SunWater Price Regulation

REVIEW OF SELECTED ANNUITY VALUES FOR REFURBISHMENT AND REPLACEMENT ITEMS

- 2 - Final
- 6 October 2011

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Limitation Statement

The sole purpose of this report and the associated services performed by Sinclair Knight Merz Pty Ltd (SKM) is to assist the Queensland Competition Authority (the Authority) in its review of renewable expenditure of SunWater Corporation (SunWater) in accordance with the scope of services set out in the contract between SKM and the Authority. That scope of services, as described in this report, was developed with the Authority.

In preparing this report, SKM has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Authority, SunWater and/or from other sources. Except as otherwise stated in the report, SKM has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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1. Introduction and Background

SunWater is a Queensland Government owned corporation that owns and manages a regional network of bulk water infrastructure throughout Queensland to support around 5,000 customers across the resources, energy, urban and irrigation infrastructures. SunWater has an asset base of 19 dams and 63 weirs and barrages, 80 major pump stations, more than 2500 km of pipelines and open channels and 730 km of drains.

These assets are divided into 23 water supply schemes across Queensland which are subdivided into 40 Service contracts consisting of the following service types:

- 23 Bulk Supply Contracts
- 8 Irrigation Distribution and Drainage Contracts
- 6 Commercial Pipeline Contracts
- 2 Potable water treatment and distribution networks
- 1 Hydroelectric generator.

The water supply schemes are supported by four regional operation centres and SunWater's head office located in Brisbane.

A map showing the extent of the coverage of SunWater's infrastructure in Queensland is provided in Figure 1.

The existing pricing mechanisms that apply to the 22 water supply schemes of SunWater are due to expire on the 30th June 2012. Prices for customers are established, in part, by an annuity mechanism. Under this mechanism the cost of replacing and or refurbishing assets that are deemed to require refurbishment and or replacement in each water supply scheme is determined for the duration of the next annuity period being 25 years from 2012 to 2037. The costs for replacement and refurbishment of the assets are brought forward to present day terms through a discounting mechanism to create an annuity value for each scheme. This annuity value is then used as an input to establish the prices for customers serviced by that scheme for the next price reset period, being 5 years.

As such it is important that the planned refurbishment and replacement spend is required and that the planned expenditure is efficient. In its capacity as regulator of SunWater's business, the Queensland Competition Authority commissioned SKM to assess the prudency and efficiency of a sample of SunWater's renewals expenditure for 2006-11 and a sample of forecast capital expenditure (renewals and major refurbishments) for 2012 to 2037. A copy of the Terms of Reference for this assignment is provided in Appendix A. A definition of the prudency and efficiency test applied is provided in the Terms of Reference and also in Section 4 of this report.

The list of past renewal annuity items[1] reviewed by us is provided in Table 1and the list of future renewal annuity items reviewed by us is provided in Table 2.

A short sub-report on each future annuity item reviewed is provided in Appendix B and a short sub-report on each past annuity item reviewed is provided in Appendix C of this report.

- **Table 1 List of Past Renewal Annuity Items Reviewed**

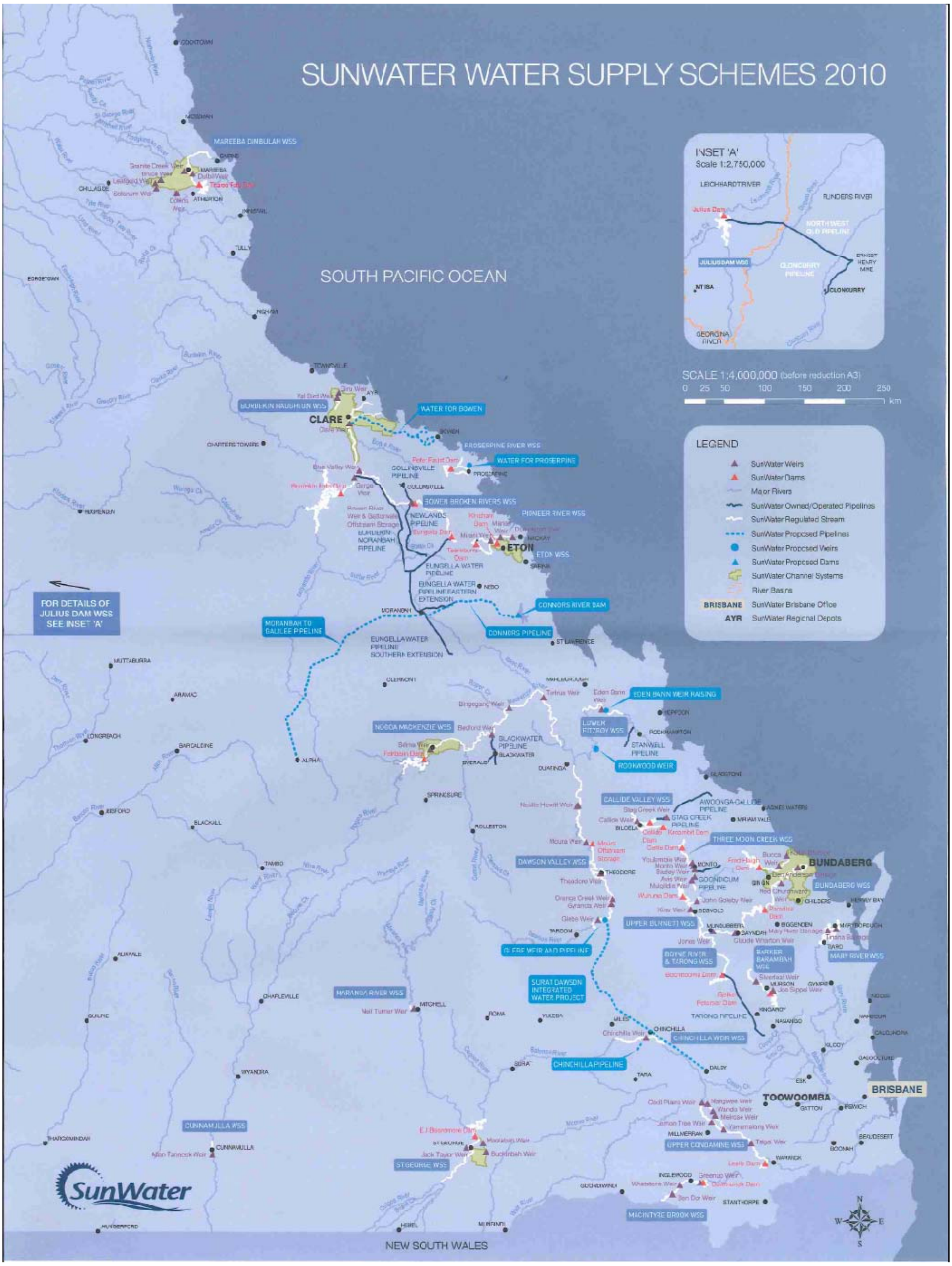
Annuity Item	Annuity Value ($2011)
Fairbairn Dam Outlet Upgrade	1,482,398
Intersafe Safety Modernisation Program	N/A
Whetstone Weir	2,350,064
Marion Weir	4,800,000
Palm Tree Creek Valve Replacement	1,875,000

- **Table 2 List of Future Renewal Items Reviewed**

Annuity Item	Year	Annuity Value ($2010)
Burdekin Falls Dam – Replace High Voltage System	2023	$2,629,204
Burdekin Falls Dam – Replace Cable	2024	$2,295,907
Peter Faust Dam – Replace Cables and Cableways	2026	$850,974
Elliot Pump Station – Replace Switchboard No 1 (Pumps 1 & 2)	2012	$262,000
Fred Haigh Dam – Replace Cable Main Wall	2014	$250,000
Tinana Barrage – Apply a concrete skin over existing rock protection	2012	$56,660
Silverleaf Weir	2012	$314,918
Boondooma Dam – Replacement of Sealer	2017	$140,000
Boondooma Dam – Replace Cables and Cableways	2032	$464,657
Owanyilla Pump station – Electrical Component Upgrade	2011	$404,022
Don Beattie Pump Station – Replace Common Controls	2019	$1,084,468
Chinchilla Weir – Purchase and Install Butterfly Valve	2016	$100,00
Allan Tannock Weir	2014	$17,655
Jack Taylor Weir	2012	$273,511
Coolmunda Dam – Paint D/S of Gate Structure; Gate 4	2012	$48,333
Coolmunda Dam – Paint D/S of Gate Structure; Gate 5	2012	$48,333

[1] By annuity item we mean a discrete infrastructure asset that SunWater has initiated replacement/upgrade or refurbishment in respect of past annuity items or that SunWater plans to replace/upgrade or refurbish classed as a future annuity item.

Annuity Item	Year	Annuity Value ($2010)
Coolmunda Dam – Refurbish D/S Gate Face; Gate 3	2013	$63,5435
Coolmunda Dam – Repaint all D/S face; Gate 6	2014	$43,625
Leslie Dam – Replace Cableways	2019	$1,376,784
St George Pump Station – Construction of New Suction Lines and Pipework	2013	$355,081
Gattonvale Off Stream Storage – Stabilise Embankment	2013	$81,000
Kinchant Dam – 5 Year Dam Inspection	2013	100,000
Dumbleton Weir – Replace Control Equipment	2019	$308,584
Brightley Pump Station No 2 – Replace Cable	2012	$21,435
Mt Alice Pump Station, Pump Unit No 3 Overhaul (Seals and Bearings)	2013	$25,000
Callide Dam – Replace Cable and Cableways	2017	$870,895
Theodore Weir – Replace Concrete/ Steel Piled Weir	2034	$532,181
Fairbairn Dam – Refurbish Right Bank Outlet Works	2012	$630,000
Cania Dam – Replace Cables & Cableways	2018	$254,414
Selma Irrigation Chanel – Replace Concrete Lining	2032	$4,435,424
South Walsh Distribution – Replace Concrete	2026	$1,956,700



- **Figure 1 Area of coverage of SunWater's operations**

2. Information Sources

In developing this report and the sub reports in the appendices, we have relied upon information retrieved from SunWater's SAP Works Management System (WMS) and a number of policy and procedural documents developed by SunWater as listed in the table below:

- **Table 3 Information Sources - General**

Document No.	Document Name	Document Title	Date
11084441	1108441 QCA Justification – Coolmunda Dam Radial Gates Painting – Gate 5	MacIntyre Brook Water Supply – Coolmunda Dam – Paint Downstream of Gate Structure (MAB-COOL – SPWY-GT05-GATE)	8th August 2011
		Review of irrigation prices: Asset Management Planning Methodology Paper	October 2010
		Methodology for Risk Assessments of Infrastructure Assets – Standard No: AM.20 Rev 2	9th October 2008
		Asset Refurbishment Planning: Methodology for Condition Assessments of Assets – Standard No. AM.21 Rev 1	7th February 2008
		Asset Condition Assessment Users Manual. Ver 5.2	5th January 2009
		Users Manual for Assessing Civil Assets. Ver 6.2	27th October 2008
		Users Manual for Assessing Mechanical Assets. Ver 5.3	5th January 2009
960626	960626-v1-Whole of Life Maintenance Planning Tool (Master)	Whole of Life Maintenance Planning Tool Spreadsheet	
956033	Standard Asset Life Document Spreadsheet	Standard Asset Life Document	
111986	Condition Based Replacement Asset Life Adjustment Tool Spreadsheet	Condition Based Replacement Asset Life Adjustment Tool	
		SunWater Asset Management System: Asset Refurbishment Planning Guideline, Rev 2.0	December 2007
		Work Planning, Management and Recording Rev. 7.0	February 2011
	Cardno	Asset Valuation Final Report	June 2008
	Arthur Anderson	Queensland Water Reform Unit: Optimised Depreciated Replacement Cost Valuation State Water Projects	30 June 2000

For future annuity item replacements/refurbishments, we have also sourced information from and relied upon annuity item specific reports produced by SunWater which capture extracts from SunWater's WMS and provide background information. These reports are listed in the annuity item specific reviews in Appendix B and in Appendix C.

3. SunWater's Annuity Item Value Setting Process

This section deals largely with the processes used by SunWater to determine which assets (annuity items) are required to be refurbished or renewed during the price setting annuity period, being 25 years from 2012 onwards. As described above, SunWater is required to develop an annuity value based on the aggregated estimated costs of replacing or refurbishing those assets that are deemed to require replacement or refurbishment in the 25 year annuity period. A more detailed explanation of SunWater's procedures for asset management is described in SunWater's report: *Review of irrigation prices – Asset Management Planning Methodology Paper*, (October 2010).

In the 25 year annuity period, SunWater is required to replace and or refurbish thousands of assets. SunWater adopts a portfolio investment plan approach to determining the overall expenditure deemed to be required to undertake necessary asset refurbishment and or replacement during this period as it is impossible for SunWater to predict with a 100% accuracy which assets will actually require refurbishment and or replacement during the annuity period, when and at what cost. The investment plan portfolio approach assumes that, by viewing the required investment as a whole, there will be an equal value of replacement annuity items that will be required to be replaced that were not planned for as the value of annuity items that were planned to be replaced and ultimately are not required to be replaced in an annuity period. This is particularly the case for those assets that are expected to have a long operating life.

Hence, by taking a portfolio approach, SunWater considers that it is able to reasonably predict the value of the annuity required to replace and or refurbish its assets in each of its water supply schemes for a 25 year period even if the actual assets refurbished and or replaced during that 25 years don't exactly align with the assets planned to be refurbished and or replaced. Similarly, SunWater considers that by taking a portfolio approach, there will, in the balance, be as many annuity items that it over estimates the expenditure required to refurbish and replace as there are annuity items that it under estimates the expenditure required to replace or refurbish.

However, this portfolio approach does not lend itself well to regulatory review of the submitted annuity value where that regulatory review is by evaluation of a sample of annuity items proposed to be replaced or refurbished on the grounds of prudency or efficiency. Such a review will only be fully reflective of the overall prudency and efficiency of the annuity value unless the sample size is sufficiently large and random as to capture an equal number and value of annuity items that are scheduled for earlier replacement/refurbishment than required as those that are scheduled for later replacement or refurbishment as required as well an equal number and value whose replacement costs have been over estimated as under estimated. Generally it is impractical on both a cost and timing basis to review a sufficiently large sample size to achieve this.

As such, in our review of prudency and efficiency, as well as looking at the timing, need and cost of individual annuity items we have also endeavoured to identify any systemic processes or systems adopted by SunWater that would tend to bias the outcome of its portfolio approach in one direction or another. Such biases could include, for example, adopting a lower run to failure asset life than the norm, use of incorrect unit rate multipliers for certain asset classes and the like.

3.1. Asset Replacement/Refurbishment Date Determination

SunWater has developed a comprehensive procedure to enable it to efficiently manage a large portfolio of assets and to develop a forward plan of replacement and refurbishment extending some 25 years out.

A key element of this procedure is the process adopted to determine (or predict) when an asset is due for replacement or refurbishment. For each asset class (object type, SunWater applies a standard run to failure asset life and a standard refurbishment frequency. In addition to use of standard asset lives, SunWater has developed a standard asset condition decay curve which predicts what the condition of an asset should be on a score of 1 to 6 (1 being new and 6 being unserviceable) over the standard asset life. A similar curve has been developed to predict asset condition between refurbishments during an asset's life. Although different asset classes have been allocated individual run to failure asset lives, currently, SunWater applies a uniform standard asset condition decay curve to each asset.

In the following text we mainly outline the process used for asset replacement. The process used for determining timing of asset (annuity item) refurbishment is largely identical.

As mentioned above, SunWater utilises just one standard asset condition decay profile (curve) for all assets. Although this condition decay curve is representative for some asset types – particularly civil assets, it is not necessarily representative of all asset types – particularly electrical control equipment, switchgear and the like. SunWater recognises this and is in the process of developing asset specific asset condition decay curves.

SunWater adjusts the standard run to failure duration for asset renewal determination (or standard refurbishment interval for refurbishment planning) by a two stage process. The first stage is an assessment of business and workplace health and safety (WH&S) risk and the second stage relates to an assessment of the condition of the asset against the condition that asset is expected to be in according to the standard asset condition decay curve. Each of these steps is explained briefly in sections 3.1.1 to 3.1.4.

SunWater applies a different process to run to failure asset life for an individual asset (annuity item) depending whether the trigger is as a result of a business risk or a WH&S risk. The process for adjusting run to failure life on business risk assessment is described below:

3.1.1. Business Risk Assessment

For each asset (annuity item) in its asset base SunWater undertakes an evaluation of the business risk implications of failure of that particular asset. For each criterion assessed, SunWater applies a consequence score and a likelihood score. The combination (multiplication) of these scores determines the overall risk rating for that criteria assessed for that asset; Low, Medium or High.

For those assets that have scored a Low to Medium risk rating on a business risk assessment criterion but where the maximum consequence score is less than 8, the adopted run to failure asset life is the standard run to failure life for that asset class.

For those assets that have scored a Low to Medium risk rating on a business risk assessment criterion but where the maximum consequence score is greater than 8, the adopted run to failure asset life is reduced to 88% of the standard run to failure life for that asset class.

Finally, for those assets that have scored a High risk rating on a business risk assessment criterion, irrespective of the consequence score, the adopted run to failure asset life is reduced to 63% of the standard run to failure life for that asset class.

The purpose of reducing the standard run to failure asset life for those assets whose failure presents an appreciable business risk is to reduce the likelihood of an asset failing before it is replaced. This process takes into account the typical distribution of run to failure times of a given asset type. Thus by bringing the replacement date forward, over a portfolio of assets of a similar type, a greater number will exhibit a run to failure date after the risk adjusted replacement date than before.

We consider this approach to be appropriate for managing a large portfolio of assets of this nature when endeavouring to maximise asset life whilst at the same time avoiding unnecessary business risk due to asset failure.

3.1.2. WH&S and environmental risk assessment

For risks associated with WH&S criteria, SunWater does not adjust asset life but instead prioritises work required to address a WH&S risk according to the risk rating, consequence score and rectification cost. This is outlined in the following table taken from SunWater’s Asset Management Planning Methodology Paper:

- **Table 4 Prioritisation of scheduling of one off tasks**

	Condition Based			Risk Based (Safety & Environment)		
Priority	**Condition Score**	**Asset Risk Rating**	**Consequence Score**	**Risk Rating**	**Consequence Score**	**Rectification Cost**
A	>2	Extreme	NA	Extreme	NA	NA
B	>3	High	NA	High	NA	NA
C	>4	Low to Medium	>8	Medium	>8	<$100k
D	6	Low to Medium	<=8			

Thus, SunWater prioritises one off work relating to a need to address a WH&S based risk according to the level of risk identified.

It is noted from the above table, that SunWater also prioritises one off work against a condition score and asset risk rating, however, we have not seen this process put into practice in our review of annuity items.

We consider the process of prioritising one of tasks according to WH&S risk as described above, irrespective of the condition score of the asset to be in keeping with good industry practice. The Intersafe Safety Modernisation works is an example of where SunWater has applied this WH&S risk assessment procedure to prioritise work.

3.1.3. Condition assessment

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of modifying the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts the asset should be in at that time.

In this process, SunWater adjusts (moves to the left or right in a temporal sense), the standard asset decay curve for a particular asset based on actual condition at a given time. Where, at a given point in time, a condition assessment reveals that the asset condition is different (achieves a different score – in the range 1 to 6) from that which the condition decay curve would predict, then the curve is moved such that it intersects this inspection determined condition score at that point in time. This can have the effect of increasing the run to failure asset life or decreasing it depending on whether the observed condition is better than predicted by the asset condition decay curve at the date at which the condition is monitored or worse.

Each asset type is condition assessed at a frequency in proportion to the standard run to failure asset life of that asset type. Hence assets with a short run to failure asset life such as control equipment are assessed more frequently than those assets with a long run to failure life such as irrigation channels.

SunWater has codified this process by allocating a number of condition criteria specific to each asset type against which an asset's condition is assessed. Following condition assessment of an asset, each of these criteria is scored from 1 to 6 see Table 5 below:

- **Table 5 Condition rating table**

Rating	Description of Condition
1	Perfect as new condition
2	Minor defects only
3	Moderate deterioration with minor refurbishment required to ensure on-going reliable operation
4	Significant deterioration with substantial refurbishment required to ensuring on-going reliable operation.
5	Major deterioration such that the asset is virtually inoperable
6	Asset has failed and is not operable.

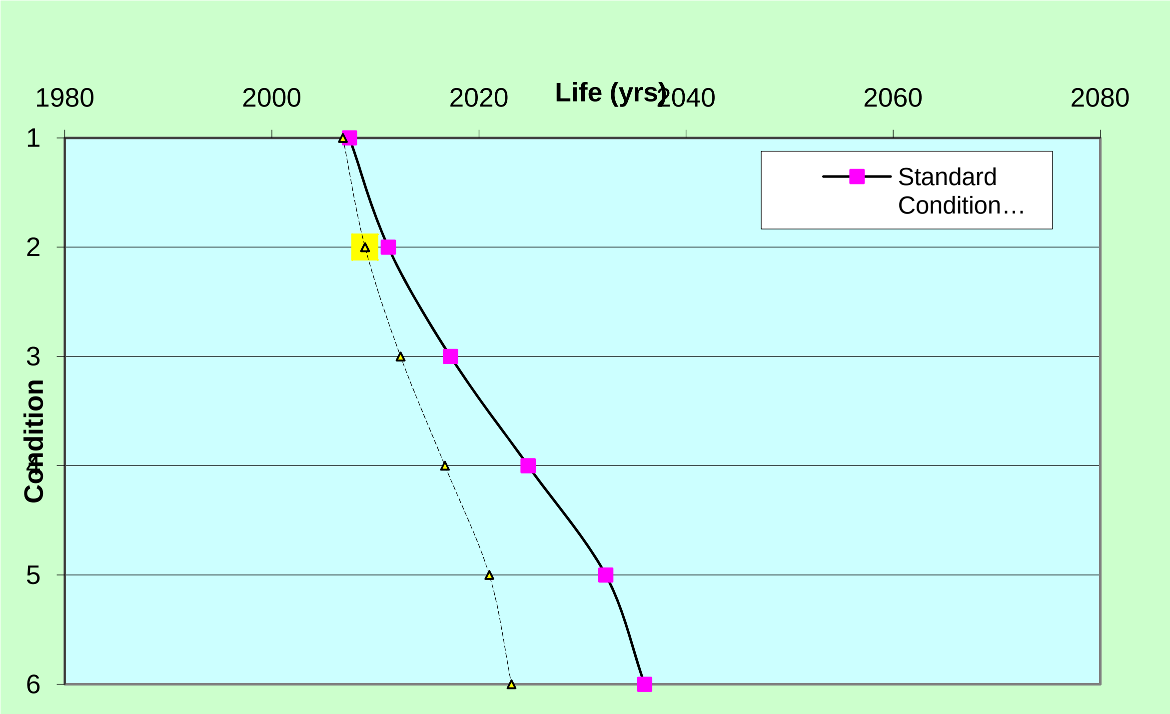
The worst (highest) asset condition criterion score is used in SunWater's condition based replacement life adjustment tool, together with the in-operation date, standard run to failure asset life, the risk score and the date on which the latest condition assessment took place to project an asset specific revised run to failure asset life and hence replacement date for planning purposes.

