scale and scope in the water industry. They quote a study by Torres and Morrison Paul (2006) who controlling for size in terms of customers and customer density estimated that the cost elasticity of volume to be on average 0.58 and smaller for smaller systems.

Externalities associated with water transport and treatment

With regard to externalities with water transport and treatment:

- We assume that any externalities associated water treatment are internalised and the residual environmental cost is negligible, and
- The only volumetric related externalities with transport are the carbon emissions associated with electricity usage. We assume these too, will be internalised.

Externalities associated with water use

A cost of additional indoor water consumption is the additional impact on cost of wastewater management. As discussed in our companion paper ('LRMC for Waste Water'), the volume of waste water is a contributor to the costs of waste water treatment. However as discussed in this paper, we do not advise applying a charge to reflect these costs, primarily because of the potential distortions associated with other water use decisions (including outdoor use and the decision to use external water sources).

5.4 Summary of costs

Figure 5 below summarises estimates of LRMC and SRMC by LRMC Area. The SRMC reflects the variable pumping and treatment costs plus abstraction charges (i.e. the cost of water allocations) in cases where SA Water has to purchase water allocations. As highlighted in the figure, the LRMC estimates range from under $0.50/kL to around $2/kL.

Figure 5: Summary of LRMC and SRMC estimates

[redacted]

Source: Sapere analysis [Drinking Water Workbook: Chart 4].

5.5 Sensitivity analysis

As has been indicated throughout this section there is some uncertainty as to a number of assumptions. In this section we provide a discussion of some of the key assumptions and the sensitivities of the estimates to the variations in the assumptions.

5.5.1 Greater Adelaide LRMC Area

A summary of the key assumptions for the Greater Adelaide LRMC Area and the implications of the assumptions is summarised in Table 6 below. The table provides a brief overview of the significance of different assumptions; however, some additional comment is warranted.

- The most significant uncertainties relate to the marginal pumping and treatment costs both in the short and long-term. We expect that uncertainty over these costs could be reduced with improved information.
- The assumptions regarding the long-run demand and supply are significant as they determine the likelihood of the ADP being used.
- The marginal cost of the ADP is currently of low significance due to the low likelihood of its use. A 10 per cent increase in the marginal cost of the ADP would results in a 2.5 per cent increase in our LRMC estimate. However, it is an important assumption as it determines (while it has sufficient capacity) the upper bound on the LRMC.

Table 6: Key assumptions for Greater Adelaide LRMC Area

Parameter	Assumption	Reasonable Range	Potential impact	Comment
Change in demand forecast by 2020-21	+30%	+0% to +50%	High	Increase due to expected price fall. 0% change possible if there is no price change. Very significant long-run affects are possible.
Long-term growth in demand	0.9%	0.7% to 1.1%	High	Long-term growth will determine need to use the ADP. Difficult to forecast.
MLR supply in light of climate change	Some reduction	Unable to assess	High	Larger reduction would increase need for ADP.

[redacted]

Parameter	Assumption	Reasonable Range	Potential impact	Comment
				[redacted]
Adelaide Pipelines capacity (net of wholesale demand)	183 GL/year	180 to 190 GL/year	Low	SA Water has confirmed the constraint. Some uncertainty over future wholesale use.
Discount rate used	SA Water cost of capital	Not assessed	Very low	Changing the discount rate has a small effect on LRMC.

A lower and upper range for the Greater Adelaide LRMC Area was constructed by modifying a number of key assumptions. To create a realistic possible range, only a few select assumptions were modified. The assumptions modified, and the results are displayed in Table 7 below.

It should be noted that the distribution of outcomes is slightly skewed as there is a limit to how small some cost components can be, but few limits as to how high they can be. The lower range represents, that when demand is sufficiently low, the LRMC of water usage will approximate the SRMC.

Table 7: Assumptions used to estimate lower and upper ranges for LRMC

Assumption	Lower	Best estimate	Upper
Change in demand due to price fall	+10%	+30%	+50%
Growth in demand post 2020-21	0.7%	0.9%	1.0%
Declining inflows to MLR	No	Yes	Yes
[redacted]			
Results			
Turvey LRMC ($/kL)	**$0.36**	**$0.62**	**$0.88**
AIC LRMC ($/kL)	**$0.30**	**$0.56**	**$0.84**

Source: Sapere analysis [Drinking Water Workbook, Key assumptions and results].

5.5.2 Other LRMC Areas

Many of the assumptions relevant to the Greater Adelaide LRMC Area are also relevant for the other LRMC Areas. The key additional assumptions, and their significance, for the other LRMC Areas are presented in Table 8 below.

