Sydney Desalination Plant - Expenditure Review

Final Report

IPART

21 February 2017

Contains *sensitive* information

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Glossary

Term	Definition
AIR	Annual Information Return
CARMS	Critical Asset Renewal Management System
CEO	Chief Executive Officer
CMA	Competition and Markets Authority, UK
CIP	Clean in Place
DBOM	Design, Build, Operate and Maintain
DWPS	Drinking Water Pumping Station
EfAM	Efficiency Adjustment Mechanism
E&W	England and Wales (water companies of)
FTE	Full Time Equivalent
GL	Giga (10^9) litre
IPART	Independent Pricing and Regulatory Tribunal
MWP	Metropolitan Water Plan
ML/d	Megalitres per Day
NSW	New South Wales
NSW Health	NSW Department of Health
O&M	Operation and Maintenance
RAB	Regulated Asset Base
RO	Reverse Osmosis
SDP	Sydney Desalination Plant
SIR	Special Information Return
SMBS	Sodium metabisulfite
SWC	Sydney Water Corporation
TDS	Total Dissolved Solids
WaterNSW	Water New South Wales which is the entity formed through the amalgamation of the Sydney Catchment Authority and State Water

Executive Summary

This report presents the findings of our review of the capital and operating expenditure for the regulated services of Sydney Desalination Plant Pty Ltd (SDP) in accordance with the Scope of Work defined by IPART[1]. It addresses the prudent and efficient expenditure in the current period from 2012-13 to 2016-17 and for the future price path period 2017-18 to 2021-22.

We have based our findings on the SDP submission dated October 2016, the special information returns presented to IPART by SDP in October 2016, three days of structured interviews with SDP's Senior Management and staff, a visit to the desalination plant, information provided by SDP and responses to subsequent written questions. Our findings are also informed by our review of the long term investment and asset management processes. We reviewed activities and expenditures related to the current and potential Operational Modes with specific review of the Water Security Mode, the transition to Restart and in Full Operational Mode.

Our approach to efficiency assessment is similar to the methodology we applied for the previous efficiency reviews of Sydney Water Corporation (SWC) in 2008, 2012 and 2016 and for Hunter Water in 2011 and State Water in 2009. The structure of the cost drivers and more specific inputs enabled us to focus on the larger input costs, the level of expenditure in the current price path, the extent of efficiencies assumed by SDP and the scope for further savings.

Our team brought experience of previous efficiency reviews in Australia and similar reviews in the United Kingdom (UK) and United Arab Emirates (UAE). The team included an international specialist in reverse osmosis plants who is currently engaged in several projects of this kind in Africa and the Middle East.

Strategic Review

The New South Wales (NSW) Government leased the desalination plant to a private consortium for a 50-year period in 2012. SDP was established to manage this lease and to meet all statutory and regulatory requirements. IPART set prices for the current period from July 2012 to June 2017.

The desalination plant was previously managed by SWC who supervised the design, build, maintain and operate contract. An Operations and Maintenance (O&M) contract was awarded to Veolia Water Australia Pty Ltd (the operator) for a period of twenty years from 2010. The plant was run in Full Operational Mode for a period of two years to June 2012 and was subsequently shut down. The plant has been in Water Security Mode since that date.

Operating Environment

The desalination plant's primary purpose is to provide water supply during drought conditions as defined in its Network Operating Licence. It is to provide potable water at time of limited water resources in accordance with rules defined by the Metropolitan Water Plan (MWP). The current rules require SDP to supply an average 250 ML/d to the SWC's supply area when dam storage falls below 70%. The plant is required to shut down when dam storage returns to 80%. The Metropolitan Water Directorate of New South Wales is currently reviewing the MWP, including operating rules for the desalination plant. Our review is based on the current operating rules.

Scope for Efficiencies

SDP has assumed that as the current operator's costs were market tested nearly ten years ago they remain competitive now. Our view is that the market has changed, productivity has improved, new technologies are emerging, more effective procurement processes are now in place and the prolonged water security status affects the optimal level of operational activity. In setting efficiency targets for the future price period we were mindful that there were no apparent efficiencies built into the forecast expenditures that can be shared with customers, nor any plans by SDP management to drive efficiencies through the business. We found that SDP's management could do more to drive efficiencies in the operating contract, through negotiation of efficiency targets, and managing its own costs. SDP commented that a reduction in charges are being proposed although this is mainly attributable to market-driven reductions in the cost of debt and debt management which is outside the scope of our efficiency review.

[1] Scope of Work as included in Appendix A

The efficiency targets we have set are at a level where SDP can outperform through focused management action either by negotiating efficiency targets with the contractor or setting internal targets on their own costs.

To date, the Efficiency Adjustment Mechanism (EfAM) process has not been pursued in earnest and savings are not material or meet the rules to qualify. We suggest that EfAM should be applied with greater management focus. We have therefore built in some efficiency targets that SDP should achieve and indeed could out-perform. With the appointment of a dedicated Chief Operating Officer, we consider that SDP's management team has the capacity and experience to deliver these efficiencies.

Strategic Review of Operating Modes

The desalination plant is currently in Water Security Mode[2]. Given the current reservoir storage level (89.3% at 11 January 2017), the probability that the plant will be required to restart before June 2020 we consider to be low under the current operational rules. By the end of the next price path period this would mean that it will be ten years since the last potable water was produced. Coarse analysis of historical data suggests that the probability of reservoir storage falling below the 70% trigger level is approximately 1 in 10 years. We have therefore taken the Water Security Mode as the base case in reviewing efficient expenditure.

We found that the Operating Licence and MWP operating rules set out clear defined processes to be followed for changing between modes. However, SDP has yet to establish and agree a written protocol to determine the timing of a restart or shutdown including liaison with SWC and statutory bodies who have a role in the process.

In Water Security Mode, the cost driver is the licence requirement in A2 (a) (i) to maintain the plant in accordance with good industry practice. Expenditure should be limited to essential maintenance activities and any periodic expenditure such as membrane replacement and periodic maintenance need to be clearly justified in terms of scope, risk and time. This criterion also applies to significant testing costs proposed in the future price path.

The MWP rules are predominant in setting the mode of operation or shutdown rather than any need to maintain a higher level of shutdown to respond to any emergencies as defined in the Water Supply Agreement with SWC. In this latter case, the SDP response is to use best endeavours with arrangements for cost recovery to be agreed on an ex-post basis as the scope, duration and volume delivered are likely to be uncertain.

The IPART 2012 Determination covered a range of modes for shutdown with varying levels of operating expenditure. We propose the defined modes of operation are simplified to:

- Water Security Mode;
- First and subsequent Restart Modes;
- Full Operational Mode; and
- Transition shutdown to Water Security Mode.

This is because of the current continuing high storages levels in the dams and lengthy period in Water Security Mode, the MWP operational rules using the 70/80 rule or any subsequent changes and the probability of a further restart after a period of Full Operation. The Operating Licence is clear on defining when the plant needs to be in operation or to be available. There are no protocols or definitions in place for determining any other mode of operation – short, medium or long term shutdown – and how any decision is made to any of these modes. A prudent approach is therefore to minimise costs when the plant is not operating. We concluded that there are no clear circumstances where short, medium and long term shutdown modes would apply. Where short or medium shutdowns occur they can be addressed under current pricing and insurance provision. We have therefore not made any recommendations on efficient costs for short, medium and long term shutdown modes.

We are aware that the MWP is considering a modification to the 70/80 rule above based on recent modelling work and the proposals are being reviewed by the NSW Government. **[Redacted Information]** Any changes in the rules are not likely to impact on the findings on operating modes and efficient costs.

During the Restart process, potable water will be produced although under current regulatory rules, SDP is not able to charge SWC. As a result, potable water is likely to be discharged to sea; not an efficient process at a time of water restrictions across Sydney. We suggest that SDP should be incentivised to produce water

[2] Water Security Mode is when the desalination plant is not in operation.

through this Restart period. Assuming a ramp up from zero after four months to full output by the end of month eight, there is potential for an output of 15 GL over the period. While currently SDP would not receive any income from water sales, it is already paid for in the restart plan. The costs of the post treatment chemicals have not been included to produce 15 GL of water. The restart costs we have allowed do not include these post treatment chemical (after RO), because the settings for dosing of these chemicals should be known from the records of the two year plant proving period, and therefore there should be no need for any significant amount of chemicals to recommission the post treatment plant. It would appear inefficient to produce water to water quality guidelines only to discharge to sea. Customers who pay for the Restart currently would not benefit.

Long Term Investment Plan
SDP does not have a long term investment plan. Capital expenditure in the future price path is limited. The plant has been in Full Operation or Water Security Mode for nearly seven years and assets are relatively young when compared with the economic life of the plant. As such, replacement expenditure is currently low. Management has been focused on recovery after the damage to the plant following a tornado in December 2015. We found that SDP management has acted prudently in developing a short term investment plan; there is insufficient evidence to demonstrate that this is efficient.

Asset Management Planning
Under the terms of SDP's O&M contracts with its operator, Veolia, the operator is responsible for maintaining asset registers and an asset management plans and reviewing maintenance and replacement schedules on an annual basis for the plant and Drinking Water Pumping Station (DWPS). Likewise, the Pipeline O&M contract requires the operator to provide SDP with an annual Planned Maintenance Scope. Veolia uses Maximo and its own Critical Asset Renewal Management System (CARMS) to plan and manage maintenance and renewals. We consider that SDP should ensure that it has rights to the asset information in these systems. Based on our observations, the operator appears to be addressing maintenance issues in a timely manner.

Operating Expenditure

Expenditure in the Current Price Path
There has been an overall increase over the period of $13.8m above the Determination for remuneration, professional services and other corporate costs. Over the period of the current price path, SDP has built up its corporate structure to seven permanent staff including senior management. A greater part of the corporate activities and professional services has been outsourced. The 2012 Determination had assumed that SWC would provide corporate support services which explains, in part, actual expenditure exceeding these forecasts. While we accept that these services formed a necessary part of establishing the business processes and services, and are prudent, we consider that there is scope for efficiencies in future years.

The plant has been in Water Security Mode over the current price path to date and is likely to be so up to at least June 2017. After removing some costs in 2012 related to shut-down and excluding **[Redacted Information]** for asset impairment, actual maintenance expenditure is $3.4m below the Determination. This is equivalent to a 7.5% reduction in operating costs while maintaining assets in accordance with good industry practice. There are wide variances in routine and planned maintenance and labour which leads us to question whether the cost allocation rules are consistent.

The main licence obligation is for the desalination plant to be maintained consistent with good industry practice. While there are no defined performance measures for this mode, we confirmed from our review that SDP has and is continuing to maintain the plant. This is consistent with the WICA[3] audit and consultant's reports[4] . With the plant likely to continue in a Water Security Mode, it is important to clearly define a small number of performance measures to monitor asset maintenance.

We have not identified any expenditure which may be considered outside the provision of regulated services. Direct costs incurred as a result of tornado damage such as asset impairment and some staff costs have been excluded, although the management team has a strong focus and input on negotiations with the insurers and implementing remedial measures.

[3] WICA Licence audit report, Risk Edge, July 2015

We review the base year expenditure in detail as this forms the basis for future operating expenditures. We comment under each main expense heading or groups of headings. We test whether this expenditure is typical or there are any abnormal expenditures.

Future Operating Expenditure – Fixed costs irrespective of mode

We based our future base level expenditure on year 2016-2017 excluding one-off expenditures. We concluded that the base year should be $8m per annum. This is similar to the average of the latter four years of the current price period. Assuming that the plant is likely to be in Water Security Mode for much of the future price period, we did not see any justification for an increase in costs over this period. A greater part of the corporate services area is outsourced. We formed the view that cost savings could be achieved through improved procurement and productivity. We have applied a 0.75% per annum efficiency to all future expenditure to reflect potential savings. This level of efficiency is similar to that applied to SWC earlier in 2016.

Future Operating Expenditure – Water Security Mode

The cost driver is the licence requirement in A2 (a) (i) of the Operating Licence to maintain the plant in accordance with good industry practice. Expenditure should be limited to essential maintenance activities and any justified periodic expenditure. Within this licence requirement we have accepted the need for a marginal increase in routine maintenance but identified several adjustments to expenditure.

- **Capitalisation of periodic maintenance:** this is because works proposed relate to significant expenditures related to the replacement and refurbishment of assets. We discuss this in Section 5.4.6;
- **Labour and other costs:** with the plant in a long period of Water Security Mode, there is potential for efficiency savings through improved productivity and new technology. There are no efficiency targets for the benefit of customers; we have assumed a 2.5% tapered efficiency to be achieved by the end of the period;
- **Drinking Water Pumping Station:** we consider the maintenance costs to be high in comparison with other utilities who maintain a range of large pumping stations in operation. We suggest this cost is reduced over the period; and
- **Partial Plant Test:** we found there is insufficient benefit to justify the partial plant test cost in the period 2017 to 2022.

A key purpose of Partial Plant Test proposed in SDP's submission is to assess the performance of the Reverse Osmosis (RO) membranes after many years under chemical preservation. There is uncertainty with regard to restart performance due to the condition of the RO membranes with respect to salt rejection, permeability and mechanical integrity. There is further uncertainty in relation to the timing of any potential Restart.

Using an *ante* partial plant test to assess membrane condition will not remove this membrane replacement funding requirement by SDP. We propose an alternative and efficient option to replace all the RO membranes should be considered on full restart instead of the 84.4 % proposed by SDP (62.8% on restart and 21.6 % over two years of operation). The benefits of this alternative approach are discussed in Sections 5.4 and 7.1. The level of prudent and efficient operating expenditure is summarised in Table S1.

Table S-1 Efficient Operating Costs – Water Security Mode

SDP EFFICIENT OPERATING EXPENDITURE: FUTURE PRICE PATH: WATER SECURITY MODE						
($m 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
Efficient expenditure						
Corporate	7.94	7.88	7.82	8.00	7.94	39.58
Plant						
Pipeline	0.31	0.32	0.32	0.32	0.32	1.59
Efficient Electricity Usage (MWh)						
SDP Proposals						
Atkins proposals	5000	5000	5000	5000	5000	
Adjustment to efficient electricity usage	0	0	0	0	0	
TOTAL EXPENDITURE excluding electricity						
Total $m						

Future Operating Expenditure – Restart Mode

The cost driver is the licence requirement in A2 (b) and (c) to restart the plant to provide full output of potable water within an eight month period. The Restart Mode is assumed to be eight months to give time for existing plant testing, adjustments to refurbished equipment, membrane purchases, installation and our assumption of full renewed membrane plant testing. We have examined the basis of the eight month period and found this to be appropriate on the basis of full membrane replacement which we discuss in Section 7.1.

We have accepted the scope of work and duration required for achieving full output but have made some adjustments to derive an efficient level of costs as follows:

- **Capitalisation of membrane replacement:** The membranes have a warranted life of up to eight years in Full Operation. Thus they clearly provide benefits over a number of years and should not be treated as operational consumables. We discuss this in Section 5.3.6;
- **Adjustment to labour costs:** there appears to be no incentive for SDP to innovate to improve productivity .We therefore suggest that efficiency targets should be agreed with the operator with savings from efficiency initiatives shared with customers. This could work through the EfAM process.
- **Adjustment to chemical costs:** Our assumption is that all membranes will be replaced on Restart. There should therefore be no need for the any RO Clean in Place (CIP) chemicals in the restart period. We have included for treatment chemicals on the assumption that potable water is allowed to be exported during the restart period;
- **Membranes:** included for full replacement as capital; and
- **Electricity usage:** our assumption on electricity usage is a lower volume than proposed by SDP.

The level of prudent and efficient operating expenditure is summarised in Table S2.

Table S-2 Efficient Operating Costs – Restart Mode

SDP EFFICIENT OPERATING EXPENDITURE: RESTART MODE						
($m 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**	
O&M and asset replacement in any one year						
SDP Proposed expenditure less electricity	[redacted]					
Capitalise membranes	-19.76	-20.89	-21.86	-22.72	-23.47	to capex
Adjust chemical costs	[redacted]					
Efficient expenditure excluding power costs	6.87	6.87	6.87	6.87	6.87	
Electricity usage (MWh)						
SDP Proposed power use	[redacted]					
Adjustment to power use	[redacted]					
Efficient Power use (MWh)	71,000	71,000	71,000	71,000	71,000	

Future Operating Expenditure – Full Operation Mode

The cost driver is the licence requirement in A2 (b) to deliver the full output of 250 ML/d of potable water. We have accepted the marginal increase in corporate costs and have made some adjustments to derive an efficient level of costs.

- **Chemicals:** our estimate of chemical use is based on the two year operational mode from 2010 which is lower than SDP's proposal. We have also reduced the extent of sodium hydroxide use because of new membranes. We found that applying inflation factors to 2007 base year chemical costs overstates some current market costs. We have therefore applied a procurement efficiency of 5% which we consider can be out-performed through effective procurement;
- **Electricity use:** SDP is proposing usage of **[Redacted Information]** kWh/m^3 (inc DWPS). Our estimate of power usage is based on actual usage (inc DWPS), from monthly reports, during the operational proving period. The usage from 2010 to 2012 was **[Redacted Information]** and during 2011 this was reduced to **[Redacted Information]**. We have carried out a bottom-up assessment which gives a similar value as the latter figure. We have assumed an efficiency target of 3.6kWh/m^3 as a realistic target which gives SDP scope to out-perform;
- **Drinking Water Pumping Station:** as Water Security Mode.

The level of prudent and efficient operating expenditure is summarised in Table S3.

Table S-3 Efficient Operating Costs – Full Operation Mode

SDP EFFICIENT OPERATING EXPENDITURE: FULL OPERATION MODE					
($m 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**
Efficient Corporate	8.79	8.73	8.67	8.85	8.79
Efficient Fixed Plant					
Total Fixed Pipeline	0.31	0.32	0.32	0.32	0.32
Total Variable Costs $m (excl. electricity)					
Fixed inputs: Efficient electricity usage (MWh)					
SDP Electricity usage fixed					
Adjust for efficient operation					
Efficient fixed electricity usage MWh	7665	7665	7665	7665	7665
Variable inputs: Efficient electricity usage (MWh)					
SDP Electricity usage variable					
Adjust for efficient operation					
Efficient variable electricity usage MWh	320835	320835	320835	320835	320835
Total Efficient Expenditure (excluding electricity and related costs)					
Total $m (excluding electricity)					

Source: Atkins Cardno analysis

These costs represent efficient expenditure in any one year. Coarse analysis of historical data suggests that the probability of an extended Full Operation Mode beyond two years is unlikely in the 2017 determination period.

Capital Expenditure

Capital Expenditure in the Current Price Path

The expenditure in the current price path is projected to be just under $1.2m, nearly $0.5m less than the Determination allowance of $1.7m (all in 2016/17 prices). These figures do not include any works carried out as a result of the tornado damage, which SDP is not proposing to add to its regulatory asset base (RAB) because of the ongoing insurance claim.

Most of the expenditure in the current price path relates to the replacement of the backup electricity supply which was required because the network operator, Ausgrid, made the pre-existing 33kV back-up connection redundant. At just over $0.9M ($ 2016/17) the outturn cost was $0.7M less than the Determination. Expenditure on corporate assets over the current price path was $0.2M. This consists of items such as IT hardware and development of a new website. There was no capital expenditure in the current price path on pipeline assets.

We consider that the capital expenditure in the current price path is prudent and efficient and have therefore made no adjustments to the level of capital expenditure reported by SDP.

Future Capital Expenditure – Water Security Mode

In its regulatory submission, SDP has assumed that the plant will remain in Water Security Mode. In this mode, SDP proposes to spend:

- $2.1m on an extra pump in the Drinking Water Pumping Station (DWPS);
- $0.4m on corporate assets; and
- **[Redacted Information]**on periodic maintenance (reallocated from opex by this review).

We consider that it would be prudent and efficient to defer installing the extra pump until closer to the time that is likely to be required; that is when the dam storage level is within a year of potentially triggering a restart. Given the uncertainty of the need for and timing of any restart, we consider that it would be more appropriate to review the expenditure *ex-post* rather than to build it into water security capex for the next price period. This will save SDP's customers from servicing the additional capex and opex until the benefits are likely to be realised.

We also make an adjustment for items (permeate hoses and associated equipment) which we consider should be covered free of charge **[Redacted Information]**

Our view of the total level of prudent and efficient capital expenditure in the Water Security Mode in the future price path is summarised below.

Table S-4 Atkins/Cardno view of capex in the future price path (Water Security Mode)

SDP CAPITAL EXPENDITURE: FUTURE PRICE PATH: WATER SECURITY MODE						
($M 2016/17) year ending June	2018	2019	2020	2021	2022	Total
ATKINS/CARDNO ASSESSMENT OF PRUDENT EFFICIENT EXPENDITURE						
Corporate	[redacted]					
Plant						
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total efficient expenditure	1.53	2.64	2.87	3.75	3.67	14.46

Source: SDP Information Return 2016 and Atkins/Cardno analysis

Future Capital Expenditure – Restart Mode

We consider that there are two items of potential additional[5] capital expenditure associated with restart from the current Water Security Mode. These are outlined below.

- **Membrane replacement:** we consider that full replacement should be carried out on restart. The estimated cost of this is $30.0m;
- **A Skid test unit** for the RO membranes would allow the operator to get a true assessment of the membrane condition while the plant is in Water Security Mode. SDP advised that a skid test unit will cost $1.0m and will require an additional operator. The skid test unit will be of use to partly monitor the condition of the next set of replacement RO membranes when they are placed into Water Security Mode. However this is not likely to occur until near or after the end of the 2017-2022 determination period. Therefore the expenditure allowance can be delayed to the subsequent determination period.

The costs outlined above relate to the capital expenditure required for the next plant restart. If the plant is restarted, shutdown and subsequently restarted a second time within the next price path period no additional capital costs would be required. This is reflected in our view of the prudent and efficient additional capex required for restart.

Table S-5 Atkins/Cardno recommended prudent and efficient additional capex required for restart in the future price path

Item	First restart	Subsequent restart
Membrane replacement	$30.0m	Depends on duration of shutdown. Not required if subsequent restart within the life of the membranes (unlikely in the future price path)

Future Capital Expenditure – Full Operating Mode

We consider that there are two items of capital expenditure potentially affected by moving to Full Operating Mode:

- **Membrane replacement:** the capex allowed for in Restart Mode means that the plant will have an entirely new set of membranes on its first restart. We consider that no membranes will therefore need to be replaced in the first two years of operation. Given that we do not anticipate there being more than two years of operation in the next price path period we consider that no further allowance for membrane replacement is required for the Full Operating Mode;

[5] I.e. in addition to the capex being undertaken under 'Water Security' Mode

- **Periodic maintenance:** we have reviewed SDP's proposed periodic maintenance expenditure under Water Security Mode. We consider that the level of expenditure required during the next price path will not be significantly affected by being in Full Operating Mode. We therefore consider that the same level of expenditure will be required as set out under 'water security' mode.

Our view of the total level of prudent and efficient capital expenditure in the future price path is summarised below. Given that we consider that no additional membrane replacement is likely to be required in the next price path and that periodic maintenance can continue at the same level as under Water Security Mode, the overall level of expenditure is the same as for Water Security Mode.

Table S-6 Atkins/Cardno recommended capex in the future price path (Full Operation Mode)

SDP CAPITAL EXPENDITURE: FUTURE PRICE PATH: FULL OPERATING MODE						
($M 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
Corporate	[redacted]					
Plant						
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total efficient expenditure	1.53	2.64	2.87	3.75	3.67	14.46

Future Capital Expenditure – Shutdown Mode
We consider that no additional capital expenditure is required for shutdown of the plant.

Membrane Replacement Program

The RO membranes have been in preservation mode for four and a half years and are likely to remain in this mode until at least 2020 given the present dam levels and current 70% restart trigger level of the MWP. No replacement was proposed by SDP in the current Water Security Mode although a partial plant test was included in the future price path.

SDP is planning to replace membranes in the Restart Mode; assuming an earliest possible Restart in 2020, the operator's replacement model shows nearly two thirds of the asset stock would be replaced in this period. Further membrane replacement in the subsequent Full Operation Mode is proposed. This partial membrane replacement program, linked to the plant testing, is limited to the current membrane supplier; this constrains the benefits of a full procurement process.

There is no precedent for preservation of the RO membranes for the length of time in Water Security Mode; eight years as a minimum. The method used for the long term preservation of the membranes is recommended by major RO membrane suppliers. The method used by the operator to preserve the membrane and therefore to extend the life of the membranes is appropriate and should be considered as best industry practice.