Extracts of the tool are shown in Figure 2 and Figure 3 below for an asset installed in 2009 with a 35 year asset life, a Medium risk score, a condition score of 2based on a 2009 assessment:

- **Figure 2 Input and output table of the planning tool**

Job Name	Example					
	Std Run to Failure Life	35	In operations since	2006	Asset Risk	Medium
			Year of last Condition Assessment	2009	Maximum Condition Score Last Assessment	2
				New Replacement Year	2021	

- **Figure 3 Graphical output of the planning tool**



In this case, the planning tool predicts that the replacement date for the asset should be brought forward from the standard life based replacement date for that asset type of 2040 to 2021 taking into account the risk rating of a particular asset and the fact that the condition assessment indicates that the asset score (yellow square) has deteriorated more rapidly than the standard decay curve would predict.

We consider that the process adopted by SunWater to plan the timing of replacement of a large portfolio of assets over a 25 year period is robust and in keeping with good industry and good engineering practice. However, we have noted in our application of the planning tool that it becomes unreliable in those instances where the asset condition is superior to that predicted by the condition decay curve, particularly early in the life of the asset. In these cases the projected run to failure asset lives are increased by several times the standard run to failure asset life. SunWater recognises this limitation and emphasises that the tool is only an aid to planning and that SunWater's Planning Team uses experience and engineering judgement in setting the planned date for replacement of the asset and do not simply rely on the tool.

Whilst we agree with the importance of using engineering judgement rather than slavishly relying on a process we feel that there would be merit in SunWater further enhancing the tool (as it plans to do so) to make it more reliable over a larger range of potential asset condition scenarios.

We have noted in our evaluation of SunWater's processes that SunWater applies an age based condition assessment criterion to a number of asset types. Assets that have age as a condition criteria include:

Mechanical
Valves (M3: VLV) % of refurbishment life
Actuators (M4 ACTU) % of refurbishment life
Regulating gates (M5 RGTE) % of refurbishment life
Hydraulic systems (M6: HYS) % of refurbishment life
Air Systems (M7 PNEU) % of refurbishment life
Vacuum Systems (M8: VACS) % of refurbishment life
Ventilation Systems (M9 VENS) % of refurbishment life
Cooing Systems (M12: COOL) % of refurbishment life
Compressors (M13: COMP) % of refurbishment life
Pressure Vessels: (M14 PRESV) % of refurbishment life
Gensets: (M15 GEN_STBY) % of refurbishment life
Fixed Wheel Gates, Slide gates & Radial Gates (M16 GATES) % of refurbishment life
Miscellaneous Mech Equipment (M17 MEQUIP) % of refurbishment life

Electrical Equipment
Switch Boards (internal equip) (E1 SWB) % of replacement life
Motor (E1 MTOR) % of refurbishment life
Cathodic Protection TX/Rect/Cntrls (E3 CP) % of refurbishment life
SCADA (E4 SCDA) % of replacement life
Batteries (E6: BATT) available remaining life
Complete Battery system (E6: BATT) % of replacement life
Uninterruptible Power Supply (E7 UPS) % of replacement life
Cabling – Power (E9: CBLE_POW) % of replacement life
Cabling – Comms (E10 CBLE_COM) % of replacement life
Cableway (E11 CBWY) % of replacement life

We question the use of age as a criterion for assessing condition given that asset age is implicit and inherently built into the standard asset condition decay curve. A well maintained asset, operating within its design parameters may exhibit a condition that is superior to that which its standard asset condition decay curve may predict at any point in time. It seems to us that by using age as a criterion for predicting replacement timing of a particular asset precludes the option of extending the run to failure asset life of that asset in circumstances where its condition is superior to that which the decay curve would predict. The net result of this, applied across the asset base, would be to skew the replacement date of those types of assets for which an age criterion is used to assess condition to an, on average, earlier date than the standard run to failure replacement date.

SunWater has responded to our comments on using age as an assessment criterion and made the following points:

"One of the reasons for developing a long term replacement and enhancement plan is to develop a portfolio wide cash flow investment profile. SunWater has adopted a risk based methodology. This means that a low risk asset will be replaced when it fails. Higher risk assets will be replaced at a predetermined condition prior to failure. In practice this approach has some difficulties when a long term plan is developed. These difficulties include:

- *A number of asset types do not demonstrate a progressive decline in condition that is easily measurable. Eg computer equipment typically fails suddenly and without warning*
- *Predicting the failure of a long life asset from condition performance early in its life requires substantial extrapolation. This results in a wide band of uncertainty in programming end of life*
- *The normal distribution experience in mean time between failure (MTBF) for similar asset types. Eg a study of centrifugal pumps in the US indicated that the MTBF has a standard deviation of 40%* [indicating significant uncertainty in predicting when that asset would fail].

Age is used to assist with placing investments that are sometime in the future. This is particularly helpful where condition is not otherwise measureable or there is no other reliable early indicator of replacement. Age is used as a substitute to assist longer term planning.

Age is never used as an indicator of failure. Condition 6 for this aspect is never reached unless it meets the criterion "failed/unrepairable/obsolete". It should be noted that age is only used up until the asset has reached 75% of its standard life. Our standard practice for higher risk assets is to undertake a condition assessment (other than age) before work is commenced."

Whilst we accept, in part, SunWater's arguments for using age as a condition assessment criterion as a proxy for condition assessment criteria that are difficult to assess or as a method of overcoming the difficulties of representing all asset condition decay- time functions with a single condition decay curve we believe that there would be merit in SunWater moving away from use of age and developing:

1) More appropriate decay curves for different asset types
2) Condition assessment methods that extend beyond visual/operational based inspections such as insulation breakdown tests and earth impedance tests for electrical cable assets.

3.1.4. Combined condition and risk assessment

In addition to the two stage – risk and condition assessment process described above, SunWater's Asset Management Planning Methodology Paper outlines a process of determining asset replacement or refurbishment based both on risk and a maximum allowable condition score as set out in Table 6 below:

- **Table 6 Asset Risk and Condition Intervention Policy Table**

Asset/Business Risk	Maximum (allowable) Condition Score
Extreme	3
High	4
Low to Medium (Consequence > 8)	5
Low to Medium (Consequence <= 8)	Run to Fail

Thus, for an asset with a business risk score of High, its replacement will be scheduled when its condition is forecast to decay to a condition assessment of 4.

Again, we consider this method for planning asset replacement to be in keeping with good industry practice. We have not seen application of this process in use for any of the annuity items that we have reviewed and hence cannot comment on its implementation.

3.2. Annuity Item Renewal/Refurbishment Cost Determination

In order to establish an overall annuity value (or portfolio investment strategy as SunWater prefers to refer to the process) a replacement or refurbishment annuity value must be assigned to each annuity item that is planned to be replaced or refurbished in the 25 year annuity period.

Developing the overall portfolio plan for replacement of assets in the 25 year annuity period is undertaken at one of the earliest stages of SunWater's planning processes. Hence the level of detail that is applied to evaluating the timing, option and cost of replacement of a particular annuity item can be likened to a pre-feasibility stage of or project evaluation. As such, SunWater's estimates for annuity item replacement/refurbishment can best be categorised as a Level 4 estimate (+30%/-20%) (see Figure 4 in Section 4.2.1).

SunWater develops more detailed studies, including options analysis (depending on the size of the project) typically 6 months to 18 months out from planned commencement dates. As such, at the time of our review, no detailed option studies were available for review for the future renewal annuity items assessed. Taking the overall portfolio and hence annuity value, this level of estimating accuracy is considered reasonable.

SunWater applies two main approaches when determining the replacement or refurbishment annuity value for a given asset. For replacements/refurbishments within five years of the annuity value determination date, SunWater applies a 'bottom up' approach or estimation based on the costs for recent similar works undertaken. For annuity item replacement/refurbishment planned for between five and twenty five years from the annuity value determination date, SunWater applies a unit rate against bill of materials quantities for the asset in question.

These two methods are described in more detail in the following sections:

3.3. Short term annuity item replacement/refurbishment cost determination

For replacements/refurbishments within five years of the annuity value determination date, SunWater applies a number of approaches to estimating the replacement/refurbishment annuity value depending on the complexity and size of the works involved:

- A 'bottom up' approach using bench mark estimating rates
- For relatively minor works such as the refurbishment of a radial gate, SunWater's planning team draw on actual costs for similar activities undertaken recently. Hence cost estimation is based on the costs for recent similar works undertaken
- A bill of materials and standard unit rates as applied to annuity items that are planned to be replaced more than 5 years after the date of planning and establishing the Network Service Plans (see section 3.4 below).

Given the size of the portfolio concerned, we consider this approach to be reasonable. Our detailed review of the bill of materials and standard component unit rates (building blocks unit rates) is provided in Section 3.4 below.

3.4. Long term annuity item replacement/refurbishment cost determination

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value is attached to each item (component or building block) making up the BOM. The unit rates were determined in an asset base wide valuation conducted in 1997. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an 'Indirect Cost' multiplier to take account of annuity item replacement specific factors such as location, project management costs etc.

This approach (including the Indirect Cost uplift multipliers but excluding the escalation factors developed by Cardno in 2008) was audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

However, we have some concerns over the method by which Cardno developed escalators for different categories of assets and the manner in which they are applied. We discuss this in Section 3.4.1 below.

We also have some concerns over SunWater's adoption of a 'like for like' replacement assumption for renewals. For longer term asset replacement, SunWater assumes a like for like replacement as standard. Adopting a like for like replacement doesn't allow SunWater to take account of changes in technology and hence, in some cases, reduction in replacement costs arising from that change in technology. For longer term asset replacements we feel that there would be merit in SunWater monitoring technical changes and apply the most appropriate current technology at the time of the annuity value development rather than always assuming a 'like for like' replacement. This would avoid least obsolete technologies (and hence potentially more expensive technologies) being incorporated into annuity value. This process would be automatic if SunWater adopted modern equivalent asset unit rates rather than using escalated 1997 rates.

3.4.1. Review of rate sets used

The basis for the capital estimates are asset component building block unit rates first established in 1997 from an asset valuation utilising as installed drawings to develop bills of materials for individual annuity assets. These asset component 1997 values (unit rates) are escalated by SunWater to June 2008 values using standard asset class escalation factors established by Cardno during a 2008 valuation.

SunWater commissioned independent consultants Cardno to develop suitable escalation factors.

In developing escalation rates to take the 1997 asset values to 2008 money terms, Cardno first grouped asset types into a number of broad categories e.g. Electrical equipment. It then sub divided these categories into identifiable asset types such as pumps of varying ratings. Cardno then compared the 1997 asset values for each asset component in a given group against a 2008 cost for that asset type identified by Cardno to produce a 1997:2008 value range of ratios. Cardno then averaged the 1997:2008 ratios for each asset component type grouping to develop an average unit rate escalator for a given group of asset building blocks so hence all electrical assets were allocated a 2.13 multiplier, all pumps were allocated a 1.5 multiplier etc.

In undertaking this exercise Cardno noted that some 1997 values were inconsistent eg a 75kW pump in a particular asset BOM was valued at a higher price (higher building block unit rate) than a 132 kW pump. To attempt to compensate for this, Cardno ignored 1997:2008 value ratios that were clear outliers eg for the pump example all ratios above 3.0 and below 0.6 were ignored in the averaging process.

These relatively broad multipliers are then applied by SunWater to the 1997 unit rates captured for each asset component on an individual basis in the 1997 valuation. Whilst we note that this approach was proposed by Cardno[2] with qualifications regarding the unspecified scope of the building blocks, potential overlap of building blocks, and time constraints that affected the ability to conduct a more extensive study, we have some concerns with the reasonableness of applying blanket escalation factors across the different asset categories covering such an extensive time interval. In particular we consider that, as the 1997 rates for similar asset types varied widely (as noted by Cardno), applying a broad based single multiplier to the individual 1997 values could result in significant cost errors on a project by project basis. Taking the example of the category of pumps, at the extreme, applying this approach could result in a pump of the same pump rating having a unit rate that ranges between 1.5/0.6 = 2.5 times a central 2008 unit rate and 1.5/3.0 = times 0.5 times a central 2008 unit rate.

Hence the result is that, for those 1997 unit rates (component costs) in the bills of materials that are higher than they should be, multiplying them by an averaged standard uplift (1997 average cost to 2008 cost ratio) exacerbates the cost inconsistency of those particular components as compared to an accurate 2008 unit rate and vice versa for those components that have a lower 1997 unit rate than then should.

Whilst the use of standard asset component class multipliers on 1997 installed component costs works when the asset base is considered as a portfolio, in that the overvalued items are compensated by undervalued (costed) items, the approach breaks down when individual replacement annuity item costs are benchmarked during a regulatory price set review. In that those annuity items for which the 1997 installed component costs are significantly higher than the 1997 mean for those components will be deemed in-efficient and hence excluded from the annuity value. Whilst those assets whose 1997 component costs were in line with or below the benchmark at the time, will be deemed, when multiplied with the Cardno multiplier to escalate to 2008 costs to be efficient. This will skew the average replacement cost (on a portfolio basis) to below the 2008 (or 2010) benchmark and hence reduce the annuity value below that required by SunWater.

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[2] Cardno, *SunWater Asset Valuation: Final Report*, June 2008

We consider that rather than using a multiplier to escalate individual 1997 values, it would have been more appropriate if Cardno had developed a standard 2008 unit rate for each asset component type (building block) and then for SunWater to apply this 2008 rate universally to replace individual 1997 unit rates in the BOMs for each asset.

We also consider, from our review of the Cardno 2008 Asset Valuation Report (the Cardno report) that the report itself does not provide sufficient detail to ascertain the accuracy of the escalation indices applied to the 1997 SunWater valuation. For the 2008 unit rate update, Cardno has escalated the 1997 unit rates based on average price increases from a combination of sources listed below:

- Direct recent contract price data for identical items to escalate from 1997 to 2008,
- Rawlinson's Australian Construction Guide for 1997 and 2008, and
- Recent SunWater dam valuations.

From review of the 4,028 items in the SunWater Bill of Materials (BOM), 11 items only were directly escalated based on recent contract price data identified by Cardno. The remaining items in the BOM have been escalated by the following method:

- Identify assets for escalation to be based against.
- Complete asset valuation based on total BOM for the asset and unit rate price in 1997.
- Compare 1997 asset valuation to 2008 asset valuation.
- Break 2008 asset valuation into individual contribution for each BOM item and compare to 1997 unit price.
- Combine BOM items into 20 material categories and average escalation ratio per category.
- Repeat for all assets being assessed.
- Average category escalation ratios for each asset, removing statistical outliers, to produce average category escalation ratio for all assets.

The Cardno report provides limited detail of where source information was derived apart from Rawlinson's and the recent dam valuations. Additionally, the grouping of BOM items into material categories has been based on item technical use. For example steel, concrete, polyethylene and glass reinforced polymer pipes have been grouped into one category 'pipe supply' for escalation as opposed to grouping items according to price drivers. Steel prices have differing market price drivers compared to oil prices (which drives plastic prices) and domestic construction drivers and therefore will experience escalation at differing rates.

We have compared the Cardno indices with other publically available data, in particular, the Australian Bureau of Statistics (ABS) Catalogue Series 6427.02 – Producer Price Index. Tables 10 and 11 for the following:

Table 7 Comparison of Cardno Escalators with ABS Derived Escalators

ABS Item	Index	ABS 1997-2008	Cardno Group	Cardno 1997-2008
Cement / Lime / Concrete	Sep-1997 = 116.6 Sep-2008 = 153.6	1.37	Dam concrete – DC2	1.89
Steel Pipe	Sep-1997 = 117.6 Sep-2008 = 224.8	1.91	Pipe Supply - PS	2.28
Polymer	Sep-1997 = 113.8 Sep-2008 = 144.6	1.27		
Electrical	Sep-1997 = 113.8 Sep-2008 = 175.1	1.53	Electrical - EL	2.13
Pipe Installation	ABS 6345.05b EGW Labour – Priv & Pub Sep-1997 = 62.9 Sep-2008 = 98.2	1.56	Pipe Installation - PI	2.34

We acknowledge that the above doesn't represent a true like for like comparison for some of the indices, for example the ABS escalators for concrete and electrical pickup material costs only, where as the Cardno escalators for these items are a composite of material and labour escalators. However on the review of available information from the Cardno report and publically available information, our analysis would suggest that the Cardno rates for 2008 are generally overstated.

In addition to the above concerns with regards to the process used by Cardno in developing escalators and their application, we are of the opinion that escalating unit rates across an 11-year interval could result in values that are potentially inconsistent with market rates. We have long maintained a position with electricity utilities and regulatory authorities that the primary cost drivers for electrical asset prices, for example, are movements in commodity prices, labour costs and common market indices including the Consumer Price Index and the Trade Weighted Index. Therefore, long-range escalation can potentially understate or overstate movements in these market indices, and caution should be exercised in relying upon such values for forecast expenditure estimates.

We would suggest that it may be prudent for SunWater to consider review their list of building blocks and rationalise it to eliminate overlaps, as well as periodically benchmarking their building block unit rates in future to ensure they remain consistent with market costs.

There may also be merit in SunWater considering moving to a modern equivalent asset classification approach in future revaluations of its asset base. By using modern equivalent asset types and unit rates for those assets applicable at the time of valuation, SunWater would be able to develop annuity values based on current technology and be assured that the rates used are more current than the escalated 1997 rates currently used.

3.4.2. Review of Asset Specific Indirect Uplift

As we discuss at the start of this section, replacement costs for annuity items that are to be replaced more than five year out from the date of the start of the planning process are developed by using the 1997 rates in the bills of material held in SunWater's SAP WMS system and by applying an escalator to individual asset component groups to bring the 1997 rates to 2008 levels. The resulting cost is then multiplied by an asset specific uplift factor termed 'Indirect Costs'. This Indirect Cost uplift factor is applied to take account of asset specific costs associated with renewing a particular asset such as locational costs, project management costs etc.

We have not had the opportunity to review the mechanism employed for developing these uplift factors (which are typically in the 30 to 50% range) however we have reviewed a year 2000 valuation report by Arthur Anderson which comments on these uplifts[3]. We note that the year 2000 valuation was undertaken on an Optimised Depreciated Replacement Cost basis using modern equivalent asset unit rates.

In the report Executive Summary, Arthur Anderson states:

"The method used by State Water Projects (SWP) to determine replacement costs is appropriate"

In the body of the report, Arthur Anderson goes on to state:

"Data contained in the asset records compiled by SWP [State Water Projects] *for asset valuation and management purposes has a high level of integrity and is well suited for the intended purpose* [valuation]".

"*In addition to the direct cost of materials, services and labour the asset bill of materials contain a cost multiplier which reflects expenditures for indirect costs associated with the assets:*

- Works area and plant facilities
- Townships and hostels
- Administration and design

The indirect percentage has primarily been determined by SWP from an analysis of historical cost data. When no historical cost data was available for analysis, a suitably qualified technical expert

[3] Queensland Water Reform Unit – Optimised Depreciated Replacement Cost Valuation: State Water Projects, 30th June 2000.

determined the appropriate indirect cost multiplier. The indirect cost multiplier also includes locational indices that reflect the relative ease or difficulty of constructing infrastructure assets in different geographic locations.

We have reviewed the process of calculating the indirect cost multiplier as part of our pilot study and concluded that the methodology and procedures that were adopted are appropriate.

Although this report was conducted some 11 years ago, we do not believe that circumstances in the different regions operated by SunWater will have changed sufficiently to make these "Indirect Cost" escalators invalid.

3.5. Asset management, governance and quality assurance processes

In undertaking our review of the prudency and efficiency of individual annuity items, and through this process a high level review of SunWater's systems for asset replacement, enhancement and refurbishment we have endeavoured to assess the government and quality assurance processes adopted by SunWater in entering and maintaining data in their SAP WMS.

We consider that SunWater has robust procedures and processes in place for utilising the information available in the SAP WMS to enable it to plan the replacement and or refurbishment of a large portfolio of assets over a 25 years period. In many ways we consider the processes adopted (and continually being refined by SunWater) to represent best practice in asset management. SunWater's asset management methods, as outlined in its Asset Management Planning Methodology Paper, represent a very detailed approach to the management of their assets supported by good probability analysis and appropriate assumptions.

The procedures are well defined for instances where the methods indicate that an asset should be replaced before its standard run to failure asset life. However the processes and procedures are less well defined for assets that are in-service beyond their nominal operational life or projected to be capable of operating beyond their standard run to failure service life. We feel that there would be merit in SunWater further developing its processes for evaluating life extension as it is important for the Planning Team to understand appetite to risk in this area.

Two of the projects we have reviewed involve assets whose replacement is scheduled well beyond their nominal life. The decision making process for planning replacement beyond nominal life in these cases was somewhat subjective. Decisions as to whether to allow an asset to run significantly beyond its nominal service life should take into account the risk appetite for SunWater and operational circumstances under which life extension is acceptable. Given that SunWater has based its program on categorising assets and therefore nominating operational lives, inspection cycles and the relevant risk category for each, it appears their risk appetite is not high. This makes the treatment of over-age assets all the more important.