Table 8: Key assumptions for other LRMC Areas

Parameter	Assumption	Possible range	Comment
Kangaroo Island LRMC ($/kl)	[redacted]		LRMC is the price that balances demand with available supply. This is less than the current tier 2 price, and possibly as low as the tier 2 price before the drought.
Eyre region LRMC ($/kL)			LRMC reflects the potential need to augment supply, the timing of which will depend on demand.
Long run abstraction costs of bulk water in areas not connected to River Murray ($/kL)			Based on a comparison with River Murray costs. There is significant uncertainty.
Additional variable costs for areas connected to Adelaide Pipelines ($/kl)			Based on differences in the average costs by LRMC Area.

Source: Sapere analysis.

5.5.3 Summary of LRMC estimates with ranges

A summary of our LRMC estimates with reasonable lower and upper ranges is shown in Figure 6 below and described in Table 9 further below. Of note, our upper range estimate, with a few small exceptions is below $1/kL.

Figure 6: Summary of LRMC with lower and upper ranges

[redacted]

Notes:

1. Mount Pleasant LRMC estimate may need to be revised due to a proposed WTP upgrade.
2. Lower range LRMC may be below the 'SRMC best estimate' due to uncertainty of SRMC estimates.
3. Source: Sapere analysis [Drinking Water Workbook, Key assumptions & results].

Table 9: LRMC by suggested LRMC areas

LRMC Areas	SRMC ($/kL)	LRMC estimates ($/kL)			Justification
		Low	Best	Upper	
Greater Adelaide (GA)	[redacted]	[redacted]	[redacted]	[redacted]	Reflects probability of needing to purchase additional permanent allocations from the River Murray and use of the ADP
Mount Pleasant	[redacted]	[redacted]	[redacted]	[redacted]	Modified from GA to account for additional pumping and treatment costs
Swan Reach to Paskeville	[redacted]	[redacted]	[redacted]	[redacted]	Modified from GA to account for additional pumping and treatment costs
Yorke	[redacted]	[redacted]	[redacted]	[redacted]	Modified from GA to account for additional pumping and treatment costs

LRMC Areas	[redacted]	Justification
Northern		Reflects pumping and treatment costs and the cost of River Murray water abstraction
Eyre (excluding West Coast)		Reflects future expansion
Tailem Bend Keith Pipeline		Reflects pumping and treatment costs and cost of River Murray water allocations
River Murray Towns		Reflects pumping and treatment costs and cost of River Murray water allocations
Myponga		Reflects existing variable costs plus an allowance for expansion and renewal
South East		Reflects existing variable costs plus an allowance for expansion and renewal
Kangaroo Island		Reflects price required to balance supply and demand
Other disconnected		Reflects existing variable costs plus an allowance for expansion and renewal

Source: Sapere analysis [Drinking Water Workbook: Key tables and Results]

6. Conclusions and pricing considerations

The previous section has provided estimates of LRMC for different LRMC areas. While there is some variation by LRMC Area, the estimates are all lower than the current mid-tier (tier 2) usage price. The estimates for Greater Adelaide, and most other large population areas, are significantly lower than the current tier 2 usage price; but they are consistent with estimates made prior to the onset of the drought.

In using these estimates to determine prices there are a number of considerations.

First, while variations between some LRMC Areas are currently small, this may change over time. Where LRMC Areas draw from the same sources (e.g. through the Adelaide Pipelines), the difference between estimates of LRMC may be reasonably stable.[78] However, the difference in LRMC between unconnected areas may diverge over time; for example, although the LRMC for Myponga and Greater Adelaide are currently similar, it is possible they could vary greatly in the future due to resource constraints.

Second, there are some special considerations in setting prices with regard to LRMC when LRMC is expected to increase with demand over time. In such situations, estimates of LRMC by the Turvey and the AIC methods may differ materially because the AIC method places greater weight on costs that are nearer in time. In our opinion, in these situations the Turvey method provides a truer estimate of the LRMC per unit of a permanent increase in demand.

However, if LRMC is increasing, then consideration may be given to the price signal for consumers. Consider, for example, that prices are set with regard to LRMC and that they are advertised as increasing over time with demand. In such case, at any point in time the long-run price signal received by consumers may exceed the current estimate of LRMC. For this reason, consideration may be given to changing prices only periodically and/or setting prices with regard to the LRMC as estimated using the AIC method.

Finally, it is important to recognise that there is some uncertainty as to the measurement of LRMC, particularly in some areas. We expect that over time, new information will become available and enable improvements in the estimates of LRMC.

78 There are some exceptions; for example, where an expansion of WTP capacity is required.

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Appendix 1 Water Infrastructure Zones

These are provided in a separate attachment.