The RO membranes should not be replaced until there is a requirement to restart the plant due to the dam level restart triggers being reached. This is because there is no benefit in changing membranes in advance of such a trigger. We compared the cost of SDP's approach - Partial Plant Test plus progressive membrane replacement in the Restart and Full Operation Modes - with replacement of all membranes under an effective and competitive procurement process. We found that the latter option of replacement of all membranes offered a cost saving of **[Redacted Information]** on a simple comparison. If restart was delayed by a further two years then the saving would increase to about **[Redacted Information]**. SDP commented that the other benefits of partial pant test are "about reducing the risks that the plant can restart within 8 months and continue to operate reliably", however Atkins do not consider the additional benefit of limited risk reduction on restart justifies the high cost of the Partial Plant Test.

The benefits from a full membrane replacement are:

- a significant reduction in risk to water quality from the use of old RO membranes operating beyond their design life;
- the shorter lead time for ordering membranes because there is no requirement to test existing membranes;
- no need for an expensive Partial Plant Test to assess the condition of the existing membranes; and
- a clear and open membrane procurement competition delivering efficient costs.

There should be no need for further replacement membranes in the first two years of operation with potential savings in expenditure.

Asset valuation

The current asset groups and associated lives in the current price path are to be continued in the future period. The main change is the addition of a new asset group for membrane replacement with a life of eight years. SDP proposed that the pipeline asset life should be reduced from 140 to 100 years based on the design life of the asset. We concluded that the average asset life should be 120 years taking into account that half the length is land-based and the other half in a more aggressive environment under Botany Bay. We have assumed that a five year average life is appropriate for corporate assets, based on normally accepted lives for assets of this type, compared with the three years proposed by SDP.

Acknowledgement

Atkins/Cardno would like to take the opportunity to thank the management of SDP for making its staff available for the interview days and the site visit and for the professional manner in which the organisation responded to our challenges and requests for further detail.

1. Introduction

1.1. Terms of Reference

In October 2016 the Independent Pricing Tribunal of New South Wales (IPART) appointed the Atkins/Cardno consortium to carry out a strategic management and expenditure review of SDP's operations. The purpose of this review is to inform the Tribunal's decision on prices for the new determination period which applies from 1 July 2017 to 30 June 2022.

This report has been prepared in accordance with the Terms of Reference set out in the contract between Atkins and IPART dated 14 October 2016. An additional review of insurance adequacy, carried out by Deloitte was added by Variation of Agreement on 25 November 2016 and 23 December 2016. The Terms of Reference are reproduced in Appendix A.

Atkins has written Chapters 1-8 of this document. These have been reviewed by Cardno. Deloitte has written Chapter 9 and Appendix B of the document. These have been reviewed by Atkins. Cardno has not had access to Chapter 9 or Appendix B or any confidential information associated with the insurance adequacy review.

The findings of this report form an important component of the overall price review process as set out in the IPART Issues Paper. The conclusions relating to prudence of expenditure in the current price path inform what IPART includes in SDP's opening Regulated Asset Base value. The conclusions relating to efficient operating and capital expenditure in the future price path assist the Tribunal's assessment of what are justified requirements to be included in the 'building block' model for determining future prices.

In parallel to this expenditure review, Atkins in association with Deloitte Consulting Pty Ltd have undertaken a review of the adequacy and appropriateness of SDP's insurance coverage in the current regulatory period and consider efficient premiums for SDP for the 2017 determination period. The outcomes of the insurance review are dealt with in a separately published report. Atkins/Cardno recommendations in this report include insurance costs as proposed by SDP without any potential adjustments informed by Deloitte's report.

1.2. SDP Submission to IPART

IPART required SDP to provide a submission outlining and substantiating its proposed prices for the period 2017-18 to 2021-2022 and historical costs for the current price path from 2012-13 to 2016-2017. The following versions of this information have been used in the preparation of this final report:

- Submission to IPART dated 24 October 2016;
- Special Information Return (SIR) dated 24 October 2016 and amended on 8 November 2016.

Whilst we have endeavoured to satisfy ourselves as to the provenance and robustness of the data provided, a detailed audit of the completeness and accuracy of the information lies outside the scope of this project.

1.3. Exclusions on energy costs

The Terms of Reference include an assessment of power requirements under differing operating modes but exclude an assessment of efficient and prudent energy costs in the current and future price path.

1.4. Review Process

We, the Atkins/Cardno team, commenced our review on 19 October 2016. We submitted an Inception Report to IPART on 25 October 2016. Following initial review of available data, we submitted an Information Request to SDP on 28 October 2016. Documents were provided by SDP from 2 November 2016. Our review team arrived in Sydney on 20 November 2016.

We held interviews with SDP between 21 and 23 November 2016 with key SDP staff.

Over the three days of interviews we requested additional supporting documentation relating to a range of issues. We believe that SDP provided us with this information in a timely manner and to the best of its ability. We then requested further information and made queries over the subsequent two weeks to which SDP was able to respond.

Atkins/Cardno would like to take the opportunity to thank SDP for making its staff available for the interview days and for the professional manner in which the organisation responded to our challenges and requests for further detail.

The SDP's expenditure proposals were presented in the SIR. It is based on the information provided to us by IPART, submissions made and supplementary information provided by SDP. We draw our findings from the review of the strategic management planning and business processes and asset management planning, the findings of our interviews and the outcome of the presentations and associated dialogue.

We submitted a draft report to IPART on 15 December 2016. IPART and SDP were invited to comment on the draft. This final report takes into account of and responds to comments from both IPART and SDP. In some areas we have amended our efficiency proposals.

1.5. Methodology

The methodology follows a similar approach we applied to the SWC efficiency reviews in 2015/16 and 2011, and Hunter Water in 2012. The SDP differs from these water utilities at it has a single treatment plant to maintain or deliver defined volumes of treated water. This arrangement is not unique and can be compared with the large conventional treatment plants such as Prospect. SDP commented that

> *'SDP is such a significantly different business to these three large and very diverse state owned water utilities, which have substantial long legacy assets and operations, that a similar approach is not automatically appropriate.'*

and

> *'As a new, single asset and privately owned, out-sourced business, SDP maintains that its baseline costs already incorporate the advantages of competitive out-sourcing, the lack of legacy systems and legacy organisational structures. SDP's organisation was based on a ground up assessment of requirements, is extremely lean with no embedded inefficiencies which we believe may be a feature of established state owned corporations.'*

Our approach to efficiency reviews is similar to that applied to privately-owned water utilities in England and is informed by regulatory outcomes in this domain. We note the differences in scope and scale that the SDP represents and take these into account in our efficiency review. There are also similarities in processes, operation and management with large-scale water and wastewater plants owned by public and private utilities. There is an assumption that monopoly companies either in the private or public sectors should seek to achieve continuing efficiencies comparable with other companies operating in an open market.

This approach to deriving efficient and prudent expenditure included a review of business processes to compare with good industry practice. For example, long term investment planning, procurement and asset management practices. These are levers for both operating and capital efficiencies. We considered to what extent these processes can be improved and drive further efficiencies through open market testing, improved productivity and innovation.

The plant can operate in Water Security Mode, Full Operation Mode and transitions for Restart and Shutdown. We sought to understand and define the statutory requirements and operating rules driving the operation of the plant. We challenged the main activities related to each primary mode such as works testing and membrane replacement, taking into account the benefits of effective procurement.

SDP outsources nearly all its services, either through its Operation and Maintenance (O&M) contract or procurement of professional services. We sought a detailed understanding of the O&M contract to identify the key cost drivers including labour, chemicals and energy use. We carried out a detailed review of the plant including the processes, the electrical and mechanical plant and historic performance and maintenance processes. We compared the plant performance and activities with other desalination plants across the world of similar size and process complexity.

While a contract is in place, we identified the scope for efficiencies in inputs - power usage and chemical storage - based on recorded works performance in the period 2010 to 2012 and our experience of similar plants. We were not able to benchmark costs due to the lack of information available in the public domain; we were able to utilise our team's experience in the design and operation of similar plants across the world, although we note the varying operational modes required of SDP. We also tested the scope for efficiency in the timing and open procurement of membranes. We also identified scope for labour efficiencies which can be taken up with the operator.

We reviewed the current price path expenditure and identified the reasons for variance. This analysis is a good basis to test future expenditure in understanding the reasons for cost variance against the 2012 Determination. We related costs against outputs. A key test is to challenge why expenditure should increase when outputs such as availability and volumes are unchanged. We applied catch-up and continuing efficiencies to corporate costs to reflect the potential for efficiency savings through procurement and new technologies.

Our approach to capital efficiency was to test the prudence and timing for proposed expenditure.

We applied our findings to SDP's proposals to derive levels of efficient expenditure.

2. Business Environment

2.1. Background

SDP's plant and pipeline are owned by the NSW Government and, from July 2012, subject to a pre-paid financial lease with a consortium comprised of Ontario Teachers' Pension Plan and Utilities Trust of Australia. The 50-year lease includes all assets associated with the plant including.

(i) The desalination plant and associated land;

(ii) The drinking water pumping station; and

(iii) The potable water pipeline.

The site is located at Kurnell with the potable water pipeline from the pumping station on the site following a route along land and under Botany Bay to discharge into the SWC distribution system at Erskineville, a length of 18km. The plant and route of the pipeline is shown in Figure 2-1.

Figure 2-1 Pipeline Route from Kurnell to Erskineville

The plant comprises:

- Seawater intake and tunnel, drum screens, Intake seawater pumping station;
- Chemical coagulation and Rapid Gravity Filtration using 24 dual media filters;
- Low pressure feed pumps to RO trains and energy recovery systems and Cartridge filters followed by RO high pressure feed pumps;
- 13 first pass RO trains and seven second pass RO trains;
- Isobaric energy recovery from the brine, (Dual Work Exchanger Energy Recovery (DWEER) system);
- Alkalinity addition using hydrated lime and carbon dioxide and treatment using sodium silicate, aqueous ammonia, sodium hypochlorite, and fluorosilicic acid;
- Product water pump station and pipeline to deliver treated water to the Sydney Water distribution system; and
- Pre-treatment waste solids thickening and solids centrifuge dewatering and brine outfall tunnel and multiport outfall diffusers.

2.2. Regulatory Requirements

SDP functions under its Network Operating Licence which sets out the requirements to maintain and operate the plant in accordance with rules defined in the MWP. It is required to ensure the sustainability of the water resources in accordance with Principal 7 (i) (c) of the Water Industry Competition Act 2006 (NSW) to:

- maintain the Water Industry Infrastructure in accordance with Good Industry Practice; and
- operate and maintain the Water Industry Infrastructure with the objective of maximising the production of drinking water for the exclusive supply into SWC's area of operation in accordance with the MWP's operating rules.

Operating Rules are defined in the 2010 MWP, known as the 70/80 rule. The MWP is currently being updated and this rule may change. We have completed our review on the basis of the current rules.

SDP supplies bulk water to SWC at its Erskineville reservoir for distribution within its reticulation system under a current Water Supply Agreement.

There is a requirement to deliver an average 250 ML/d into the SWC over the period in which it is in Operation Mode. SDP does not have to forecast growth over the price review period but needs to deliver this total output. In the long term, there may be a requirement to extend the plant to deliver a further 250 ML/d; this would require an instruction from Government. SDP is required to meet the latest Australian Drinking Water Quality Guidelines.

We have reviewed the plant operating modes and comment in Section 3.

Under the *IPART Act 1992,* IPART is responsible for setting prices for SDP including fixed periodic (daily) water service charges and variable (per ML of water produced) water usage charges. The last price path review covers the period to June 2017. The future price path period will cover a period of up to five years from July 2017 to June 2022.

2.3. Business Structure

SDP has a Board comprising seven directors both independent and representing the investors. The Chairman is independent. The business has a small core of permanent staff including the Chief Executive Officer, Chief Financial Officer and a recently appointed Chief Operating Officer. There is a small support staff and a total headcount of seven. A greater part of its functions are outsourced including professional support services such as legal, counsel, tax support, IT, communications and recruitment. Technical support to support specific tasks is also externally sourced. The legal services are also providing support to the management of the contract with Veolia.

The O&M of the desalination plant is outsourced under a 20-year contract with Veolia Water Australia Pty Ltd. Veolia is responsible for all operations including asset management systems and processes. The MAXIMO system is used to record information on assets and their performance.

3. Task 1: Strategic Review of Operating Modes

3.1. Objective

The overall objective of the expenditure review is to establish and recommend the most efficient way to deliver SDP's monopoly services of the supply of non-rainfall dependent drinking water to purchasers and the making available of the desalination plant to supply non-rainfall dependent drinking water, subject to SDP meeting the drought response role prescribed in the MWP.

We are asked to take into account SDP's operating rules under an updated MWP (although these have yet to be placed in the public domain), SDP's operating protocols for entering shutdown or restart, the O&M contract with Veolia and past and forecast operating decisions. We are also asked to take into account international experience of desalination plants in shutdown modes and the effects of these long-term shutdowns on technical reliability of the plan and good industry practice.

3.2. Background

The IPART 2012 Determination set prices for five modes of operation:

- Full operation – when the plant operates at full production of 250 ML/d converted into a volumetric charge and a fixed daily charge;
- Short term shutdown for 2 to 10 days;
- Medium term shutdown for 11 to 90 days;
- Long term shutdown for 91 days to 2 years;
- Water security shutdown for more than 2 years.

In addition, prices are set for varying Restart modes:

- Restart from short term shutdown mode;
- Restart from medium term shutdown mode;
- Restart from long term shutdown mode;
- Restart from Water Security Mode.

While IPART uses the term 'Water Security Mode', the contract with Veolia defines a 'mothball' mode for the period from 2 to 5 years. For the purposes of this report, we refer to the Water Security Mode.

3.3. Regulatory Requirements

SDP's Operating Rules are defined in the 2010 MWP, known as the 70/80 rule. The MWP is currently revising the Operating Rules which may change. As these changes have not been published we are assuming that the current Operating Rules will apply. We shall test the impact of any changes in the rules on the level of prudent and efficient expenditure. The current rule in the MWP defines the rules as follows:

> *Desalination – new operating rules to come into effect in 2012, following the two-year proving period: the plant will operate at full production capacity and supply desalinated water to Sydney Water's area of operations when the total dam storage level is below 70 percent and will continue to do so until the total dam storage level reaches 80 percent.*[6]

This rule is reflected in the statutory SDP Network Operating Licence, Condition A29(c):

> *When the Available Storage falls below 70%, the Licence Holder must, until the Available Storage rises to 80% operate and maintain the Water Industry Infrastructure with the objective*

[6] Metropolitan Water Plan 2010, p7, WaterNSW 2010

> *of maximising the production of drinking water for the exclusive supply into the Sydney Water Corporation's area of operation (as defined in Sydney Water's Operating Licence).*[7]

The 70/80 rule was determined by the MWP from modelling of water resources and the cost and benefits of various interventions including demand management and operation of the plant. The Licence is silent on what SDP has to do when water storage increases above 80%. Currently the IPART 2012 Determination makes it uneconomic to supply water above the 80% water storage trigger.

In addition, condition A2(c) of the Operating Licence states that

> *The Licence Holder is not required to comply with paragraph (b): (i) when the Water Industry Infrastructure is in a Restart phase of production; or (ii) during the time and to the extent that such compliance is prevented wholly or in part by an event outside the reasonable control of the Licence Holder.*

The key definition of Available Storage is included in the Operating Licence definitions:

> *Available storage means the available storage in Sydney's water supply reservoirs as published on a weekly basis on the website of the Sydney Catchment Authority. If for any reason the Sydney Catchment Authority is unable to calculate or publish the available storage, the available storage is the amount of water as calculated and notified from time to time by such other authority as is nominated by the Minister.*

WaterNSW has taken over the responsibilities of the former Sydney Catchment Authority and publishes weekly verified water storage in volume and percentage terms on its website. We understand that it is SDP's responsibility to meet its Network Operating Licence requirement based on this published data. SDP does not have a written protocol for plant Restart or Shutdown; this appears to be a key omission in the overall process involving several government agencies and SWC. At this time, SDP will direct its operator, Veolia, to restart under the existing O&M contract.

The capacity of the plant is defined in the Operating Licence definitions as 250 ML/d measured as a rolling average over 365 days. Restart is defined in the Network Operating Licence:

> *'Restart' has the same meaning as the definition in the Desalination Project O&M Contract between Sydney Desalination Plant Pty Ltd and Veolia Water Australia Pty Ltd. That is, 'the recommencement of production of drinking water at the plant'.*

It appears anomalous that the statutory Network Operating Licence relies on a definition in a contract document that is not in the public domain. The License also includes in Condition A2 (a) stating that

> *The Licence Holder must maintain the Water Industry infrastructure in accordance with Good Industry Practice.*

This is relevant to all operating modes.

Potential changes to the MWP Operating Rules

We note above that the MWP is considering a modification to the 70/80 rule above based on recent modelling work and the proposals are being reviewed by the NSW Government. We have reviewed the impact of possible changes to the operating rules on the level of efficient expenditure in the future price path. We concluded that any changes in the rules are not likely to impact on the findings on operating modes and efficient costs.

[7] Network Operator's Licence, Sydney Desalination Plant Pty Ltd, 2010

3.4. O&M contract

SDP has an Operating and Maintenance Contract with Veolia Water Australia Pty Ltd[8].**[Redacted Information]**

Shutdown Categories

The Shutdown categories and related durations and the period to shutdown are **[Redacted Information]**

Table 3-1 Restart and Shutdown Categories

Shutdown Category	Shutdown Duration	Restart Period	[redacted]
Short Term	2-10 days	72 hours	
Medium Term	11-90 days	5 days	
Long Term	91-730 days	12 weeks	
Mothball	2-5 Years	8 months	

Source: Veolia contract

3.5. Water Supply Agreement with SWC

A Water Supply Agreement dated June 2012 is in place between SDP and SWC setting out the terms and conditions for the supply of desalinated water. **[Redacted Information]**

Our interpretation of this clause is that while there is a requirement to provide drinking water to mitigate any emergency, the terms '*reasonable endeavours'* and '*having regard to the current operating or shutdown mode'* implies that this clause is not determining the shutdown mode to be maintained; this is determined by the water resource situation and dam storage levels.

SWC commented on the IPART Issues Paper in its submission[9] page 14.

> *In practice, such requests would only be necessary if dam storages had risen above the shutdown trigger in the operating rules, since the desalination plant would otherwise be operating at full capacity. As such, the Water Supply Agreement effectively anticipates that water will only be supplied to Sydney Water outside the operating rules in exceptional circumstances.*

The example of the planned Warragamba dam wall raising to enable flood management works to trigger a start of the plant was referenced by SDP. There is no reason why this cannot be managed under the existing 70/80 operational rule. Other examples such as the water quality impact from bush fires or the loss of any output from the Prospect water treatment plant need to be rigorously tested through risk management processes before any plan can be considered.

This confirms our view that the relevant shutdown mode is driven by the water resource situation and reservoir storage levels and not any requirements of the Water Supply Agreement with SWC. Any shutdown mode other than Water Security would drive a higher level of expenditure to be recovered through the charging arrangements.

SDP commented that

> **[Redacted Information]**
>
> *If SWC calls upon SDP, SDP is contractually obliged to meet this obligation. The probability of such an event occurring, or the risk management processes that SWC would undertake prior to issuing SDP such a request, are not relevant to SDP's contractual obligation.*

[8] Sydney Desalination Project O&M Contract, Sydney Desalination Plant Pty Ltd and Veolia Water Australia Pty Ltd, July 2007 and amended in June 2012
[9] Sydney Water's response to IPART Issues Paper, November 2016

We stated above that while there is a requirement to provide drinking water to mitigate any emergency, the terms '*reasonable endeavours'* and '*having regard to the current operating or shutdown mode'* implies that this clause is not determining the shutdown mode to be maintained; this is determined by the water resource situation and dam storage levels.

3.6. Findings on Efficient Modes of Operation

The desalination plant's primary purpose is to provide water supply during drought conditions. The desalination plant has not produced potable water since June 2012.The operating rules are clearly defined in the MWP and Network Operating Licence. We have assumed that the current MWP rules will apply for the upcoming Determination period although note that these may change shortly. These rules are setting the mode of operation or shutdown rather than any need to maintain a higher level of shutdown to respond to any emergencies as defined in the Water Supply Agreement with SWC. In this latter case, SDP's response is to use best endeavours.

The Operating Licence is clear on defining when the plant needs to be in operation or to be available. There are no clear protocols or definitions in place for determining any other mode of operation – short, medium or long shutdown modes– and how any decision is made to enter these modes. A prudent approach is to minimise costs when the plant is not operating. This implies moving to Water Security Mode.

Water Security Mode

The desalination plant is currently in Water Security Mode. Dam storage is currently at 89.3% (at 11 January 2017). A coarse analysis of historical data shows that it is likely to take about one year for the dam levels to drop 10% in a drought; meaning that it would be a number of years before the dam trigger level is likely to be reached. We accept that dam storage is variable in the short run; the probability of reservoir storage falling below the 70% trigger level is approximately 1 in 10 years. We have therefore taken the Water Security Mode as the base case in reviewing efficient expenditure.

The cost driver is the licence requirement in A2 (a) (i) to maintain the plant in accordance with good industry practice. Expenditure should be limited to essential maintenance activities and any periodic expenditure such as membrane replacement and periodic maintenance needs to be tested and justified in terms of scope, risk and time. This criterion also applies to significant testing costs proposed in the future price path. We discuss specific asset management activities in Sections 5 and 6.

We are not aware of any similar-sized desalination plants which have been in a shutdown mode for an extensive time except for the Victorian Desalination Plant in Melbourne. SDP commented that this plant is not in the same shutdown mode as SDP and has a higher cost base with a full workforce on site. This plant has been instructed to operate over the summer 2016/17. Most desalination plants operate with a base load output.

Restart

A long period of Water Security Shutdown places great importance on the Restart with the need to procure membranes, carry out essential asset replacement, recruit and train additional operators and test the individual processes and the complete works. An eight month period has been assumed in the MWP modelling so there is sufficient time to bring the plant to full output without having a detrimental impact on the water resource situation. We had considered a shorter restart period but concluded that this length is needed to restart from a long Water Security Mode because of the time taken for ordering membranes and full plant testing. We comment on the detailed Restart activities and costs in Section 5.3.3.

In the Restart Mode, the plant is likely to be producing potable water to licence standards as the plant is going through the period of increasing output up to full production. While SDP can recover the cost of restart, water produced is not necessarily accepted by SWC and may be discharged to sea. We suggest this is not efficient as the output from the restart process is not available to customers. The effective pricing regulation would allow to make efficient use of water produced during restart. Some incentive might be considered to maximise potable water delivery at a time when water resources are stretched and water restrictions applied to customers.

Full Operation Mode

The cost driver is the licence requirement in A2 (b) to deliver the full output of 250 ML/d of potable water. We have accepted the marginal increase in corporate costs and have made some adjustments to derive an efficient level of power usage and fixed and variable costs.

In this mode, the plant will be operated at full average 250 ML/d output to meet network operating requirements. The maximum daily output is 266 ML[10]. The plant is at risk of abatement of daily fixed charges should the average output reduce below 250 ML/d over a defined period where the plant is in Full Operation Mode.

Transition to Water Security Mode

The transition to Water Security Mode is not referenced in the Operating Licence although there is a specific requirement to move from one mode to another. The Mode will commence when dam storage increases to 80% under current MWP rules. At this time, potable water supply will cease and a process of shutdown will follow through the plant using the operator's protocols. The duration of the transition is defined in the O&M contract. Coarse analysis of historical data suggests that the probability of reservoir storage falling below the 70% trigger level is approximately 1 in 10 years. This suggests that there could be eight or nine years between each Full Operation Mode. We have therefore assumed that the shutdown procedure will move the plant to the Water Security Mode as the base case in reviewing efficient expenditure.

Other Shutdown Modes

The 2012 Determination set prices for short, medium and long term shutdown modes with periods defined **[Redacted Information]** in Table 3-1 above. The Operating Licence does not refer to different types or durations of shutdown. We have not seen any protocols to define when these shutdown modes should apply.

Water demand is assumed to deplete storage at a rate of 10% per annum assuming limited river inflow over this period. So when the plant is shut down after a storage of 80% is achieved, the duration of any shutdown is likely to be at least a year. This means that the short and medium term shutdown modes are not relevant to the primary objective of the plant.

As noted above, there could be eight or nine years between each Full Operation Mode. At the time of any shutdown when the 80% criteria has been achieved, there is unlikely to be any indication of its duration. In the absence of any protocol to explain why a Long Term Shutdown Mode should apply, it is prudent to minimise costs and move to the Water Security Mode.