We have noted that in applying SunWater's condition based replacement life adjustment tool, changes to run to failure asset life based on condition can be course. For example, for concrete channels a change in condition score from 3 to 2 in 2000 for the Selma Channel, changes the projected run to failure asset life by 50 years. We feel it important that, for major assets, SunWater ensures that a recent condition assessment has been undertaken prior to the development of the annuity value submission (i.e. at most 5 years previously)

We have also noted, from the samples we have reviewed, that there are a number of data entry errors in SunWater's SAP WMS in terms of allocation of the correct asset type (object code) to individual assets. This can result in an incorrect run to failure asset life being applied to a give asset which in turn may lead to planned replacement or refurbishment earlier or later that required. In every instance of this that we have observed the data error has been identified by the individual planners in the Planning Team and the correct run to failure life applied for planning purposes. However there does not appear to be any systemised process for data checking and data clean up in SAP WMS.

As the SunWater program relies almost entirely on the asset life allocated to the different assets, the categorisation is critical and must be kept current and accurate. Renewing/changing/correcting this at the time the capital program is being developed is not ideal.

We have also observed that the nominated condition inspection cycles for a given asset have not always been adhered to with the condition assessment for a number of assets being out of date. This might have serious consequences if an asset that has an assessed higher risk or major consequences arising from failure does fail in service and SunWater's records are consequently found to be incomplete.

Similarly we have noted that the completion of the condition reports and subsequent transfer of that data into SAP WMS is of variable quality and on occasions ambiguous. For example in one condition report for a valve, the condition criterion relating to operability was marked as N/A but with a comment of the assessor stating 'unable to operate'. It was unclear whether the statement of unable to operate was as a result of the valve being unserviceable (in which case a score of 6 should have been allocated) or whether there were operation reasons as to why the assessor was unable to operate the valve on that occasion to determine its operability.

We consider that there would also be merit in SunWater enhancing its processes to make it mandatory for underlying reasons and justification to be recorded alongside risk and condition scores. This would allow a third party reviewer to achieve a greater understanding why one asset may score a high risk score but an apparently identical asset scores a low risk score.

So, in conclusion, given that SunWater appears, appropriately, to be conservative in their risk appetite in planning to replace assets, the stated approach is considered reasonable and robust. However, the evidence that we have seen during this review would suggest that the process is not always applied robustly either as a result of data entry errors in SAP WMS or as a result of condition assessments and risk assessment reporting and documenting not always being performed to a level of rigour that will withstand independent scrutiny.

We believe that there would be merit in SunWater developing and implementing a data and data entry validation process and systematically checking the categorisation of all their assets to ensure that they are managing their assets as they would expect to under their asset management approach, and for their methodology to consider how to deal with over-age assets. We also believe that there would be merit in SunWater formalising the recording of condition and risk scores to ensure key aspects are explained and high scores justified. In this way, we believe that SunWater will be better able to justify the scheduling of projects, and more clearly demonstrate how they schedule asset replacement based on demonstrated business risk and actual condition. This would provide a more robust feel to SunWater's capital program and not leave it open to an external party questioning an, on occasions, apparent arbitrary timing.

3.6. Conclusions

Following our review of SunWater's procedures, we consider that the approach adopted by SunWater in determining the future renewal/refurbishment date of a large portfolio of assets for up to 25 years hence is considered to be appropriate and robust. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, the asset management method implemented by SunWater is considered reasonable and in accordance with good industry practice, particularly where the management of a large portfolio of assets is concerned and asset replacement/refurbishment planning over a 25 year cycle is required.

Whilst we generally consider the processes and procedures established and implemented by SunWater in managing the planning and valuing of replacement of assets to be robust we have noted a number of areas that would merit enhancement and improvement by SunWater:

- There are a number of data inconsistencies in SAP WMS. We have noted a significant number of cases in the annuity items we have reviewed where an incorrect asset type (object code) has been applied to a particularly annuity item. Data errors of this type can lead to an incorrect run to failure asset life being applied to a particular asset and hence an incorrect replacement date being planned.
- There are a number of instances where the rationale and reasoning behind a certain risk score or condition score being applied to an asset is not clear and or the score is ambiguous. This

again may lead to an incorrect planning decision if an incorrect interpretation is applied to a given asset condition or risk assessment;

- We have some concerns over the use, for some assets, of an age based condition assessment criterion. We recognise that an age based criterion is used to compensate for instances where the standard asset condition decay curve may not be appropriate for a particular asset type (such as control systems), however we consider that using an age based criterion may bias asset replacement to earlier than required date on a portfolio wide (particularly where the age criterion score is the highest of the condition criteria scores);
- We have concerns over the method by which SunWater's external consultant Cardno developed multipliers to escalate 1997 based unit rates in bills of materials to 2008 unit rates and the application of those multipliers by SunWater. Cardno aggregated the unit costs for grouped classes of components to produce an average multiplier (as opposed to a standard 2008 unit rate). SunWater then disaggregates this averaging process to apply the developed multiplier to individual 1997 component costs in the bills of materials. Hence if a 1997 component cost in a bill of materials is too high (or too low) it will remain too high (or too low) when escalated by the Cardno multiplier to bring it to a 2008 value. We believe it would have been more appropriate for Cardno to have developed a standard 2008 unit rate for each component type and for that unit rate to have been substituted for the 1997 rate in the bills of materials in SunWater's SAP WMS.
- Similarly, we have some concerns with SunWater adopting, by default, a 'like for like' asset replacement assumption when determining the annuity value of a future annuity item replacement. Adopting a 'like for like' replacement and hence using existing BOM components and their 1997 unit rates escalated to 2008 results in an overestimation of replacement costs for those asset types where technological advancement has reduced costs. Assets that this affects include, for example, control equipment, telecommunications equipment, irrigation channels (where HDPE is now the preferred material rather than concrete).
- We would recommend that future valuations are undertaken on a Modern Equivalent Asset basis (as adopted by Arthur Anderson in their valuation) where the current costs of modern equivalent assets/components are substituted for the original component unit rate in the BOM for annuity assets. There may also be merit in SunWater identifying where technical advances make a 'like for like' replacement assumption inappropriate at the commencement of development of Network Service Plans and substituting the modern equivalent component and its cost for the existing asset in the planned replacement.

4. Method used for Capital Project Evaluation

The methods by which we have reviewed past and future annuity items are driven in part by the regulatory tests of prudency and efficiency applied to regulated utility capital expenditure programs.

In its Terms of Reference for this assignment, the Authority has provided a definition of what is meant by the regulatory tests of prudent and efficient which is provided here for convenience.

"Capital expenditure is prudent if it is required as a result of a legal obligation, growth in demand, renewal of existing infrastructure that is currently used and useful, or it achieves an increase in the reliability or the quality of supply that is explicitly endorsed or desired by the Water Grid Manager."

Included in this prudency test is a determination as to whether the proposed timing of the expenditure is appropriate, for example it may be that expenditure may be deferred as a result of changes in maintenance regimes. A further sub test is whether the proposed implementation is the optimum implementation to meet the need. That is to say, the review must consider whether an alternative more cost efficient or operationally more effective implementation could be achieved.

The second part of the regulatory test is efficiency, that is whether the amount spent on the implementation required to meet the need is no greater (within certain bounds) than what an efficient operator would spend. The Authority considers that:

Capital expenditure is efficient if:

- *a) the scope of the works (which reflects the general characteristics of the capital item) is the best means of achieving the desired outcomes after having regard to the options available, including the substitution possibilities between capex and opex;*
- *b) the standard of the works conforms with technical, design and construction requirements in legislation, industry and other standards, codes and manuals. Compatibility with existing and adjacent infrastructure is relevant as is consideration of modern engineering equivalents and technologies; and*
- c) *the cost of the defined scope and standard of works is consistent with conditions prevailing in the markets for engineering, equipment supply and construction. The consultant must substantiate its view with reference to relevant interstate and international benchmarks and information sources. For example, the source of comparable unit costs and indexes must be given and the efficiency of costs justified. The consultant should identify the reasons for any costs higher than normal commercial levels."*

We have systematically applied these two regulatory tests of prudency and efficiency to each of the sample annuity items (past and future annuity items) that we have reviewed.

4.1. Prudency evaluation method

In reviewing prudency of proposed or past spend we have evaluated the need for expenditure against the test identified above by reviewing documentation provided by SunWater, which outlines the requirement for the spend and the proposed implementation to address the need be it replacement or refurbishment of an asset.

For past annuity items, we have reviewed any option studies developed by SunWater and determined if the preferred option is the optimum option for implementation that an efficient operator would have selected. This analysis ideally should include a ‘do nothing’ assessment. Additionally, we have reviewed the implementation program adopted by SunWater and assessed whether this is in keeping with what may be expected of an efficient operator.

For future annuity items, given the portfolio approach adopted, necessarily, by SunWater and the processes by which SunWater determines which assets required to be replaced in the annuity period, when and at what cost as described earlier in Section 3, we have adopted our usual methods for determining prudency of expenditure to accommodate SunWater’s processes. At the planning stage used by SunWater to establish its forward expenditure programme, SunWater does not carry out an option assessment where the date of replacement or refurbishment of an asset is five years or more out from the annuity planning date. The planning year addressed by this review is 2010. For those assets that are planned to be replaced within that five year period, SunWater may carry out a high level option analysis as a part of its planning process but this is not always the case. Whether a high level option analysis is undertaken depends on the nature of the asset and the replacement/refurbishment annuity value.

Under SunWater’s processes, a detailed option analysis is only carried out either in the year of the planned replacement or up to two years before the planned replacement depending on the planning time and procurement time required for the annuity item in question. As such, no detailed options analysis reports were available for any of the future annuity items reviewed.

In absence of this information, we reviewed, through analysis of annuity item briefing papers developed by SunWater and through direct interrogation of SunWater’s systems, particularly SAP WMS, the adherence to the process used by SunWater in planning refurbishment and replacement of assets during the price set annuity period. As a part of this analysis we also evaluated the appropriateness of certain elements of the process to the annuity item in question. For example, where we considered that either the refurbishment life applied by SunWater to an asset class or the run to failure asset life used by SunWater for a particular asset class is not in keeping with industry norms, we have highlighted this and re-cast the replacement date for that annuity item utilising

SunWater's own planning tools. Similarly, if we have taken a different interpretation of condition assessments and the impact of that assessment on the timing of replacement or refurbishment of an annuity item than SunWater we have identified, for that annuity item, the impact of that different interpretation on the need or timing of the need for replacement or refurbishment of that item.

Finally, for those annuity items where a modern equivalent asset replacement is considered an alternative to 'like for like' replacement, we have compared the cost of the modern equivalent asset with a 'like for like' replacement. The Selma concrete channel upgrade is an example where we have compared refurbishing the channel by replacing the concrete (like for like replacement) with the alternative of using High Density Poly Ethylene (HDPE) as a lower cost modern equivalent substitute that is now widely used in industry.

4.2. Efficiency evaluation method

As mentioned earlier, the second test is that of efficiency ie whether the costs proposed for the replacement or refurbishment of an annuity item is in keeping with the costs that would be incurred by an efficient operator. This test generally is applied through a series of steps:

1) Is the proposed solution to address the need the most cost effective solution, or is there a more cost effective alternative and if so how does the cost of the more efficient solution compare with the cost proposed
2) If the proposed solution is considered to be appropriate the next stage of analysis is to determine if the costs proposed for that solution (replacement or refurbishment of an annuity item) are efficient.

In both cases we seek to benchmark the proposed costs against alternative costs either drawn from previous project implementation, or from development of costs using unit rates available to us as we detail below. We have used a test of comparing SunWater's proposed (for future annuity items) or expended (for past annuity items) costs against our level 4 estimate of costs to meet the requirement (+30%/-20%). Where SunWater's costs are below the upper level of this estimate (ie within +30% of our estimate, we have considered them to be efficient. Conversely, where costs exceed our estimate plus 30%, we have deemed them to be inefficient).

Typically we have obtained information on the past and future annuity items by interrogating SunWater's SAP WMS, by reviewing SunWater's report on that annuity item's replacement or refurbishment and by reviewing other relevant information such as built drawings, bills of materials and unit rates, options studies (where available) as described in Section 2.

The following describes in more detail the process steps that we undertook in reviewing capital expenditure:

- The scope of work for the SunWater estimates were compared with the scope of our reference asset estimates to ensure that there was a comparison of like-for-like

- SunWater estimates were compared with our estimates and our estimates were adjusted as appropriate for valid comparison with the SunWater estimates
  - where there was agreement within our estimating range (+30%/-20%) we considered the SunWater estimates appropriate and no further detailed assessment was undertaken
  - where the estimates differed by more than +30%, we carried out more detailed assessments in an attempt to identify the reasons for the differences for example we looked for trends in the SunWater estimating process that may have influenced the outcomes.

4.2.1. Development of unit rates used in assessment of efficiency of costs

The following outlines how we have developed and used unit rates to develop benchmark costs for annuity items, in particular electrical infrastructure related annuity items. Similar processes were used for development of unit rates for civil and mechanical infrastructure, such as use of standard cost reference material eg Rawlinson's Construction Cost Guide and these are detailed in the individual sub-reports for the annuity items evaluated contained in Appendix B and Appendix C as well as in Section 3.4.1 above.

General

Unit rates represent the average current cost of replacing existing assets with modern equivalent assets. The modern equivalent asset (MEA) is the asset, with the same service capability as an existing asset, which would be selected to replace the existing asset if it was to be replaced in 2010. The MEAs should be of commercially available technology and be proven to the extent that a prudent network owner would use them on its network.

These rates are the long run sustainable competitive prices for assets constructed by a competitive industry service provider using the most efficient means. For each asset, the price is based on a modern equivalent reference asset, which assumes average conditions for construction difficulty associated with the installation of the asset in a brownfield environment.

Brownfield principles reflect a new asset being installed proximate to existing assets or other infrastructure and services (eg buildings, roadways, areas of high public activity, telecommunications, water or gas), resulting in increased installation time and costs than over Greenfield sites.

The asset unit rates include:

- any applicable indirect taxes but are exclusive of Goods and Services Tax (GST)
- indirect costs associated with the acquisition and/or creation of the asset such as:
  - on-costs

- design and engineering costs
- project management
- freight
- local delivery

No allowance has been made for overtime in the unit rates.

Unit rate data sources

The unit rates for this valuation were developed using a variety of sources, including:

- June 2006 procurement study of transmission and distribution asset costs - this survey involved collecting, collating and analysing actual contract prices from seven Australian electricity distributors and four transmission companies for primary items such as circuit breakers, current transformers, voltage transformers, disconnectors, power transformers and conductor
- SKM market price survey of material costs and construction and maintenance activities - activity man-hours used in comparative estimates were based on responses to a market price survey of construction and maintenance activities in the electricity distribution system, conducted by SKM over the period June 2001 to May 2009. The surveys included a wide range of capital and operating activities, and attracted between 10 and 15 participants to each survey. Survey participants included government owned utilities, privately owned utilities and private contracting businesses
- Contract and procurement costs incurred by utilities on recent projects
- Trade price lists for low voltage switchgear, cable, conduit and cable support
- Prices from recently completed projects or design work undertaken for other water utilities
- Other recent reference estimates by SKM
- SKM asset valuation database
- Prices from Rawlinson's Construction Cost Guide

Labour rate

During 2002 and 2003, SKM conducted surveys with utilities, service providers and contractors to review labour costs associated with a selected range of construction and maintenance activities. As part of these surveys, SKM was able to establish average allocations allowed for overhead and on-cost provisions within labour rates across a sample of the Australian market.

SKM developed labour hourly rates for this unit rate review was based on the following parameters:

- Basic hourly rates and allowances were based on the Power and Energy Industry Electrical, Electronic and Engineering Employees (EEEE) Award;

- Market average values for on-costs including:
  - Payroll tax
  - Superannuation
  - Annual, Long Service and Sick leave
  - Workers Compensation
  - Public holidays

Based on the assumption that SunWater will be utilising contract personnel, the labour rate assumed a 5% profit margin.

This information was supplemented by labour rate information from our cost estimating team. Our cost estimating team has, over a number of years, built up a range of labour cost indices for civil infrastructure works applicable to construction projects in different Queensland locations.

Basis for developing unit rates

We consider that the reference asset unit rates in our database reflect good industry practice in terms of community standards, national and international technical standards, an appropriate balance between reliability and capital costs and the efficient application of resources for the design and construction of assets.

The database has been updated regularly as assignments are undertaken for electricity and water utilities, in Australia and overseas. These assignments cover a wide range of activities and include network asset valuations, pricing studies and internal tracking of commodity price movements.

Accuracy

In establishing a criterion for assessing the reasonableness of the SunWater unit rates, we are of the opinion that consideration must be given to the level of accuracy that can be achieved.

The graph shown in Figure 4 indicates the levels of accuracy that can be expected for estimates prepared for capital works at various stages of a project development. Due to the different levels of engineering input, and completeness in the design, there are various levels of accuracy that can be reasonably expected in forecasts. It shows that for budgeting where the asset is reasonably well defined an accuracy of ±20% can be expected. Whereas at a pre-feasibility stage an accuracy of ±30% may be expected.

We have also reviewed an international recommended practice for cost estimating[4], and found that:

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[4] AACE International, *Recommended Practice No. 17R-97: Cost Estimating Classification System (TCM Framework: 7.3 – Cost Estimating and Budgeting)*, 12 August 1997

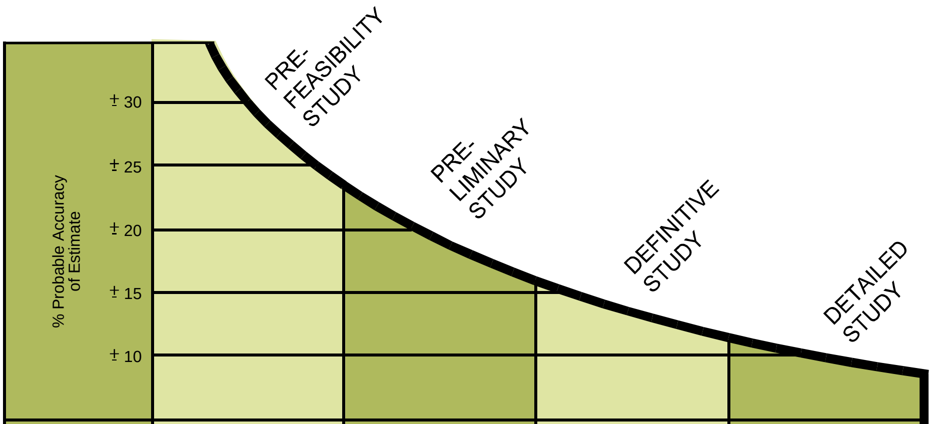
- There are 5 classes of estimate, with class 5 based upon the lowest level of project definition, and class 1 closest to full project definition;
- A feasibility level forecast is categorised as a class 4 estimate, which is considered to have 1-15% project definition, and a range of accuracy of approximately +30%/-20%;
- The level of project definition roughly corresponds to the percentage complete of engineering, and includes project scope definition, requirements documents, specifications, plans, environmental considerations and other information that must be developed to define the project.[5]

Based on these analyses, we have adopted a criterion of +30%/-20% as the first pass for comparing the SunWater estimates with our reference estimates. For those SunWater estimates where the variation is outside this range, we have reviewed the underpinning assumptions to identify the potential reasons.

In the development of our benchmark estimates, we have assumed that the SunWater estimates are referenced to June 2010. As a result, we have made no allowance for adjustment of the comparative estimates to reflect the indicated construction date for the SunWater projects. Also, for the majority of future annuity items (future renewals, refurbishments), we have based the comparative estimates upon the BOM listing provided by SunWater, and have included the site-specific on-cost percentage provided by SunWater to account for site construction and remote location costs. There has been no allowance for construction work outside of normal hours.

[5] Refer Table 8 for table of generic estimate classifications

Figure 4 Standard Estimating Accuracy Levels



Type of Estimate	Order of Magnitude	Preliminary	Definitive	Detailed
Provided Documentation	• Product capacity and Location • Cost Data on Similar Projects • Major Equipment List	• Preliminary Equipment List • Engineering Line Diagram • Plant Outline General Arrangement • Maps and Surveys • Bench Test Results • Nature of Facilities	• Equipment Specifications and Vendor Quotations • Construction Schedule • Electrical One Lines • Piping and Instrumentation Flow Diagrams • Soil Data and Architect Features • Site Survey and Labour Complete	• Bulk Material Specifications and Vendor Quotes • Construction Specification and Sub Contractor Quotations • Engineering Advanced Approximately 10%
Definition of Scope of Work	Conceptual	Approximate	Clearly Described Essentially Complete	Complete. Well Detailed
Estimating Procedure	Factoring	Combination of Factoring and Quantity Take-Off	Most Quantity Take-Off. Very little Factoring	Complete Quantity Take-Off
Use of Study	Comparison/ Rejection	Final Feasibility	Budget	Funding

- **Table 8 AACE IRP No. 17R-97 Generic Cost Estimate Classification Matrix[6]**

	Primary Characteristic	***Secondary Characteristic***			
ESTIMATE CLASS	LEVEL OF PROJECT DEFINITION Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical +/- range relative to best index of 1 (a)	PREPARATION EFFORT Typical degree of effort relative to least cost index of 1 (b)
Class 5	0% to 2%	Screening or Feasibility	Stochastic or judgement	4 to 20	1
Class 4	1% to 15%	Concept Study or Feasibility	Primarily stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget, Authorisation or Control	Mixed, but primarily stochastic	2 to 6	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Primarily deterministic	1 to 3	5 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Deterministic	1	10 to 100

Notes:

(a) If the range index value of 1 represents +10/-5%, then an index value of 10 represents +100/-50%

(b) If the cost index of 1 represents 0.005% of project costs, then an index value of 100 represents 0.5%

6 AACE International, *Recommended Practice No. 17R-97: Cost Estimating Classification System (TCM Framework: 7.3 – Cost Estimating and Budgeting)*, page 2, 12 August 1997

5. Summary and Conclusions

5.1. Future Renewals

Details of our evaluation of future annuity items are provided in Appendix B. A summary of our conclusions on prudency and efficiency evaluation for the future renewals reviewed is provided in Table 9 below:

- **Table 9 Summary Table of Assessment of Prudency and Efficiency of Future Annuity Items Reviewed**

Annuity Item	Year	Annuity Value	Prudent	Efficient	Comment
Burdekin Falls Dam – Replace High Voltage System	2023	$2,629,204	Yes	No	Unit rate for HV conductor high
Burdekin Falls Dam – Replace Cable	2024	$2,295,907	Yes	Yes	
Peter Faust Dam – Replace Cables and Cableways	2026	$850,974	Yes	Yes	
Elliot Pump Station – Replace Switchboard No 1 (Pumps 1 & 2)	2012	$262,000	Yes	Yes	
Fred Haigh Dam – Replace Cable Main Wall	2014	$250,000	Yes	Yes	
Tinana Barrage – Apply a concrete skin over existing rock protection	2012	$56,660	Yes	Yes	
Silverleaf Weir	2012	$314,918	Yes	Yes	
Boondooma Dam – Replacement of Sealer	2017	$140,000	No	Yes	We do not consider replacement of sealer to be the correct solution.
Boondooma Dam – Replace Cables and Cableways	2032	$464,657	Yes	Yes	
Owanyilla Pump station – Electrical Component Upgrade	2011	$404,022	Yes	Yes	
Don Beattie Pump Station – Replace Common Controls	2019	$1,084,468	Yes	No	Cost for replacement of PLCs overstated and does not take into account price reductions since first installed.
Chinchilla Weir – Purchase and Install Butterfly Valve	2016	$100,00	No (unless deferred to 2024)	Yes	Uncertain interpretation of condition assessment in that it is not clear that valve is inoperable. Recommend including in annuity as a 2024 replacement

Annuity Item	Year	Annuity Value	Prudent	Efficient	Comment
Allan Tannock Weir	2014	$17,655	Yes	Yes	
Jack Taylor Weir	2012	$273,511	Yes	Yes	
Coolmunda Dam – Paint D/S of Gate Structure; Gate 4	2012	$48,333	Yes	Yes	
Coolmunda Dam – Paint D/S of Gate Structure; Gate 5	2012	$48,333	Yes	Yes	
Coolmunda Dam – Refurbish D/S Gate Face; Gate 3	2013	$63,5435	Yes	Yes	
Coolmunda Dam – Repaint all D/S face; Gate 6	2014	$43,625	Yes	Yes	
Leslie Dam – Replace Cableways	2019	$1,376,784	No	Yes	Timing is not considered prudent due to asset class age adopted not being in keeping with industry practice.
St George Pump Station – Construction of New Suction Lines and Pipework	2013	$355,081	Yes	Yes	
Gattonvale Off Stream Storage – Stabilise Embankment	2013	$81,000	Yes	Yes	
Kinchant Dam – 5 Year Dam Inspection	2013	100,000	Yes	Yes	
Dumbleton Weir – Replace Control Equipment	2019	$308,584	Yes	Yes	
Brightley Pump Station No 2 – Replace Cable	2012	$21,435	Yes	Yes	
Mt Alice Pump Station, Pump Unit No 3 Overhaul (Seals and Bearings)	2013	$25,000	Yes	Yes	
Callide Dam – Replace Cable and Cableways	2017	$870,895	Yes	Yes	
Theodore Weir – Replace Concrete/ Steel Piled Weir	2034	$532,181	Yes	Yes	
Fairbairn Dam – Refurbish Right Bank Outlet Works	2012	$630,000	Yes	Yes	
Cania Dam – Replace Cables & Cableways	2018	$254,414	Yes	Yes	
Selma Irrigation Chanel – Replace Concrete Lining	2032	$4,435,424	No	No	Solution not optimum, HDPE liner replacement now industry standard. This reduces costs on a PV basis
South Walsh Distribution – Replace Concrete	2026	$1,956,700	Yes	Yes	

5.2. Past Renewals

Details of our evaluation of future annuity items are provided in Appendix C. A summary of our conclusions on prudency and efficiency evaluation for the future renewals reviewed is provided in Table 10 below:

- **Table 10 Summary Table of Assessment of Prudency and Efficiency of Past Annuity Items Reviewed**

Annuity Item	Annuity Value ($2011)	Prudent	Efficient	Comment
Fairbairn Dam Outlet Upgrade	1,482,398	Yes	Yes	
Intersafe Safety Modernisation Program		Yes	Yes	Efficiency determined on the basis that contracts were competitively tendered and hence market rates achieved.
Whetstone Weir	2,350,064	Yes	Yes (partially)	Costs deemed efficient with the exception of the sheet piling costs of $220,000.
Marion Weir	4,800,000	No	No	Deemed not prudent as insufficient information available to determine if the no-build alternative was a viable option. Approximately $1m could have been saved by SunWater delaying works until after the wet season.
Palm Tree Creek Valve Replacement	1,875,000	Yes	No	Estimate that cost savings of 20 to 30% of actual expenditure could have been achieved.

5.3. Conclusions of review of SunWater's processes

Following our review of SunWater's procedures, we consider that the approach adopted by SunWater in determining the future renewal/refurbishment date of a large portfolio of assets for up to 25 years hence is considered to be appropriate and robust. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, the asset management method implemented by SunWater is considered reasonable and in accordance with good industry practice, particularly where the management of a large portfolio of assets is concerned and asset replacement/refurbishment planning over a 25 year cycle is required..

Whilst we generally consider the processes and procedures established and implemented by SunWater in managing the planning and valuing of replacement of assets to be robust we have noted a number of areas that would merit enhancement and improvement by SunWater:

- There are a number of data inconsistencies in SAP WMS. We have noted a significant number of cases in the annuity items we have reviewed where an incorrect asset type (object code) has been applied to a particularly annuity item. Data errors of this type can lead to an incorrect run to failure asset life being applied to a particular asset and hence an incorrect replacement date being planned.
- There are a number of instances where the rationale and reasoning behind a certain risk score or condition score being applied to an asset is not clear and or the score is ambiguous. This again may lead to an incorrect planning decision if an incorrect interpretation is applied to a given asset condition or risk assessment;
- We have some concerns over the use, for some assets, of an age based condition assessment criterion. We recognise that an age based criterion is used to compensate for instances where the standard asset condition decay curve may not be appropriate for a particular asset type (such as control systems), however we feel that using an age based criterion may bias asset replacement to earlier than required date on a portfolio wide (particularly where the age criterion score is the highest of the condition criteria scores);
- We also have concerns over the method by which SunWater's external consultant Cardno developed multipliers to escalate 1997 based unit rates in bills of materials to 2008 unit rates and the application of those multipliers by SunWater. Cardno aggregated the unit costs for grouped classes of components to produce an average multiplier (as opposed to a standard 2008 unit rate). SunWater then disaggregates this averaging process to apply the developed multiplier to individual 1997 component costs in the bills of materials. Hence if a 1997 component cost in a bill of materials is too high (or too low) it will remain too high (or too low) when escalated by the Cardno multiplier to bring it to a 2008 value. We believe it would have been more appropriate for Cardno to have developed a standard 2008 unit rate for each

component type and for that unit rate to have been substituted for the 1997 rate in the bills of materials in SunWater's SAP WMS.

- Similarly, we have some concerns with SunWater adopting, by default, a 'like for like' asset replacement assumption when determining the annuity value of a future annuity item replacement. Adopting a 'like for like' replacement and hence using existing BOM components and their 1997 unit rates escalated to 2008 results in an overestimation of replacement costs for those asset types where technological advancement has reduced costs. Assets that this affects include, for example, control equipment, telecommunications equipment, irrigation channels (where HDPE is now the preferred material rather than concrete).

We would recommend that future valuations are undertaken on a Modern Equivalent Asset basis (as adopted by Arthur Anderson in their valuation) where the current costs of modern equivalent assets/components are substituted for the original component unit rate in the BOM for annuity assets. There may also be merit in SunWater identifying where technical advances make a 'like for like' replacement assumption inappropriate at the commencement of development of Network Service Plans and substituting the modern equivalent component and its cost for the existing asset in the planned replacement.

Appendix A Terms of Reference

Terms of Reference

SunWater Irrigation Prices 2012-17

Assessment of Renewals Expenditure

6 October 2011

1. **Project Background**

Queensland Competition Authority

The Queensland Competition Authority (the Authority) is an independent statutory body responsible for assisting with the implementation of competition policy for government owned business entities in Queensland.

SunWater

2. As a Queensland Government-owned Corporation (GOC), SunWater provides a range of services including infrastructure ownership, water delivery, operation and maintenance of infrastructure and engineering consultancy services. Over the last 80 years, SunWater has built and now owns and operates a regional network of water supply infrastructure throughout Queensland which supports irrigated agriculture, mining, power generation, industrial and urban development.

SunWater's water storage and distribution infrastructure includes 19 major dams, 63 weirs and barrages, 80 major pumping stations, and more than 2500 kilometres of pipelines and open channels. The existing price paths that apply to the 22 water supply schemes (WSSs) are due to expire on 30 June 2011.

The water supply schemes are supported by four regional operation centres and SunWater's head office located in Brisbane. On 1 July 2008, a number of water supply schemes were transferred to SEQWater.

Ministerial Direction

3. The Premier and the Treasurer (the Ministers) have directed the Authority to develop irrigation prices to apply to 22 SunWater WSSs from 1 July 2012 to 30 June 2017. A copy of the amended Ministers' Referral Notice (the Notice) is available at http://www.qca.org.au/water/Sun-Irrig-Price/index.php

4. The Ministers' Referral Notice requires that bulk water supply and channel prices/tariff structures are set so as to provide a revenue stream that allows SunWater to recover:

efficient operational, maintenance and administrative costs to ensure the continuing delivery of water services;

prudent and efficient expenditure on renewing and rehabilitating existing assets through a renewals annuity;

costs are to exclude any rate of return on existing rural irrigation assets (as at 30 June 2012) unless current prices are already above the level required to recover (i) and (ii), in which case prices are to be maintained in real terms based on an appropriate measure of inflation as recommended by the authority; and

a commercial rate of return of, and on, prudent capital expenditure for augmentation commissioned after 30 June 2012.

5. Purpose/Outline of Consultancy

6. The purpose of the consultancy is to assess the prudency and efficiency of a sample of SunWater's renewals expenditure for 2006-11 and forecast capital expenditure (renewals for 2012-37).

As a prelude to the analysis of individual renewals, the consultant is to review and comment upon SunWater's asset management planning methodology (including the appropriateness of a sample of material bills of materials and unit rates adopted) and the drivers for capital expenditure.

For this purpose the consultant should specify the benchmark unit rates to be adopted. If no proprietary unit rates are available recourse should be made to the Queensland Engineering Construction Activity Implicit Price Deflator (derived from the relevant periods of quarterly ABS data). The Authority has identified a sample list (Attachment A) of renewals capital expenditure items, which have been derived on the basis of key criteria including:

(a) issues raised by stakeholders;

capex items identified by the Authority's consultants; and

items of a material nature which could affect the renewals annuity charge.

7. For these items, and potentially others yet to be identified, the consultant is required to review SunWater's application of its asset management planning methodology and cost estimates and provide comment on:

the timing of asset replacement or refurbishment. For each asset, the consultant is required to comment on the standard run-to-failure asset life, and risk-adjusted asset life determined or proposed by SunWater. Any material variations in expected asset lives should be explained where possible;

condition assessment – including frequency of assessments and results of most recent assessments. Where possible, the consultant should comment on any reasons for revised condition assessments. Reference can be made to photographic evidence where available;

the proposed refurbishment/ replacement cost. The consultant should review SunWater's Bill of Materials (BOM), and specifically details of item specification (scope and scale), volumes/quantities of key inputs (materials etc), unit rates for inputs, and identify the level of indirect cost allowances. This should take into account technological change and process redundancy as well as costs associated with improving general business performance; and

options analysis – where options analysis has been performed by SunWater, for example for renewals over the period 2006-11 and for assets due to be refurbished or replaced over the next 12 months, the consultant should review the options proposed and procedures used by SunWater for determining the least cost or preferred option. The consultant is required to advise whether SunWater's approach is appropriate.

8. The consultant is required to recommend whether the capex is considered to be prudent and efficient taking account of the above review. For clarity, the definitions of prudency and efficiency are provided below.

9. Capital expenditure is prudent if it is required as a result of a legal obligation, growth in demand, renewal of existing infrastructure that is currently used and useful, or it achieves an increase in the reliability or the quality of supply that is explicitly endorsed or desired by the WGM. In most cases, SunWater's capital expenditure relates to renewal or compliance.

10. Capital expenditure is efficient if:

(a) the scope of the works (which reflects the general characteristics of the capital item) is the best means of achieving the desired outcomes after having regard to the options available, including the substitution possibilities between capex and opex;

(b) the standard of the works conforms with technical, design and construction requirements in legislation, industry and other standards, codes and manuals. Compatibility with existing and adjacent infrastructure is relevant as is consideration of modern engineering equivalents and technologies; and

(c) the cost of the defined scope and standard of works is consistent with conditions prevailing in the markets for engineering, equipment supply and construction. The consultant must substantiate its view with reference to relevant interstate and international benchmarks and information sources. For example, the source of comparable unit costs and indexes must be given and the efficiency of costs justified. The consultant should identify the reasons for any costs higher than normal commercial levels.

11. The consultant must clearly identify the nature and value of any proposed renewals expenditure considered not prudent or efficient. Where the consultant considers that the projected timing and/or cost of an expenditure item is not efficient, the consultant is required to recommend an alternative estimated timing or cost estimate.

12. In this consultancy it is not intended that the consultant undertake a physical (i.e. site) assessment of assets; rather, the emphasis for the consultant is to review SunWater's processes for determining the timing and cost of capital expenditure.

13. Resources/Data Provided

The Authority will make available to the consultant relevant documents, including SunWater's Network Service Plans and associated supporting materials, Treasury's approved list of bulk water storage assets to be valued, and the Authority's technical issues papers, as appropriate.

The Authority's consultants' reports (Halcrow, ARUP, Aurecon and GHD) will also be available as an initial input to the exercise.

The consultant will also be expected to liaise with the consultant undertaking a separate review of SunWater's business information system and financial management and pricing model as required.

The consultant will be required to liaise with SunWater, the Authority, and other agencies and stakeholders as appropriate to source further relevant information if needed.

The Authority expects that the consultant will be familiar with the following information sources:

(a) SunWater, 2006, Irrigation Price Paths 2006/07-2010/11 Final Report http://www.sunwater.com.au/irrigationpricing/SunWater_Irrigation_Price_Paths_Final_Report.pdf

Queensland Competition Authority (QCA), 2000, Statement of Regulatory Pricing Principles for the Water Sector, December 2000. http://www.qca.org.au/files/PricingPrinciples.pdf

SunWater, SAP-based asset and financial management system, and financial statements;

QCA, July 2010, Final Report – SEQ Interim Price Monitoring Information Requirements for 2010/11. http://www.qca.org.au/files/W-2010SEQretail-price-SEQIntReq-0710.pdf

QCA, April 2010, Final Report – SEQ Interim Price Monitoring Framework http://www.qca.org.au/files/W-SEQinterim-price-QCA-FinalReport-PriceFramWork-0410.pdf

Additional information relevant to this consultancy may also be found in the Authority's publications, available from the Authority or for downloading from its website at www.qca.org.au

14. Project Time Frame

The consultancy will commence in July 2011 with a completion date of 30 August 2011.

15. Proposal Specifications and Fees

The proposal should:

include the name, address and legal status of the tenderer; and

provide details of staff, contract rates and availability.

Total payment will be made within 28 days of receiving an invoice at the conclusion of the consultancy.

16. Contractual Arrangements

This consultancy will be offered in accordance with the Authority's standard contractual agreement.

This agreement can be viewed at http://www.qca.org.au/about/consultancyagreement.php

17. Reporting

The consultant will be required to provide the Authority with progress reports and draft preliminary text on a daily basis. Drafts of final reports will be required prior to project completion. If necessary, the consultant should advise at earliest opportunity any critical issues that may impede progress of the consultancy, particularly issues that impact on the successful delivery of the Consultancy Objectives outlined in Section 2 above.]

The consultant will also provide detailed data for each renewals project, including subcategories under the headings of direct, indirect and overhead costs. An excel spreadsheet is required, documenting the costs of each renewals project. All entries must be referenced to the primary source material.

At the conclusion of the consultancy, the consultant will be required to provide the Authority with a personal presentation on the findings of the analysis in addition to presenting three (3) copies of a written report. An electronic version of the final report is also required, saved in Microsoft© Word with any numeric data in Microsoft© Excel.

18. Confidentiality

Under no circumstance is the selected consultant to divulge any information obtained from any DNSP or the Authority for the purposes of this consultancy to any party other than with the express permission of the DNSP concerned and the Authority.

19. Conflicts of Interest

For the purpose of this consultancy, the consultant is required to affirm that there is no, and will not be any, conflict of interest as a result of this consultancy.

20. Authority Assessment of Proposal

The proposal will be assessed against the following criteria:

- understanding of the project;

- skills and experience of the firm and team;
- the proposed methods and approach;
- capacity to fulfil the project's timing requirements; and
- value for money.

In making its assessment against the criteria, the Authority will place most weight on relevant experience of the team members involved and the proposed method for the completion of the task.

21. Insurance

The consultant must hold all necessary workcover and professional indemnity insurance.

22. Quality Assurance

The consultant is required to include details of quality assurance procedures to be applied to all information and outputs provided to the Authority.

Appendix B Future Renewals Projects

This appendix contains the sub-reports on the future annuity renewal/refurbishment items reviewed.

B.1 Burdekin Falls Dam – Replace High Voltage System

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.1.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of an existing high voltage (HV) electrical system (11 kV). This work involves the replacement of 11kV distribution transformers, overhead line and switchgear based on the assets reaching the end of their nominal operating life of 35 years.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1987. SunWater has submitted an annuity item value of $2.62m for replacement of the existing HV system in 2023.

B.1.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 11 Documentation Reviewed Specific to Replacement of the Burdekin Falls Dam Replacement of HV System**

Document No.	Document Name	Document Title	Date
1109905	1109905 1. QCA Justification Paper H1 – Burdekin Falls Dam – Replace High Voltage System	Burdekin Water Supply – Burdekin Falls Dam – Replace High Voltage System (BRI-BURD-BFD-ELEC-HVS)	21st August 2011

B.1.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we

have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is CAHVAG – HV above ground cable which has a standard life of 35 years and a condition inspection frequency of 5 years. We consider the standard run to failure asset life for this asset to be at the lower end of what is typically allocated by distribution network service providers in Australia to this type of asset. However we note that Burdekin is in the tropics, as such, it is appropriate for Wet Conditions asset lives to be adopted. With the exception of the overhead lines, these asset lives are in keeping with SunWater's adopted asset lives for these assets. Standard asset lives applied by power distribution network services providers in Queensland are shown in Table 12 below:

- **Table 12 Typical Asset Lives Applied by Power Distribution Companies**

Asset Type	Asset Life in Wet Conditions (Years)	Asset Life in Dry Conditions (Years)
Distribution Transformers – Pole Mounted 11kV	35	45
Overhead Lines (11kV)	45	55
Pole Mounted Circuit Breakers	35	45

We consider that the condition assessment frequency applied to this asset type to be reasonable. We note that the asset has been allocated an incorrect asset type in SAP WMS, that of ELAUX – Auxiliary Power Supply – AC which has a standard life of 15 years. This error has been identified by SunWater and a replacement year commensurate with the correct asset type has been submitted to the Authority in the NSPs.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1987.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005 which was a desk top as opposed to in-field evaluation. This risk assessment yields a highest risk score of Low. As such, under SunWater's systems, there should be no risk related adjustment to the standard run to failure asset life. We have reviewed SunWater's submission and confirmed that this is the case.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment was undertaken in 2001 which is outside SunWater's stated maximum condition inspection periods for this asset type and hence, as SunWater has acknowledged *"is out of date"*. This 2001 condition assessment indicates that the highest condition score allocated was a 2 (Minor Defects Only) for the protective enclosure criterion. As this condition assessment is capture in WMS as a 'Conversion' from earlier databases, no additional information is available.

SunWater has advised that:

"As there is no current condition assessment report available for this asset the replacement has been scheduled at the end of the risk based asset life of 35 years".

Hence, in absence of data to the contrary, SunWater has assumed a standard run to failure asset life for this asset and scheduled replacement at the end of that life, ie 1987 installed date plus 35 years standard life gives a 2023 replacement date.

We have evaluated the projected run to failure asset life using SunWater's asset life adjustment planning tool. Inputting a Low business risk and worst case condition score in 2001 of 2 for this asset with a standard run to failure life of 35 years into SunWater's planning tool results in a projected run to failure life of 80 years and a projected required replacement year of 2067.

SunWater has advised that the when extrapolating from a low condition score, they find the planning tool to be *"unreliable and prone to large errors"*. We concur with this comment and accept that judgement should be used when applying the tool.

Thus, when taking a pragmatic engineering approach, it is unreasonable to adopt this projected life, there is no reason why a well maintained asset of this type, operating within its design parameters, would not be capable of operating significantly beyond SunWater's allocated standard run to failure asset life. From our experience, overhead 11kV lines, pole mounted transformers etc have been known to operate for in excess of their standard asset lives without loss of performance. And, as has been mentioned above, power distribution utility industries would normally adopt an asset life of 45 years for 11kV overhead lines operating in wet (tropical) conditions. However, the assets in question also include components that typically have a 35 year operating life in these conditions. As such, we consider it reasonable that SunWater adopts an asset life for the whole asset in line with the industry standard life for the shortest asset life component (i.e. 35 years). The alternative would be to disaggregate this asset into overhead lines and pole mounted transformers and circuit breakers.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item, however, given the nature of this asset, the limited alternative technical options available and the date at which replacement is planned, we consider that not conducting an option assessment at this stage is in keeping with good industry practice.

Timing of Renewal/Refurbishment

SunWater has planned replacement based on its standard run to failure asset life for this asset since the current condition assessment is out of date i.e. more than 5 years old. However, given that the 2002 condition report indicated that the asset was in good condition, we consider this approach to be conservative.

There is no reason why a well maintained asset of this type, operating within its design parameters, would not be capable of operating significantly beyond its standard run to failure asset life. From our experience, overhead 11kV lines, pole mounted transformers etc have been known to operate for in excess of 45 years without loss of performance. However, we recognise that these assets are operating in tropical conditions and hence tropical condition asset lives should apply.

We therefore conclude that the proposed timing for replacement of this asset is not prudent and that an appropriate replacement date can only be determined following receipt of information from a more current condition assessment than that conducted in 2002. However, given that the assets are operating in wet conditions, we do think it appropriate to plan for replacement of this asset within this annuity period as, if a 45 year life is adopted for all assets, based on the in service date, replacement should be planned for 2032. Therefore we consider that inclusion of this asset replacement in this current price determination annuity value is t prudent.