We formed the view that a short term shutdown, for example for maintenance purposes, can be accommodated through the modified abatement mechanism. The plant can produce up to 266 ML/d so a short term outage can be managed with or without abatement depending on the duration of any outage.

We envisage that a medium term shutdown would be possible following some emergency repairs requiring more time than a short term shutdown. This should be covered by business interruption insurance for the loss of revenue through the abatement mechanism. Any transitional costs would be covered in the business interruption insurance.

SDP commented that

> *For example, if the plant is in an Operation mode and the pipeline was damaged by a 3rd party (e.g. pipeline currently damaged due to drilling incident), the plant may have to enter a Short, Medium or Long term mode while the pipeline is repaired prior to going back into an Operating mode. SWC may also have a network constraint which prevents them from accepting SDP's water for a period of time.*

Our view is that should the pipeline or other assets be damaged by a third party, then this situation and related costs are addressed through business interruption and associated insurance. Any network constraint reported by SWC can be addressed through a reduced output through current contractual arrangements.

We compared the costs of the Long Term Shutdown Mode with the Water Security Mode, assuming marginal increase in transition and restart costs. The Long Term Shutdown Mode has a marginal cost of **[Redacted Information]**, predominantly labour, compared with the Water Security Mode. The shutdown cost for the Water Security Mode is a marginal **[Redacted Information]** increase. The marginal restart costs from Water

[10] SDP Submission page 36, October 2016

Security Mode compared with Long Term Shutdown is **[Redacted Information]** based on our estimates and excluding membrane replacement costs which are independent of the mode. This shows that there is no benefit in extending the long term shutdown mode beyond eighteen months. As the duration of any shutdown is not likely to be less than this period, there is little cost benefit in using the Long Term Security Mode. It would be prudent to minimise costs through application of the Water Security Mode.

We concluded that there are no clear circumstances where short, medium and long term shutdown modes would apply. The absence of any clearly defined protocols to determine and agree modes of operation limit the application of shutdown beyond the Operating Licence requirement. Where short or medium shutdowns occur they can be dealt with under current pricing and insurance provision. We have therefore not made any recommendations on efficient costs for these modes.

We propose that the short, medium and long-term shutdown modes should not apply.

Other shutdown modes for short, medium and long term appear unlikely to be relevant.

4. Task 2: Strategic Management Review

4.1. Long term Investment Planning

We are required to undertake a strategic management review of SDP's long term investment plan over a minimum of ten years. This is to enable the capital expenditure proposals in the future price path to be placed in the context of the long term plan.

SDP's objective is to provide a bulk supply of potable water from desalination at a time of limited water resources. Its assets comprise a seawater intake band screen and pumping station; a RO treatment plant and delivery of potable water through a pumping station and large diameter pipeline.

SDP advised us that the main expenditure drivers are in the Network Operating Licence and refer to maintaining assets to good industry practice for the Water Security Mode and to maintaining works full output during the Full Operating Mode. In the first role the focus is on asset management. The driver for the second role is production and risk management to reliably meet defined output. There is no requirement to extend the capacity of the plant unless directed by Government. The regulatory framework allows SDP to supply other customers in the SWC supply area although current water pricing constrains any cost effective development.

SDP advised us that it does not have a long term investment plan. Capital expenditure in the future price path is limited mainly to the provision of an additional pump in the DWPS and some periodic maintenance. The plant has been in Full Operation or Water Security Mode for nearly seven years and assets are relatively young when compared with the economic life of the plant. As such replacement expenditure is currently low.

We have not seen any reference to whole of life cycle planning, capital and operating expenditure trade-offs leading to prudent and efficient expenditure. Management has been focused on recovery after the damage to the plant following a tornado in December 2015. While we found that SDP management has acted prudently in developing a short term investment plan, there is insufficient evidence to demonstrate that this is efficient.

SDP has assumed that as the current operator's costs were market tested nearly ten years ago they remain competitive now. Our view is that the market has changed, productivity has improved, new technologies are emerging, more effective procurement processes are now in place and the prolonged water security status affects the optimal level of operational activity. In setting efficiency targets for the future price period we were mindful that there were no apparent efficiencies built into the forecast expenditures that can be shared with customers, nor any plans by SDP management to drive efficiencies through the business. We found that SDP's management could do more to drive efficiencies in the operating contract, through negotiation of efficiency targets, and managing its own costs.

SDP commented that

> *the O&M contract was procured under a long term Design, Build, Operate and Maintain arrangement with substantial design and contract risk transferred to the operator which is reflected in its costs*

We have taken this into account and note that there are contractual arrangements to review the contract after ten years operation.

4.2. Asset Management Systems and Processes

Under the terms of SDP's O&M contracts with its operator, Veolia, the operator is responsible for maintaining asset registers and an asset management plan and reviewing maintenance and replacement schedules on an annual basis for the plant and DWPS. There is no annual Planned Maintenance Scope for the pipeline.

Veolia uses two main asset management systems as summarised below:

- IBM's Maximo asset management system. Maximo is a widely-used asset management tool. The operator's Maximo database contains approximately **[Redacted Information]** asset items for the plant, DWPS and pipeline; it is used by Veolia to schedule preventative maintenance and is discussed further in O&M Planning below; and

- Veolia's Critical Asset Renewal Management System (CARMS). This contains approximately **[Redacted Information]**asset items deemed to be 'critical'.

CARMS **[Redacted Information]**. It was used as the basis of SDP's projected periodic maintenance requirements for the next price path period.

[Redacted Information]

4.3. [Redacted Information]Operations and Maintenance Planning

As noted, the operator uses the Maximo asset management system. This is used for maintenance management, to provide a registry of assets and for spare parts inventory management.

The Maximo and CARMS systems are effective uses of information systems to manage the plant maintenance and asset renewal. SDP has contractual rights in clause 37 to continuing using these software systems in the event that the SDP decides to change operators in the future. We consider that SDP should own its asset information to reduce the risks of data loss during any contractual changeover.

The operator reports to the owner the major maintenance activities carried out each month in a monthly report. The report also summaries the percentage work orders which are considered preventative maintenance, break down maintenance or corrective maintenance. The greatest number of work orders are for preventative maintenance as would be expected of a plant in the Water Security Mode. The operator's monthly reports to SDP before the tornado damage indicate that the operator is addressing maintenance issues in a timely manner.

[Redacted Information]

5. Task 3.1 Operating Expenditure

5.1. Overview

Scope of assessment

We are required to provide recommendations on the efficiency of past operating expenditure for the period 1 July 2012 to 30 June 2016 and the forecast for the year ending 30 June 2017. This Section reports the actual expenditure incurred by SDP over this period, disaggregated to the plant, pipeline and associated corporate services. We review and comment on the variance in operating expenditure when comparing actual against the 2012 Determination.

Expenditure trends

Figure 5-1 shows the actual and forecast operating expenditure to 2022 compared with the 2012 Determination.

Figure 5-1 Actual and Forecast Expenditure compared with the 2012 Determination

Source: Atkins analysis: Note label corresponds to year ending 30 June (e.g., 2013 means 'year ending 30 June 2013', or 2012-2013)

Actual operating expenditure in the current price path is $8.5m in total for the period above the Determination mainly as a result of increased corporate expenditure offset in part by a small reduction in plant and pipeline costs. Expenditure increases over the future price path relate to increases in periodic maintenance and the plant capacity test. Excluding periodic maintenance, which we propose is capitalised, a lower expenditure profile is forecast, shown as a broken line in Figure 5-1. The forecast opex includes for a plant capacity test in years 2020-2021 and 2021-2022. We discuss this proposal in Section 5.3.2.

5.2. Expenditure in the current price path

We have compared actual expenditure in the current price path from 1 July 2012 to 30 June 2017 including a forecast for the current year, with the Determination set by IPART in 2012[11]. During this period the plant has been in a Water Security Mode. Some expenditure in 2013 related to the works shutdown so has been excluded from the variance analysis. Asset impairment costs as a result of the tornado damage, some **[Redacted Information]**, has also been excluded from the analysis.

We have analysed the operating expenditure by expense line and identified and commented on material variances. We identify cost savings and increases as a result of external factors and SDP's management actions. We also comment on the prudence of expenditure in the current price path and identify any areas of expenditure which are not consistent with the definition. The analysis has been based on the SIR submission and SDP's view of dis-aggregated Determination expenditures.

Actual Expenditure

We have taken actual and forecast expenditure for the current price path from 2012-2013 to 2016-2017 and compared these values with the Final Determination 2012 brought up to the 2016/17 price base using inflation factors advised by IPART. Actual expenditure is reported in Table 5-1.

[11] Review of Water Prices for Sydney Desalination Plant, IPART December 2011

Table 5-1 Current Price Path Actual Expenditure

SDP ACTUAL OPERATING EXPENDITURE: CURRENT PRICE PATH: WATER SECURITY MODE						
($m 2016/17) year ending June	2013	2014	2015	2016	2017	Total
SDP Actual Expenditure - Corporate						
Remuneration						
Professional fees						
Rental						
Insurance						
Council rates						
Land tax						
Asset Imparement (XXm excluded)						
Marine monitoring						
Other Corporate Costs						
Total Corporate $m	9.78	7.29	6.76	7.98	8.81	40.62
SDP Actual Expenditure - Plant (excluding electricity)						
Routine asset maintenance						
Periodic maintenance						
Standby charges						
Safety incentive						
DWPS charges (excl insurance)						
Labour and other fixed costs						
Insurance						
Shutdown charge		0.00	0.00	0.00	0.00	
Membrane replacement	0.00	0.00	0.00	0.00	0.00	
Total fixed plant costs $m						
SDP Determination Expenditure - Electricity						
Average annual electricity use (MWh)	5000	5000	5000	5000	5000	
Fixed Energy						
Other energy charges						
Renewable energy						
Energy efficiency						
Total Electricity costs						
SDP Actual Expenditure - Pipeline						
Total Fixed Pipeline Costs $m	0.10	0.20	0.18	0.19	0.20	0.87
SDP Efficiency Sharing (excluding electricity)						
Periodic Maintenance	0.00	0.00	0.37	0.00	0.00	
Membranes	0.00	0.00	0.38	0.00	0.00	
TotalEfficiency Sharing (excl electricity)	0.00	0.00	0.75	0.00	0.00	0.75
TOTAL EXPENDITURE						
Total $m	20.69	17.55	17.29	16.62	17.85	89.99

Source: SIR

Expenditure set by IPART

We have also restated the 2012 Determination using the same expense codes in actual expenditure. This is shown in Table 5-2 below. Expenditure is reported by Corporate, Desalination Plant and the potable water pipeline. The plant expenditure includes the DWPS. The analysis excludes energy network charges as this was considered as a 'pass through' by IPART in its 2012 Determination.

Table 5-2 Current Price Path Determination

SDP OPERATING EXPENDITURE DETERMINATION: CURRENT PRICE PATH: WATER SECURITY MODE						
($m 2016/17) year ending June	2013	2014	2015	2016	2017	Total
SDP Expenditure in Determination - Corporate						
Remuneration	[redacted]					
Professional fees						
Rental						
Insurance						
Council rates						
Land tax						
Asset imparement (XXm excluded)						
Marine monitoring						
Other corporate costs						
Total Corporate $m	6.11	5.58	5.22	5.41	5.60	27.93
SDP Expenditure in Determination- Plant (excluding electricity)						
Routine asset maintenance	[redacted]					
Periodic maintenance						
Standby charges						
Safety incentive						
DWPS charges (excl insurance)						
Labour and other fixed costs						
Insurance						
Shutdown charge						
Membrane replacement						
Total fixed plant costs $m	[redacted]					
SDP Determination Expenditure - Power						
Average annual electricity use (MWh)	9000	9000	9000	9000	9000	
Fixed energy	[redacted]					
Other energy charges						
Renewable energy						
Energy efficiiency						
Total Electricity costs	[redacted]					
SDP Actual Expenditure - Pipeline						
Total Fixed Pipelinecosts $m	0.10	0.20	0.18	0.19	0.20	0.87
SDP Efficiency Sharing (excluding electricity)						
Periodic maintenance	0.00	0.00	0.00	0.00	0.00	
Membranes	0.00	0.00	0.00	0.00	0.00	
Total Efficiency Sharing (excl electricity)	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL EXPENDITURE						
Total $m	15.65	15.86	16.46	16.24	15.72	79.94

Source: SDP analysis reconciled to IPART Determination 2012

We then analysed the variance between actual and Determination by expense lines. The analysis is summarised in Table 5-3.

The main variance is an increase of $12.69m in corporate costs over the period. Prior to 2012, corporate support services were provided by SWC and IPART assumed in the 2012 Determination that this would continue through the current price path. With the purchase of the lease for the plant, support from SWC ceased and SDP undertook to provide these services itself. SDP comprises a small team of executives with the professional support services such as legal, counsel, tax support, IT, communications and recruitment are all externally sourced. The legal services are also providing support to the management of the contract with Veolia. The $12.69m increase in total corporate expenditure is attributable mainly to remuneration and professional fees combined **[Redacted Information]** and 'Other' corporate costs **[Redacted Information]** where there was no previous allowance. The reducing trend in insurance costs was reversed in the current year following the tornado.

Table 5-3 Current Price Path Determination Variance Analysis

SDP OPERATING EXPENDITURE: CURRENT PRICE PATH: WATER SECURITY MODE VARIANCE						
($m 2016/17) year ending June	2013	2014	2015	2016	2017	Total
Variance in expenditure - Corporate						
Remuneration	[redacted]					
Professional fees						
Rental						
Insurance						
Council rates						
Land tax						
Asset imparement (XXm excluded)						
Marine monitoring						
Other corporate costs						
Total Corporate $m	3.67	1.71	1.54	2.57	3.20	12.69
SDP Expenditure in Determination- Plant (excluding electricity)						
Routine asset maintenance	[redacted]					
Periodic maintenance						
Standby charges						
Safety incentive						
DWPS charges (excl insurance)						
Labour and other fixed costs						
Insurance						
Shutdown charge						
Membrane replacement						
Total fixed plant costs $m	[redacted]					
SDP Determination Expenditure - Power						
Average annual electricity use (MWh)	-4000.00	-4000.00	-4000.00	-4000.00	-4000.00	
Fixed energy	[redacted]					
Other energy charges	0.05	0.56	0.05	0.00	0.05	
Renewable energy	[redacted]					
Energy efficiiency	0.28	0.41	0.26	0.22	0.00	
Total Electricity costs	[redacted]					
SDP Actual Expenditure - Pipeline						
Total Fixed Pipeline costs $m	0.00	0.00	0.00	0.00	0.00	0.00
SDP Efficiency Sharing (excluding electricity)						
Periodic maintenance	0.00	0.00	0.37	0.00	0.00	
Membranes	0.00	0.00	0.38	0.00	0.00	
TotalEfficiency Sharing (excl electricity)	0.00	0.00	0.75	0.00	0.00	0.75
TOTAL EXPENDITURE						
Total $m	5.04	1.68	0.82	0.38	2.13	10.0

Source: Atkins calculation

Expenditure on plant is **[Redacted Information]** below the Determination, reducing to **[Redacted Information]** after taking efficiency sharing into account. While routine maintenance shows an increase of **[Redacted Information]** above the Determination, this is more than offset by a **[Redacted Information]** reduction in periodic maintenance and **[Redacted Information]** labour and other costs. The variance is a net 2.5% saving on the IPART Determination. The plant has been in standby mode for the complete determination period from 2013. **[Redacted Information]**

Energy costs have reduced mainly due to a reduction in energy units used. The IPART Determination assumed 9000 MWh per annum compared with actual average annual usage of 5000 MWh per annum. The net impact of this lower energy use is a reduction of **[Redacted Information]** over the period.

Expenditure on the pipeline is low and variance is not material.

The variance in operating expenditure is summarised in Table 5-4.

Table 5-4 Current Price Path Determination summary variance analysis

SDP OPERATING EXPENDITURE: CURRENT PRICE PATH: VARIANCE WITH DETERMINATION						
Excludes Electricity fixed costs						
($m 2016/17) year ending June	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
Actual Expenditure	20.69	17.55	17.29	16.62	17.85	89.99
Actual expenditure less shutdown costs	19.09	17.55	17.29	16.62	17.85	88.39
Determination	15.65	15.86	16.46	16.24	15.72	79.94
Variance $m	3.45	1.68	0.82	0.38	2.13	8.46

Source: SIR and SDP analysis; minor differences due to rounding

Findings

There has been an overall increase in operating expenditure when compared with the 2012 Determination.

The main feature of the current price path is the increase of $12.69m above the Determination for remuneration, professional services and other corporate costs. Over the period of the current price path, SDP has built up its corporate structure with seven permanent staff including a Chief Executive Officer and a Chief Financial Officer; the Chief Operating Officer was recruited in 2016. The Executive Manager Regulatory and Commercial is a member of the Executive. These executives are supported by a team of four staff. A greater part of the corporate activities and professional services including counsel, legal, IT, communication and finance support has been outsourced. The total expenditure was $13.8m above the 2012 Determination which was based on the assumption that SWC would provide corporate support services. While we accept that these services formed a necessary part of establishing the business processes and services, there is scope for efficiencies in future years.

The Plant has been in Water Security Mode for the entire price path to date. After removing some costs in 2012 related to shut-down and excluding **[Redacted Information]**asset impairment, actual expenditure is **[Redacted Information]** below the Determination. This is equivalent to a 7.5% reduction in operating costs while maintaining assets in accordance with good industry practice. There are wide variances in routine and planned maintenance and labour which leads us to question whether the cost allocation rules are consistent.

The negative variance on periodic maintenance is understood to be due to a mismatch between the IPART Determination categorisation of O&M line items and the O&M Contract line items. We understand that it is not the result of significant underspend.

The main licence obligation is for the plant to be maintained consistent with good industry practice. While there are no defined performance measures for this mode, we confirmed from our review that SDP has and is continuing to maintain the plant. This is consistent with the WICA[12] audit and consultant's reports. With the plant likely to continue in a Water Security Mode, it is important to clearly define a small number of performance measures to monitor asset maintenance.

We have not identified any expenditure which may be considered outside the provision of regulated services. Direct costs incurred as a result of Tornado damage such as asset impairment and some staff costs have been excluded, although the management team has a strong focus and input on negotiations with the insurers and implementing remedial measures.

The Efficiency Adjustment Mechanism (EfAM) described in Section 8 has been applied for one instance, to reflect $0.05m savings in insurance costs as a result of management action. We comment on this in Section 8.

The SIR identifies payments for efficiency sharing with Veolia for periodic maintenance and membrane efficiency savings. Expenditure of **[Redacted Information]** and **[Redacted Information]** respectively are reported in year 2015. SDP explained that

[Redacted Information]

The efficiency sharing payments related to the 5-yearly sharing of membrane replacement and periodic maintenance from 2010 to 2015 including the two years when the plant was operational and the replacement

[12] WICA Licence audit report Risk Edge, July 2015

budgets activated. While these two years were outside the current price path, the contractual date for payment fell inside the current price path. While these payments increase total operating expenditure in the current price path and greater than the Determination, there is no impact on costs to customers.

In the future price path we have assumed that the membrane replacement and periodic maintenance expenditures are capitalised. Any future efficiency payments will need to meet the efficiency and prudence tests in a subsequent efficiency review.

2016-2017 Base Year Expenditure

We review the base year expenditure in detail as this forms the basis for future operating expenditures. We comment under each main expense heading or groups of headings. We test whether this expenditure is typical or there are any atypical expenditures.

Remuneration: this includes employees and director fees. This expenditure has increased over the current price path as additional staff are employed. This is forecast to remain at the 2016-2017 level through the future price path. No further staff are envisaged under the Water Security Mode.

Insurance: expenditure has increased in 2016-2017 and attributed to the tornado damage. A review of insurance coverage and costs is considered in a separate report.

Professional fees: there are one-off expenditures related to the preparation of the IPART submission **[Redacted Information]**, pipeline-related costs **[Redacted Information]**, other professional fees **[Redacted Information]** and tax review **[Redacted Information]**. Excluding these atypical expenditures, a typical year's corporate expenditure would be $8.0m. This is similar to the average annual expenditure over the current price path.

Plant costs: expenditure is mainly related to the Veolia contract and driven by routine maintenance and labour and other costs. Expenditure in 2016-2017 is **[Redacted Information]** and similar to the average over the last four years.

Energy costs: the 2016-2017 expenditure is based on the actual units used in the Water Security Mode; this is typical usage for projecting into the future price path.

Corporate Benchmarking

There is little information available in the public domain to benchmark the level of corporate expenditure. SDP did not propose any benchmarking and cautioned the use of this approach. We have therefore reviewed the component of corporate expenditure and established a base year expenditure for 2016-2017.

5.3. Expenditure in the future price path

We have taken the SDP expenditure proposals for the Water Security Mode as a base case in the future price path as discussed in Section 3. This is because it is unlikely that the plant will be required to commence operation due to the current dam storage level which is 89.3% as at 11 January 2017. We then consider the Restart Mode as this is then linked to the full Operational Mode. We assume that the base case for a Shutdown Mode is the change to Water Security Mode. We then address the marginal change in costs for alternative shutdown modes and the marginal increase in costs of the plant in Short, Medium and Long term Shutdown Modes.

5.3.1. Fixed costs- irrespective of mode

Nearly all the proposed corporate expenditure is independent of the mode of operation. Proposed expenditure is shown in Table 5-5.

Table 5-5 Future Price Path SDP Corporate expenditure

SDP OPERATING EXPENDITURE: FUTURE PRICE PATH: WATER SECURITY MODE						
($m 2016/17) year ending June	2018	2019	2020	2021	2022	Total
SDP Proposals - Corporate						
Remuneration	[redacted]					
Professional fees						
[redacted]						
Insurance						
Council rates						
Land tax						
Other corporate costs						
Total Corporate $m	8.23	8.11	8.36	8.64	8.63	41.98

Source: SIR and SDP SIR opex model

In Section 5.2 we discussed the base year expenditure for 2016-2017 taking the forecast for this current year and excluding one-off expenditures. We concluded that the base year should be $8m per annum. This amount was also the average expenditure over the current price path and over 40% above the 2012 Determination. This forecast forms part of the Water Security Mode expenditure. SDP produced this forecast from a bottom-up estimate of future expenditure across its corporate functions and we have not seen any evidence of internal challenge to these forecasts. A greater part of corporate expenditure is procured from professional providers and we consider there is scope for efficiencies here. Given that the Water Security Mode assumes no change in outputs or performance over the current year, there is no justification for increasing the corporate expenditure above the base year costs at the 2016-2017 price base. The one exception is for a one-off expenditure related to the preparation of the Price Review submission in 2021.

SDP commented that

> *'…there is a range of project- based expenditure which must be undertaken on a regular basis as part of the prudent management of the business. Not all of these activities must be undertaken annually, however that does not automatically means that they are "abnormal".'*
>
> *'This adjustment also excludes new costs which will be incurred in the new regulatory period which reflects the fact that SDP is still maturing as an organisation and that some ongoing and necessary costs will be incurred for the first time during the 2017-2022 regulatory period. Examples include the full year of the new COO costs, a graduate engineer cost, credit rating fee costs,* **[Redacted Information]** *costs for internal audit, risk management reviews.'*

Applying our methodology of a utility operating in an open market, there would be cost pressures applied to limit costs compared with other similar agencies. Taking the average annual expenditure over the current price path provides a realistic basis for future costs given there are no changes in outputs and performance. While there are cost pressures for additional activities driving cost increases of 2% to 4% per annum, we consider that these should be absorbed through re-prioritising activities. We would also expect that efficiencies would be gained through the period from improved procurement, business practices and innovation. This is common across all utilities in the public and private sectors. For example, in 2016 SWC was set opex efficiencies of 0.25% per annum continuing and 0.5% to 2.0% continuing; this reflected an average 0.75% per annum tapered over the period.

The UK the Competition and Mergers Authority (CMA) reported in October 2015 on its Bristol Water referral[13]. Its report considered operating expenditure efficiency as a combination of continuing and catch-up components and evaluates methodologies developed by Ofwat, proposed by Bristol Water and with other recent regulatory reviews and Determinations. It considered the Ofwat approach of using the upper quartile value of water company data and an initial catch-up efficiency and then a marginal increase in input costs with an alternative approach using an average benchmark and assuming the catch-up occurs over a five year period. For Bristol, this resulted in a net efficiency of 1% per annum. It considered the Bristol Water proposal of 0.5% per annum and considered would over-state its level of efficient expenditure. We use this comparison to place our findings

[13] Markets and Competition Authority report 'A referral under Section 12 (3) (a) of the Water Industry Act 1991, October 2015

in the context of efficient expenditure of a water company in the context of efficient expenditure in a different another regulatory domain.