Conclusion on Prudency Evaluation

We conclude that it in absence of a recent and current condition assessment, it is appropriate to plan for replacement of this asset at or around the date of the end of the run to failure asset life t. As such the inclusion of this annuity item in the annuity value is considered to be prudent.

B.1.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+44.62%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 44.62%. Whilst this is at the upper end of the range of multipliers used by SunWater to capture asset item specific costs such as location, project management, engineering we have insufficient information to determine its reasonableness.

We have calculated a 2008 replacement value for this asset based on the standard 1997 to 2008 multiplier of 2.13 for electrical assets as determined by Cardno which yields a replacement value of approximately $1.78m. In order to reconcile this to the replacement cost contained in SAP WMS of 2.195m a further multiplier of approximately 1.24 must be applied[7]. In order to reconcile this replacement cost contained in SAP WMS to the annuity item value submitted by SunWater to the authority of $2.629m a further multiplier of approximately 1.20 must be applied. We are uncertain as to why an escalator above that determined by Cardno has been used by SunWater to calculate a replacement cost and a further multiplier applied to calculate the annuity value submitted to the Authority as this is not in line with the method for determining annuity replacements advised by SunWater.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our

[7] SunWater has advised that this uplift was recommended by Arthur Anderson in their 2000 valuation report: Queensland Water Reform Unit: Optimised Depreciated Replacement Cost Valuation State Water Projects, 30 June 2000, however we are not able to identify a reference to a 1.24 multiplier in the Arthur Anderson report.

estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%.

We have compared our cost estimate against SunWater's cost estimate in Table 13 below:

- **Table 13 Burdekin Dam HV System Replacement Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
2,629,204	1,228,694	+114%

SunWater's estimate is some 114% higher than our estimate for this asset. The primary contributing factor to this difference in estimated values is the building block rate used by SunWater for ACSR "Banana" overhead conductor. The SKM rate of approximately $2.14k per km (ex works) is in sharp contrast to the 2008 escalated value of $29k per km ($87k per km installed) used by SunWater, and for this reason we would recommend that the scope of this building block is reviewed to ensure it is suitable for use in the capital estimate as it has been applied.

We have relied on a number of sources to determine the $2.14k/km rate for the overhead conductor:

- SKM conducted a procurement survey for ENERGEX in June 2006, where we asked for material only costs for various assets, including overhead conductor. This yielded a cost, for bulk purchases, of $1k/km
- We revisited this price directly with ENERGEX as part of this project which yielded cost of $2.12k/km for 210mm^2 aluminium overhead conductor (compared to Banana which is 77mm^2 with steel reinforcement)
- We obtained prices from Alcan (via a US website) which yielded $2.14k/km;
- Finally we have obtained a budget price from Olex which yielded $1.65k/km.

Our reference estimate using the SunWater value for the "Banana" overhead conductor is $2.5M, highlighting the singular impact of the value of this building block.

SunWater has developed a planning order for this annuity item replacement which details the following breakdown of costs between contractors, overheads and materials based on a standard costing apportionment of: 45% material, 35% contractors with the rest on plant, internal labour and overheads. We note that the SAP WMS planning order breakdown does not adhere to this standard costing apportionment as is shown in Table 14.

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■ **Table 14 SunWater Breakdown of Costs – Burdekin Falls Dam Replace Cable**

Cost Item	Planned Costs
Contractors	$890,000
Internal Labour Transfer	$61,550
Internal Overhead Transfer	$190,654
Materials	$1,357,000
Plant Equipment and Vehicles	$130,000
Total	$2,295,906

SunWater has advised that Internal Overhead Transfer relates to corporate overhead costs that are allocated to this annuity item replacement activity.

Conclusion on Efficiency Evaluation

Based on our estimated cost of a modern equivalent asset, we consider the proposed annuity item value of $2.629m not to be efficient.

B.1.5 Summary and Conclusions

This annuity item consists of a number of components that have varying industry standard asset lives. SunWater has adopted an asset life consisted with the life of the lowest asset life items (35 years). Unless the annuity item is disaggregated and the 11kV line separated out (which has an industry norm asset life of 45 years), we consider this approach to be reasonable. However, the condition assessment is out of date and given that this asset has been allocated a risk category of Low, we consider that a detailed condition assessment should be undertaken prior to establishing a replacement date for this asset. However, if an aggregate life of 45 years were to be adopted, this would still place replacement of this asset item within this price setting annuity period. We therefore consider that inclusion of this annuity item in this price set annuity value to be prudent.

From our benchmarking of the replacement costs we consider that SunWater's annuity value submitted for this annuity item to be 114% higher than our cost estimate. The difference between SKM's estimated cost and SunWater's arises from a difference in the unit rate adopted for the 11kV overhead line. If we use the rate used by SunWater in our estimate then the difference between the two estimates falls within the normal estimating range of +30%/-20% for this level of estimate. We therefore conclude that the annuity item replacement value submitted by SunWater to the Authority is not efficient.

B.2 Burdekin Falls Dam – Replace Cable

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.2.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of a low voltage (LV) above ground cable system.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1987. SunWater has submitted an annuity item value of $2.296m for replacement of the existing low voltage (LV) above ground cable system in 2024.

B.2.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 15 Documentation Reviewed Specific to Replacement of the LV Above Ground Cable at Burdekin Falls Dam**

Document No.	Document Name	Document Title	Date
1105989	1105989 2. QCA Justification Paper H2 – Burdekin Falls Dam – Replace Cable	Burdekin Water Supply – Burdekin Falls Dam – Replace Cable (BRI-BURD-BFD-WALL-CBLE)	21st August 2011

B.2.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is CALVAG – LV above ground cable that SunWater has allocated a standard run to failure asset life of 35 years and a condition inspection frequency of 5 years. We consider the standard run to failure asset life to be towards the low end of what may be expected for above ground LV cable. For example, most electrical distribution utilities in Australia would apply an asset life of 45 to 60 years for above ground LV cables depending on whether it is operated in dry or wet (tropical) conditions. We consider the condition assessment frequency applied to this asset type to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1987.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005 which was a desk top as opposed to in-field evaluation. This risk assessment yields a highest risk score of Low. As such, under SunWater's systems, there should be no risk related adjustment to the standard run to failure asset life. We have reviewed SunWater's submission and confirmed that this is the case.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment was undertaken in 2001 which is outside SunWater's stated maximum condition inspection periods for this asset type and hence, as SunWater has acknowledged *"is out of date"*. This 2001 condition assessment indicates that the highest condition score allocated was a 3 (Moderate deterioration with minor refurbishment required to ensure on-going operation). This was a high level assessment with no condition scores being applied to the different condition assessment criteria for this asset.

We note though that, although SunWater's SAP WMS record states that the condition assessment was carried out in 2001, there is a note on the record which states that a 2005 desk top assessment indicated that there is a requirement for a *"high level of routine maintenance on lightning arrestors –HV"*.

SunWater has advised that:

"As there is no current condition assessment report available for this asset the replacement has been scheduled at the end of the risk based asset life of 35 years".

In other words, in absence of data to the contrary, SunWater has assumed a standard run to failure asset life for this asset and scheduled replacement at the end of that life, ie 1987 installed date plus 35 years standard life gives a 2023 replacement date. In fact SunWater has scheduled replacement for 2024.

We have evaluated the projected run to failure asset life using SunWater's modelling tool. Inputting a Low business risk and worst case condition score in 2001 of 3 for this asset with a standard run to failure life of 35 years into SunWater's planning tool results in a projected run to failure life of 37 years and a projected required replacement year of 2024. If a 45 year run to failure asset life is applied to the planning tool, a replacement year of 2024 is similarly projected as the condition score of 3 indicates a higher rate of deterioration than the standard condition decay curve predicts at that time for a 45 year life.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item, however, given the nature of this asset, the limited alternative technical options available and the date at which replacement is planned, we consider that not conducting an option assessment at this stage is in keeping with good engineering practice. We note that SunWater has planned to undertake a project in 2022 to review the options for replacement of the cable which we believe is appropriate and again in keeping with good industry practice.

Timing of Renewal/Refurbishment

SunWater has planned replacement based on its standard run to failure asset life for this asset given that the current condition assessment is out of date i.e. more than 5 years old. However, the proposed replacement date is in line with the date that SunWater's planning tool predicts when the condition assessment score and date of the condition assessment score is input into the tool.

We consider that it would be preferable for SunWater to undertake a further condition assessment (as SunWater's procedures require for this asset) to obtain a more current and definitive assessment of the condition of the asset than the high level assessment undertaken in 2001 prior to determining the projected replacement date for this asset. We recommend that condition assessment should extend beyond a visual assessment and include electrical testing such as insulation breakdown testing, earth impedance testing and similar to determine the condition of the cable installation.

In absence of this information, if a 45 year run to failure asset life is applied to the planning tool, a replacement year of 2024 is projected as the condition score of 3 indicates a higher rate of deterioration than the standard condition decay curve predicts at that time for a 45 year life.

We therefore consider that the SunWater proposed timing for this asset replacement of 2024 is prudent, and hence it is prudent to include this asset item replacement value in the current price set annuity period annuity value.

Conclusion on Prudency Evaluation

We conclude that it is appropriate to plan for replacement of this asset within this annuity period at the proposed date of 2024. As such the inclusion of this annuity item in the annuity value is considered to be prudent.

B.2.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+44.62%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 44.62%. Whilst this is at the upper end of the range of multipliers used by SunWater to capture asset item specific costs such as location, project management, engineering we have insufficient information to determine its reasonableness.

We have calculated a 2008 replacement value for this asset based on the standard 1997 to 2008 multiplier of 2.13 for electrical assets as determined by Cardno which yields a replacement value of approximately $1.85m. In order to reconcile this to the annuity item value submitted by SunWater to the authority of $2.296m a further multiplier of approximately 1.24 must be applied. We are uncertain as to why an escalator above that determined by Cardno has been used by SunWater as this is not in line with the method for determining annuity replacements advised by SunWater.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%.

We have compared our cost estimate against SunWater's cost estimate in Table 16 below:

- **Table 16 Burdekin Falls Dam Replace Cable Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
2,295,907	2,076,000	+9.6%

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $2,295,906 to be efficient.

SunWater has developed a planning order for this annuity item replacement which details the following breakdown of costs between contractors, overheads and materials based on a standard costing apportionment of: 45% material, 35% contractors with the rest on plant, internal labour and overheads. We note that the SAP WMS planning order breakdown does not adhere to this standard costing apportionment as is shown in Table 17.

- **Table 17 SunWater Breakdown of Costs – Burdekin Falls Dam Replace Cable**

Cost Item	Planned Costs
Contractors	$802,908
Internal Labour Transfer	$114,692
Internal Overhead Transfer	$231,296
Materials	$802,908
Plant Equipment and Vehicles	$344,103
Total	$2,295,906

SunWater has advised that Internal Overhead Transfer relates to corporate overhead costs that are allocated to this annuity item replacement activity.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $2,295,906 to be efficient.

B.2.5 Summary and Conclusions

We conclude that it is appropriate to plan for replacement of this asset within this annuity period at the proposed date of 2024. As such the inclusion of this annuity item in the annuity value is considered to be prudent.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.3 Peter Faust Dam Replacement of Cables and Cableways

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.3.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of cables and cableways at Peter Faust Dam in the Three Moon Creek Water Supply area.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1990 and was installed as part of the original construction works of the dam. SunWater has submitted an annuity item value of $851k for replacement of the existing cable in 2026.

B.3.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 18 Documentation Reviewed Specific to Replacement of the LV Above Cable at Peter Faust Dam**

Document No.	Document Name	Document Title	Date
1105717	1105717 3 -QCA Justification paper H3 – Peter Faust Dam – Cable and Cableways	PRO-PFD-ELEC-CBLE: Replace Cables and Cableways - $850,974	21st August 2011

B.3.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is CALVAG – Low Voltage above ground cable. We note that in SunWater's Whole of Life Maintenance Planning Tool (Master), SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 5 years. We consider the standard run to failure asset life to be conservative for above ground LV cable. For example, most electrical distribution utilities in Australia would apply an asset life of 45 to 60 years for above ground LV cable depending on whether it is operated in wet (tropical) or dry conditions respectively. We consider the condition assessment frequency of every 5 years applied to this asset type to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1990.

We note that for the next future replacement of this asset, the asset life has been set to 30 years. It is not clear why this is the case and could be a data entry error in SAP WMS. However this is beyond this current annuity period and hence has no impact on the current annuity value.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has a financial risk criterion consequence rating of moderate (score 18). This, together with a probability (likelihood of occurrence) score of 1 results in an overall risk score of 18 which, under SunWater's risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating.

Under SunWater's asset life adjustment policies, where an asset scores a Low or Medium risk and where the worst business criterion consequence score is greater than 8 (Major consequence or above), SunWater reduces the run to failure asset life to a risk adjusted run to failure life of 88% of the asset type run to failure life, in this case 31 years.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment was undertaken in 2008 with the highest scoring condition criteria being Conduits (Metal) (Corrosion/Damage) and Cable Pits and Lids (Struct Integ/Siltation/Vermin ...) both being allocated a score of 3 (Moderate deterioration with minor refurbishment required to ensure ongoing reliable operation).

Inputting a condition score of 3, a standard run to failure life of 35 years, a Medium business risk rating (to take account of the consequence score of greater than 8) and in operation date of 1990 into SunWater's condition based replacement life adjustment modelling tool yields a recommended condition based replacement date of 2032. If SunWater's procedures are applied, and ignoring for the incurred asset risk classification applied, then a replacement date of 2032 should be planned for and not 2026 as specified in SunWater's submission to the Authority.

SunWater has stated in its report on this annuity item that:

"This [the results of the condition based replacement life adjustment tool] *indicates that the decay is less than the standard rate of decay. If the next condition assessment report in 2013 has a similar shift, there would be evidence to move the decay curve for this asset to the correct* [condition based end of life projection]"

SunWater goes on to state that:

"On a single *assessment point in time we will not move the* [condition decay] *curve out, however if we can establish some trend over a couple of assessments the shift would be justified".*

We consider that there is merit, where the latest available condition assessment is high level and or out of date, in not making projected run to failure end of life adjustment decisions based on a single condition assessment. However, this is not the case for this annuity item. The assessment is within date and is relatively detailed. We therefore consider that by SunWater not taking cognizance of this condition assessment, and hence not adjusting asset life outwards based on the current condition assessment, SunWater has not adhered to its procedures. Again, whilst we accept that there should be some subjective decision making in this process, we note that, for the replacement annuity items we have reviewed, where a single condition assessment projects a shortening in run to failure asset life, this is invariably adopted.

By having a different process for extending lives over reducing lives, SunWater will, by default, incorporate a bias for the asset replacement dates within its asset portfolio towards earlier than required replacement dates.

We have also evaluated the projected run to failure asset life using SunWater's condition based replacement life adjustment modelling tool using a 45 year standard run to failure asset life which we consider to be in line with industry norms. Inputting a Medium business risk (to take account of the consequence score of greater than 8) and worst case condition score 3 in 2008 for this asset also results in a projected run to failure life of 42 years and a projected required replacement year of 2032.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item, however SunWater has advised that:

"Peter Faust Dam is scheduled to undergo a comprehensive dam safety inspection during 2014 during which time a condition assessment of the cables will occur to refine the scope of works of this project.".

Given that the planned replacement date is 2026 and that there will be at least one further price reset prior to 2026, in 2015, we consider this approach to be reasonable on the assumption that the 2013 condition assessment and scope definition will be taken into account in the annuity value submitted for this asset in the 2015 price reset.

We also recommend that SunWater conducts electrical condition tests on the cable at this time such as earth impedance testing, insulation breakdown testing rather than rely on visual inspections.

Timing of Renewal/Refurbishment

We do not agree with the standard run to failure asset life applied by SunWater to this asset class and consider that 45 years would be a more appropriate run to failure asset life. An asset life of 45 years is in line with the asset type life adopted by power network utilities in Queensland for this asset type.

We therefore do not consider that the timing for replacement of 2026 is prudent. However we do consider it prudent to include this annuity item's replacement value in this current price setting annuity value as on either a 45 year life, or an adjusted standard life of 35 years, based on condition, in line with SunWater's procedures the run to failure date (2032) is within this current price setting annuity period.

We recognise though that a new condition assessment may reveal accelerated condition deterioration which may make it appropriate to bring forward the replacement date in due course.

Conclusion on Prudency Evaluation

We consider that it is prudent to plan for replacement within this annuity period based on the consequence risk score applied to this asset.

B.3.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+47.35%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 47.35%. Whilst this is at the upper end of the range of multipliers used by SunWater to capture asset item specific costs such as location, project management, engineering we have insufficient information to determine its reasonableness.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%.

We have compared our cost estimate against SunWater's cost estimate in Table 19 below:

- **Table 19 Peter Faust Dam Cable Replacement Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
850,974	836,908	+1.6%

A Planning Order has not yet been developed for this asset, as such SunWater has not developed a breakdown of direct and overhead costs.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $850,974 to be efficient.

B.3.5 Summary and Conclusions

We do not agree with the timing of the replacement of this asset. However we do consider that it is prudent to plan for replacement within this annuity period based on the consequence risk score applied to this asset.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.4 Elliot Pump Station Replacement of Switch Gear

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.4.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of Elliot Pump Station Switchboard No. 1 (Pumps 1 & 2) in 2012 at a cost of $262k.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation at its current location since 1987. However, SunWater has advised that this asset was relocated from a previous site to its current location in 1987 and is therefore over 24 years old. SunWater is not able to advise the actual age of this asset but considers that it is possible that it may have initially been installed in 1978 at the Mirani temporary pumping station.

SunWater has identified that the asset should be replaced on two counts:

3) The asset is scored 'High' on a Workplace Health and Safety (WH&S) criterion. This score is driven by a condition assessment undertaken by Parsons Brinckerhoff (PB) in which PB commented that there were safety issues associated with access to live parts of the installation.
4) Asset age. The asset has been allocated an age related condition criterion of 5. This score, coupled with the current site in operation date of 1987 advances the standard asset condition deterioration curve, bringing forward the recommended replacement date to 2012[8].

SunWater has submitted an annuity item value of $262k for replacement of Switchboard No 1 in 2012.

B.4.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review along with a Parsons Brinckerhoff report following audit of electrical sites:

[8] It is recognised that the 'In Operation Date' contained within SAP WMS does not reflect the true age of this asset.

- **Table 20 Documentation Reviewed Specific to Replacement of the LV Switchboard at Eliot PSTN**

Document No.	Document Name	Document Title	Date
1108993	1105969-QCA Justification – Elliot Pump Station Switchboard 1	Elliot Pump Station – QCA Justification: Replace Switchboard No. 1 (Pumps 1 &2)	8th August 2011
837517	837517 Final Report: SunWater audit of Electrical Sites.	SunWater: Audit of Electrical Sites	24th July 2009

B.4.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such.

The standard object type (asset type) for this infrastructure is ELLVSB – Low Voltage Switchboard. We note that in SunWater's Whole of Life Maintenance Planning Tool (Master), SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 2 years. We consider the standard run to failure asset life and condition assessment frequency applied to this asset type to be reasonable

We have viewed the WMS record for this asset and note that the asset has been in service since 1989 at its current location. However, SunWater has advised that the switchboard was relocated to this site in 1989 from a previous installation and hence it is older than the in-service date in SAP WMS would indicate. SunWater has advised that the switchboard initially "*may have entered service in 1978 in the Mirani temporary pump station.*" This would place the switchboard age as being 32 years old at the time of development of the NSPs.

SunWater commissioned Parsons Brinckerhoff (PB) to undertake a condition assessment and audit of all its electrical sites in 2009. The condition report and risk report in SunWater's SAP WMS is therefore derived from a high level recommendation provided in the PB report. The risk assessment template in SAP WMS records a Low risk for the business risk items used for asset replacement planning purposes (in fact no score at all has been given for these criteria). However, a High risk score has been allocated to the Workplace Health & Safety (WH&S) criteria, based on a 'Critical' consequence score (2,000) and a probability score (likelihood of occurrence) of 20. Under SunWater's systems, these scores combine to 40,000 which places the overall risk as a High category.

Under SunWater's systems, any asset that has been allocated a High risk category on a WH&S assessment criterion is scheduled as a priority 'A' (ie highest priority) asset for remedial/rectification works to address the hazard causing the High WH&S risk criterion rating irrespective of the condition of the asset. We consider this approach, which places a high value on employee safety to be not only prudent but in keeping with good electricity industry practice.

That said, the reason provided by PB which drives this High WH&S risk rating is that there are live parts (i.e. electrically energised parts) which can be accessed (touched) without isolating (i.e. without any interlocks ensuring isolation before access) and without the use of a tool or key (i.e. without a panel that requires a particular tool, or interlock key to open).

We also note that, in the standard SunWater Risk and Condition Assessment Collection Form prepared by PB following site inspection and from the relevant section of the PB report (Audit of Electrical Sites) that PB states that oversized fuses have been used (450A in 400A combination fuse switch (CFS) circuits), and that labelling of the switch gear component live parts etc. is not in keeping with AS/NZS 3439.1:2002.

On this basis PB has provided a high level recommendation that:

"Due to the age of the switchboard, potential for access to live parts and the availability of components, it [sic] *should be planned for the future replacement of this switchboard".*

As mentioned above, SunWater's Planning Team has proposed replacement on two grounds, the first relating to the WH&S risk described immediately above, the second on a condition score of 5 related to a condition criterion of age. As is discussed in the main body of this report, we question the use of age as a criterion in assessing condition as age should be inherently captured in the asset condition decay curve used by SunWater. If age is used as a condition assessment criterion then it precludes SunWater, under its systems, from extending the run to failure life of an asset above an assets standard run to failure asset life for those assets that are otherwise in good condition. We note that in absence of the age based condition criterion score of 5, the next worst highest condition score recorded in SunWater's SAP WMS is 2 across all other categories. Applying this condition score and business risk score of Low to SunWater's method for determining individual asset projected run to failure life yields a projected run to failure life of 177 years and a projected replacement date of 2155.

This is clearly unrealistic and it must be concluded that the SunWater method becomes unreliable when a condition assessment is significantly better than the standard run to failure condition deterioration curve projects.

That said, we note that, in its report, PB has stated that *“The board was observed to be in relatively good condition; ...”* but went on to state that: *“... however there are major issues with access to live parts and with the age and availability of components utilised in the switchboard”.*

We believe that the statement that the switchboard is in relatively good condition goes someway to justifying our view that age, in its self, should not be used as a condition assessment criterion.