We concluded that a target of 0.75% per annum should be applied to all SDP's corporate expenditure. The impact of this adjustment is shown in Table 5-6. SDP has a team of highly experienced professionals who should achieve and out-perform these efficiency targets through improved procurement, methods of working and innovation.

SDP commented that

> **[Redacted Information]** *Consequently, in order to achieve these cost reductions, SDP will have to eliminate necessary and prudent professional services. SDP is concerned the approach taken by Atkins to this aspect of the review is inappropriate and based on a fundamentally flawed principle related to future procurement savings which SDP has already obtained and factored into its forecast spend.*

Our methodology assumes that a utility in an open market would seek to improve its efficiency through savings from procurement and innovation. The 0.75% per annum target, based on comparative analysis of recent determinations, is modest and gives SDP the opportunity to out-perform. SDP questioned the applicability of the Bristol Water determination on efficiency. Our view is that this is a good example of determining a level of continuing efficiency of a private monopoly. The efficiency adjustments of $60k/a cumulative over the period are relatively small but gives SDP a focus to seek efficiencies as if it is operating in an open market.

Table 5-6 Future Price Path Efficient Corporate expenditure

SDP OPERATING EXPENDITURE: FUTURE PRICE PATH: EFFICIENT EXPENDITURE						
($m 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
Assessment of Efficient Expenditure						
Total Corporate $m	8.23	8.11	8.36	8.64	8.63	41.98
Adjust to base year	-0.23	-0.11	-0.36	-0.64	-0.63	
Add for one-off expenditure	0.00	0.00	0.00	0.25	0.25	
Efficiency adjustments (%)	0.75	1.50	2.25	3.00	3.75	
Efficiency adjustments ($m)	-0.06	-0.12	-0.18	-0.25	-0.31	
Efficient Corporate	7.94	7.88	7.82	8.00	7.94	39.58

Source: Atkins Cardno analysis

We discuss plant and pipeline efficient expenditure in Section 5.3.2 below.

5.3.2. Water security mode

The plant has been in Water Security Mode through the whole of the current price path. Current dam levels suggest that this mode is likely to continue through a greater part of the future price path. We have therefore used this mode as the base case. Expenditure proposals are presented in Table 5-7.

Table 5-7 Future Price Path Water Security Mode

SDP OPERATING EXPENDITURE: FUTURE PRICE PATH: WATER SECURITY MODE						
($m 2016/17) year ending June	2018	2019	2020	2021	2022	Total
SDP Proposals - Corporate						
Total Corporate $m (as Table 5-6)	8.23	8.11	8.36	8.64	8.63	41.98
SDP Proposals - Plant						
Routine asset maintenance	[redacted]					
Periodic maintenance						
DWPS charges (excl insurance)						
Labour and other fixed costs						
Insurance						
Plant capacity test	0.00	0.00	0.00	8.76	8.76	
Membrane replacement	[redacted]					
Safety incentives and standby						
Total fixed plant costs $m	[redacted]					
SDP Proposals - Electricity						
Usage MWh/a	[redacted]					
Electricity usage costs	see Marston Jacobs Report					
RECs costs	see Marston Jacobs Report					
Total electricity costs $m	[redacted]					
SDP Proposals - Pipeline						
Total Fixed Pipeline costs $m	0.31	0.32	0.32	0.32	0.32	1.59
TOTAL EXPENDITURE (excluding electricity)						
Total $m	[redacted]					

Source: SIR

The expenditure proposals for the plant comprise an average **[Redacted Information]** per annum compared with the current price path expenditure of **[Redacted Information]** per annum and a similar expenditure forecast for 2017. We comment below on each area of expenditure.

Routine Maintenance

Routine maintenance comprises work by the contractor, excluding labour, and work carried out by sub-contractors including plant manufacturers and their agents. Routine maintenance shows an increase from an average **[Redacted Information]** in the current period to **[Redacted Information]** in the future price path. SDP explained that this maintenance is likely to increase as the plant ages; costs are derived from the current contract. We have not challenged this assumption in detail as the value of the increase in **[Redacted Information]** per annum.

Periodic Maintenance

We consider that periodic maintenance should be capitalised; the reasons are set out in Section 5.4.6. We have therefore excluded periodic maintenance from operating expenditure.

SDP has included in periodic maintenance the replacement of hoses and associated plant. The desalination plant was designed to achieve the asset design lives provided in the Durability Plan. The plant permeate pipework system is a mechanical asset and is supposed to have a design life of 25 years.

It was clear from our site inspection that all the permeate hoses will need to be replaced. This is because many of the hose connectors to the pressure vessels have cracks for which replacement funding is requested. Many of the pressure vessel end caps have also been shown to be corroded.

SDP is proposing a significant investment, about **[Redacted Information]**, for replacement of these defective items on the basis of their status only seven years after their installation. We consider that these items should still be in reasonable condition at this stage and should not yet need to be replaced. We consider that the cost should not be passed on to customers, but should be dealt with as a defect, fault or deficiency **[Redacted Information]** contract or other mechanism.

The design and material selection of the items needs to be reviewed by SDP and enhanced to prevent funding requests every six years. We consider that this asset deterioration is a design fault which should either have been remedied by the plant constructor or **[Redacted Information]** which provides a warranty that defects, faults or deficiencies will be remedied by the operator.

Labour and Other Costs

Annual labour and other costs are forecast to continue at an average **[Redacted Information]** per annum, similar to the average in the current price path. There are no evident efficiency targets in the current price path to reflect improved productivity and new technology. The current staffing level comprises an average **[Redacted Information]**in process and O&M roles. With the continuing Water Security Mode, and excluding the impact of the tornado damage, we consider there is scope for efficiencies to be made over time through improved productivity and innovation.

We believe that with the management resources SDP now in place and the likelihood of a prolonged Water Security Mode, there is an opportunity to set and achieve realistic efficiency targets through greater productivity and the application of innovation and new technology. We consider that, in the medium term, with a continuing Water Security Mode, there is potential for efficiency savings. We propose a modest reduction in staffing levels from **[Redacted Information]** to about **[Redacted Information]** FTEs tapered over a five year period. This is equivalent to a 2.5% per annum efficiency over the period from year 2 to 5 in the future price path. We have not found any direct comparisons with other desalination plants of similar size in a non-operational mode.

DWPS

Expenditure to maintain the DWPS is **[Redacted Information]** per annum over the first three years of the future price path which is a similar level as the current period. This is forecast to increase to **[Redacted Information]** per annum in years 4 and 5 linked to the provision of the additional pump. We comment in Section 6 that this capital work should be deferred into a future price path period; there is therefore no need to increase maintenance cost in the future price path. The DWPS maintenance costs are over 25% of the total routine maintenance costs for the whole works.

A separate maintenance contract for the pumping station was signed by SDP and Veolia in 2012. Companies such as SWC have achieved significant efficiencies in maintenance costs over recent years[14]. We consider that these savings should be reflected in the expenditure proposals of maintaining this pumping station. We suggest that the maintenance costs should be no more than 20% of the current total routine maintenance costs. We believe this efficient cost is a more representative and recent market cost for maintaining assets of this type.

Partial Plant Test

[Redacted Information]a summary list of the reasons why **[Redacted Information]**(SDP's consultants) considers a Partial Plant Test justified as follows:

- Build confidence in the restart process;
- Allow for commissioning of overhauled or replaced equipment;
- Allow for testing of membranes against performance specification to ascertain performance; and
- Allow for testing to assure the plant meets its drinking water quality obligations.

We address these issues below:

a) "Build confidence in the restart process"

An eight month process to recommission a plant is the similar to the time allowed for new plant commissioning and performance testing of newly constructed large desalination plants. When a new plant is being commissioned for the first time there are many aspects that delay the commissioning process, including:

- The construction activities are usually not finished on site;
- The plant control treatment philosophy has not been tested;
- The equipment manufacturer's defects are exposed for the first time;

[14] Sydney Water 2016-20 Price Proposal, October 2015

- The plant constructer's defects are exposed for the first time;
- The seawater condition's true range and response to pre-treatment are not well established; and
- The proper chemical dosing set points are not known.

For the full plant restart of the plant should have faster commissioning time for the following reasons:

- The construction activities involving the process should have long finished.
- The plant control philosophy does not need retesting as this was established during the original plant commissioning period and optimized during the two year proving period.
- The plant and equipment original defects should have already been identified and rectified during the proving period.
- The two year proving period provides sufficient data to understand the seawater conditions likely to be experienced on restart and how the pre-treatment plant will respond to those conditions.
- The chemical dosing set points and response ranges for seawater conditions and post-treatment water quality should already be established from the proving period.

Once the RO desalination plant was commissioned and the short performance test carried out, the plant is then handed over by the plant constructer to the operator who operates it in a production mode for a two year defects liability period. During this time many issues with equipment manufacturers defects, and design defects are observed by the operator and rectified usually by the constructor.

Once defects are rectified a higher level of spare parts are often carried by the operator and manufacturers for equipment that has demonstrated manufacturer defect issues to reduce future repair times. The long two year production proving period should ensure that manufacturer defect issues on restart are minimized.

All plant equipment is well maintained and is regularly serviced. The plant mechanical equipment is exercised by hand where recommended and as needed by the manufacturer. Continuing to apply good asset management processes should reduce the risk of any major issues on restart.

According to the **[Redacted Information]**report (plant history section 2.1) the plant was commissioned in six months from January 2010 to June 2010

The full restart of the plant should be far easier and less time consuming than the initial plant commissioning. The eight month allowed restart time is needed to allow for the order, manufacture, delivery and installation of the replacement RO membranes. The remainder of the plant should be able to be recommissioned in a shorter timeframe using the existing old RO membranes.

b) "Allow for commissioning of overhauled or replaced equipment."

Many of the RO major pumps and check valves have been overhauled and replaced, mostly due to corrosion defect related issues. Replaced or overhauled equipment should perform similar to the original plant. These pumps and valves are made from super duplex, these are typically long lead time items, but they should be now in very good condition, better than when they were operating successfully during the two year plant proving period. The pump manufacturer will be on site during the restart of the pumps.

Some equipment such as SCADA software and instrumentation is replaced because of obsolescence.

The pumps, SCADA and other equipment were originally commissioned within a six month time frame. It is reasonable to assume they can be recommissioned in an eight month time frame.

A partial plant test is not justified to allow for recommissioning of overhauled or replacement equipment.

c) "Allow for testing of membranes against performance specification to ascertain performance."

The testing of the membranes against performance specification to ascertain performance, does not need a partial plant test because all the RO membranes can be funded to be replaced for the full restart. This removes concerns about the RO membrane integrity and permeate quality of old RO membranes at the end of their design life. This is further discussed later.

d) "Allow for testing to assure the plant meets its drinking water quality obligations."

The replacement of the all the RO membranes with new RO membranes should ensure that restart risk to the final product water quality specification is minimal. In addition, the plant was operated for a two year proving period during which time the manufacturers and constructer's defects were identified and eliminated. The product water quality was consistently achieved during the two year proving period. Partial plant testing is not justified to assure the plant meets its drinking water obligations.

A key purpose of the Partial Plant Test proposed in SDP's submission is to assess the performance of the existing RO membranes after many years under chemical preservation. The greatest uncertainty with regard to restart performance is the condition of the RO membranes with respect to:

- Salt rejection;
- Permeability; and
- Mechanical integrity (e.g. glue lines).

The condition of the RO membranes themselves cannot be determined without periodic operation of the RO trains. The operator has arranged for a program of autopsies of the RO membranes which provides a very limited assessment of their condition under long term preservation. The latest autopsies are indicating that there is some decline in the membrane salt and boron rejection but this decline is slow. It is however not possible to confidently infer the condition of all the membranes based on the small number of RO membranes that are autopsied.

The proposed full plant restart test has a long period where the production and permeate quality performance of the old existing RO membranes is being assessed. If the restart occurs in the year 2020, SDP has requested the funding of the replacement of 62.8 % of membranes of the existing membranes with the replacement of further 21.6% the first two years of operation.

Using an *ante* Partial Plant Test to assess membrane condition will not remove this membrane replacement funding requirement by SDP. We propose an alternative and efficient option to replace all the RO membranes on full restart instead of two thirds proposed by SDP should be considered. The benefits of this alternative approach are summarised below and discussed in Section 7.1.

1. A Partial Plant Test will not be needed to gain confidence in the RO membrane condition for operation during drought relief saving $17.5m;
2. There will be a full and open competition among the RO membrane suppliers which should deliver lower membrane unit cost and shorten the delivery schedule; with full replacement and lower unit costs, discussed in Section 7.1 the net impact on costs is a saving of **[Redacted Information]** mainly related to the Partial Plant Test; and
3. There will be no need for any further membrane replacement in the Determination period (assuming restart on or after 2020),

Carrying out a Partial Plant Test to provide SDP with confidence in the mechanical and electrical integrity of the plant is not justified for the following reasons:

- The operator ensures that the mechanical, electrical and civil, and safety assets all undergo regular inspection with routine and periodic maintenance which should enable the design lives to be achieved. The mechanical and electrical design life is 25 years, the instrument and control design life is 15 years;

- The plant was fully commissioned and operated for a two year proving period which should have identified and remedied the typical new plant equipment supplier and constructor defects;

- The plant pumps, and actuated valves and major drives are regularly turned by hand except for the high pressure pumps;

- All of the high pressure pumps have been fully refurbished by the supplier, KSB, at its Sydney facility and reinstalled on site. **[Redacted Information]**. The repairs and refurbishment should reduce the vulnerability to below the proving period;

- There may be some vulnerability due to atmospheric corrosion to the plant's motor control panel internals and variable speed drives. However, the plant electrical variable speed drives are regularly inspected, serviced and repaired by the suppliers;

- The plant has a full stand by first pass RO train and full standby second pass RO train available to ensure availability is achieved in the case that equipment failure on a train leads to stopping of a train; and

- When the plant goes for full restart there will be some residual limited vulnerability to mechanical and electrical equipment issues. It should be possible to repair/ refurbish such defective items in an eight month restart period.

We have therefore concluded that the proposal for plant testing in the future price path period is not justified.

Pipeline costs

We have accepted the level of pipeline maintenance costs as efficient and have not made any adjustments.

Efficient plant expenditure for the Water Security Mode

We summarise the efficient operating expenditure for the Water Security Mode in Table 5-8 below. This includes cost adjustments for exclusion of permeate hose replacement costs and transfer of periodic maintenance to capital, adjustments to the DWPS charge and labour, and removal of the plant capacity test costs.

Table 5-8 Efficient Operating Expenditure Water Security Mode

SDP EFFICIENT OPERATING EXPENDITURE: FUTURE PRICE PATH: WATER SECURITY MODE						
($m 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
SDP proposals						
Total Corporate $m (as Table 5-6)	7.94	7.88	7.82	8.00	7.94	39.58
Total Plant Expenditure $m						
Efficiency Adjustments to SDP proposals						
Transfer PM to capex						
DWPS charges (excl insurance)						
Labour and other fixed costs						
Plant capacity test	0.00	0.00	0.00	-8.76	-8.76	-17.51
Efficient plant costs						
SDP Proposals - Pipeline						
Total Fixed Pipeline Costs	0.31	0.32	0.32	0.32	0.32	1.59
Efficient Electricity Usage (MWh)						
SDP Proposals						
Atkins proposals	5000	5000	5000	5000	5000	
Adjustment to efficient electricity usage	0	0	0	0	0	
TOTAL EXPENDITURE excluding electricity						
Total $m						

Source: Atkins Cardno assumptions

We have made no adjustment for a Leap Year in 2020 as the adjustments above are based on the SDP proposals.

The adjustments to future plant operating costs gives an average expenditure of **[Redacted Information]** per annum which is similar to the average of the years two to five of the current price path. Year one is not considered as typical expenditure. This expenditure profile is consistent with the view of a continuing Water Security Mode with no production and the main measure of maintaining the assets applying good industry practice.

The efficient expenditure for the Water Security Mode in the future price path is summarised in Table 5-9.

Table 5-9 Future Price Path Efficient Expenditure Water Security Mode

SDP EFFICIENT OPERATING EXPENDITURE: FUTURE PRICE PATH: WATER SECURITY MODE						
($m 2016/17) year ending June	2018	2019	2020	2021	2022	Total
Efficient expenditure						
Corporate	7.94	7.88	7.82	8.00	7.94	39.58
Plant						
Pipeline	0.31	0.32	0.32	0.32	0.32	1.59
Efficient Electricity Usage (MWh)						
SDP Proposals						
Atkins proposals	5000	5000	5000	5000	5000	
Adjustment to efficient electricity usage	0	0	0	0	0	
TOTAL EXPENDITURE excluding electricity						
Total $m						

Source: Atkins Cardno analysis

5.3.3. Restart Mode

SDP propose the total costs for the Restart Mode for a restart in any one year in Table 6.6 of Appendix 6 of its submission. These are summarised in Table 5-10 below. The costs are derived from SDP's contract with its operator.

Table 5-10 Future Price Path SDP Proposed Expenditure Restart Mode

SDP OPERATING EXPENDITURE: FUTURE PRICE PATH: RESTART MODE					
($m 2016/17) year ending June	2018	2019	2020	2021	2022
O&M and asset replacement in any one year					
Pipeline recommissioning	0.59	0.59	0.59	0.59	0.59
Membranes	19.76	20.89	21.86	22.72	23.47
Labour and fixed costs					
Total costs					
Electricity in any one year					
Units assumed MWh					
Cost	see Marston Jacobs Report				
Total Electricity cost					
Total Expenditure excluding electricity					
Total $m					

Source: SDP submission appendix 6 table 6.6

The Restart Mode is assumed to be eight months to give time for existing plant testing, adjustments to refurbished equipment, membrane purchases, installation and full renewed membrane plant testing. We have examined the basis of the eight month period and found this to be appropriate on the basis of full membrane replacement which we discuss in Section 7.1. During the Restart process, potable water will be produced although under current regulatory rules, SDP is not able to charge SWC. As a result, potable water is likely to be discharged to sea; not an efficient process at a time of water restrictions across Sydney.

We suggest that SDP should be incentivised to produce water through this Restart period. Assuming a ramp up from zero after four months to full output by the end of month eight, there is potential for an output of 15 GL over the period. While currently SDP would not receive any income from water sales, it is paid for restarting the plan and it would appear efficient to supply potable water to customers who pay for the Restart.

The cost variance across any year of restart is related to the membrane replacement with numbers derived from the operator's replacement model. We explain in Section 5.3.6 why we propose that expenditure on membrane replacement should be capitalised. We comment on the number and cost of membrane replacement in Section 7.1.

Power

The estimated electricity consumed in the Restart Mode is shown in Table 5-9. The total power consumed during the restart period is calculated by Veolia for SDP[15] as **[Redacted Information]**under which a full restart could be completed within 126 days if the existing membranes were suitable for reuse. Our estimate of the power demand, from a bottom-up estimate of the power requirement assuming the same time line, is 63,000 MWh. Our value includes power for the drinking water pump station which SDP's figure excludes.

Our proposal for the full replacement of the RO membranes during the Restart Mode, discussed in Section 7.1, would extend the restart period. In this extended period, there will be fixed energy users - air conditioning, SCADA, UPS, control - and for the intake and pre-treatment plant. The overall running time of the high pressure trains is assumed to be the same. Our estimate of efficient power consumption is 71,000 MWh for the complete Restart Mode, including the DWPS assuming an 8 month restart period,

Electricity costs are provided separately by Marsden Jacob, based on our finding on efficient power use, and are excluded from our review of efficient expenditure.

Labour and Fixed Costs

The labour and fixed costs are assumed to occur over an eight month period. A breakdown of the labour and fixed costs has not been provided for the Restart Mode. We have assumed that the **[Redacted Information]** covers the same items as listed in SDP's submission for the partial restart costs. This includes for

- Additional operational staff $ **[Redacted Information]**
- Chemicals $ **[Redacted Information]**
- Waste Disposal $ **[Redacted Information]**
- Analysis $ **[Redacted Information]**
- Consumables $ **[Redacted Information]**
- Marine intake and outfall opening $**[Redacted Information]**

We have been provided with details of the breakdown of the costs for each of these items. They appear reasonable with the reservation on chemical usage and costs. The above list sums to **[Redacted Information]**. The total figure requested in the submission for restart labour and fixed costs in Table 5.9 is **[Redacted Information]**.

The labour cost is derived from SDP's contract with the operator. This is an average of **[Redacted Information]**m/month over eight months compared with **[Redacted Information]**/month for Water Security Mode and **[Redacted Information]**/month for Full Operating Mode.

This level of expenditure appears reasonable, given the need to increase staff over this period with associated training for operations and maintenance. However, there appears to be no incentive to be efficient through improved productivity and innovation. We therefore suggest that efficiency targets should be agreed with the operator with savings from efficiency initiatives shared with customers. This could work through the EfAM process.

Chemicals

The chemical costs comprise **[Redacted Information]** of the Restart costs. The chemicals required will be those associated with RO plant pre-treatment, anti-scalant, second pass pH increase, and treatment testing. Apart from testing of the treatment plant, further treatment chemicals are only required if water is delivered to SWC during the restart process.

The existing RO membranes were all CIP cleaned before being preservation began. The CIP plant mechanical and electrical defects was supposed to have been carried out during the proving period. The plant can be sufficiently tested with RO permeate for control and automation. There is little value in carrying out actual chemical CIPs during the testing period, when new membranes are to be provided. Our assumption set out

[15] Workbook Restart Time line.xslx under the tab " Restart all OK, Veolia

in Section 7.1 is that all membranes will be replaced on Restart. There should therefore be no need for the any RO CIP chemicals in the restart period.

The estimated volumes of chemicals need for a restart are understood to be provided in SDP document '*Capacity Restart Timeline*'[16]. The unit cost of each of the chemicals has increased by between 30 and 200% from the June 2007 unit costs provided in **[Redacted Information]**contract, depending on the chemicals selected. We have not made any adjustment to chemical usage assumptions. We have applied a procurement efficiency of 5% as also applied to the Full Operational Mode as the two are intricately linked and should provide economies of scale.

The chemical prices used in the SDP submission were provided by the Operator. These are reported by SDP to be real NSW chemical prices as at 18 July 2016 using the Operator's claimed to be competitive procurement process and compared to other NSW based Operator run sites. The Operator has extensive experience in operating water treatment plants across Australia and other parts of the world and therefore is well-placed to negotiate competitive chemical prices, where possible.

Atkins believes that an operator with this scale of operation in Australia and worldwide should be able negotiate significant discounts based on economies of scale. Buying challenge discounts, usage efficiency and the lack of need for CIP chemicals at restart justifies the use of a cost efficiency challenge of 5% for chemical expenditure.

Efficient Expenditure

We summarise proposed efficient operating expenditure and power use in Table 5-11.

Table 5-11 Efficient expenditure and power use Restart Mode

SDP EFFICIENT OPERATING EXPENDITURE: RESTART MODE						
($m 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**	
O&M and asset replacement in any one year						
SDP Proposed expenditure less electricity	[redacted]					
Capitalise membranes	-19.76	-20.89	-21.86	-22.72	-23.47	to capex
Adjust chemical costs	[redacted]					
Efficient expenditure excluding power costs	6.87	6.87	6.87	6.87	6.87	
Electricity usage (MWh)						
SDP Proposed power use	[redacted]					
Adjustment to power use	[redacted]					
Efficient Power use (MWh)	71,000	71,000	71,000	71,000	71,000	

Source: SDP submission appendix 6 table 6.6

5.3.4. Full Operating Mode

SDP propose the total costs for the Full Operating Mode for any one year in Table 6.6 of Appendix 6 of its submission. These are summarised in Table 5-12 below. The costs are derived from SDP's contract with its operator. Expenditure is grouped by Corporate, fixed plant costs and variable costs.

[16] "Capacity restart test costs for SDP from Veolia (00036684xCE34F).xlsx" , sheet "Opt 2", lines 24 to 43.

Table 5-12 Future Price Path Proposed Expenditure Full Operating Mode

SDP OPERATING EXPENDITURE: FUTURE PRICE PATH: FULL OPERATION MODE						
($m 2016/17) year ending June	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
SDP Proposals - Corporate						
Total Corporate $m	9.06	8.95	9.21	9.49	9.48	46.19
SDP Proposals - Plant Fixed Costs						
Routine asset maintenance	[redacted]					
Periodic maintenance						
DWPS charges (excl insurance)						
Labour and other fixed costs						
Insurance						
Plant capacity test						
Membrane replacement						
Safety incentives and standby						
Total fixed plant costs $m						
SDP Proposals - Plant Electricity Fixed Costs						
Electricity usage costs	[redacted]					
RECs costs						
Total fixed plant costs $m						
SDP Proposals - Plant Variable Units						
Water production ML/d	250	250	250	250	250	
Chemical Usage (tonnes)	[redacted]					
Electricity usage MWh						
SDP Proposals - Plant Variable Costs						
Chemical costs	[redacted]					
Electricity costs						
RECs costs						
Total Variable Costs $m						
SDP Proposals - Pipeline						
Total Fixed Pipeline costs $m	0.31	0.32	0.32	0.32	0.32	1.59
TOTAL EXPENDITURE						
Total $m	96.23	96.22	96.25	96.70	96.95	482.36

Source: SDP Submission and SIR opex model

These expenditures relate to the year of operation although this variance between years, and whether a year is a leap year is not material. In practice, a pro-rata daily rate would be applied based on the defined start and close-down dates. As these variances across all five years are small, we suggest that an average is taken for any one year in the future price path. The duration of the Full Operating Mode is likely to be six months as a minimum and given the water resource modelling, is unlikely to operate for longer than one two years during the 2017 determination period.

We have compared costs for year 2019-2020 in the Full Operation Mode compared with the Water Security Mode using data from the SIR. Corporate fixed costs increase by $0.85m per annum. SDP explained that an increase in remuneration of **[Redacted Information]** relates to additional staff to manage the interface with SWC and the increase in business activity. Insurance costs increase by **[Redacted Information]** per annum and other corporate costs of **[Redacted Information]** per annum.

Plant fixed costs are shown to increase by **[Redacted Information]** and attributable to **[Redacted Information]**additional labour costs and **[Redacted Information]** membrane replacement costs. Electricity fixed costs increase by **[Redacted Information]** per annum.

Variable costs include chemicals including sludge transportation and disposal and consumables such as cartridge filters,

Additional Insurance costs

These are addressed separately in the insurance review report.

Labour and fixed costs

Labour costs increase to **[Redacted Information]**/month compared with **[Redacted Information]**/month in Water Security Mode and **[Redacted Information]**/month in Restart Mode. The Full Operation Mode will require 24-hour working in three shifts. We compared manpower levels with desalination plants of similar design and output operating at full capacity. We concluded that the SDP level of manpower and expenditure is reasonable given the need to have three shifts and standby maintenance because of the risk of reduced output.

Periodic Maintenance

We are proposing to capitalise this expenditure which we discuss in section 5.3.6 below.

Membrane Replacement

We are proposing to capitalise this expenditure which we discuss in section 5.3.6.below. Our proposals for the full membrane replacement in restart Mode, further replacement in years 1 and 2 is not likely.

Chemical usage and costs

SDP assumes **[Redacted Information]**per annum for the plant in Full Operation and delivering 250 ML/d of potable water to SWC.

The main chemicals used by the desalination plant are:

- Sodium Hypochlorite used to control marine fouling and for post treatment;
- Ferric Chloride and polyDadmac used as coagulants/flocculent for the dual media filter pre-treatment;
- Sulphuric Acid used to lower the pH to enhance coagulation for the dual media filtration;
- Sodium metabisulfite (SMBS) used to dechlorinate the feed to the RO and for CIPs;
- Antiscalant, used to prevent scale on the RO first and second pass membranes;
- Sodium Hydroxide , used in the second RO pass to enhance Boron removal and used in CIP cleaning;
- Hydrate Lime and carbon dioxide, used to add alkalinity to the RO permeated;
- Sodium Silicate, Ammonia, and Fluorosilic acid, all used for water treatment;
- Polymers used for wastewater thickening and sludge dewatering;
- Hydrochloric acid, Citric Acid, and surfactants used for RO membrane cleaning CIP; and
- Hydrochloric acid, Sodium Hydroxide, and Sodium Hypochlorite used for neutralisation of CIP.

We have reviewed the chemical usage based on an average 250 ML/d annual production. We have assumed chemical usage figures based on the actual chemicals needed to achieve the product water quality standard during the two year proving period of June 2010 to June 2012. The chemical needed for CIP are based on the assumption that the first pass membranes would be CIP cleaned every three months and the second pass membranes would be CIP Cleaned once per year.

We have taken the unit cost of chemicals from the data presented by SDP for the Partial Plant Test restart. The chemical unit costs appear to be between 30 and 200% greater than the 2007 figures used in the O&M contract. The analysis gives a total estimated chemical costs as detailed in Table 5-13 and Table 5-14 below.

Table 5-13 Future Price Path Chemical Use and Pre-efficiency Costs

FUTURE PRICE PATH: FULL OPERATION MODE - CHEMICAL USE AND COSTS						
Chemical Name	Chemical Purity %	Chemical Dose @ 100% mg/l	Total Annual Consumption Tonnes	2016 Unit Cost Delivered $/tonne	2016 Delivered Cost $m	Unit Cost increase %
[redacted]						
Total $m					[redacted]	

Source: Atkins analysis based on actual usage' unit cost increase relates to the 2007 base.

Table 5-14 Future Price Path CIP Chemical Use and Pre-efficiency Costs

FUTURE PRICE PATH: FULL OPERATION MODE - CIP CHEMICAL USE AND COSTS							
CIP Chemicals	Chemical Purity %	Use Per CIP as delivered tonnes/CIP	No 1st pass CIPs	No 2nd Pass CIPS	Total Annual Consumption Tonnes	2016 Unit Cost Delivered $/tonne	2016 Delivered Cost $m
[redacted]							
Total $m							[redacted]

Source: Atkins analysis based on actual usage

The dosing of sodium hydroxide to the second pass to enhance boron removal has been included. However with the new RO membranes it is likely that the boron target can be achieved with no use of the sodium hydroxide to the second RO pass as was demonstrated during period March 2011 to June 2012. We have therefore assumed half of this chemical usage giving a $0.62m efficiency saving.

Cartridge Filters

No information was provided in the monthly reports with regards to the historical recorded cartridge filter replacement. An estimate of the cost is provided in Table 5-15 below.

Table 5-15 Cartridge Filter Pre-efficiency Costs

FUTURE PRICE PATH: FULL OPERATION MODE - CARTRIDGE FILTER COSTS			
Component	**Size**	**Units**	**Notes, source**
Cartridge filters on seawater feed to the RO			
Changes per year			
Filter elements for RO feed			
CIP cartridge filters on CIP circuit			
Cartridge filter elements for the CIP system			
Total Cartridge Filter elements			
Unit Cost inc disposal			
Total Cost			

Source: Atkins analysis based on actual usage

Sludge Disposal

An estimate of the (iron rich) sludge production has been established based on data in the monthly reports for the two year proving period. Table 5-16 below provides an estimate of these costs. The unit cost for transport and disposal of sludge cake seems to be high. It is assumed that the lime sludge will continue to be beneficially re-used without added cost for disposal as was the case for the two year proving period.

Table 5-16 Ferric Sludge Disposal Pre-efficiency Costs

FUTURE PRICE PATH: FULL OPERATION MODE - FERRIC SLUDGE DISPOSAL			
Component	**Size**	**Units**	**Notes, source**
Total sludge to landfill during proving period			
Total Water produced			Operator Monthly reports supplied by SDP, 2 year proving period
Average ferric sludge production			Wet cake
Annual average sludge production			
Safety factor to allow variation in sea conditions			
Total ferric sludge quantity			
Disposal cost unit			
Cost of sludge disposal			
Notes: Post treatment lime sludge is assumed to be beneficially resused at no cost to operator as was the case for proving period. Only pretreatment ferric sludges go to land fill after centrifuge dewatering to a cake.			

Source: Atkins analysis based on actual usage

These tables show an annual chemical cost of $11.88m, comprising $10.56m for production chemicals and $1.32m for CIP chemicals. We then consider the current cost of chemicals though open procurement and apply an efficiency factor. We consider that a 5% saving through competitive procurement processes can be achieved based on our recent review of SWC's efficient historic and future expenditure[17]. We consider that the plant operator has sufficient purchasing power from its extensive operations.

In Summary, we find that an efficient cost for chemical use is

- Chemical use from 2010 to 2012 operations using unit costs inflated to $2016: $11.88m per annum;

[17] SWC Expenditure Review Final Report, Atkins Cardno, December 2015

- Less use of sodium hydroxide for boron removal: -$0.62m per annum;
- Include cartridge filters and sludge treatment chemicals $2.96m;
- Less procurement efficiency at 5%: -$1.11m per annum; giving
- Efficient chemical costs: $13.51m per annum.

We consider that this still provides flexibility to the operator and reasonable incentive for the operator to be efficient with the use of chemicals.

Electricity demand

SDP is proposing energy usage of **[Redacted Information]** per annum[18] equivalent to **[Redacted Information]** of potable water produced.

The plant was operated for two years of the proving period ending on the last day of June 2012. The operator monthly reports[19] provide the full power used by the plant and the water exported to SWC in the month. The total power figure includes power used by the product water pump station. For the period July 2010 to June 2012 inclusive the average specific electrical power required to deliver each m^3 of the product water was **[Redacted Information]** kWh/m^3. During the period from Jan 2011 to November 2011, each month had average daily export production exceeding 228 ML/d, the specific energy consumption was always less than **[Redacted Information]** kWh for each month.

Our estimate is based on several assumptions: using the plant pump curves, RO projections and with the drive list, that for the plant operating at 30% bypass of the first pass permeate, and seawater TDS of less than 36,000 mg/l. This gives an average specific power requirement less than 3.34 kWh/m^3.

We consider that an efficient power consumption based on the 3.6 kWh/m^3 of exported water should be set. This is a **[Redacted Information]** reduction on assumed usage. This should be an achievable target based on the actual plant operating records. This gives an annual energy use of 328,500 MWh per year.

Electricity costs

Electricity costs are provided separately by Marsden Jacob, based on our finding on efficient power use, and are excluded from our review of efficient expenditure.

Efficient Expenditure

We summarise the outcome of our efficient cost adjustments in Table 5-17 below.

[18] SIR Opex model worksheet assumptions F94, SDP

Table 5-17 Efficient Expenditure Full Operation Mode

SDP EFFICIENT OPERATING EXPENDITURE: FULL OPERATION MODE						
($m 2016/17) year ending June	2018	2019	2020	2021	2022	Total
Efficiency Corporate Expenditure						
Efficient Corporate	8.79	8.73	8.67	8.86	8.79	43.85
Efficiency Adjustments to SDP proposals						
SDP Total Plant Expenditure (ex electy) $m						
Capitalise periodic maintenance						
Capitalise membrane replacement						
DWPS charges (excl insurance)						
Efficient Fixed Plant						
Efficient Expenditure - Pipeline						
Total Fixed Pipeline	0.31	0.32	0.32	0.32	0.32	1.59
Water production ML/d						
Water production ML/d	250	250	250	250	250	
Variable inputs: Chemical Usage and costs and efficient costs						
SDP chemical usage (tonnes)						
Efficient chemical usage						
Efficient chemical costs	13.51	13.51	13.51	13.51	13.51	
Fixed inputs: Efficient electricity usage (MWh)						
SDP Electricity usage fixed						
Adjust for efficient operation						
Efficient fixed electricity usage MWh	7665	7665	7665	7665	7665	
Variable inputs: Efficient electricity usage (MWh)						
SDP Electricity usage variable						
Adjust for efficient operation						
Efficient variable electricity usage MWh	320835	320835	320835	320835	320835	
Total Efficient Expenditure (excluding electricity and related costs)						
Total $m (excluding electricity)						

Source: Atkins Cardno analysis

These expenditures relate to the year of operation although this variance between years, and whether a year is a leap year is not material. In practice, a pro-rata daily rate would be applied based on the defined start and close-down dates. As these variances across all five years are small, we suggest that an average is taken for any one year in the future price path.

Table 5-17 presents the efficient operating expenditure for any year in the future price path. In practice, the plant is most unlikely to be Full Operation Mode in the first three years of the period because of the current level of storage in the Greater Sydney catchment impounding reservoirs and the ongoing repairs to the plant after the December 2015 tornado damage. In addition, the Full Operation Mode is unlikely to continue for more than two consecutive years during the 2017 determination period.

5.3.5. Shutdown mode

SDP's proposed expenditure for transition to Water Security Mode is summarised in Table 6.9 of Appendix A of its submission. This is summarised in Table 5-18 below. This expenditure is derived from the O&M contract although there is little supporting information available to detail the activities and costs. We discuss in Section 3 that any transition from Full Operation Mode is likely to be to the Water Security Mode. **[Redacted Information]** transition to be completed within eight weeks.

Table 5-18 SDP Proposals for Transition to a Water Security Shutdown

SDP OPERATING EXPENDITURE: SHUTDOWN TRANSITION TO WATER SECURITY MODE					
($m 2016/17) year ending June	2018	2019	2020	2021	2022
O&M and asset replacement in any one year					
Operation and Maintenance Plant	[redacted]				
Operation and Maintenance Pipeline					
Energy costs					
Other Operating Costs					
Total costs	1.69	1.69	1.69	1.69	1.69

Source: SDP Submission Appendix 6 Table 6.9

The shutdown mode is a transition after Full Operation for the preparation to enter the Water Security Mode. During the shutdown time some of the activities will include:

- All the RO trains are flushed and CIP cleaned and filled with preservative SBS solution;
- The RO feed pumps and energy recovery system are all flushed with water and drained;
- The post-treatment plant is flushed with water, drained, and cleaned;
- The pre-treatment plant is flushed with water, and drained;
- Wastewater plant is flushed with water and drained;
- Used chemicals returned to suppliers where possible; and
- The intake and outfall are capped in the sea.

The precedence for the transition to shutdown mode is the period between July 2012 and January 2013, when the plant when from Full Operation to Water Security Mode. The transition took longer than defined in the contract. The plant intake and outfalls were capped after four months.

The input costs are related to electricity, chemicals and labour. We estimated that costs for an eight week transitional period including the tasks above would be similar to SDP's costs presented in Table 5-18. We have therefore deemed these costs to be efficient and have made no adjustments.

5.3.6. Capitalisation of periodic maintenance and membranes

SDP states that it capitalises expenditure consistent with Australian Accounting Standards Board (AASB) 116[20]. Articles 7 and 8 of this standard imply that costs should be recognised as an asset if they generate benefits over more than one year.

SDP's price submission treats membrane replacement and periodic maintenance as operating expenditure. This is consistent with the 2012 Determination. However, our interpretation of the definition of capital expenditure is that it relates to expenditure which is expected to generate benefits over more than year (see box below for example).

[20] [20] 'Australian Accounting Standard AASB 116 Property, Plant and Equipment

Definition of capital assets

In response to our question about capitalisation policy, SDP stated that it capitalises consistent with Australian Accounting Standards Board (AASB) 116. Articles 7 and 8 of this standard imply that costs should be recognised as an asset if they generate benefits over more than one year, as demonstrated by the excerpt below:

> *7 The cost of an item of property, plant and equipment shall be recognised as an asset if, and only if:*
>
> *(a) it is probable that **future economic benefits** associated with the item will flow to the entity; and*
>
> *(b) the cost of the item can be measured reliably.*
>
> *8 Spare parts and servicing equipment are usually carried as inventory and recognised in profit or loss as consumed. However, major spare parts and stand-by equipment qualify as property, plant and equipment when an entity expects to use them during **more than one period**...*[1]

We therefore consider that the following expenditures should be treated as capital rather than operating expenditure.

(i) Periodic maintenance. We have reviewed the proposed periodic maintenance expenditure over the next price path period. It is clear from this, **[Redacted Information]**, that, unlike routine asset maintenance, periodic maintenance expenditure relates to significant expenditures involving replacement, renewal and/or refurbishment of items which are proposed to take place on a cycle of multiple years. The inclusion of a *de-minimus* threshold also reinforces the fact that it relates only to significant non-routine maintenance work and therefore the appropriateness of classifying periodic maintenance as capex.

(ii) Membrane replacement. Membranes have a warranted life of up to eight years in full operation. Thus they clearly provide benefits over a number of years and should not be treated as operational consumables.

We consider that capitalisation of membrane replacement is preferable to a cost pass-through mechanism as setting a prudent and efficient capex allowance *ex-ante* provides a strong efficiency incentive to SDP without requiring the detailed hands-on regulation associated with administering a significant cost pass-through item.

Our experience of cost pass-through is that it has been applied where a regulated entity is exposed to items or areas of expenditure which are uncertain and where it has no control over the likely costs so there is little potential to drive efficiencies. We consider that SDP has significant influence on membrane replacement expenditure and should therefore be incentivised to spend prudently and efficiently without allocating adverse cost-risk wholly to SDP's customers through a cost-pass through mechanism.

5.4. Efficient Energy Use

Table 5-17 provides a summary of the power demand by mode of operation as proposed by SDP and as suggested by Atkins.

The power consumed by a desalination plant is predicable based on the pressures obtained from the membrane projection software, pump curves, the plant motor list and the pressure RO software.

In Full Operation Mode and with new membranes, the RO feed pumps are oversized with regards to the actual pressure required and significant pressure energy is required to be lost across the RO train pump high pressure discharge valve. Despite the over sizing of the RO feed pumps the plant should be able to achieve a specific energy consumption of 3.6 kWh/ m^3 of water delivered into the network.

Table 5-19 Summary of the Power Demand by Mode of Operation

FUTURE PRICE PATH: POWER DEMAND		
Annual Power in MWh (365 days)	**Any year 2018 to 2022**	**Profile**
Water Security Mode		
Power demand fixed	5000	[redacted]
Demand variable	0	
Restart Mode		
SDP Proposed	[redacted]	
Atkins Cardno efficient level	71000	
Full Operation Mode Fixed		
SDP Proposed	[redacted]	
Atkins Cardno efficient level	7,665	
Full Operation Mode Variable		
SDP Proposed	[redacted]	
Atkins Cardno efficient level	320,835	
Total Atkins Cardno efficient level	**328500**	
Note: year 2020 is a leap year so annual power demand is adjusted 366 days		

Source: SDP SIR Submission and Atkins Cardno estimates

The power demands relate to any year of operation and whether a year is a leap year is not material. In practice, a pro-rata daily usage rate would be applied based on the defined start and close-down dates. As these variances across all five years are small, we suggest that an average is taken for any one year in the future price path.

5.5. Findings on Efficient Expenditure

SDP has assumed that as the current operator's costs were market tested nearly ten years ago they remain competitive now. Our view is that the market has changed, productivity has improved, new technologies are emerging, more effective procurement processes are now in place and the prolonged water security status affects the optimal level of operational activity.

In setting efficiency targets for the future price period we are mindful that there were no apparent efficiencies built into the forecast expenditures that can be shared with customers, nor any plans by SDP management to drive efficiencies through the business. We found that SDP's management could do more to drive efficiencies in the operating contract, through negotiation of efficiency targets, and managing its own costs.

SDP commented that a reduction in charges is being proposed although this is mainly attributable to market-driven reductions in the cost of debt and debt management which is outside the scope of our efficiency review. Operating experience has shown that a lower level of electricity use can be assumed for the Water Security Mode.

SDP further commented that

[Redacted Information]

SDP added that

> **[Redacted Information]**
>
> *Technology improvements - this would require some upfront investment which SDP is not seeking in this price path. Investment in new technologies (eg retrofitting parts of the plant to reduce costs) would only generate cost reductions when SDP operates there they will only be warranted when SDP is likely to be operating for long enough to justify the capital investment.*
>
> *More effective procurement processes – SDP is unaware of any significant advancements in procurement*

processes that are superior to an open competitive process

While productivity may be included within the contract and there are performance incentives, these are not reflected in efficiency savings that may be passed to customers. The EfAM process has not been pursued in earnest. We suggest that EfAM should be applied with greater management focus. We have therefore built in some efficiency targets that SDP should achieve and indeed could out-perform through focused management action either by negotiating efficiency targets with the contractor or setting internal targets on their own costs. With the appointment of a dedicated Chief Operating Officer, we consider that SDP's management team has the capacity and experience to deliver these efficiencies.

[Redacted Information]

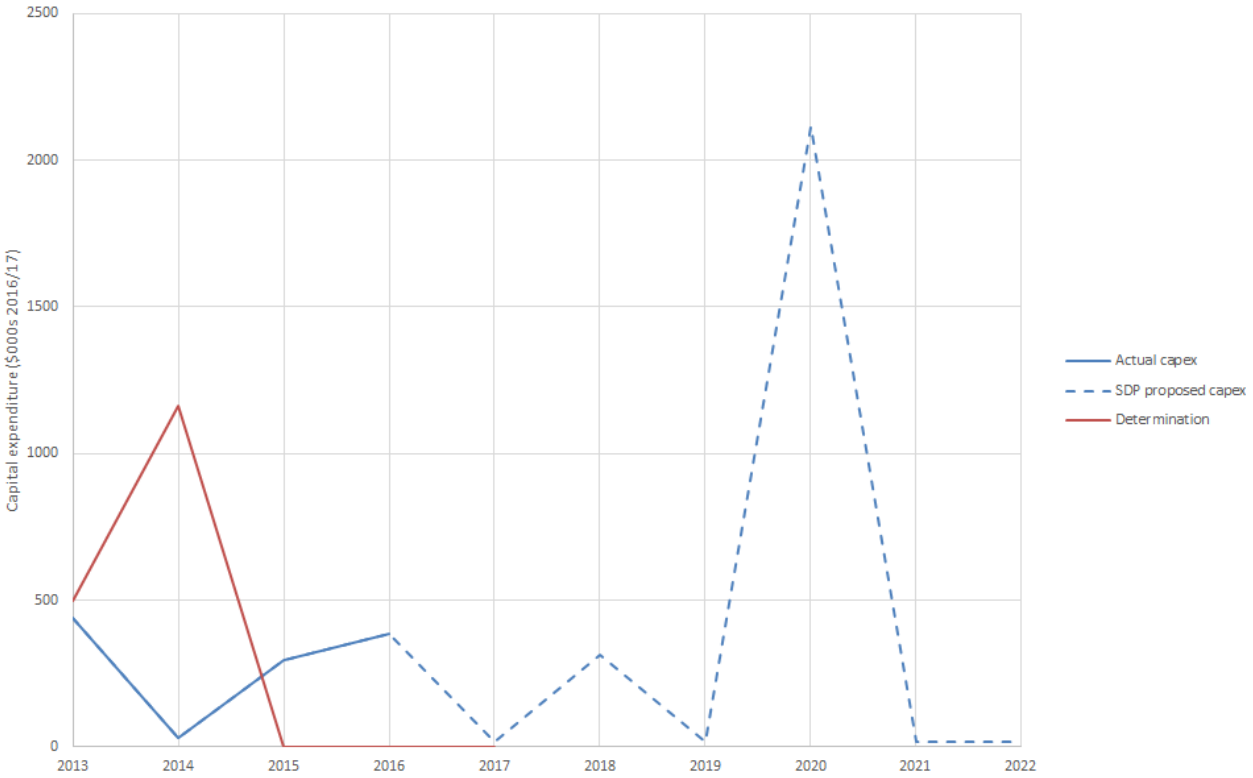
6. Task 3.2: Capital Expenditure

This section presents the results of our review of the prudence and efficiency of SDP's capital expenditure.

6.1. Overview

Capital expenditure is low relative to operating expenditure and SDP is proposing that it remains relatively low, with the additional DWPS pump in 2019/20 being the only significant capex item proposed in the next price path.

Figure 6-1 Total Capital Expenditure 2012-2013 to 2021-2022 (2016-17 prices)- excluding insurance-funded expenditure and periodic maintenance



Source: SDP Information Return 2016, IPART 2012 Determination and Atkins/Cardno analysis

The reclassification of future periodic maintenance as capital expenditure, as discussed in Section 5.3.6, would significantly increase capex levels. For context, the proposed periodic maintenance spend over the next price path is approximately 0.3% per annum relative to the opening plant RAB[21]. No membrane replacement is incorporated in SDP's projections for the next price path period.