We also note that PB commented that there were major issues with *“...availability of components utilised within the switchboard.”*. It is our experience that, given the significant market in replacement switchgear, most modern replacement switchgear and components are backwards compatible, allowing older boards with obsolete parts to be upgraded or defective parts replaced without significant re-work. This availability of backwards compatible parts should allow the life of the switchboard to be extended beyond standard run to failure life before a complete replacement is required.

We also believe that all of the safety issues (access to live parts, non compliance with standards for labelling of live electrical equipment, fuse ratings can be addressed without resorting to a full replacement of the switchboard:

Elliot Pump Station No. 1 switchboard can be refurbished by the addition of the following items:

1) Replacement of existing 450A fuse cartridges with suitably sized motor starting class fuse cartridges to match the motor starting duty. It is expected that TM400M450_GEC type fuses would be suitable, subject to checking. These are 400A with a starting characteristic of 450A for motor current inrush during starting.
2) Insulated panel escutcheon(s) (safety barrier) with suitable cutouts for MCCB and MCB toggles to be operated when fitted. Lexan polycarbonate is a suitable material for the escutcheon. The escutcheon is to be fastened with nuts that require a tool to remove the escutcheon. In accordance with AS/NZS 3000.
3) Additional safety barriers and shrouds as required for segregation of live parts to IP2x level of ingress protection. In accordance with AS/NZS 3000.
4) Safety warning labels. Engraved Traffolyte, Ultrapas or approved equivalent to meet AS/NZS 3439.1:2002.
5) Circuit identification labels. Engraved Traffolyte, Ultrapas or approved equivalent.
6) Neutral circuit identification of individual circuits, both stamped on the neutral bar and with matching wire numbers on the neutral circuit wiring. In accordance with AS/NZS 3000.

7) Neutral circuit identification of individual circuits, both stamped on the neutral bar and with matching wire numbers on the neutral circuit wiring. In accordance with AS/NZS 3000.
8) Wiring duct and flexible insulated wiring conduit for internal wiring segregation behind escutcheon.
9) Installation of RCDs to protect lighting circuits.

In addition, we would recommend that testing of the switchboard to AS/NZS 3497.3 Section 8 - Tables 7 and 7b should be conducted following modifications Arc flash hazard assessment should be conducted also.

The current Wiring Rules, AS/NZS 3000 section 2.5.5, requires all electrical installations to have protection against internal arcing faults to AS/NZS 3439.1. Compliance with AS/NZS 3439.3 is required for access by unskilled persons.

Arc Flash assessment should be conducted to IEEE 1584 and NFPA 70E, with mitigating action taken where required, including the provision of appropriate personal protective equipment. as detailed above.

It is expected that such refurbishment will be less costly to the end of life than full switchboard replacement.

We note in PB's report that PB makes almost identical recommendations in respect of labelling, modification of panels and installation of covers to prevent access to live parts, installation of RCDs together with a recommendation to:

"Investigate and rectify the use of over-rated fuses in the CFS units for the Pump circuits."

We therefore conclude that PB's recommendation for planned future replacement of the switchboard should not be interpreted as being a recommendation for immediate replacement and that lower cost alternatives as described above and, in large part, in PB's report could be carried out until such time as actual asset condition would dictate replacement.

Based on the above, in particular that the WH&S risk can be addressed relatively cheaply and that the condition of the switchboard is generally good, we find the proposed timing for replacement of the switchboard of 2012 (i.e. one year prior to the standard run to failure asset life projected replacement of 2013 based on an assumed initial in use date of 1978 and a standard run to failure asset life of 35 years) not to be prudent.

However, we recognise that spares for failed component replacement are become more difficult to obtain and hence, even though the physical condition of the switchboard indicates that it could achieve a run to failure life significantly in excess of the standard run to failure life of this asset class, it is highly likely that the asset will require to be replaced within the next decade (assuming the above mentioned modifications are implemented to overcome the WH&S risk issue). As such it is appropriate for SunWater to plan for replacement of this asset significantly prior to the end of the current price set annuity value determination period.

We therefore consider that the inclusion of an annuity item replacement value in respect of this asset in the overall annuity value to be prudent and note that the difference in annuity value arising from deferring replacement to say 2022 as a result of additional discounting of the annuity item replacement value represents less than 0.4% of the overall annuity value for that asset annuity group.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item other than the proposal promoted in PB's report to address the WH&S issues in a similar manner to our recommendation set out above. We consider that undertaking the works set out above would be significantly cheaper than complete replacement of the switchboard, albeit it may only allow for deferral of replacement of the switchboard by up to ten years.

Timing of Renewal/Refurbishment

As discussed above, the timing of the replacement of the asset is driven by the use of an age criterion in the condition assessment method for this type of asset, the WH&S driven timing can be addressed by a cheaper alternative of installing key or tool accessed panels and covers to prevent access to live parts as recommended by both ourselves and PB. Putting age aside, the score of the next work condition criterion indicates that the switchboard is in good condition (as is also stated in PB's report). However, given the nature of the asset, it is prudent to plan for replacement at most by 2022, i.e. within this annuity value determination period.

Conclusion on Prudency Evaluation

We conclude that it is prudent to plan for replacement of this asset at or around the date of the end of the run to failure asset life based on the In Operation date of 1987. As such the inclusion of this annuity item in the annuity value is prudent.

B.4.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced within 5 years of the planning date, SunWater uses a bottom up approach to determine the asset replacement annuity value, or draws on recent experience of pricing/outturn costs of replacing similar annuity items. We note that on a bill of materials (BOM) based replacement cost assessment as used by SunWater for assets being replaced more than five years hence of the planning date, the standard replacement cost for this annuity item captured in SunWater's SAP WMS is $362,712. The BOM based valuation method is described in the main part of this report. In short, SunWater uses BOM annuity asset item component quantities, 1997 (as installed) unit rates, an annuity item specific 'Indirect' multiplier to capture locational cost factors project management etc and a standard multiplier to escalate the 1997 unit rates to 2008 unit rates of 2.13 as developed by Cardno in order to develop a BOM based asset replacement value.

However we note that a value of $262,000 has been captured in SunWater's SAP WMS for the proposed 2012 replacement and this replacement value has been submitted to the Authority by SunWater.

Renewal/Replacement Project Cost Evaluation

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for modern equivalent electrical assets. We have compared our cost estimate against SunWater's cost estimate in Table 21 below:

- **Table 21 Elliot Pump Station Switchboard No 1 Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
262,000	333,370	-21.4%

SunWater's annuity item replacement value estimate of $262k as submitted to the Authority is some 21% lower than our estimate. We also note that the standard replacement asset item value of $362k is only 8.8% higher than our estimate.

We therefore consider that the annuity value as submitted to the Authority is efficient.

Conclusion on Efficiency Evaluation

We consider the proposed annuity item value as submitted to the Authority of $262k to be efficient. Indeed, had SunWater submitted its standard annuity asset item replacement cost of $362k, then this would have been deemed efficient.

B.4.5 Summary and Conclusions

We are not satisfied that the timing of replacement of this annuity item is prudent as submitted to the Authority as the main WH&S risk based driver for replacement can be addressed by a lower cost alternative than complete replacement.

However, we are satisfied that this annuity asset will need to be replaced within the next ten years and hence the replacement annuity asset item value should be captured in the annuity value used to determine this current price reset.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.5 Fred Haigh Dam Replacement of Cables and Cableways

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.5.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of cables and cableways at Fred Haigh Dam in the Three Moon Creek Water Supply area.

The replacement annuity item submission encompasses the replacement of both high voltage (HV) (11kV) and low voltage (LV) cables through a main dam wall and includes for the replacement of conduits and a light pole.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1975 and was installed as part of the original construction works of the dam. The estimated value for the entire replacement annuity item as shown in SunWater's SAP WMS is approximately $474k. SunWater has suggested that the work will be undertaken in two parts over the period 2014 to 2015. SunWater has not provided information to indicate how the works are to be split, or which assets are to be replaced at each stage. SunWater has submitted an annuity item value of $250k for phase 1 of replacement of the existing cable through the main wall in 2014. A further $250k is planned to be spent in 2015 to complete the works. We have therefore undertaken an efficiency evaluation against the costs for the complete replacement of the asset of $500k.

B.5.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 22 Documentation Reviewed Specific to Replacement of the LV Under Ground Cable at Fred Haigh Dam**

Document No.	Document Name	Document Title	Date
1106063	1106063 5 -QCA Justification paper H4 – Fred Haigh Dam – Cable and Cableways	BIA-KOLA-FHD-ELEC-CBL2: Replace Cable Main Wall	21st August 2011

B.5.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) allocated for this infrastructure in SAP WMS is CALVAG – Low Voltage above ground cable.

We believe it would be prudent for SunWater to check that it has adopted the correct standard object type for this annuity asset. SunWater's report (#1106063) states:

"The object type of the asset is CALVUG –HV Cable Underground."

The CALVUG standard object type is applied to LV underground cable, not HV underground cable. Also, CALVUG is not the object type recorded in SAP WMS, CALVAG is recorded in SAPWMS. In the body of its report, SunWater states that the cable is buried which suggests, at least, an Under Ground classification should apply. However, in respect of determining asset life, under SunWater's systems, as set out in SunWater's Whole of Life Maintenance Planning Tool (Master), all of these cable asset object types (CALVAG, CALVUG and CAHVUG) have the same run to failure asset life of 35 years applied and the same condition assessment frequency of 5 years applied.

We note that SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 5 years. We consider the standard run to failure asset life to be conservative for both above and below ground LV and HV cable. For example, most electrical distribution utilities in Australia would apply an asset life of 45 to 60 years for above ground LV cable depending on whether it is operated in wet (tropical) or dry conditions respectively. We consider the condition assessment frequency of every 5 years applied to this asset type to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1975.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has a financial risk criterion consequence rating of minor (score 8). This, together with a probability (likelihood of occurrence) score of 3 results in an overall risk score of 24 which, under SunWater's risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. An overall risk category of Low should not trigger any reduction in the standard run to failure asset life of this type of asset and we confirm this to be the case for this asset.

Under SunWater's systems, a business risk classification of Low does not result in a reduction in the standard run to failure asset life for that asset. Hence the risk adjusted run to failure asset life for this asset is 35 (as per the standard asset life).

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

SunWater has advised that, as the cable is buried, SunWater has not carried out a visual condition assessment nor has SunWater carried out any electrical test to determine eg if there has been degradation in the insulation. As such there is no condition assessment contained in SAP WMS. Whilst we accept that a visual inspection cannot be easily undertaken, this should not preclude electrical testing of the cable or, in absence of that, a 'desk top' condition assessment being undertaken based on typical degradation profiles for this cable. We have noted that SunWater uses a mix of 'Field' and 'Desktop' assessments to populate SAP WMS.

SunWater has advised that:

"The condition was discussed with SunWater's electrician during the annual dam safety inspection and it was decided to push this project out by a few years as:

- *The electrical system was not giving any apparent trouble;*
- *We hadn't employed anyone to actually test/challenge the electrical system."*

Based on a 35 year life with no risk or condition related reduction, under SunWater's systems, the cable should have been replaced in 2010. We find the justification provided by SunWater for delaying the project beyond 2010 not to be convincing. All other issues aside, the lack of recent condition assessment data does not support the extension of the service life due to the absence of operational issues. Generally, we would not consider evidence of this nature to be sufficient to satisfy a regulatory test.

Options Evaluation

SunWater has advised that it has scheduled for a $20,000 project to be undertaken in 2013 to carry out a full condition assessment and options analysis before undertaking any of the planned works. This options analysis is intended to determine the optimum time for replacement of the asset and each of its components.

SunWater considers that *"At this stage of planning, there is no obvious alternative to like for like replacement that would reduce costs by more than 30%"*.

We concur with this statement and hence consider it is prudent to consider a like for like replacement at this stage of the planning process. We assume that, in assessing condition under this project, SunWater will conduct electrical condition tests on the cable at this time such as earth impedance testing, insulation breakdown testing rather than operational performance.

Timing of Renewal/Refurbishment

SunWater has planned for replacement of this asset based on a standard run to failure asset life for this asset type given that no condition assessment has been undertaken to date. However, given that SunWater intends to undertake a condition assessment in 2013, a major intention of which is to determine the optimum replacement date, we consider that it is not appropriate to plan a replacement date until that condition assessment has been completed.

Further, and as previously mentioned, we do not agree with the standard run to failure asset life applied by SunWater to this asset class and consider that 45 years would be a more appropriate run to failure asset life. An asset life of 45 years is in line with the asset type life adopted by power network utilities in Queensland for this asset type.

Conclusion on Prudency Evaluation

We do not consider that it is prudent to plan for replacement of this asset until a full condition assessment has been undertaken. Further, we consider that the standard run to failure asset life applied to this asset class by SunWater is less than industry norms would suggest (35 years as opposed to a minimum of 45 years).

However, even if a 45 year life is adopted it is appropriate to plan for replacement of this annuity item within this current price setting annuity period. As such it is prudent to include a replacement value for this annuity item in the overall annuity value for this price setting period.

B.5.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+46.359%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 46.359%. Whilst this is at the upper end of the range of multipliers used by SunWater to capture asset item specific costs such as location, project management and engineering, we have insufficient information to determine its reasonableness.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%.

We note that SunWater's estimate based on the process described above is $474,308, and not $500,000 captured in WMS SAP for the annuity item replacement total.

We have compared our cost estimate against SunWater's cost estimate in Table 23 below:

- **Table 23 Fred Haigh Dam Cable Replacement Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
$500,000+	512,778	-2.5%

+ The annuity item is planned to be replaced in two stages, each stage costing $250k (according to SAP WMS). We note that SunWater's estimate based on the process described above is $474, 308, not $500,000.

A Planning Order has not yet been developed for this asset, as such, SunWater has not developed a breakdown of direct and overhead costs.

Given the total replacement valuation for the installation is shown in SAP as $474,308, the SunWater estimate of two stages of $250k is not supported by any recommended staging of asset replacement. Therefore, and whilst we have used the combined value for the comparison and found the aggregate estimate to be reasonable, this should not be inferred as SKM finding the nominal 2-stage $250k split in expenditure reasonable in itself. Such a conclusion could only be drawn based on more detailed project information.

From the SunWater analysis, it is not apparent why it is necessary to smooth the cable replacement over a 2-year period, nor the justification for the total $474k forecast becoming two $250k stages.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $500k in total to be efficient.

B.5.5 Summary and Conclusions

We do not agree with the timing of the replacement of this asset principally because we consider that standard asset life adopted by SunWater to be less than industry norms. However we consider it prudent to include this asset's replacement value in this current price set annuity value since if an industry standard 45 years asset life is applied, this asset would reach the end of its run to failure asset life by 2020.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.6 Silverleaf Weir – New Inlet Structure

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.6.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the installation of an inlet structure to enable isolation of the intake structure, dewatering of the outlet works and cleaning of the trash screens, of the Silverleaf Weir in 2012 at a projected cost of $314,918. A site inspection conducted in 2010 indentified a Workplace Health and Safety concern with the existing layout. The scope of works proposed is to address the concerns raised.

SunWater advises that the asset was constructed in 1949 as part of the original construction of the distribution system.

The standard object type (asset type) for this infrastructure is OWKS, Outlet Works, which SunWater has allocated a standard run to failure asset life of 80 years and a refurbishment period of 20 years.

B.6.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater:

Document No.	Document Name	Document Title	Date
1106884	1106884 – v1-7 – H6 – Silverleaf Weir Inlet Structure	Barker Barambah Water Supply – Silverleaf Weir – New Inlet Structure	22 August 2011

B.6.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on data provided.

SunWater's SAP records state that the object type for this asset is an Outlet works (OWKS) with a standard run to failure life of 80 years and a refurbishment period of 20 years. We consider the applied run to failure asset life and refurbishment period for this asset to be appropriate for this asset type and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1949.

SunWater has applied its risk evaluation method to this asset. It determined that the asset has a Workplace Health and Safety risk listed as critical consequence rating (score 100). The consequence rating together with a probability (likelihood of occurrence) score of 20 results in an overall risk score of 2000 which places this asset in a risk category of 'High'. For this asset type, an overall risk category of high reduces the run to failure asset life from 80 years to 50 years and the refurbishment period from 20 years to 13 years. We note that once the WH&S issue has been addressed the overall risk category reduces to a Medium. For this asset type the run to failure life reduces from 80 to 70 years and the refurbishment period from 20 years to 18 years for a risk category assessment of 'Medium'. We consider this reduction in run to failure asset life and refurbishment period based on the medium risk , after addressing the WH&S issue, assessment for asset replacement/refurbishment planning purposes to be appropriate and in keeping with good industry practice.

The replacement of this asset type is projected to be in 2019, based on its construction date and adjusted replacement period of 70 years. The scope of works proposed provides for removal of the existing outlet gate and re-installation of it as part of the inlet structure.

The latest condition assessment, being a desk top assessment, as recorded in WMS for this asset, was undertaken in 2010. The condition assessment interval is 10 years for this object type (OWKS). The condition assessment was recorded to a higher level functional location. The condition assessment does not conform to SunWater's policy and procedures as no detailed condition assessment was undertaken. A high level condition score of '2' (Minor defects) was applied at the time of the assessment together with a comment:

"Timber cribs in poor condition: Outlet needs reconfiguring: access issues – no public safeguards".

Options Evaluation

The proposed scope of work is to install a new inlet structure to enable isolation of the intake structure, dewatering of the outlet works and cleaning of the trash screens. The design proposed has been implemented by SunWater in the past with minor adoptions to suite. SKM considers the design cost effective. The design address the WHS concerns raised and are therefore deemed appropriate.

Timing of Renewal/Refurbishment

Based on the 2010 condition assessment score of 2 and in accordance to SunWater's policies for one off projects related to identified non-business risk (Environment or Workplace Health & Safety) the installation of the proposed inlet structure is classified as a B Priority and therefore should be addressed within the next fiscal year. We therefore consider the timing of this replacement to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for identifying risk and assessing asset condition have been followed, we conclude that the need of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.6.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

For asset refurbishment works where the planned refurbishment date is less than five years hence from the planning date, SunWater's planning team draw on actual costs for similar activities undertaken recently or from a zero based budgeting approach in absence of recent project data. Given the volume of annuity items that SunWater's Planning Team are engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned. SunWater Planning has drawn on costings from various projects to develop the cost estimate.

Renewal/Replacement Project Cost Evaluation

SunWater made the Final Report - Silverleaf Weir - Outlet Upgrade, dated July 2009 available to SKM. This design report consists of a design drawing and a cost estimate. SKM has developed a cost estimate making use of the information and rates provided by SunWater. SKM has reviewed the rates provided by SunWater and consider these rates as per the design report to be efficient and have made use of the rates to compile a cost estimate. The cost breakdown is supplied in the Table 24 below:

Table 24 SKM Cost Estimate

No.	Description	Amount ($)
1	**DIRECT COST**	
1.1	Access and Cofferdam	24,000
1.2	Demolition	8,000
1.3	Piling	15,900
1.4	Concrete Works	62,500
1.5	Metal Works	94,500
1.6	Hydraulics	18,560
2	**SUB-TOTAL A**	**223,460**
3	Preliminary and General at 17% of Sub-Total A[9]	37,990
4	**SUB-TOTAL B**	**261,450**
5	INDIRECT COST	105,030
6	**TOTAL**	**366,480**

It is to be noted that there is a cost discrepancy between the annuity value submitted to QCA, the cost breakdown in SAP and the Cost Estimate conducted as part of the design. These differing cost figures are summarised in Table 25 below.

Table 25 Cost figures Recorded

Description	Amount ($)
Annuity value submitted to QCA.	314,918
Total Cost as per the breakdown as recorded in SAP.	332,568
Design Estimate (July 2009).	320,490[10]

The existing total cost as recorded in SAP differs from the annuity value submitted to the Authority in that it includes for a Service Charge.

The detailed design estimate, as part of the Final Report – Silverleaf Weir – Outlet Upgrade Report dated July 2009, included the following two items that has been excluded for from the amount in Table 25. Reasons for exclusion are as follow: $46,690 being contractor's mark-up as the rates are deemed to include a contractor's margin and $25,000 for design and drafting that was incurred in the 2008/2009 fiscal year.

[9] The preliminary and general item is to make provision for mobilisation and demobilisation of the contractor, conforming to standard environmental and WH&S regulations and the Contractor's overheads.
[10] The amount excludes for the Contractor mark-up, design and drafting cost incurred in the 2008/2009 fiscal year, contingencies and owner direct cost.

SunWater has developed a planning order for this annuity item replacement which details the following breakdown of costs between contractors, overheads and materials. We note that the SAP WMS planning order breakdown does not adhere to this standard costing apportionment as is shown in Table 26.

- **Table 26 SunWater Breakdown of Costs – Silverleaf Weir New Inlet Structure**

Cost Item	Planned Costs
Contractors	$55,000
Internal Labour Transfer	$25,980
Internal Overhead Transfer	$42,528
Materials	$182,600
Plant Equipment and Vehicles	$6,500
Service Charges	
Travel & Accommodation	2,400
Total	$314,918

SunWater has advised that Internal Overhead Transfer relates to corporate overhead costs that are allocated to this annuity item replacement activity.

The annuity value that was submitted to QCA is 14% less than the cost estimate that we have developed.

We therefore consider the cost submitted to the Authority for this annuity item to be efficient.

Conclusion on Efficiency Evaluation

The value submitted for this annuity item is efficient, based on the information provided.

B.6.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of the refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent.

SunWater has trimmed the detailed cost estimate that was compiled as part of the design report by excluding costs that have already been incurred including an additional Contractor's mark-up. From our benchmarking of SunWater's applied rates and overall costs, we consider the annuity value submitted for the installation of the inlet structure to be efficient.

B.7 Boondooma Dam – Replacement of Sealer in upstream concrete liner

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.7.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment, i.e. replacement of the sealer to the upstream concrete contraction joints of the dam wall at Boondooma Dam in 2017 at an estimated cost of $140,000.

SunWater advises that the contraction joints were constructed in 1980 as part of the original construction of the dam wall.

There are no standard object type (asset type) for this infrastructure, and therefore SunWater has not allocated a standard run to failure asset life nor a refurbishment period.