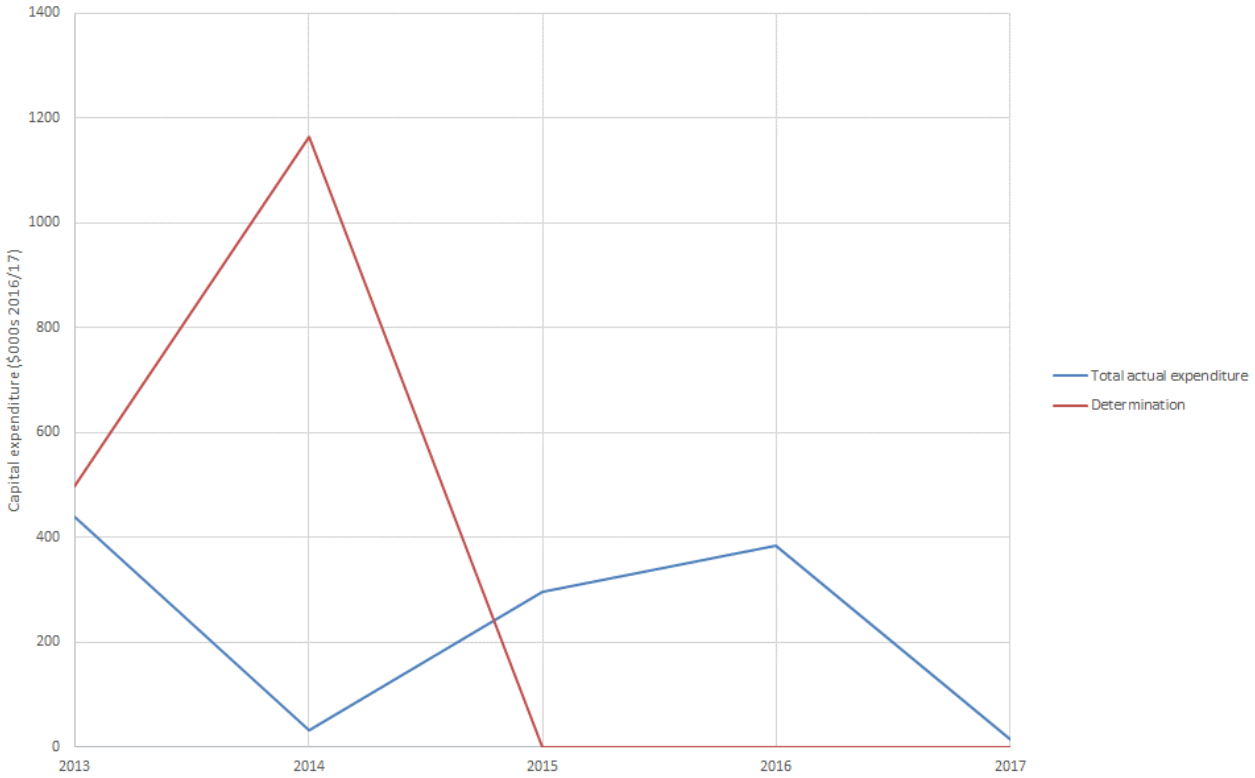
6.2. Expenditure in the current price path

The expenditure in the current price path is projected to be just under $1.2m, nearly $0.5m less than the Determination allowance of $1.7m (all in 2016/17 prices).

These figures do not include any works carried out as a result of the tornado damage, which SDP is not proposing to add to its RAB because of the ongoing insurance claim.

[21] SDP proposed opening RAB value of $1,207.51 for the plant, Table 5.10 of the Proposal

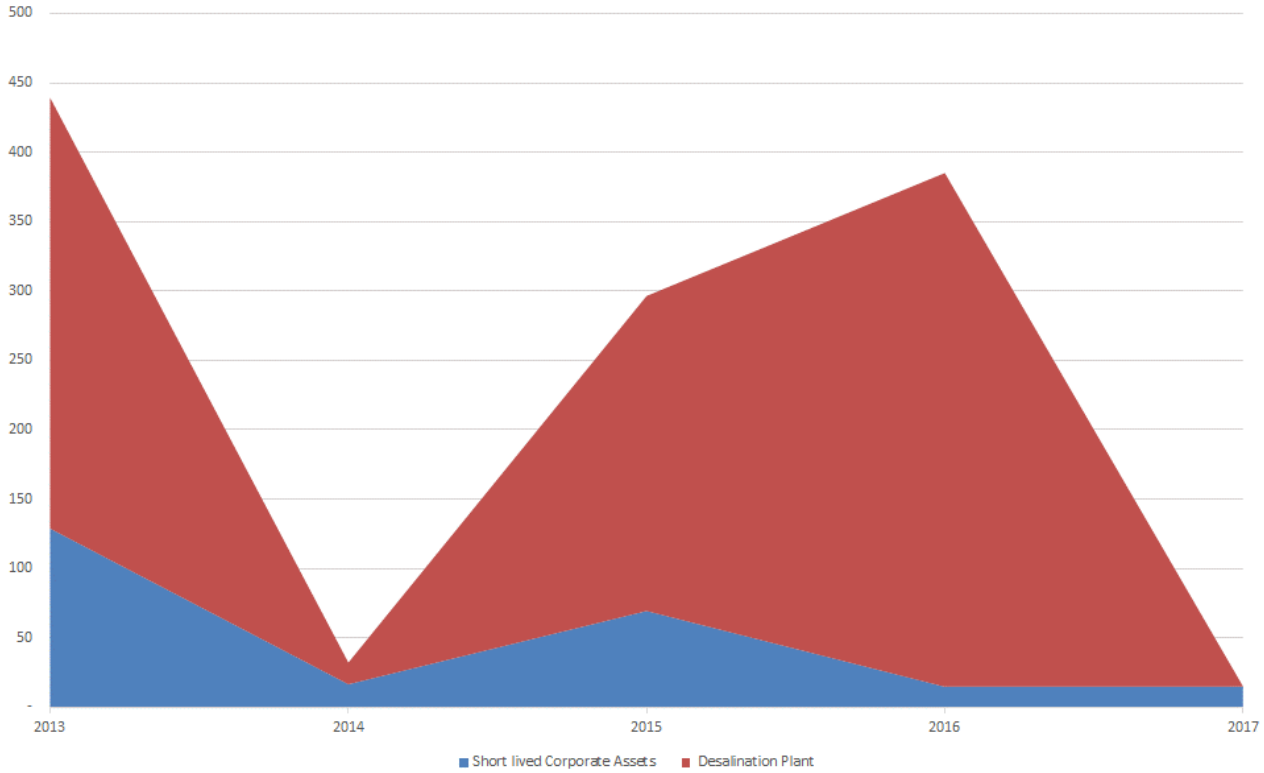
Figure 6-2 Total Capital Expenditure in the current price path (2016-17 prices)- excluding insurance-funded expenditure



Source: SDP Information Return 2016, IPART 2012 Determination and Atkins/Cardno analysis

As can be seen below, most of the expenditure in the current price path has been assigned to the "desalination plant" asset class. This expenditure relates to the replacement of the backup electricity supply which was required because Ausgrid made the pre-existing 33kV back-up connection redundant. The works were carried out by Veolia as primary constructor on behalf of SDP. The 2012 Determination allowed $1.5M ($1.7M in 2016/17 prices) for the backup electricity works. The outturn cost was just over $0.9 ($ 2016/17): an underspend of $0.7M after rounding.

Figure 6-3 Total Capital Expenditure in the current price path (2016-17 prices)- excluding insurance funded expenditure



Source: SDP SIR 2016, IPART 2012 Determination and Atkins/Cardno analysis

Expenditure on corporate assets over the current price path was $0.2M. This consists of items such as IT hardware and development of a new website.

There was no capital expenditure in the current price path on pipeline assets.

We consider that the capital expenditure in the current price path is prudent and efficient and have therefore made no adjustments to the level of capital expenditure reported by SDP as summarised in Table 6-1 below.

Table 6-1 Atkins/Cardno recommended capex in the current price path

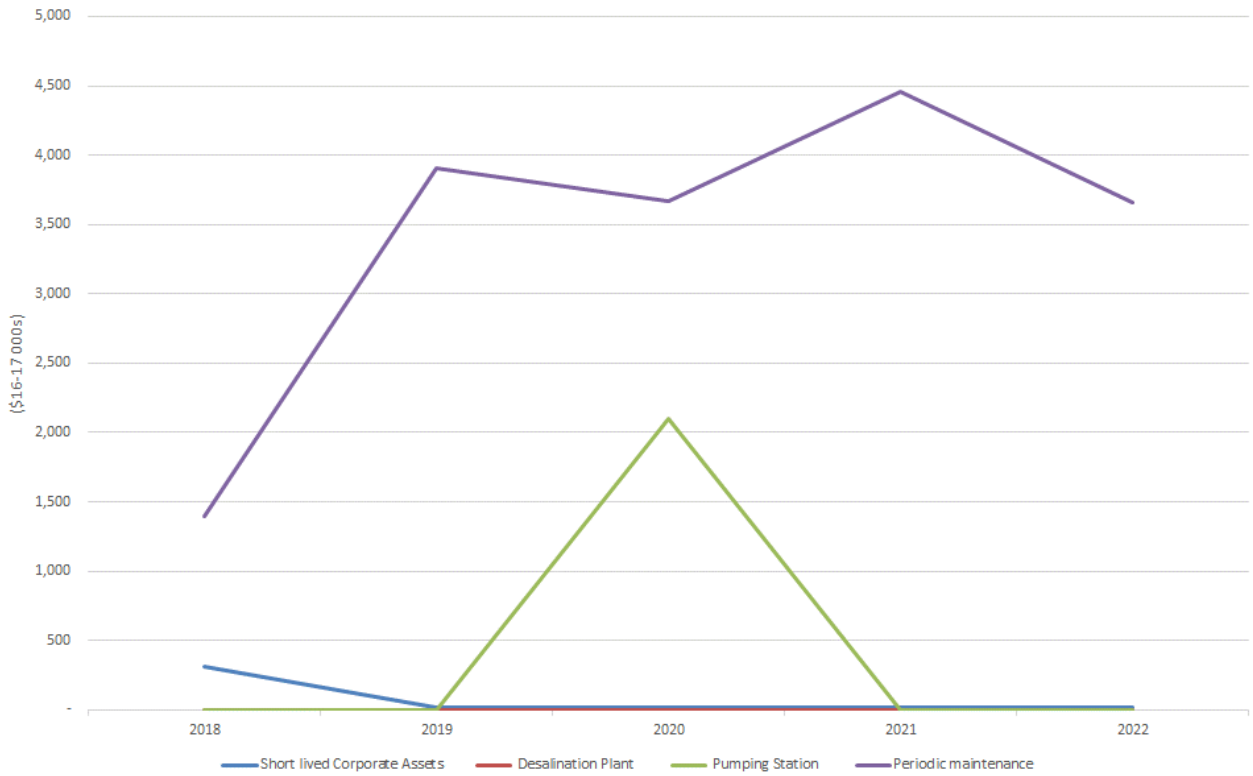
SDP CAPITAL EXPENDITURE: CURRENT PRICE PATH						
($M 2016/17) year ending June	2013	2014	2015	2016	2017	Total
SDP Actual Expenditure						
Corporate	0.13	0.02	0.07	0.01	0.02	0.24
Plant	0.31	0.02	0.23	0.37	0.00	0.92
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total actual expenditure	0.44	0.03	0.30	0.39	0.02	1.17
Atkins/Cardno Recommended Adjustments						
None	0.00	0.00	0.00	0.00	0.00	0.00
ATKINS/CARDNO ASSESSMENT OF PRUDENT EFFICIENT EXPENDITURE						
Corporate	0.13	0.02	0.07	0.01	0.02	0.24
Plant	0.31	0.02	0.23	0.37	0.00	0.92
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total efficient expenditure	0.44	0.03	0.30	0.39	0.02	1.17

Source: SDP Information Return 2016 and Atkins/Cardno analysis

6.3. Expenditure in the future price path

SDP's proposed capital expenditure in the next price path period is summarised below, with proposed periodic maintenance transferred from opex, reflecting our view that it should be capitalised.

Figure 6-4 SDP proposed capital expenditure in the next price path (16/17 prices) INCLUDING Periodic Maintenance (but excluding insurance funded expenditure)



Source: SDP Information Return 2016, IPART 2012 Determination and Atkins/Cardno analysis

Our view is that capital expenditure is required for the following modes of operation: Water Security, Restart and Operation. We do not consider that capital expenditure is required for the 'shutdown' mode. Our view of the expenditure requirements for each of these modes is set out below.

6.3.1. Water Security Mode

In its regulatory submission, SDP has assumed that the plant will remain in Water Security Mode. In this mode, SDP proposes to spend:

- $2.1m on an extra pump in the DWPS;
- $0.4m on corporate assets; and
- $17.1m on periodic maintenance (reallocated from opex by this review).

SDP is not proposing to spend any money on membrane replacement in Water Security Mode.

The planned spend on the extra pump and periodic maintenance are discussed below. We have not reviewed the proposed corporate capex spend in detail due to its small magnitude.

Extra pump in the DWPS

In Full Operation Mode, SDP is currently incentivised through an abatement mechanism to produce 266 ML/d at 94% availability, i.e. an average of 250ML/d. The DWPS is responsible for delivering all of this water into supply. It has two pumps, in a 'duty-duty' arrangement, i.e. no standby pump capacity.

The lack of standby capacity presents a risk to the reliability of supply. To date, this has been addressed by purchase of critical spares, thereby reducing the consequence of failure of the pump by making it possible to replace critical elements relatively quickly, reducing the downturn caused by equipment failure.

SDP commissioned a study by KBR[22], which examined the options to improve the availability of the DWPS. This study evaluated twelve options against the ability to secure supply and to accommodate future potential low flow productions modes, i.e. continuous reduced flows. The preferred option identified by the study was the installation of an additional pump, in the existing building, capable of delivering 266ML/d flow when run in parallel with one of the existing pumps.

The cost of this option is estimated to be $2.1m of capex and additional opex of **[Redacted Information]**.

The KBR study references the Basis of Design availability for the DWPS as 85% but does not provide a quantification of average availability through failure mechanisms, taking account of mitigation measures in place, such as the critical spares which have been purchased for that purpose. It is not therefore clear what the 'without intervention' average availability would be.

As discussed in Section 3.7, we have taken the Water Security Mode as the base case in reviewing efficient expenditure as it is unlikely that the dam trigger level will be reached early in the next price path period. In the past, dam storage levels have generally taken a number of years to reduce significantly. Our view is that, if dam storage levels were to fall, SDP could install a pump within the existing building with a reasonably short lead time prior to the trigger level being reached. This is a standard water pump where this trigger would give sufficient lead time for procurement and installation. If the plant is required for purposes outside of the dam level operating rules, we understand that it would be required to apply best endeavours and would thus not be subject to the current 94% availability objective.

We therefore consider that it would be prudent and efficient to defer the cost of installing the additional pump until closer to the time that is likely to be required; that is when the dam storage level is within a year of potentially triggering a restart. Given the uncertainty of the need for and timing of any restart, we consider that it would be more appropriate to review the expenditure *ex-post* rather than to build it into water security capex for the next price period. This will save SDP's customers from servicing the additional capital and operating costs until the benefits are likely to be realised.

Periodic maintenance

In total, SDP proposes to spend **[Redacted Information]** on periodic maintenance in the next price path period. We consider that periodic maintenance should be treated as capex.

Examples of SDP's proposed expenditure includes a number of significant items of expenditure, for example:

- 'Refurbishment of RO trains': replacement of permeate hoses, end plate assemblies, permeate adaptors and a number of vessels;
- Refurbishment of site electrical control system;
- Refurbishment of HV Switch Board;
- Refurbishment of air conditioning compressors, condenser units and fans;
- Repairs to RO structural steelwork;
- Refurbishment of RO area bunds;
- Refurbishment of seawater intake drum screens;
- Replacement of ERD boost pump variable speed drives' main circuit and control circuits, cooling fans.

These investments have been derived from Veolia's CARMS asset database. They have been prioritised based on their criticality and condition. We reviewed the need for the expenditure listed above and found the

[22] Sydney Desalination Plant Drinking Water Pump Station Water Security Review, Kellogg Brown & Root, July 2016

need to be robust in all cases. We found that in many cases the interventions had been deferred to take account of the fact that they have been in Water Security Mode.

However, we consider that an adjustment needs to be made to the proposed expenditure amounts. **[Redacted Information]**effectively grants SDP a warranty against any fault or deficiency in respect of the design and construction of the Plant and against any defective equipment or materials for a period of ten years. We consider that the rapid deterioration of the permeate hoses and associated equipment falls under this warranty as the desalination plant was designed to achieve the asset design lives provided in the Durability Plan, i.e. 25 years for mechanical assets. For this reason we consider that just over **[Redacted Information]** of expenditure should not be charged to customers.

Prudent and efficient expenditure

Our view of the total level of prudent and efficient capital expenditure in the Water Security Mode in the future price path is summarised below:

Table 6-2 Atkins/Cardno recommended capex in the future price path (Water Security Mode)

SDP CAPITAL EXPENDITURE: FUTURE PRICE PATH: WATER SECURITY MODE						
($M 2016/17) year ending June	2018	2019	2020	2021	2022	Total
SDP Proposals						
Corporate	0.32	0.02	0.02	0.02	0.02	0.38
Plant	0.00	0.00	2.10	0.00	0.00	2.10
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total proposed expenditure	0.32	0.02	2.12	0.02	0.02	2.48
Atkins/Cardno Recommended Adjustments						
Deferral of DWPS investment						
Transfer of periodic maintenance from opex						
Removal of permeate hose + associated						
ATKINS/CARDNO ASSESSMENT OF PRUDENT EFFICIENT EXPENDITURE						
Corporate						
Plant						
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total efficient expenditure	1.53	2.64	2.87	3.75	3.67	14.46

Source: SDP Information Return 2016 and Atkins/Cardno analysis

This is summarised in graph form in Figure 6-5 below.

Figure 6-5 Proposed and recommended capex in the future price path (Water Security Mode)

Source: SDP Information Return 2016 and Atkins/Cardno analysis

6.3.2. Restart Mode

We consider that there are two items of potential additional[23] capital expenditure associated with restart from the current Water Security Mode. These are outlined below.

Membrane replacement

Membrane replacement is discussed in detail in Section 7 of this document. We consider that full replacement should be carried out on restart. The estimated cost of this is $30.0m as set out in Section 7.

Skid test unit

The operator has investigated the possibility of using a portable skid unit to carry out high pressure testing of the membrane condition in situ. This would allow the operator to get a true assessment of the membrane condition while the plant is in Water Security Mode. SDP advised that a skid test unit will cost $1.0m and will require an additional operator. The skid test unit will be of use to partly monitor the condition of the next set of replacement RO membranes when they are placed into Water Security Mode. However this is not likely to occur until near or after the end of the 2017-2022 determination period. Therefore we consider that the expenditure allowance can be delayed to the subsequent determination period.

Prudent and efficient expenditure for first and subsequent restarts

The costs outlined above relate to the capex required for the next plant restart. If the plant is restarted, shutdown and subsequently restarted all within three years , then no additional membrane replacement will be

[23] I.e. in addition to the capex being undertaken under 'water security' mode

required (see Section 7). If the shutdown period is greater than two years then some catch-up membrane replacement may be required, depending on the duration of the shut-down period.

The table below summarises our view of the prudent and efficient additional capex required for restart.

Table 6-3 Atkins/Cardno recommended prudent and efficient additional capex required for restart in the future price path

Item	First restart	Subsequent restart
Membrane replacement	$30.0M	Depends on duration of shutdown. Not required if subsequent restart within three years of first (unlikely in the future price path)

6.3.3. Full Operation Mode

We consider that there are two items of capital expenditure potentially affected by moving to Full Operation Mode. These are outlined below.

Membrane replacement

The capex allowed for in Restart Mode means that the plant will have an entirely new set of membranes on its first restart. We consider that no membranes will therefore need to be replaced in the first two years of operation. Given that we do not anticipate there being more than two years of operation in the next price path period we consider that no further allowance for membrane replacement is required for the Full Operation Mode.

Periodic maintenance

We have reviewed SDP's proposed periodic maintenance proposed expenditure under 'water security' mode. We consider that the level of expenditure required during the next price path will not be significantly affected by being in Full Operation Mode. We therefore consider that the same level of expenditure will be required as set out under Water Security Mode.

Prudent and efficient expenditure

Our view of the total level of prudent and efficient capital expenditure in the future price path is summarised below. Given that we consider that no additional membrane replacement is likely to be required in the next price path and that periodic maintenance can continue at the same level as under Water Security Mode, the overall level of expenditure is the same as for Water Security Mode.

Table 6-4 Atkins/Cardno recommended capex in the future price path (Full Operation Mode)

SDP CAPITAL EXPENDITURE: FUTURE PRICE PATH: FULL OPERATING MODE						
($M 2016/17) year ending June	2018	2019	2020	2021	2022	Total
SDP Proposals (assumed same as 'water security' mode)						
Corporate	0.32	0.02	0.02	0.02	0.02	0.38
Plant	0.00	0.00	2.10	0.00	0.00	2.10
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total proposed expenditure	0.32	0.02	2.12	0.02	0.02	2.48
Atkins/Cardno Recommended Adjustments						
Deferral of DWPS investment						
Transfer of periodic maintenance from opex						
Removal of permeate hose + associated						
ATKINS/CARDNO ASSESSMENT OF PRUDENT EFFICIENT EXPENDITURE						
Corporate						
Plant						
Pipeline	0.00	0.00	0.00	0.00	0.00	0.00
Total efficient expenditure	1.53	2.64	2.87	3.75	3.67	14.46

Source: SDP Information Return 2016 and Atkins/Cardno analysis

6.3.4. Shutdown mode

We consider that no additional capital expenditure is required for shutdown of the plant.

7. Task 3.3: Special Review Item

7.1. Membrane Replacement Program

We are asked to address the following issues related to membrane replacement, drawing on Tasks 1 and 2 and best available information so as to inform overall assessment of the operating and capital expenditure in Tasks 3.1 and 3.2.

a. evaluate the appropriateness of SDP's and the plant operator's protocols to extend the expected useful life of the RO membranes in the water security shutdown mode;
b. assess efficient deferral costs of membrane replacement in water security shutdown (long term storage);
c. assess efficient membrane replacement costs, membrane lives and resale values in each mode of operation discussed in Task 1; and
d. in performing tasks b)-c), discuss timing of the costs (e.g., periodic, one-off, etc.).

The RO membranes have been in preservation mode for four and a half years and are likely to remain in this mode for a number of years given the present dam levels and current 70% restart trigger level of the MWP.

SDP is planning to replace membranes in the Restart Mode; no replacement is proposed in the current Water Security Mode. Assuming an earliest possible Restart in 2020, the operator's replacement model shows that **[Redacted Information]**membranes would be replaced at a cost of $21.9m[24]; this would be nearly two thirds of the asset stock. Further membrane replacement in the Full Operation Mode is proposed at **[Redacted Information]** over the period of operation, thus 84.4% of the existing membranes would be replaced by end of the determination period.

Appropriateness of protocols to extent useful life

There is no precedent for preservation of the RO membranes for the length of time in Water Security Mode; eight years as a minimum. The method used for the long term presentation of the membranes is the continuous immersion of the membranes in a solution of Sodium Bi-Sulphite (SBS). The solution is periodically circulated around the membranes using the RO chemical CIP system pumps. The SBS solution is periodically drained down and replaced with fresh solution. The solution will also be replaced if the lab analysis of the SBS condition shows that its monitored parameters are out of range.

There is extensive sampling and lab analysis each month of the condition of the SBS solution in each of the RO racks, this results of this sampling are available in operator's monthly reports to SDP. The parameters monitored are and allowed limits are detailed below.

[Redacted Information]

This is the method recommend by major RO membrane suppliers, DOW, Toray, and Hydranautics for long term preservation of the RO membranes. The method used by the operator to preserve the membrane and therefore to extend the life of the membranes is appropriate and should be considered as best industry practice.

Efficient deferral costs of membrane replacement in Water Security Shutdown

The RO membranes should not be replaced until there is a requirement to restart the plant due to the dam level restart triggers being reached. This is because there is no benefit in changing membranes in advance of such a trigger.

If the plant is required to start due to an extraordinary event triggered by SWC, the plant should be started with the existing membranes in place and the permeate water quality of the membranes should be established. If there is need to replace some membranes to achieve the product water quality requested then these reasonable restart costs should be recovered by SDP from SWC. The recovery of reasonable costs for non-dam level restart is already covered by the Water Supply Agreement section 4.5.

[24] Spreadsheet 'SIR Model Final Atkins Spreadsheet, SDP 23Nov16

Efficient membrane replacement costs, membrane lives and resale values

There are in effect only two modes of operation actually used by SDP

a. Water Security Mode; and
b. Restart and full production when dam trigger levels reached.

There is no justification for any membrane replacement during Water Security Mode because no water is being produced.

[Redacted Information]. On a normally operating desalination plant there will be annual replacement of some of the membranes in each pressure vessel. After a few years, there will be range of ages for the membrane elements in the pressure vessel, with the oldest element eight years old and the youngest less than one year old. The membrane replacement rate is set to achieve an average age of the elements at three and a half years for RO first pass system and five years for the second pass system. **[Redacted Information]**

[Redacted Information] Both Dow and the Operator attempts to quantify the reduced ageing effect of preservation are fully speculative without data.