B.7.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater together with information from a number of as installed drawings for the asset:

Document No.	Document Name	Document Title	Date
1106444	1106444 – v1A – Boondooma Sealant	Boondooma Dam – Refurbish: Replacement of Sealer in Upstream slope to specification detailed in scoping project of 2012 (BYR-BOON-WALL)	8 August 2011

B.7.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report. The standard object type (asset type) in SunWater's SAP WMS for this infrastructure is EMBK – Dam Wall/Embankment. This single asset types covers all types of dam wall and embankment constructions. SunWater has allocated a standard run to failure asset life of 200 years with no refurbishment period allocated for this asset type. SKM considers that the standard run to failure is more likely to be 100 years for a Concrete Faced Rockfill Dam (CFRD).

We have viewed the WMS record for this asset confirmed that the asset, dam wall, has been in service since 1980. No work has been conducted in regards to the joint seals and as such would be the first time that replacement of the joint seals or refurbishment of the dam wall is required.

In our review of the data in SAP and the information contained in the SunWater report specified above, it was identified that SunWater does not have any policy or procedure to determine the annuity item replacement/refurbishment dates and costs for joint sealers of a CFRD. As such, the planned replacement of this sealant has been established outside of SunWater's established asset management policies and procedures that utilise a run to failure asset life adjusted by a condition and risk assessment. There may be merit in investigating ways of addressing various wall types within the Dams section contained within the Standard Asset Lives Document 956033. At present the embankment (EMBK) object type is used for an array of wall types such as: CFRD, Clay core rock fill dams and earthfill dams. However, the different wall types contained within the EMBK object type have different standard run to failure and refurbishment lives which SunWater is not currently able to capture given that a single object type is used. There is therefore merit in SunWater considering creating object types for each type of wall construction. By distinguishing between the different types of walls it will also be possible to adapt a more specific condition assessment and capture the relevant run to failure asset life for that wall type.

SunWater's asset management policy and procedures currently do not classify joint sealers as an asset and therefore do not provide for a standard run to failure asset life for joint sealers or a recommended refurbishment period. Equally, the procedures do not specifically require that a condition assessment is undertaken for joint seals separate to a general condition assessment of the dam wall/embankment. It is common for the joint seals to perish as they are exposed to cycles of wet and dry, exposed to UV light, direct sunlight and temperature differentials. As such, there is merit in SunWater considering whether the joint seals should be viewed as an asset or as part of the planned refurbishment of the dam wall/embankment. The latter option would benefit from the inclusion of the joint seal as a condition criterion within the condition assessment criteria for assessing the dam wall. The issue with the joints was highlighted during the 2010 annual inspection of the Boondooma Dam. The SunWater report, as referenced above, makes reference to an Engineering Study, to be commissioned in 2012 to establish the need for replacement and to make recommendation in relation to a refurbishment/replacement method to be implemented.

Given the above, we do not consider that SunWater has provided enough information to make an informed assessment as to the prudency for refurbishment of this annuity item. We therefore consider that the Engineering Study should be completed before including the replacement of this annuity item within the overall annuity value.

Options Evaluation

The proposed refurbishment operation of removing and replacing the existing sealant within the contraction joints has been sufficiently detailed within the SunWater report, as reference above. This report makes reference to undertaking an Engineering Study to determine the optimal solution. SunWater has advised that the scope of the Engineering Study, which will include an analysis of a 'Do Nothing' option will focus on determining the need for replacement of the joint sealer and consequences should it not be replaced. The Engineering Study is intended to evaluate:

5) Best product selection, determine the most appropriate product for the job. Investigate the cost of the material, expected life and installation methods.
6) Costing options to investigate how best to address cash flow by either spreading out the project over more than one year or do it all in one hit, and
7) Method to be used to investigate if there is an alternative product or method that would suit the application.
8) Whilst we consider that the above scope of work for the Engineering Study is appropriate given the limited options available.

Timing of Renewal/Refurbishment

Based on the 2010 yearly inspection of the Dam Wall, in absence of a SunWater policy or procedure and in reference to the Engineering Study to be commissioned the replacement of the joint sealer to the upstream face of the embankment it is not possible to establish the optimum date, for the replacement or refurbishment of the sealant. We do not consider the proposed timing of this refurbishment/replacement to be prudent. Further, we believe that the above mentioned Engineering Study should be carried out to determine a maintenance intervention strategy for the joint seals before a replacement date is established.

Conclusion on Prudency Evaluation

We conclude that the need for replacement of this annuity asset has not been demonstrated. SunWater has put in place a process to give guidance, in the form of an Engineering Study, to making a decision on the timing and method to be implemented. As such, until the Engineering Study is complete, we consider that the inclusion of this annuity item in the annuity value is not prudent.

B.7.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

For asset refurbishment works where the planned refurbishment date is less than five years hence from the planning date, SunWater's planning team draw on actual costs for similar activities undertaken recently or from a zero based budgeting approach in absence of recent project data.

Given the volume of annuity items that SunWater's Planning Team are engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned. Since SunWater has no records of any similar work undertaken of this nature SunWater's Planning Team has undertaken the replacement costing from first principals.

Renewal/Replacement Project Cost Evaluation

We have made use of as built drawings for the dam wall and had access to available dimensions of the area affected. As such, we have been able to develop bench mark costs for refurbishing/replacing the sealant to the contraction joints on the upstream embankment of the Boondooma Dam.

SunWater has undertaken an approximate costing making use of labour and materials components. We have considered the cost component items proposed by SunWater and included an additional component to make provision for specialist equipment and preliminary and general expenses that a project of this nature would normally attract. SKM's costing for this project is as per Table 27 below.

- **Table 27 SKM Costing**

No.	Description	Quantity Required	Unit Cost	Cost ($)
1	Materials			
1.1	Joint Sealant	9260, 600 ml tubes. (3.7 tubes/m @ 2525m). Includes 10% for wastage	$5/tube	46,300
1.2	Backing Strip	2525 m/60m rolls = 42 Rolls	$115/roll	4,830
2	Labour	421 hours for a 3 person team (6 m/hr)	$85/hr/person	107,355
3	**Sub Total A**			**158,485**
4	Preliminary and General (P & G) + Specialist Equipment.	17% of Sub Total A		26,942
5	**Total**	**No. 3 + No. 4**		**185,427**

* Preliminary and General covers costs associated with mobilising and demobilising the contractor, and includes items such as an environmental planning and execution, WH&S plan and execution. It also includes the overheads for running this type of project from the Contractor's perspective and would also include insurances and bonds.

The cost submitted to the Authority is $140,000. The costing calculation that SKM has undertaken, as per Table 27 above yields a cost that, is 32% more than that submitted to the Authority by SunWater. Both SKM and SunWater costings make no allowance for any contingency and SKM's is based on the following assumptions:

9) The length of contraction joints were taken and scaled from the As-Built drawings with the slope taken as 1:1.3.
10) A bulk discount, of 33% of normal price, will apply for the tubes of joint sealant.
11) The 17% allowed for the P&G and Specialist Equipment section is deemed to include Health and Safety and Environmental aspects that will need to be addressed for the expected 11 week construction period.

From our experience, the majority of the costs involved in a project of this nature relate to preparation works such as draining the dam, drying and cleaning the surfaces, removal of old sealant from the joints, rectifying any mechanical defects with the joints. We therefore consider the costs submitted to the Authority for this annuity item to be efficient.

Conclusion on Efficiency Evaluation

The value submitted for this annuity item is efficient but potentially understated and should be reviewed to make provision for expected additional cost associated with a project of this nature.

B.7.5 Summary and Conclusions

We are not satisfied that SunWater's robust procedures for determining the timing of replacement/refurbishment of an annuity item have been followed. We do not consider that the timing and need for replacement/refurbishment of this annuity item can be determined until such time that the Engineering Study sets a clear policy on how SunWater is to deal with CFRD contraction joint sealant failures.

The cost submitted by SunWater and the costing done by SKM differs by 32%. We are not satisfied that SunWater has fully accounted for all the costs likely to be incurred by it in replacing the sealant. However, as the annuity item value submitted by SunWater to the QCA is below our benchmark costs, consider the cost of the replacement/refurbishment to be efficient.

B.8 Boondooma Dam Replacement of Cables and Cableways

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.8.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of cables and cableways at Boondooma Dam in the Three Moon Creek Water Supply area.

The replacement annuity item submission encompasses the replacement low voltage (LV) underground cables and conduits.

SunWater has submitted an annuity item value of $464,675 for replacement of this annuity item in 2032.

B.8.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 28 Documentation Reviewed Specific to Replacement of the LV Under Ground Cable at Boondooma Dam**

Document No.	Document Name	Document Title	Date
1109858	1109858 5 -QCA Justification paper H10 – Boondooma Dam – Cable and Cableways	BYR – BOON-OWKS-ELEC-CBL Replace Cable Main Wall	21st August 2011

B.8.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we

have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) allocated for this infrastructure in SAP WMS is CALVAG – Low Voltage above ground cable.

We note that SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 5 years. We consider the standard run to failure asset life to be conservative for both above and below ground LV cable. For example, most electrical distribution utilities in Australia would apply an asset life of 45 to 60 years for above ground LV cable depending on whether it is operated in wet (tropical) or dry conditions respectively. We consider the condition assessment frequency of every 5 years applied to this asset type to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1981.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has a financial risk criterion consequence rating of insignificant (score 3). This, together with a probability (likelihood of occurrence) score of 10 results in an overall risk score of 30 which, under SunWater’s risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. An overall risk category of Low should not trigger any reduction in the standard run to failure asset life of this type of asset and we confirm this to be the case for this asset. Hence the risk adjusted run to failure asset life for this asset is 35 (as per the standard asset life).

The next stage of SunWater’s method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment, a Field assessment, was undertaken in 2010 with the highest scoring condition criterion being an Age based criterion score of 3 (Moderate deterioration with minor refurbishment required to ensure ongoing reliable operation). As we discuss in the main body of this report, we question the use of age as a criterion for assessing condition given that asset age is implicit and inherently built into the standard asset condition decay curve. A well maintained asset, operating within its design parameters may exhibit a condition that is superior to that which its standard asset condition decay curve may predict at any point in time. By using age as a criterion for a particular asset precludes the option of extending the run to failure asset life of that asset in circumstances where its condition is superior to that which the decay curve would predict. The net result of this, applied across the asset base, would be to skew the replacement date of those types of assets for which an age criterion is used to asses condition to an, on average, earlier date than the standard run to failure replacement date.

However, inputting a 2010 condition score of 3, a risk adjusted run to failure life of 35 years and in operation date of 1981 into SunWater's condition based replacement life adjustment modelling tool yields a projected run to failure asset life of 77 years and a recommended condition based replacement date of 2058.

We consider that assuming an asset life of 77 years as predicted by SunWater's condition based replacement asset life modelling tool would be unreasonable, even if a standard run to failure asset life of 45 years was adopted.

As such, we agree with SunWater's proposal to extend the asset life, based on this condition assessment, by 16 years beyond the standard asset life replacement date of 2016 to 2032. Whilst SunWater considers this to be a *'risky strategy'*, given the business risk category of Low applied this asset and that power utility industry norms would be to adopt a minimum of a 45 year life, we consider that planning a replacement at 2032 is prudent. Further, we note that should future condition reports indicate that the asset condition is beginning to deteriorate more rapidly, SunWater has the ability to bring this replacement date forward in future price reset reviews.

Options Evaluation

SunWater has advised that, as per its standard procedures:

"An option analysis will need to be carried out before any planned works [are commenced]*. This would basically revolve around the optimum time for replacement for the asset and if possible each of its components. This would involve a detailed study and condition assessment, occurring around 2028/29.*

At this stage of planning, there is no obvious alternative to like for like replacement that would reduce costs by more than 30%".

We concur with this statement and agree that the option analysis should identify the optimum date for replacement, as well as alternative options to replacing like for like. We also consider it is prudent to consider a like for like replacement at this stage of the planning process. We assume that, in assessing condition under this project, SunWater will conduct electrical condition tests on the cable at this time such as earth impedance testing, insulation breakdown testing rather than operational performance.

Timing of Renewal/Refurbishment

SunWater has planned for replacement of this asset based on a condition adjusted standard run to failure asset life in 2032.

We agree with the approach adopted by SunWater which is in line with its procedures and consider the replacement date of 2032 to be prudent.

Conclusion on Prudency Evaluation

We agree with SunWater's planned replacement date for this annuity item of 2032 based on a condition related extension to its standard operating life. We therefore consider that inclusion of the replacement value of this annuity item in the current price reset annuity period to be prudent.

B.8.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+33.86%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 33.86%.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%.

We have compared our cost estimate against SunWater's cost estimate in Table 29 below:

- **Table 29 Boondooma Dam Cable Replacement Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
$464,657	402,010	+15.7%

A Planning Order has not yet been developed for this asset, as such; SunWater has not developed a breakdown of direct and overhead costs.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $465k to be efficient.

B.8.5 Summary and Conclusions

We agree with the timing of the replacement of this asset and consider it prudent to include this asset's replacement value in this current price set annuity value since if an industry standard 45 years asset life is applied, this asset would reach the end of its run to failure asset life by 2020.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.9 Owanyilla Pump Station

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.9.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the electrical component upgrade of the electrical control gear of the Owanyilla pump station.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1987. SunWater has submitted an annuity item value of $404k for a major component upgrade for this asset in 2011.

B.9.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 30 Documentation Reviewed Specific to Owanyilla Pump Station**

Document No.	Document Name	Document Title	Date
1108434	1107255 QCA Justification – Owanyilla Pump Station – Electrical Component Upgrade	Owanyilla PSTN – QCA Justification: Owanyilla Pump Station: Electrical Component Upgrade	8th August 2011

B.9.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is ELCONG – Electrical Control Gear. We note that in SunWater's Whole of Life Maintenance Planning Tool (Master), SunWater has allocated a standard run to failure asset life of 20 years and a maximum condition assessment frequency of every 2 years. However we note that in SunWater's WMS the standard run to failure asset life of this asset type is specified as 15 years. It is not clear why there is a discrepancy between the standard run to failure asset life for this type of asset specified in the Whole of Life Maintenance Planning Tool and that captured in SAP. However, given the in operation date of the asset being considered, this discrepancy has no impact on the annuity item value associated with the component upgrade but it may impact on annuity item value associated with future replacements.

SKM considers a run to failure asset life of 20 years is at the upper end of what may be considered reasonable, considering good industry practice, for this type of asset. We also consider that a condition assessment frequency of two years reasonable for electrical control system infrastructure to be appropriate.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1987.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2007, that it has a production/operations risk criterion consequence rating of moderate (score 18). This, together with a probability (likelihood of occurrence) score of 45 results in an overall risk score of 818 which places this asset in a High risk category. For this asset type, an overall risk category of High reduces the run to failure asset life from 20 years to 13 years in accordance with SunWater's method. The reasons for such a reduction are that the standard asset run to failure life is only a medium value and actual run to failure life for a particular asset may be higher or lower than this, the spread being typically in the form of a normal distribution. As such for high risk assets where it is preferable to schedule replacement before run to failure, the run to failure asset life is reduced from the standard. We consider this approach to be in keeping with good industry practice and find that the reduction in run to failure asset life for this particular asset to 13 years to be reasonable.

In an earlier risk assessment, conducted in 2005, the overall risk rating is determined as being 'Low', with the risk consequence applied to production/operations and stakeholder relations being 'Minor' (score 8) and 'Insignificant' (score 3) respectively and with the likelihood score being 3. The combination of the worst case consequence score and likelihood score results in an overall worst case risk assessment score of 24 (category 'Low'). Under SunWater's systems, such a score dictates no adjustment to the standard run to failure.

It is not clear why the worst case consequence risk rating has been changed from Minor to Moderate, nor what the reason is for the change in likelihood (probability) score from 3 to 45. However, SunWater has advised that:

"It can be noted that the electrical control gear has proven to be very reliable up until 2007 with very few faults experienced. However in recent years there have been an increasing number of faults and breakdowns recorded against the asset and these are becoming difficult to rectify as some parts are no longer available or supported."

Four condition assessments are recorded in WMS for this asset. All of the assessments determine the worst case condition criterion as being availability of spare parts which has progressed from a score of 3 (in 2007) to 5 (in 2007). Under SunWater's condition assessment procedures, asset condition is rated from 1 to 6, 1 being as new and 6 being unserviceable. We note that this asset has an age related condition assessment criterion. As discussed in the main report, we question the use of age as a criterion in assessing condition as age should be inherently captured in the asset condition decay curve used by SunWater. However, in this instance, the age related criterion has no material effect on determining replacement/refurbishment timing for this asset.

Despite the above mentioned differences in standard run to failure asset life and the sudden transition in risk rating (which occurred before the noted increase in failure rate), given that the asset was installed in 1987, it is now operating beyond its standard, run to failure asset life (whether based on 15 years or 13 years or 20 years). As such, scheduling a replacement or, in this case, a major refurbishment in 2011 is considered reasonable.

Options Evaluation

SKM has not sighted any option evaluation for this annuity item. However we note that, from the run to failure asset life for this asset, the asset is overdue for replacement. As such the proposed refurbishment of the asset (rather than renewal) is assumed to have resulted from evaluation of the benefits of selective component upgrade over renewal. A selective component upgrade is a more cost effective option than renewal, provided that the upgrade will provide a similar run to failure asset life as would a new asset. For this asset, the upgrade is planned by SunWater to provide a further 13 years of life (the risk adjusted run to failure asset life of the asset). As such the option to refurbish selected by SunWater is considered a more prudent option than replacement.

This conclusion is drawn on the understanding, from discussion with SunWater staff, that appropriate replacement/alternative component parts can be sourced for this refurbishment to give an equivalent in service life of the asset to that of a complete asset renewal/replacement. As such we note that the efficacy of the replacement program is dependent upon the selection of the components to be replaced given that a full replacement is not envisaged.

Timing of Renewal/Refurbishment

As discussed above, given the in operation date and the typical reliable operating life of this asset type, the timing of this major refurbishment in the form of a component overall is appropriate.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment (in the form of component replacement) of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.9.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

SunWater has advised that for projects of a moderate to significant size, a range which is understood to capture this refurbishment project, SunWater would typically conduct an options study and undertake a zero based costing, where the timing for the annuity item refurbishment/replacement is within 12 months to 5 years of the date of planning date.

Renewal/Replacement Project Cost Evaluation

We have not sighted an options study for this annuity item, nor a detailed bottom up costing for the works. In absence of this, we have therefore relied on the information provided in the WMS to which we have had access to.

We note from this information that the annuity item value submitted to the Authority for the refurbishment (major component replacement) for this asset is $404,022. We also note that the annuity item replacement cost, based on SunWater's standard determination of annuity value replacement cost for assets to be replaced five years or more post the planning date as outlined in the main body of this report, is some $1,172m.

We have estimated the cost of a modern equivalent asset that would be used to replace an obsolete asset based on the bill of materials for this annuity item as contained in SunWater's WMS.

We have price-checked the replacement purchase cost of a representative sample of the equipment with a focus on the high cost items and in particular the SquareD PLC. Replacement costs for the Square D equipment was obtained from the supplier (Schneider Electric). Rather than the original 'Symax' equipment Schneider has offered as a direct replacement the 'Quantum' equivalent (with wiring adaptors). The price for the 'Quantum' equipment was considered in the evaluation.

With regards to the non-PLC equipment; given the time constraint of the project no detailed consideration of the specific installation equipment requirements and generic equipment replacements were considered.

Comparing the sample present day price checks against the 1997 bill of material costs for those items that we were able to obtain prices for we have established an average price multiplier of approximately 1.45. Using this multiplier against the original 1997 asset costs (*$550,150.28)* the estimated replacement cost (materials only) is $798,000. On applying a conservative 50% uplift for installation costs, this yields an installed complete replacement cost of $1.18m. This compares favourably with the $1.17m replacement cost for this asset item captured in SunWater's SAP WMS.

Conclusion on Efficiency Evaluation

Based on this estimated cost of a modern equivalent asset and given that the additional extended life of the asset is projected to be equivalent to a new replacement asset, we consider the proposed annuity item value of $404,022 for a selective component upgrade to be efficient.

B.9.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent.

Given that SunWater plans to refurbish the annuity item rather than replace it at less than half of the cost of a replacement asset, we consider the annuity item refurbishment value submitted to the Authority to be efficient, on the understanding that the life extension of the refurbishment is equivalent to the run to failure asset life of a complete replacement.

B.10 Don Beattie Pump Station – Replace Common Control

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.10.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of common controls at the Don Beattie Pump Station in 2019 at an estimated cost of $1.1m.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation at its current location since 1989 and was installed as part of the original pump station construction.

B.10.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review along with a Parsons Brinckerhoff report following audit of electrical sites:

- **Table 31 Documentation Reviewed Specific to Replacement of the Common Control System at Don Beattie PSTN**

Document No.	Document Name	Document Title	Date
1107342	1107342-QCA Justification – Don Beattie PSTN replace common Controls	Bundaberg Irrigation Area – Don Beattie Pump Station – Replace common control	19th August 2011

B.10.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such.

The object type (asset type) assigned for this equipment is EL – Electrical Equipment. In SunWater's systems this is a header level object type and hence does not have a standard replacement or refurbishment period assigned to it. The components that make up this equipment are predominantly programmable logic controllers (PLCs), computer, communications equipment and electrical control gear. Given that the main components are PLCs it may be appropriate for SunWater to reassign this asset to the object type ELPLC – PLC. SunWater has allocated a standard run to failure asset life of 15 years and a maximum condition assessment frequency of every 2 years. We consider the standard run to failure asset life and condition assessment frequency applied to this class of assets to be reasonable and in keeping with industry practice.

We have viewed the WMS record for this asset and note that the asset has an "In Operation" from date of 1989 which would suggest that the asset has been in operation for 23 years as of 2012. However, in its report 1107432, SunWater advises that:

"The asset has only been replaced recently with a project that commenced in 2004."

"A number of asset components were replaced between 2004 and 2007 at a total cost of about $560,000. However, not all components were replaced.

We note that in this partial replacement, all the programmable logic controllers (PLCs) were replaced and that the components not replaced consist of components to which a 15 year life would normally be attributed.