It is unlikely that the plant will be triggered to restart before 2019-2020. At that time, the total number of membranes for replacement is estimated from the model as **[Redacted Information]**first pass and **[Redacted Information]**second pass Membranes). This represents 62.8 % of the total number of existing membrane. If the plant is then operated for two years a further **[Redacted Information]** membranes will need to be replaced. By the end of 2022, 84.4% of the current installed membranes would require replacement to achieve the desired membrane average.

Funding for full replacement of RO membranes on restart instead of partial replacement of the membranes is recommended for the following reasons:

a. It eliminates risk to the water quality from the use of old RO membranes operating beyond their design life (nine years);
b. The ordering lead time of the RO membranes will likely require that the membranes are ordered before the existing membranes could be fully tested;
c. It eliminates the need to have an expensive Partial Plant Test to assess the condition of the existing membranes;
d. Full membrane replacement will allow maximum RO membrane supply competition. The current plant uses Dow Filmtec RO membranes. Other major RO membrane suppliers include Toray (Japan) and Hydranautics (USA and Japan) all of which can provide suitable membranes for this desalination plant. The competition will tend to drive down the price of the membranes and improve the delivery terms; and
e. There should be no need for further replacement membranes in the first two years of operation. After Full membrane replacement on restart, the average membrane age will be less than three and a half years for the remaining time of this determination period. No operational budget is required for annual membrane replacement. This allows the membranes cost to be fully capitalised.

[Redacted Information]

However **[Redacted Information]**Therefore, the estimated supply price with the Dow Guarantee method for the first pass membranes is USD**[Redacted Information]** and for the second pass RO membranes is USD**[Redacted Information]**.

The document *SDP Asset CARMS renewal plan 2015 final (short).pdf*[25] created by the operator, provides a table (table 5 page 15 of 40) which indicates the unit cost of first and second pass RO membranes is USD**[Redacted Information]** and USD**[Redacted Information]**. The second pass membranes are normally significantly cheaper than first pass membranes but in this table they have higher unit cost. If there were to be full membrane replacement (**[Redacted Information]**elements instead of the **[Redacted Information]** in

[25] SDP Asset CARMs renewal plan 2015 final (short).pdf

the table) then there is likely to be substantial discounts applied by the membrane manufacturer to be competitive against other suppliers.

Table 7-1 SDP Membrane Replacement Proposals

[Redacted Information]

There needs to sufficient funding available to ensure the membranes replacement. The membrane supply to site unit cost used by Atkins will be **[Redacted Information]**for the first pass membranes and **[Redacted Information]**for the second pass membranes. A further allowance on top of the supply price of 11 % should be made for installation, but the unit cost (higher than Dow guarantee) and installation allowance should be sufficient to also include 1% spares, and membrane disposal.

Table 7-2 below shows the funding needed to replace all of the first and second pass membranes.

Table 7-2 Membrane Replacement Costs

SDP EFFICIENT OPERATING EXPENDITURE: MEMBRANE REPLACEMENT COSTS						
	Number	Unit Cost $ (US)	Unit Cost $	Supply $m	Installation $m	Total Cost $m
No First Pass Membranes to be replaced						
No Second Pass Membranes replaced						
Total						29.98

Source: SDP and Atkins Cardno estimates

When a full restart is triggered by dam levels falling below 70%, which we consider unlikely to occur before 2019-2020, then the existing membranes will be nearly 11 years old. The desalination plant can use the existing membranes to test all the plant systems while waiting for the new replacement membranes to arrive. Testing during this time of the permeate quality from the existing membranes may indicate that there is some potential life left in the old membranes. This could possibly allow the operator to delay installation of the membranes and to prioritise early delivery of water before the eight month restart period is completed.

The old membranes will need to be disposed of when the replacement membranes are fitted. These old membranes will not likely have a significant residual resale value in Australia as they will be without manufacturer's warranty. However, there may be considerable life left in these membranes identified during plant restart testing which could be useful for use in other desalination plants in low income countries such as Egypt and Tunisia. It might be possible to make a commercial arrangement for the bagging with preservative and transport of the membranes to another country to cover just the disposal cost of the membranes. We have assumed that there is no residual value for membranes but the costs for their disposal are included in the installation allowance and unit costs of the new replacement RO membranes.

Basis and timing of costs

SDP's proposal is for a phased replacement of membranes over the Restart and Full Operation Mode. In addition, the plant test in the Water Security Mode is used to evaluate the performance of the existing membranes. We discuss the approach to plant testing in Section 5.

We consider a prudent and efficient approach is that there is insufficient justification for a Partial Plant Test and there are significant cost advantages from an open procurement of all membranes from a range of approved suppliers. A phased replacement does not give the same procurement leverage as there is greater dependency on the original supplier. There are also advantages of improved performance at Restart and a reduction of risk through use of all new membranes.

We compare the relative costs in Table 7-3 combining plant testing and membrane replacement. This shows that there are clear cost advantages in the full replacement. Timing of the Restart and Full Operation is uncertain although is not likely in the short run.

Table 7-3 Membrane Testing and Replacement Options

SDP FUTURE PRICE PATH: MEMBRANE REPLACEMENT						
($ 2016/17) year ending June	Plant test in Water	Restart	year 1	year 2	total cost	
SDP Proposals - Membrane replacement						
Membranes for replacement						
Total cost ($m)						
Unit cost ($)						
Atkins Cardno proposals						
Unit cost	0		0	0		
Membranes for replacement	0		0	0		
Efficient expenditure	0.00		0.00	0.00		
Cost savings compared with SDP proposals						

7.2. Asset lives and Regulatory Asset Base

7.2.1. Asset lives

We are asked in Task 3.3.2 (a) to audit and assess the accuracy with which SDP has classified its existing assets, historical and planned expenditure. We are asked to make recommendations on

a. the value of all existing assets in each asset class;
b. the efficient capital expenditure on new assets in each asset class, and asset lives for new assets by asset class;
c. the average remaining life of existing assets by asset class and
d. the asset value for inclusion in the RAB.

Table 7-4 Asset Lives

SDP ASSET LIVES AND RAB VALUE					
Years	IPART 2012 Determination	SDP Assumptions July 2017	SDP Average remaining life July 2017	Atkins proposed asset life July 2017	Atkins remaining asset life July 2017
Desalination plant					
Plant including periodic maintenance	30			30	26
Intake infrastructure	90			90	86
Outlet infrastructure	100			100	96
Pumping Station	25			25	21
Pre-operations payment	20			20	16
Sydney Water related costs	44			44	40
Membrane Replacement NEW	not included	not included	not included	8	n/a
Non-depreciated	n/a	n/a	n/a	n/a	n/a
Pipeline					
Non-depreciating	n/a				n/a
Pipeline	140	100		120	116
Corporate					
Short Life assets	not stated			5	

Source: IPART 2012 Determination, SIR and Atkins Cardno estimates

The value of existing assets

In the SIR submission[26], SDP reports on groups of assets defined as intake, outfall, plant, pumping station, pipeline and non-depreciable assets. In addition, there are asset categories for pre-operations payments and SWC related costs

The asset valuation (RAB) is rolled forward from 2012 Determination using asset lives, discussed below, to derive depreciation; asset additions are included and indexation applied to bring the value up to the 2016/17 price base. The asset additions are small in relation to the total RAB value. The $1974m value of the 2017 RAB in Table 5.10 of SDP's submission is consistent with the proposals in the 2012 Determination inflated to 2016/17. This value is sub-divided into plant and pipeline.

The efficient capital expenditure on new assets in each asset class

Efficient capital expenditure is reported in Table 6-3. Using SDP's asset groups defined above, this expenditure is mainly allocated to plant with a small element of corporate expenditure.

Asset Lives

Asset lives for SDP's groups of assets are defined in Table 7-1 above. IPART advise that these asset categories are to be used for RAB calculations in the future price path. The average remaining life is derived from a 2013 base year and the assumed opening life less one year for each year of the period.

We are proposing one additional asset category for membrane replacement. In Section 5.4.6. We suggest a life of eight years based on our experience of membrane use in established desalination plants.

SDP proposes two changes to asset life assumptions from the 2012 Determination

- to reduce the assumed asset life of the pipeline asset from 140 to 100 years; and
- to include a short life asset category of 3 years for corporate IT

The current assumption of 140 years is the same as SWC[27] applies to its water mains of a similar diameter. SDP proposes a reduction in the asset life as it states that the design life is 100 years. SDP provided a report[28] on the asset management of the pipeline which indicates a design life of 100 years although there is little evidence to justify this. The asset lives set for determining depreciation are economic design lives which in some instances are greater than the design lives defined in design contracts.

Our view is that that the land-based pipeline asset life should be consistent with SWC assumption of 140 years; a lower asset life for the length of main in twin under-sea pipelines, some 50% of total length, would be appropriate. It is inconsistent to have buried or over ground pipelines having different asset lives. The SDP states that the asset is well maintained and there is no evidence of pipeline deterioration.

There is a case to consider the under-sea section of pipeline as having a lower life because of the more aggressive environmental conditions. We accept that the proposed 100 year life for the under-sea length of pipeline. The report identifies some mechanical assets such as valves having a lower life although we are unclear of the proportion of these assets by value. We suggest a weighted life of 120 years should be used to take account the relative lengths of pipeline on land and under the sea.

Corporate assets: an asset category of corporate assets has been included as 3 years. SDP has identified these assets as laptops, iPads and phones having three years estimated life. The level of expenditure for this asset type is not material. However for consistency with previous Determinations for SWC and commonly-accepted water industry practice we suggest a 5 year average life should apply. This would include other IT assets having lives greater than five years.

In addition, our review of asset lives showed that the combined 25 year asset life of the pumping station appeared low when compared with similar assets of this type which combine civil, mechanical and electrical assets. Similarly, the combined 30 year asset life for the desalination plant could be under-stated because of

[26] Special Information Return, worksheet 'Assets', SDP October 2016
[27] Review of prices for Sydney Water Corporation from 1 July 2016, IPART June 2016
[28] Sydney Desalination Plant Pipeline Asset Management Review, KBR July 2016

the extent of civil works particularly for the raw water pumping station and filter structures. However, we do not have sufficient information to challenge the basis of this weighted asset life.

Periodic maintenance expenditure should be combined with the desalination plant as a category 'Desalination Plant including periodic maintenance'.

The initial preparation and design costs incurred by SWC prior to 2012 were capitalised and included within the RAB. An assumed life of 44 years was applied at that time. We were asked to review the applicability of this asset life assumption. We found that there was no reason to change this assumption which was based on the weighted asset life of the complete SDP assets.

7.2.2. Insurance funded works

SDP's insurance claim for the damage caused by the tornado is still in progress so there is currently limited confidence in the capex likely to be funded by SDP's insurers. SDP has assumed that no adjustment to RAB will be needed as a result of the insurance-funded works and has assumed no impact on average remaining asset life.

Our view is that, for the purpose of setting prices, the approach of making no adjustment to RAB and average remaining asset life is appropriate. This is because:

- it means that the insurance-funded works will have a neutral effect on SDP's revenue requirements, which is reasonable given that the purpose of the insurance cover (paid for through SDP's prices) is largely to protect SDP and its customers from the effects of events such as this;
- it is likely that the alternative approach would involve a positive adjustment to RAB to take account of the replacement of depreciated assets but lower depreciation rates because of greater average remaining asset life. This would be a complex set of adjustments, which, given that the two adjustments have opposite effects on SDP's revenue requirements, may result in a minor aggregate effect; and
- it is our understanding that much of the insurance-funded capital expenditure is likely to be repair work (rather than asset replacement) or relate largely to civil assets which have less of an impact on future renewal requirements than replacement of shorter asset life items would have. This therefore limits the impact on future prudent and efficient expenditure.

We do, however, recommend that assets which are replaced as part of these works should have their 'last intervention date' reset in CARMS and Maximo so that future periodic maintenance takes this into account.

8. Task 4: Efficiency Adjustment Mechanism

The Efficiency Adjustment Mechanism

EFAM is a regulatory tool used to equalise the incentive to achieve permanent efficient savings over the regulatory period. EfAM ensures the business is able to retain efficiency savings and enable customers to benefit from efficiency savings sooner than previously. EfAM ensures the business is able to retain efficiency savings for a fixed period of time before they are passed on to customers.

EfAM applies only to non-energy related operating expenditure and must be driven by management initiatives, represent improvements in productive efficiency and be net of any efficiency losses. Efficiencies can be either 'mode specific' or 'general'. Mode specific efficiencies are only carried over to the extent that SDP continues to operate in the same mode during the carryover period. General efficiencies are to be carried over regardless of operating mode.

Requirement

We are asked to report on and recommend any permanent efficiency savings made by SDP in non-energy related operating expenditure in each year from 2012-13 to 2016-17 for the purposes of applying the EfAM.

Specific Efficiencies

There is only one efficiency identified by SDP and detailed in Section 5.3.5 of its submission. This amounts to a saving of $0.05m and relates to combining the plant operator's insurance premium for the DWPS with the insurance premium for the whole plant. This resulted in an overall reduction to the operator's insurance premiums from 2016-17 of $0.05m compared with the costs incurred in 2015-16.

This item is classified under the 'general' category. We noted that the average annual plant insurance for the plant, reported under plant costs for the current price path is $0.46m/a; this reduces to $0.35m/a in the future price path. We concluded that the item meets the criteria for EfAM.

Findings

We formed the view that the EfAM process has not been progressed with much focus in the current price path. We found that SDP's management could do more to drive efficiencies in the O&M contract and its own costs. The EfAM process should be applied to the future price path with greater management focus. We have built in efficiency targets that SDP should achieve and indeed out-perform so that benefits can be shared between customers and SDP. SDP's management is highly experienced to deliver this.

Appendices

Contains *sensitive* information

Appendix A. Terms of Reference

SCOPE OF WORK

PROJECT NAME: Sydney Desalination Plant - Expenditure Review

1. BACKGROUND

The Independent Pricing and Regulatory Tribunal (IPART) is conducting a review of Sydney Desalination Plant Pty Limited's (SDP's) maximum prices for its declared monopoly services, to apply from 1 July 2017 for a period up to five years (**the 2017 Determination**).

We released our first determination of SDP's prices in December 2011, for the period from 1 July 2012 to 30 June 2017 (**the 2012 Determination**).

IPART's role is to set prices which reflect the efficient costs of delivering SDP's monopoly services. Our price reviews seek to protect customers from paying for inefficient or unnecessary expenditure, while ensuring SDP raises adequate revenue to cover the efficient costs required to deliver its monopoly services. IPART seeks to set prices which do not reward inefficient investment and asset management decisions, or inefficient operations and practices.

Key context for this expenditure review, including a description of IPART's pricing role, is provided at **Appendix A.**

IPART's Issues Paper is due for release on 29 August 2016.

SDP's pricing submission is due to IPART on 24 October 2016.

Information on IPART's price review is available at http://www.ipart.nsw.gov.au/Home/Industries/Water/Reviews/Metro_Pricing/Review_of_Sydney_Desalination_Plant_prices_from_1_July_2017

OBJECTIVES

IPART is seeking the services of a suitably qualified consultant to assess and provide advice on SDP's prudent and efficient costs over the regulatory period.

In addition, as a part of this project, IPART is also seeking advice on whether SDP's proposed operating regime is prudent and efficient. This will include consideration of, amongst other things, SDP's proposed options for the plant operation and shutdown (including a range of scenarios) and the associated technical implications and related costs. The scope of this review will also need to consider SDP's current contractual obligations and rights under these scenarios.

2. DESCRIPTION OF SERVICES

The consultant must undertake an expenditure review, including the following tasks:

- Task 1: conduct a strategic review of SDP's operating modes, taking into account its drought response role as per the Government's Metropolitan Water Plan and SDP's WICA licence conditions
- Task 2: conduct a strategic review of SDP's long term investment plans and its asset management systems and processes.
- Task 3: conduct a detailed review of the prudence and efficiency of SDP's past and proposed operating expenditures and capital expenditures, and

- Task 4: provide inputs into the application of the Efficiency Adjustment Mechanism (EfAM) in the 2017 Determination of SDP's prices, and into the review of the Methodology Paper on the EfAM for the future determination period(s).

IPART requires the consultant to provide the following services:

Task 1: Strategic review of SDP's operating modes

The objective of the strategic review of SDP's operations is to establish and recommend the most efficient way to deliver SDP's declared monopoly services of:

- the supply of non-rainfall dependant drinking water to purchasers; and
- the making available of the desalination plant to supply non-rainfall dependant drinking water,

subject to SDP meeting its drought response role (operating rules) prescribed by Government under the Metropolitan Water Plan.

In undertaking this task the consultant must take into account:

– SDP's operating rules, including any new operating rules under an updated Metropolitan Water Plan

– SDP's operating and management (O&M) contract with Veolia

– SDP's operational protocols for decisions about entering shutdown or restart

– SDP's past and forecast operating decisions taking into consideration SDP's drought response role and operational protocols

– International experience of desalination plants in mothball shutdowns, in particular on the effects of long-term shutdowns on technical reliability of the plant, and Good Industry Practice.[29]

As part of the strategic review of SDP's operations, we need to establish the ongoing relevance of the operating modes used in the 2012 Determination for the new regulatory period. In the 2012 Determination, we set separate prices (in the form of daily fixed charges) for each of SDP's operating modes, including:

– Plant Operation Period

– Shutdown (in Short Term, Medium Term, Long Term and Water Security shutdown categories)

– Restart (from each of the shutdown categories).

We also set one-off fixed transition charges associated with shutdowns of longer durations, reflecting the fixed costs of transitioning between the modes.

The consultant must review and provide recommendations on the efficiency of:

a) SDP's proposed modes of operations

29 Good Industry Practice, as defined in SDP's network operator licence, means the exercise of that degree of skill, diligence, prudence and foresight that reasonably would be expected from a prudent desalination plant operator acting in accordance with good industry practice and applicable Australian and internationally recognised standards, having regard to the capacity of the water infrastructure, its duty, age and technological status.

b) any other mode of operation considered relevant by IPART (to be specified at the inception meeting), including:

i) 'soft shutdown' and 'soft restart', when SDP is allowed to supply water while transitioning to, or coming out of, shutdown, by mode of operation (shutdown) (the consultant is required to assess technically prudent duration of the 'soft shutdown' and 'soft restart' periods, and discuss the link between these durations and the relevant one-off transition charge and daily fixed payments)

ii)periodic capacity testing the plant when in water security shutdown (the consultant is required to recommend frequency, duration and protocols for such testing, based on its technical merits, and discuss the link between these parameters and the relevant one-off transition charge and daily fixed payments).

Task 2: Strategic management review

The objective of the strategic management review is so that SDP's expenditure proposals for the 2017 Determination can be considered in the context of its longer term plans. The consultant should use any findings from Task 1 to inform this review.

The consultant must undertake a strategic management review of SDP's long term investment planning (minimum of 10 years), its asset management systems and practices, and its operations and maintenance planning as specified below.

The consultant must provide advice on:

a) Whether the longer term capital investment strategy is the most efficient, and whether processes supporting this including procurement processes, whole of life cycle planning and assessment of capital and operating expenditure trade-offs are best-practice and therefore likely to result in prudent and efficient investment decisions

b) The key assumptions that are driving expenditure (eg, asset replacements, demand forecasts, growth assessments, environmental requirements, licensing standards), including comment on the reasonableness of these assumptions and how they have been considered and tested by SDP

c) The consistency of SDP's proposed 5 year capital expenditure program with its longer term program of capital expenditure, and implications and risks associated with the 5 year program for the longer term program

d) The robustness of systems for linking asset management decisions with current and future levels of service and performance requirements, taking into consideration SDP's operating environment and contractual obligations

e) The way in which SDP manages the risks associated with asset failure or underperformance, and

f) Any particular concerns or issues relating to SDP's process for determining and prioritising future infrastructure expenditure and asset management decisions.

Task 3: Detailed review of operating and capital expenditure

As part of the price review, IPART makes decisions on SDP's operating and capital expenditure allowances over the 2017 Determination. To do so, IPART examines:

- actual expenditure incurred since the last price determination (the 2012 Determination), and
- forecast expenditure for the next determination period (2017 Determination).

To assist IPART in this task, the consultant must assess and report on SDP's:

Task 3.1 Operating expenditure: the *efficiency* of past and proposed operating expenditure for the period from 1 July 2012 to 30 June 2022

Task 3.2 Capital expenditure: the *prudence and efficiency* of past and proposed capital expenditure for the period from 1 July 2011[30] to 30 June 2022.

Task 3.3 Special review items.

An explanation of the efficiency and prudence tests that the consultant is required to undertake is provided at Appendix B.

A list of tasks that the consultant must undertake to review SDP's operating and capital expenditure are outlined below.

Task 3.1 Detailed review of operating expenditure (excluding energy costs)

The consultant will be required to review SDP's operating expenditure from 2012-13 to 2021-22, as specified in sections 3.1.1 and 3.1.2 below. The consultant should use any findings from Tasks 1 and 2 to inform this review.

In Tasks 3.1.1 and 3.1.2, the consultant must recommend efficient levels of operating costs for the plant and pipeline (as separate items and combined) in **each mode of operation** discussed in **Task 1.**

In undertaking this task the consultant must review, for the plant and pipeline (as separate items and combined),[31] and provide recommendations on:

a) all efficient operating costs that vary with the production of water, by mode of operation and level of output

b) all efficient operating costs that are fixed and do not vary with water output, by mode of operation. Fixed operating costs, should include:

- baseline costs that are incurred regardless of whether or not the plant is operating
- incremental fixed costs which do not vary with the volume of water produced (with water security shutdown as a base)

c) efficient level of fixed one-off operating costs associated with transitioning the plant from one mode of operation to another, informed by findings of Task1 on the likelihood of transition charges still required, by mode of operation

d) operating costs items, including, but not limited to:

- SDP's insurance coverage (including analysis of its adequacy)
- chemical costs and an appropriate chemical price index
- membrane replacement costs and an appropriate price index

30 As 2011-12 was the year in which the 2012 Determination was undertaken, capital expenditure was a forecast value. We require an assessment of capital expenditure for 2011-12 in order to roll forward the utility's regulatory asset base for the purposes of calculating the efficient return on and of capital to be reflected in prices.

31 In our 2012 Determination, we established a separate revenue requirement and set separate prices for the desalination plant and the pipeline connecting the plant to Sydney Water's distribution system. In line with this approach, with require the consultant to establish prudent and efficient costs for the plant and pipeline as separate items and also combined.

- periodic asset maintenance costs and an appropriate price index
- appropriate corporate costs and cost allocation by business area

e) benchmark costs where available and comparison with industry best practice

Energy costs are excluded from this review and will be assessed in a separate consultancy. However, the consultant is required to provide recommendations on the efficient volume of energy (in MWh) associated with each operating mode, reporting separately electricity consumption contributing to fixed and variable costs, for the plant and pipeline (as separate items and combined).

Task 3.1.1 Efficiency of actual operating expenditure from 2012-13 to 2016-17

The consultant must provide recommendations on the *efficiency* of past operating expenditure for the period from 1 July 2012 to 30 June 2017 (ie, 2012-13 to 2016-17).[32]

In undertaking this task the consultant must:

a) Report on the historical operating expenditure (by program) for each year of the current determination period (ie from 2012-13 to 2016-17).

b) Review the variations in operating expenditure from what was allowed in the 2012 Determination for SDP and, where assessed as material, comment on the reasons for this variation including the extent to which these variations are justified

c) Assess the extent to which the operating expenditure incurred since the 2012 Determination has delivered the service standards on which the expenditure allowance was based

d) Advise whether the operating expenditure is directly related to the provision of regulated services, and

f) Comment on whether operational savings have been captured in the operating expenditure as opposed to shifting costs within the regulated business.

g) Report any permanent efficiency savings in non-energy related operating expenditure, by mode of operation, for the purposes of applying Efficiency Adjustment Mechanism (EfAM) (as per Task 4).

Task 3.1.2 Efficiency of proposed operating expenditure from 2017-18 to 2021-22

The consultant must provide recommendations on the *efficient* annual operating expenditure allowances for the period from 1 July 2017 to 30 June 2022 (ie, 2017-18 to 2021-22).

In undertaking this task the consultant must:

a) Assess and provide recommendations as to the efficiency of SDP's proposed level of operating expenditure for each year.

b) Identify the potential for and recommend efficiency savings to be achieved within the operating expenditure allowance, providing information and reasoning to support the recommended savings.

c) Recommend additional expenditure required if proposed expenditure in an area of operations is assessed as inadequate.

d) Provide an opinion on the cost effectiveness and efficiency of SDP's procurement processes in relation to operation services provided by third parties.

32 As 2016-17 is the year in which the review is undertaken the operating expenditure will be a forecast value.

e) Where appropriate, have regard to productivity benchmarking analysis.

Task 3.2 Detailed review of capital expenditure

The consultant will be required to undertake a detailed review of SDP's capital expenditure from 2011-12 to 2021-22 according to sections 3.2.1 to 3.2.2 below. The consultant should use any findings from Tasks 1 and 2 to inform this task.

In Tasks 3.2.1 and 3.2.2, the consultant must recommend prudent and efficient levels of capital expenditure for the plant and pipeline (as separate items and combined) in **each mode of operation** discussed in **Task 1.**

In undertaking the review of capital expenditure for the plant and pipeline (as separate items and combined) in Tasks 3.2.1 and 3.2.2, the consultant must:

a) Assess the reasonableness of SDP's capital program as a whole, within the context of its long term plans and the assumptions underlying them, including the scale, scope and planning of the entire capital expenditure program, from 2011-12 to 2021-2022 and identify any consequential impacts on operating expenditure (ie, increased or reduced costs) of this capital expenditure, by mode of operations and business area.

b) Advise on the appropriateness of the cost allocation method used by SDP to allocate operating costs to capital projects.

Task 3.2.1 Prudence and efficiency of past capital expenditure from 2011-12 to 2016-17

The consultant must provide recommendations on the *prudence* and *efficiency* of actual capital expenditure for the period from 1 July 2011 to 30 June 2017.[33] In undertaking this task the consultant must:

a) Report on the historical capital expenditure values (for the plant and pipeline (as separate items and combined, and by program) for each year of the current determination period (ie from 2012-13 to 2016-17, and for 2011-12).

b) Assess the extent to which the expenditure approved in the 2012 Determination has delivered the service standards and outcomes on which the expenditure was based.

c) Provide a recommendation on the *prudence* and *efficiency* of SDP's capital expenditure (for the plant and pipeline (as separate items and combined)) for the period from 2011-12 to 2016-17.

d) Recommend a value for any capital expenditure considered imprudent or inefficient, providing information and reasoning to support the recommendation.

e) Where appropriate, have regard to productivity benchmarking analysis.

Task 3.2.2. Prudence and efficiency of proposed capital expenditure from 2017-18 to 2021-22

The consultant must provide recommendations on the *prudence* and *efficiency* of proposed capital expenditure for the plant and pipeline (as separate items and combined) for the period from 1 July 2017 to 30 June 2022. In undertaking this task the consultant must:

a) Report on the proposed capital expenditure values (by program) for each year for the period 2017-18 to 2021-22.

b) Provide a recommendation on the *prudence* and *efficiency* of SDP's proposed capital expenditure program for the period from 2017-2018 to 2021-2022 and provide for each year reasoned estimates of

33 As 2016-17 is the year in which the review is undertaken the capital expenditure will be a forecast value.

the level of capital expenditure that the consultant considers prudent and efficient in order for SDP to supply its regulated monopoly services.

c) Identify the potential for efficiency savings to be achieved by SDP within its capital expenditure program over the next determination period of 2017-18 to 2021-22 and provide information and reasoning to support the proposals.

d) Where appropriate, have regard to productivity benchmarking analysis.

Task 3.3 Special review items

As part of the detailed review of operating and capital expenditure Tasks 3.1 and 3.2, the consultant will be required to undertake an assessment of several targeted programs. The weight given to each of these special items will be finalised at the inception meeting.

Task 3.3.1 Membrane replacement program

Drawing on Tasks 1 and 2 and best available information, and to inform overall assessment of the operating and capital expenditure (Tasks 3.1 and 3.2), the consultant is required to:

a) evaluate the appropriateness of SDP's and the plant operator's protocols to extend the expected useful life of the reverse osmosis (RO) membranes in the water security shutdown mode

b) assess efficient deferral costs of membrane replacement in water security shutdown (long term storage)

c) assess efficient membrane replacement costs, membrane lives and resale values in each mode of operation discussed in Task 1

d) in performing tasks b)-c), discuss timing of the costs (eg, periodic, one-off, etc).

Task 3.3.2. Asset lives and Regulatory Asset Base (RAB)

Based on Tasks 1 and 2, and in tandem with the capital expenditure review Task 3.2, the consultant is required to, for the plant and pipeline (as separate items and combined):

a) Audit and assess the accuracy with which SDP has classified its existing assets, historical and planned capital expenditure. The consultant is required to review SDP's information return and other relevant information and make recommendations regarding:

i) the value of all existing assets in each asset class

ii)the efficient capital expenditure on new assets in each asset class, and asset lives for new assets by asset class

iii) the average remaining life of existing assets by asset class iv) the asset value for inclusion in the RAB

b) Assess the impact of the December 2015 storm event on SDP's actual and proposed capital expenditure, RAB and asset lives, by:

i) Undertaking a detailed investigation into assets funded by the SDP's insurers. For each capital project, the consultant must identify any amount that relates to the insured event, and clearly explain what prudent and efficient expenditure should be included in the RAB recommended in part a) above, for the purposes of setting prices.

ii)Ensuring that recommendations in part a) above take into account the appropriate asset lives of the replacement assets that relate to the insured event.

Task 4. Inputs to application and review of efficiency adjustment mechanism

Under the Terms of Reference (ToR) for its price determination, IPART is required to implement an Efficiency Adjustment Mechanism (EfAM). Appendix A provides detail on the EfAM as background for this task.

In reviewing efficiency savings the consultant should have regard to:

a) *The impact of any existing incentive mechanisms between SDP and the plant operator* - The relationship between SDP (owner) and Veolia (operator) may have several implications for the application of the EfAM.

Task 4.1 Application of efficiency adjustment mechanism to include in 2017 prices

Based on findings of Tasks 1 to Task 3, the consultant must report on and recommend any permanent efficiency savings made by SDP in non-energy related operating expenditure, in each year from 2012-13 to 2016-17, for the purposes of applying the EfAM.

The final year's permanent efficiency saving (ie, 2016-17) will need to be estimated based on the most recent information available at the time.

In undertaking this task the consultant must follow IPART's Methodology Paper, which includes providing evidence that efficiency savings are:

a) driven by management initiatives,

b) represent improvements in productive efficiency (ie, less input per unit of output), and

c) be net of any efficiency losses (ie, represent true 'whole of business' efficiency savings that can be passed on to customers through lower prices).

The consultant's recommendations on permanent efficiency savings must be classified as either being mode specific or general.

Task 4.2 Review of Methodology Paper on the efficiency adjustment mechanism (EfAM)

As part SDP's price review, IPART is reviewing and if necessary updating the EfAM methodology. Any updates to the methodology would apply at future reviews (ie, the revised 2017 Methodology Paper would be used to implement the EfAM over the 2017 determination period in prices from 1 July 2022).

The consultant must:

a) Undertake an assessment of the EfAM, informed by Tasks 1, 2 and 3, and identify areas of the current methodology that could be improved. In particular, the consultant should identify any ambiguities, redundancies and unnecessary complexities in our EfAM.

b) Provide advice on amending the EfAM based on the consultant's assessment and stakeholder submissions on the EfAM.

3. REQUIRED OUTPUT

The primary output items from the project are set out below.

3.1 Reports

Inception Report

The consultant is required to produce an Inception Report (no more than 5 pages) to be provided shortly after the inception meeting (exact date to be agreed to by IPART and the consultant at the inception meeting) that outlines agreed:

- methodologies and terminology

- key issues and/or areas of focus
- protocols for interaction with SDP and stakeholders
- any changes to proposed resourcing and costs by task.

Draft and Final Reports on the expenditure review

The consultant will be required to produce a Draft and Final Report, which address Tasks 1 to 4 above. The reports must include:

- a clear explanation of the consultant's reasons or rationale for each of these findings/outcomes, including its information sources, approach and any key assumptions used
- report values in $2016-17, applying CPI indexes to be provided by IPART.

Furthermore:

- all tables and calculations in the reports must also be provided in Excel format to facilitate the transfer of the consultant's outputs to IPART's pricing models (to avoid rounding errors introduced through text-only formats), and
- the consultant must conduct a thorough Quality Assurance check of all outputs to eliminate errors and inconsistencies.

The Appendix of the Draft and Final Report should contain a one-page summary for each capital project examined in detail (as per section 3.2 and 3.3.2(b)). The one-page summaries should include the following:

- the planned project budget, program and outputs
- the actual project costs, program and outputs (appropriate to the stage in the project)
- reasons for variations between actual and forecast expenditures
- additional information that identifies any proactive planning by SDP for change of project scope or process development as a result of the project
- assessment of the project procurement approach, outcomes and contribution to SDP's capital program drivers, and
- an assessment of the project's prudence and efficiency.

The Draft and Final Reports should be clearly and logically set out and written in plain English, avoiding the unnecessary use of technical terms. The reports should incorporate appendices for supporting information and evidence where necessary.

The Draft Report is required to be a complete document that addresses all tasks, as outlined in this scope of works, with supporting justification. Its purpose is to provide IPART and SDP with the opportunity to comment on the consultant's recommendations. Therefore, it should not be a 'working draft' document. The consultant must present clear and well-argued recommendations on whether expenditure is prudent and efficient.

The Final Report must take into account comments provided by IPART and SDP on the Draft Report, including an explanation of how the comments have been addressed.

The consultant should note that the Final Report will be released as a public document and made available on the IPART website. SDP may identify expenditure projects or other detail that is commercial-in-confidence. The consultant must provide a version of the Final Report suitable for publication without commercial-in-confidence information, subject to IPART's instructions as to whether it agrees that the

identified information is commercial-in-confidence. Therefore, the consultant must provide two versions of the Final Report:

- one confidential version
- one public version suitable for publication without confidential information.

The Draft and Final Reports must be provided in both Word and PDF format suitable for web publication (ie, on IPART's website for stakeholder comment).

3.2 Additional outputs of the consultancy

Additional required outputs of the consultancy include:

- Regular discussions and meetings with SDP, IPART and/or the IPART Secretariat (as requested by IPART) on progress and any issues arising so that there are 'no surprises'.
- An information request to SDP setting out the information required (in addition to currently available information) to be provided to the consultant to perform the required services, as set out in this scope of works. This is to be provided in advance of interviews with SDP staff.
- Presentations to the IPART Tribunal and/or the IPART Secretariat, which outline the major issues and findings of the Draft Report and the Final Report.

If requested by IPART as an extension to the consultancy, the consultant is to provide written response to SDP's submission to IPART's Draft Report and Determination.

4. SOURCES OF INFORMATION

The list of documents below is provided as a guide only, it should not be considered exhaustive.

Task 1: Strategic review of SDP's monopoly services

- 2010 Metropolitan Water Plan and new Metropolitan Water Plan (subject to availability) and supporting reports.
- SDP pricing proposal (due 24 October 2016),

Task 2: Strategic asset management review

- SDP will provide its long-term strategic business and investment plan (at least 10 years).
- SDP's WICA licences[34] and audit reports for these licences.

Task 3: Detailed review of operating and capital expenditure

SDP's pricing proposal (due 24 October 2016) will provide the full financial details of its past and forecast operating and capital expenditure. SDP's submission will also include:

- an Annual Information Return (AIR) in Excel format, and
- a Special Information Return (SIR) in Excel format including any supporting documentation

In addition to its own analysis of available information provided, the consultant is required to source and report analysis of other inputs through:

- interviews with SDP staff

34 http://www.ipart.nsw.gov.au/Home/Industries/Water/Private_Sector_Licensing_WICA/Sydney_Desalination_Plant_Pty_Ltd

- comparisons with relevant organisations, and
- the consultant's experience in desalinated water, water and wastewater businesses and in undertaking other similar tasks.

In the event that the consultant identifies gaps in the information, it is the responsibility of the consultant to take the necessary steps to acquire the required information and to liaise promptly with IPART to ensure that the consultancy outputs are delivered on time. Should the reliability of the information be in doubt, the consultant is expected to source 'second best information', apply sound judgement and provide detail and justification for assumptions made.

Task 4: Inputs to application and review of efficiency adjustment mechanism (EfAM)

- IPART, Sydney Desalination Plant – Efficiency and Energy Adjustment Mechanisms, Methodology Paper, April 2012 (Methodology Paper).

5. SELECTION CRITERIA

IPART will evaluate each quote based on the following criteria:

- the proposed methodology to perform the required Services (this includes understanding of the Services required) (20%)
- demonstrated capacity to perform the required Services (including the proposed team, the team's experience and the allocated hours to complete the required Services) (20%)
- total cost to IPART of the delivery of the required Services (20%)
- experience and expertise in desalination technology, including strategic advice on major desalination projects of similar nature to SDP (20%)
- experience in providing Services of a similar nature to other regulators or industry including any prior work undertaken for IPART (10%)
- timeframe to perform the Services, including guaranteed availability of staff (5%) proposed quality assurance procedures and risk management procedures (5%).

6. LIAISON/CONSULTATION

The consultant may be required to attend and participate in meetings, have involvement in consultation, and attend and present at workshops or Tribunal meetings as circumstances dictate.

7. TIMETABLE

The consultant must meet the following work schedule:

Date	Activity
10 October 2016	Inception meeting with IPART
Mid- October 2016 (to be agreed by IPART and the consultant)	Inception Report
24 October 2016	SDP submission and AIR/SIR

By 27 October 2016 (or earlier)	IPART confirms weighting on special review items Task 3.3
By 31 October 2016 (to be agreed by SDP with the consultant)	Consultant inception meeting with SDP.
14 November 2016	Commence expenditure interviews at SDP – (about 1 week)
9 December 2016	Provide Draft Report on the expenditure review to IPART and SDP
21 December 2016	Present findings of Draft Report on the expenditure review to the IPART Tribunal
23 December 2016	SDP and IPART comments on Draft Report on the expenditure review due to consultant
9 January 2017	Provide Final Report on the expenditure review
Possible extension to the consultancy	
April 2017	Provide written advice in response to SDP's submission to IPART's Draft Report and Determination

8. RESOURCING

As far as is reasonably practicable, the consultant is to commit to and maintain a single project manager for the duration of this review. The consultant will ensure that the persons assisting the consultant in providing the services includes persons with appropriate expertise including desalination technology, engineering, accountancy, economics and knowledge of water industry.

In drafting the quote, the consultant should attach the resume for each of the personnel nominated for this expenditure review. In addition, the consultant should provide a breakdown of the proposed hours for each of the above tasks, by personnel.

9. CONFIDENTIALITY AND CONFLICT OF INTEREST

The quote should explicitly address any conflicts of interest (actual or perceived), and the consultants' capacity to comprehensively and effectively manage it. Please contact us once you identify any conflict of interest, before lodging your response.

The successful tenderer, and each of its employees who works on this matter, would be required to execute a deed poll obliging it to refrain from making any public statement about, or disclosing, certain confidential information associated with the matter. IPART would provide a template deed poll to the successful tenderer for that purpose.

APPENDIX A - Overview 2017 SDP price review

IPART is conducting a review of SDP's maximum prices for its declared monopoly services, to apply from 1 July 2017 (**the 2017 Determination**).

SDP's declared monopoly services are:

a) the supply of non-rainfall dependent drinking water to purchasers; and

b) the making available of the desalination plant to supply non-rainfall dependent drinking water.

IPART's Terms of Reference

We set prices for SDP's declared monopoly services under a Ministerial referral that contains a standing Terms of Reference (ToR) for future price determinations.[35]

The ToR require us to consider a range of pricing principles in making our pricing decisions. These are outlined in the Box 1 below. These principles provide very specific guidance on the structure of the prices we are to set and the type of costs to be recovered through the various price components. However, the ToR also allow us to consider any other relevant matters.

Box 1 Pricing principles for the determination of SDP prices

- The prices should be set so the revenue they are expected to generate will recover the **efficient costs** of providing the services over the life of the assets. These costs include operating costs, a return of assets (depreciation) and a return on assets.
- The depreciation should reflect the economic lives of the assets.
- In calculating the return on assets, an appropriate opening asset value should be determined, and then a rate of return that reflects the commercial risks faced by the asset owner in providing services.
- The structure of prices should encourage SDP to be **financially indifferent** as to whether or not the plant supplies water. This implies that the structure of prices should comprise (at least) separate prices for the different water supply services (the supply of non-rainfall dependent drinking water, and making the plant available to supply non-rainfall dependent drinking water).
- The prices for the supply of non-rainfall dependent water should reflect all efficient costs that vary with output, including variable labour, energy and maintenance costs.
- The prices for making the plant available to supply non-rainfall dependent drinking water should be a periodic payment. These should reflect fixed costs, including the fixed component of operating costs, a return of assets and a return on assets. SDP should be entitled to charge for making the plant available to supply non-rainfall dependent drinking water irrespective of the levels of water in dam storages servicing Sydney or the availability of water from other sources.
- Any other matters that IPART may consider relevant.

IPART's role is to set prices which reflect the efficient costs of delivering SDP's monopoly services. Our price reviews seek to protect customers from paying for inefficient or unnecessary expenditure, while ensuring SDP raises adequate revenue to cover the efficient costs required to deliver its monopoly services. IPART seeks to set prices which do not reward inefficient investment and asset management decisions, or inefficient operations and practices.

35 Pursuant to section 52(1)(a) of the *Water Industry Competition Act 2006*.

In setting prices, we are also required to consider the matters set out in section 15 of the *Independent Pricing and Regulatory Tribunal Act 1992*, which include the standards for quality, reliability, and safety.

To satisfy the ToR, it is crucial that IPART gains a detailed understanding of all costs that vary with the production of desalinated water; and those costs that are fixed and do not vary with output. We also need to consider how these costs might differ between different modes of operation.

Current price structures

We released our first determination of SDP's prices in December 2011, for the period from 1 July 2012 to 30 June 2017 (**the 2012 Determination**).

We set separate maximum prices based on five possible operational modes, including a full operation mode and four shutdown modes. Prices payable for each of these modes were based on our estimate of the SDP's notional daily revenue requirement in that mode. Fixed charges for all modes include a full return on capital, depreciation and return on working capital, as well as the efficient fixed operating costs of that mode. All variable operating costs are included in the water usage charge (per ML of desalinated water supplied). Table 1 contains annual revenues based on prices for 2016-17 set in the 2012 Determination, assuming that SDP has been in a mode for the whole year.

In addition, for the three longer shutdowns there are other fixed charges that are payable once each time the plant changes from one mode of operation to another (a 'transition to shutdown' charge and 'transition to restart' charge) that reflect the fixed costs of transitioning between the modes.

Table 1 SDP's allowed revenue from prices to Sydney Water in 2016-17 at 2012 Determination prices (excluding network electricity costs), per year

Charge	$2016-17
Water usage charges	$686.55/ML
Full Operation mode fixed charges	$207.6 million
Short Term Shutdown mode (2 – 10 days) fixed charges	$203.1 million
Medium Term Shutdown mode (11 – 90 days) fixed charges	$210 million
Long Term Shutdown mode (91 days – 2 years) fixed charges	$199.7 million
Water Security Shutdown mode (more than 2 years) fixed charges	**$194.1 million**
Water Security Shutdown payment	$1.6 million
Water Security Restart payment	$6.1 million

Note: assumes full 366 days in 2016-17 in the specified mode. Includes pipeline fixed charges. Actual operating mode in 2016-17 is Water security shutdown (no water is supplied).

Revised terms of reference - Efficiency and energy adjustment mechanisms

The ToR were amended on 16 February 2012, for future SDP's price determinations to provide for an:

- energy adjustment mechanism (EnAM) - provides for the carryover and pass-through to SDP's customers of gains or losses, outside a core band, associated with the sale of surplus electricity and Renewable Energy Certificates (RECs), and

- efficiency adjustment mechanism (EfAM) - provides the opportunity for SDP to retain the benefit of an efficiency savings for a period of four years following the year in which the efficiency saving was achieved

Following consultation, we released a Methodology Paper in April 2012 that sets out how we intend to implement these mechanisms in future price determinations.[36]

The 2017 Determination is the first to apply the EnAM and EfAM.

We will also be undertaking a review of our Methodology Paper concurrent to this SDP price review. Any changes or updates made to the Methodology Paper as a result of this review will not affect prices in the 2017 Determination, but future determinations.

The efficiency adjustment mechanism

The EfAM is a regulatory tool used to equalise the incentive to achieve permanent efficient savings over the regulatory period, removing any potential incentive for business to delay efficiency savings and enabling customers to benefit from efficiency savings sooner. EfAM ensures the business is able to retain efficiency savings for a fixed period of time (regardless of when these savings are achieved within a regulatory period) before they are passed on to customers through lower prices.

The Methodology Paper sets out that efficiencies must:[37]

- be driven by management initiatives,

- represent improvements in productive efficiency (ie, less input per unit of output), and

- be net of any efficiency losses (ie, represent true 'whole of business' efficiency savings that can be passed on to customers through lower prices).

EfAM applies only to non-energy related operating expenditure. Efficiencies can be 'mode specific' or 'general'. Mode specific efficiencies are only carried over to the extent SDP continues to operate in that same mode during the carryover period. General efficiencies are to be carried over regardless of which operating mode SDP is in during the carryover period. SDP has the option to apply for an efficiency carryover in its price submission to this review.

SDP's operating rules

Sydney Desalination Plant was constructed by Sydney Water from 2007-2010 as a drought response measure in accordance with the NSW Government's Metropolitan Water Plan. SDP's operating rules are set in the Metropolitan Water Plan and are incorporated as conditions of SDP's network operator licence under the *Water Industry Competition Act 2006* (WIC Act).

36 IPART, *Sydney Desalination Plant – Efficiency and Energy Adjustment Mechanisms, Methodology Paper, April 2012* (Methodology Paper).

37 IPART, *Sydney Desalination Plant – Efficiency and Energy Adjustment Mechanisms*, Methodology Paper, April 2012, pp 16-20.

The current Metropolitan Water Plan was released in 2010. It states that SDP is to operate at full production and supply Sydney Water's area of operations when the total dam storage level is below 70% and continue to do so until the total dam storage level reaches 80% (**the 70/80 rule**).[38]

The 2010 Metropolitan Water Plan is currently being reviewed to take account of changes in demand and supply, new data and research.[39] The updated Plan may change SDP's role as a drought response measure (ie, storage trigger levels and sequencing). Contingent on the Plan being released in time, we will take into account any new operating rules or modes of operation prescribed for SDP when setting prices.

SDP is currently in Water Security Mode

SDP produced its first desalinated drinking water in February 2010. The plant then ran continuously for two years, from 2010 to 2012, to prove plant capacity and reliability. SDP went into water security (shutdown) mode after its proving period in June 2012, as dam levels were 98%. It has remained in Water Security Mode since.

On 16 December 2015, SDP sustained damage from a storm event that occurred in areas across Sydney. As a result, SDP is currently undertaking procurement processes to award a construction contract to repair the plant and equipment. SDP anticipates repairs will commence in September 2016 and will continue for 12 months. SDP reports that it has comprehensive insurance to support the repairs to the facility.

APPENDIX B - Efficiency test and prudence test

Efficiency test

In reviewing expenditure, the *efficiency test* is used to determine how much of SDP's proposed expenditure (operating and capital) for the upcoming determination period (commencing on 1 July 2017 for a period up to five years) will go into IPART's determination of SDP's revenue requirement. The efficiency test should examine whether SDP's actual and proposed expenditure represents the best and most cost effective way of delivering the regulated services.

Prudence test

The prudence test assesses whether, in the circumstances existing at the time, the decision to invest in an asset is one that SDP, acting prudently, would be expected to make. In assessing prudence, the consultant should assess both *how the decision was made*, and *how the investment was executed* where the asset has been built (ie, the construction or delivery and operation of the asset), having regard to information available at the time. In examining forecast expenditure, the prudence test should examine the consistency of this expenditure with SDP's longer term capital expenditure program.

The *prudence test and efficiency test* is used to determine how much of SDP's:

- actual capital expenditure in the current determination period (1 July 2011 to 30 June 2017) should be rolled into SDP's Regulatory Asset Base (RAB) for the start of the upcoming determination period, for the purposes of calculating allowances for return on and return of capital
- forecast capital expenditure in the upcoming determination period (1 July 2017 to 30 June 2022) should be rolled into SDP's RAB over the course of the upcoming determination period, for the purposes of calculating allowances for return on and return of capital.

38 NSW Government, *2010 Metropolitan Water Plan*, August 2010, p 36.

39 NSW Government, Metropolitan Water Directorate, *Updating the Plan*, at http://www.metrowater.nsw.gov.au/planning-sydney/updating-plan/current-review, accessed on 11 July 2016.

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