As such, 2004 is taken as the In Operation date for this review. This places replacement of the asset on a standard asset life of 15 years as 2019.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has a financial risk criterion consequence rating of minor (score 8). This, together with a probability (likelihood of occurrence) score of 10 results in an overall risk score of 80 which, under SunWater's risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. An overall risk category of Low does not trigger any reduction in the standard run to failure asset life of this type of asset and we confirm this to be the case for this asset.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment which was a desk top assessment was undertaken in 2009 and SunWater advises that the condition assessment was "*within date at the time the NSPs were compiled.*". The condition assessment, which was undertaken prior to SunWater implementing its detailed condition monitoring method, yielded a worst case criterion score of 1 (Perfect, as new-condition). SunWater has advised that it considers that there is insufficient information in this condition assessment to change the asset life from the standard asset life of 15 years. This, coupled with the fact that not all the components were replaced in the 2004 to 2007 upgrade period has prompted SunWater to plan a total replacement 15 years from the date of commencement of the refurbishment ie in 2019.

This approach is not strictly in keeping with SunWater's procedures. Given that some of the main components were replaced in 2007, and that the condition score is 'as new' we consider that it would be more appropriate to plan for a replacement date 15 years from the date of the installation of the latest components ie in 2022 rather than 2019.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item and SunWater has stated that, in accordance with its asset management procedures:

"Any options analysis would need to be done closer to the scheduled timing of the project".

Given the rapidly changing technology in this area, we agree with this approach as a replacement PLC selected now may not be available in 2019 (or 2022).

Timing of Renewal/Refurbishment

The actual in operation date for individual components making up this asset ranges from the original installation date of 1989 to 2007. Given that the 2009 condition assessment allocated a condition rating of 1, we consider that planning for a complete asset replacement in 2019 to be overly conservative and consider that at 2022 replacement date would be more appropriate.

Conclusion on Prudency Evaluation

We consider that a replacement date of 2022 rather than 2019 should be planned for given the 'as new' condition assessment rating undertaking in 2009.

As this is within this annuity price reset period, we consider inclusion of the replacement value of this annuity item within this annuity period to be prudent.

B.10.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+30.8%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

SunWater has advised that as not all the asset components were replaced in the 2004 to 2007 upgrades, SunWater has used the as originally installed BOM and the process outlined above to determine replacement cost.

We don't agree with this approach and believe that it would be more accurate for SunWater to have stripped out the replaced components from the BOM and substituted the replacement costs of these components with the installed costs as incurred between 2004 to 2007 appropriately escalated to 2010 money terms, particularly since the cost for PLCs has fallen since 1997.

We note that a value of $1,084, 468 has been captured in SunWater's SAP WMS for the proposed 2012 replacement and this replacement value has been submitted to the Authority by SunWater.

Renewal/Replacement Project Cost Evaluation

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for modern equivalent electrical assets and against modern equivalent replacement budget prices from equipment suppliers.

In particular, we have price-checked the replacement purchase cost of a representative sample of the control system equipment with a focus on the high cost items and in particular the Honeywell PLC. Honeywell has advised that the 620 series PLC is now superseded and although refurbished spare parts were available in the short term direct replacement with 620 series equipment was not a viable option. Honeywell did propose replacement with an equivalent system but were not able to price this without more detail of the specific application including software than was available. As an alternative Siemens was asked to provide an equivalent hardware platform based upon the same broad configuration details, that is three PLC processors with networking, and the equivalent input/output provision of the existing system. The platform they proposed used S7-300 processors with ET200 I/O modules – this equipment is very widely used and accepted within industry and is considered to be a viable replacement option. The new platform would require programming and additional miscellaneous hardware within the control cubicles. With provision for these the total cost of the PLC replacement is estimated to be approximately $113,500. This compares with the total hardware of $217,000 cost at 1997 levels for the Honeywell equipment.

A sample of other hardware was considered. For this sample we have determined a cost multiplier of approximately 1.3 on the 1997 levels to bring them to 2010 values. Considering both this multiplier for the balance of the non-PLC equipment and the cost of the PLC replacement as noted above the total replacement cost is estimated as $311,274 (ex works). On applying a 100% uplift for installation costs (including overheads) and the SunWater Indirect multiplier of 30% yields an installed complete replacement cost of $809K.

We categorise this estimate as a class 4 estimate, having an accuracy of +30%/-20%.

We have compared our cost estimate against SunWater's cost estimate in Table 32 below:

- **Table 32 Don Beattie Pump Station Replacement of Common Controls Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
1,084,468	$809,000	+34%

SunWater's annuity item replacement value estimate of $1.1m as submitted to the Authority is some 34% higher than our estimate.

We therefore consider that the annuity value as submitted to the Authority is not efficient, albeit the estimate is just outside our cost estimate. We consider that the reason for this is that SunWater has used 1997 prices for the major components (PLCs), multiplied by the standard Cardno uplift for electrical assets of 2.13. However, as noted above, the cost of PLCs has dropped since 1997. If SunWater were to substitute the 2004-2007 installation costs (derived from the 2004-2007 program to replace the PLCs) for the costs derived from the 1997 prices per the BOM then we believe that SunWater's cost estimate would decrease.

A Planning Order has not yet been developed for this asset, as such; SunWater has not developed a breakdown of direct and overhead costs.

Conclusion on Efficiency Evaluation

We consider the proposed annuity item value as submitted to the Authority of $1.1m not to be efficient. However the costs only just exceeds the 30% estimating error of our estimate. We believe that the difference lies mainly in the fact that PLC costs have declined since the 1997 valuation.

We consider that an efficient replacement cost would be circa $800k.

B.10.5 Summary and Conclusions

We are not satisfied that the timing of replacement of this annuity item is prudent as submitted to the Authority as some of the main PLC components were replaced as late as 2007 and the condition assessment gives an ‘as new’ rating. However we believe it would be appropriate to plan for replacement at or around 2022 (15 years, being the standard asset life, from the latest component replacement).

As such we conclude that it is prudent to include an annuity replacement value in this current price reset annuity value.

From our benchmarking of the replacement costs, we are not satisfied that the annuity item replacement value submitted by SunWater is efficient. We believe this is because of the use of 1997 values, escalated by a standard multiplier for electrical plant developed by Cardno and that prices for the main control components, PLCs, has dropped since 1997. We consider that an efficient replacement cost would be in the order of $800k.

B.11 Chinchilla Weir – Purchase Butterfly Valve

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.11.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the purchase and installation of a butterfly valve in 2016 and a projected cost of $100,000.

SunWater advises that the asset was initially installed in 1973 as part of the original construction of the dam.

The standard object type (asset type) for this infrastructure as a general gate valve is VLGATE. The existing valve is a gate valve, however the replacement is proposed to be a butterfly valve. The new valve will have an object type of VLBUTF. SunWater has allocated a standard run to failure asset life of 40 years and a refurbishment period of 10 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.11.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

Document No.	Document Name	Document Title	Date
1108982	1108982-v1A Chinchilla_Weir_Valve_Replacement	Chinchilla Weir Water Supply – Chinchilla Weir – Purchase Butterfly Valve (Replace existing gate valve) (CHW-CHIN-VLV-VLV3)	8th August 2011

B.11.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

We have viewed the WMS record for this asset. The record confirms that the asset has been in service since 1973.

SunWater has applied its risk evaluation method to this asset. A risk assessment was undertaken in October 2005. Two scenarios were considered:

Risk	Valve stuck open	Valve stuck shut
Comment	Upstream valves cannot be serviced, Chinchilla town water supply.	
WH&S	Low	Low
Environmental risks	Low	Low
Business risks	Moderate	Low

The highest risk is assessed as 'Production/Operations', with a consequence of 'Critical'. The comments added suggest that failure of the valve would lead to SunWater not being able to service the upstream valves resulting in an impact on the Chinchilla town water supply. SunWater's risk consequence table includes the following comments for critical production/operations risks "*Total loss of storage resulting in major flooding and/or long term loss of supply. Certain crop failure on a large scale. Failure of supply to urban or industrial sectors resulting industry closure or significant reduction in production. Need to establish alternative urban supplies*". The recorded comment suggests that failure of the valve in the open position will affect the Chinchilla town water supply and therefore may result in the need to establish an alternative supply to this area. Without further knowledge of the system, we are unable to assess whether this risk rating is appropriate. However, it should be noted that downgrading this risk from 'Critical' to 'Major' would still result in a risk assessment level of 'Moderate'.

Based on the above condition assessment and SunWater's processes, we consider that application of a risk based asset life of 35 years is appropriate.

Two condition assessments have been undertaken, the first in March 2005 and the latest in January 2009. This is within SunWater's condition assessment frequency of every five years.

It is noted that the risks for WH&S is classed as 'Low' (based on a consequence = insignificant) however, two WH&S problems have been identified within the provided documentation (1108982-

v1A Chinchilla_Weir_Valve_ Replacement) as part of the justification for the provision of an actuator for the valve.

The maximum condition of the asset in 2009 was a four for 'External Coating / Surface / Bolts'. However, the condition assessment also contains a ranking of 'N/A' for 'Operation' and associated comment of 'Unable to Operate', also a ranking of 'N/A' for 'Function' and associated comment of 'Not Known'.

The provided documentation (1108982-v1A Chinchilla_Weir_Valve_ Replacement) suggests that "*the combined comments of 'Valve stuck open' and 'Unable to Operate' suggest that the valve has failed (condition 6) and should have been replaced earlier than planned in 2016*". We are unable to identify the "*Valve stuck open*" comment in the condition assessment. We consider therefore that there may have been confusion between the risks assessed above, and the condition assessment profile.

The condition assessment does not indicate whether the inability to operate the valve was due to the valve failing or other circumstances (e.g. lack of access or equipment). If the valve had been stuck open or been unable to be operated due to a fault with the valve, it should have received a condition assessment score of six (asset has failed and is not operable), not a ranking of 'N/A'. Either the form has been incorrectly completed, or SunWater interpretation of the information contained in the form is incorrect. In the absence of information clarifying what the assessor intended to record, we are unable to support the statement that the valve has failed.

The provided documentation (1108982-v1A Chinchilla_Weir_Valve_ Replacement) contains a table of the recommended replacement date (Table 4-2). There is a minor error in the table. Table 4-2 notes that the valve has been in operations since 1972, whereas SAP states July 1973. Based on the asset risk and maximum condition score, Table 4-2 indicates that the value should be replaced in 2024. SunWater has proposed replacement of the valve is 2016, due to concerns within the condition assessment, as discussed above. Based on our concerns of the interpretation of the condition assessment, we are unable to confirm that bringing forwards the timing of the replacement of the valve is prudent.

Whilst the 2024 replacement date still falls within the current annuity period of 25 years, restating its replacement date as 2024 will impact on the actual amount, due to greater discounting.

We recommend that the condition assessment is reviewed to confirm the existing condition of the valve. If the valve is inoperable, the condition assessment score for operations and function should be revised to a six, this would result in a new recommended replacement year of 2005, ie that the valve should be replaced as soon as is reasonably practical.

We note that it is intended to replace the existing gate valve with a butterfly valve. Within the Refurbishment and Maintenance Planning data, the frequency for replacement for the future butterfly valve is stated as 25 years. SunWater has allocated a standard run to failure asset life of 80 years and a refurbishment period of 20 years for butterfly valves. Following SunWater's procedures and allowing for a medium risk (as per the risk assessment), a risk based asset life of 70 years should be applied.

Whilst this makes little difference to the proposed replacement in 2016 (which as stated above is subject to confirmation of condition) this does affect the future planned replacement of the valve, which is scheduled for 2050, and associated annuity values. If the replacement date of the initial valve is set at 2016, according to SunWater's procedures, the valve should not be replaced again until 2086, some 36 years later then currently scheduled for the valve.

It is recommended that the dates for future replacement are reviewed. It is further recommended that SunWater investigates opportunities to allow for automatic updating of data fields in SAP WMS, to reduce the potential for errors caused by manually entering data fields. It is possible that some of the data errors above are a result of updates, which have not fully carried through to all sections of SAP.

Options Evaluation

It is proposed to replace the existing manual valve, with an actuated valve. The main reason for this is to provide SunWater with cost effective control and reliable operation of the valve. The valve is currently operated by Chinchilla Council under SunWater's instruction. A fee is payed to the council per operation of the valve. This arrangement has been made as the cost of SunWater operators travelling to Chinchilla to regularly operate the valve is excessive. However, historically there has been resistance on the part of the council to release water from the weir, especially given the recent prolonged drought that has seriously threatened Chinchilla Council's water security. We have been advised that directions to release water from the weir required to meet SunWater's obligations under the interim Resource Operations Licence (iROL) generally result in debate between SunWater and Chinchilla Council and regularly see the matter escalated to state ministerial level. This problem is likely to cause SunWater to breach requirements of the Resource Operation Plan (ROP) once it comes into force. Requirements for passflows at the weir under the ROP are understood to be more onerous than under the iROL. There is no provision for delaying releases while decisions are made under the ROP and there is a requirement to adjust flows on a daily basis under the ROP.

In addition to the above issues, two WH&S problems have been identified by SunWater:

- *"The work required to operate the valve is excessive. This is a damaging energy that is likely to cause back injuries to operators.*

- *Access to the valve is dangerous. Operators are required to traverse a steep uneven river bank and then walk across slippery wet concrete.*"

Based on the daily requirements to adjust flows, the expense associated with SunWater operators travelling to Chinchilla to regularly operate the valve, the historical issues with Chinchilla Council operating the valve, and the identified WH&S issues, we consider the proposed installation of an actuator is reasonable.

Two options have been considered for actuation of the valve:

1. Install a manual hydraulic actuator at the weir so that the valve can be operated from the top bank
2. Install a remote control actuation system for the valve

The first option still requires an operator to visit the site. An NPV analysis has been undertaken based on analysis of releases from the weir made over the previous 6 years, which show that the valve is adjusted approximately 20 times per year. A reasonable rate of $300 per operation has been used. This rate of operation is likely to increase with introduction of the ROP however this increase is yet to be analysed.

On the basis of the NVP analysis, we agree that remote actuation of the valve is the most cost effective option.

We would recommend that a detailed review is undertaken of the replacement of the gate valve with a butterfly valve. Butterfly valves may experience problems in raw water applications where there are high volumes of sediment, which may result in problems with the valve sealing. In order to resolve this, the valve may be mounted in the horizontal position. Based on the photograph within SAP, it appears the valve is installed in a chamber. SunWater will need to confirm that there is sufficient room within the chamber to install the butterfly valve and actuator. Whilst a butterfly valve is likely to be significantly cheaper at this size than a gate valve, this cost saving is likely to be offset by the need to modify existing pipe work to allow for the dimensions of the butterfly valve.

Timing of Renewal/Refurbishment

As documented above, based on our concerns of the interpretation of the condition assessment, we are unable to confirm that the proposed timing of the replacement is prudent.

Conclusion on Prudency Evaluation

Following SunWater's procedures for risk and condition assessment, the valve is due for replacement in 2024, therefore the current proposed replacement of the valve in 2016 is not considered prudent. Therefore whilst it is prudent to include the cost of the valve within the current annuity period of 25 years, restating its replacement date as 2024 will impact on the actual amount, due to greater discounting.

We recommend that the condition assessment is reviewed to confirm the existing condition of the valve. If the valve is inoperable, the condition assessment score for operations and function should be revised to a six, this would result in a new recommended replacement year of 2005, ie that the valve should be replaced as soon as is reasonably practical.

We recommend that the WH&S risks are reviewed and updated if necessary to reflect the WH&S risks identified within the provided documentation.

We further recommend that the dates for future replacement are reviewed, and that the replacement period is updated from 25 years to 70 years, or as appropriate based on the updated risk profile.

B.11.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

The project costs have been derived from a document prepared by the Ipswich regional manager during February 2008 (An extract of Hummingbird Document 604708 has been included in 1108982-v1A Chinchilla_Weir_Valve_ Replacement). The cost estimate for this work is as follows:

Cost Item	2008 $	Comment
Replacement of valve	$60k	Including a new valve, labour and crane hire
GSM Remote Operation Equipment (20yr Life)	$7k	
Power Supply	$10k	
Rotork	$12k	
Total	**$89k**	

Allowing for additional costs associated with CPI, SunWater has allowed for $100,000 in the current estimate. SKM notes that this equates to an allowance of 6% for CPI (assuming costs are escalated over 2 years to 2010 costs). This is considered to be high. However, it is also noted that this figure may contain some allowances for rounding.

Renewal/Replacement Project Cost Evaluation

Based on our recent project experience, we have obtained quotations from Tyco for large diameter valves.

Cost Item	2010$	Comment
900mm Gate Valve	$83.5k	900 FL RS CC Fig 400 16:1 G/BX including a Rotork actuator
900mm Butterfly Valve	$22.0k	F627PQ 403S AD including a Rotork actuator

In addition to the materials costs above, there will be a need to supply and install specials and flexible couplings, as well as labour and crane hire costs. Based on our project experience and typical rates from Rawlinsons, we estimate the costs to be just below $70,000 and therefore outside the 30% estimating range. As such, by strictly applying the Authority's guidelines, we consider the costs submitted to the Authority for this annuity item of $100,000 not to be efficient. However, given the low valve of the difference in expenditure and uncertainties within the estimating process, the sum proposed by SunWater may not necessarily be unreasonable, and therefore applying a pragmatic approach, it could be considered for inclusion in the current annuity period.

For the proposed 2050 works, i.e. the next replacement of the valve, we have reviewed the BOM costs and agree that the correct procedure has been used to calculate the costs, but note that the stated BOM costs are based on the replacement of a gate valve not a butterfly valve, which at this size will be cheaper. The cost estimate costs for the supply of a gate valve is $93.5k, compared to $31.9k for the supply of a butterfly valve. If this valve is changed to a butterfly valve, it is likely that it will be replaced by a butterfly valve in future. Future costs should also be allowed for the refurbishment and replacement of the actuator.

Conclusion on Efficiency Evaluation

Based on our project experience and typical rates from Rawlinsons, we believe the costs to be high, although the estimated cost is just outside the 30% estimating range. As such, by strictly applying the Authority's guidelines, we consider the costs submitted to the Authority for this annuity item of $100,000 not to be efficient. However, given the low valve of the difference in expenditure and uncertainties within the estimating process, the sum proposed by SunWater may not necessarily be unreasonable, and therefore applying a pragmatic approach, it could be considered for inclusion in the current annuity period.

We recommend that future replacement costs are reviewed, although note that these are outside of the current annuity period.

B.11.5 Summary and Conclusions

Following SunWater's procedures for risk and condition assessment, the Chinchilla gate valve is due for replacement in 2024. SunWater has stated that this period should be reduced based on the condition assessment undertaken. Based on the condition assessment presented, we are unable to ascertain whether the valve has failed, therefore the current proposed replacement of the valve in 2016 is not considered prudent. Whilst the 2024 replacement date still falls within the current annuity period of 25 years, this will impact on the actual amount, due to greater discounting.

We recommend that the condition assessment is reviewed to confirm the existing condition of the valve. If the valve is inoperable, the condition assessment score for operations and function should be revised to a six, this would result in a new recommended replacement year of 2005, ie that the valve should be replaced as soon as is reasonably practical.

We recommend that the WH&S risks are reviewed and updated if necessary to reflect the WH&S risks identified within the provided documentation.

We further recommend that the dates for future replacement are reviewed, and that the replacement period is updated from 25 years to 70 years, or as appropriate based on the updated risk profile.

Based on our project experience and typical rates from Rawlinsons, we believe the costs to be high, although the estimated cost is just outside the 30% estimating range. As such, by strictly applying the Authority’s guidelines, we consider the costs submitted to the Authority for this annuity item of $100,000 not to be efficient. However, given the low valve of the difference in expenditure and uncertainties within the estimating process, the sum proposed by SunWater may not necessarily be unreasonable, and therefore applying a pragmatic approach, it could be considered for inclusion in the current annuity period.

We recommend that future replacement costs are reviewed, although note that these are outside of the current annuity period.

B.12 Allan Tannock Weir – Place rock and re-profile upstream batter of main wall

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.12.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment, i.e. placing and re-profiling of the upstream rock batter of the main wall, of the Allan Tannock Weir in 2014 at a projected cost of $17,655.

SunWater advises that the asset was constructed in 1991 as part of the original construction of the distribution system.

The standard object type (asset type) for this infrastructure, Sheet Piling weir or barrage, is WESP which SunWater has allocated a standard run to failure asset life of 75 years and a refurbishment period of 25 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.12.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

- **Table 33 Documentation Reviewed Specific to the Allan Tannock Weir Refurbishment**

Document No.	Document Name	Document Title	Date
1108257	1108257 – v1A – Allan Tannock Weir Refurbishment	Cunnamulla Water Supply – Allan Tannock Weir – Place rock and re-profile upstream batter of main wall. (CUW-TANN-WALL)	8 August 2011

B.12.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on data provided.

It is noted that for this annuity asset, an incorrect object type has been allocated in SunWater's SAP WMS; that of a sheet pile weir at the functional level in the WMS. A sheet pile weir has a refurbishment period of 25 years; however at the equipment level the object type is listed as EMBK which has no refurbishment life listed (and a standard run to failure asset life of 200 years).

SunWater has advised that the correct object type for this sheet pile weir is WESP. This error in data contained in the WMS does not impact on the annuity item value.

We consider the applied run to failure asset life and refurbishment period for this asset to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1991.

SunWater has applied its risk evaluation method to this asset. It determined that the asset has a Production/Operations and Environmental risk with a major consequence rating (score 40). The consequence rating together with a probability (likelihood of occurrence) score of 3 results in an overall risk score of 120 which places this asset in a medium risk category. For this asset type, an overall risk category of Medium reduces the run to failure asset life from 75 years to 66 years and the refurbishment period from 25 years to 22 years. We consider this reduction in run to failure asset life and refurbishment period based on this risk assessment for asset replacement/refurbishment planning purposes to be appropriate and in keeping with good industry practice.

The first refurbishment of this asset type is projected to be in 2013, based on its construction date and adjusted refurbishment period of 22 years.

A business case was prepared to undertake refurbishment after an inspection was conducted on 1 March 2006. The site inspection highlighted that the rock protection of the upstream batter had experienced undermining and that two major scour holes had formed downstream of the concrete apron. The business case recommended the work required to rectify the issues. There are no records linking any work executed directly to this business case.

The SAP WMS records state that the following work was undertaken in 2009: Refurbish/repair protection works (flood damage 2007/8), at a cost of $28,208. No cost breakdown of this amount has been provided by SunWater and the scope could not be ascertained. It cannot be established if any of the work identified in March 2006 was incorporated within this scope of works.

The latest condition assessment, as recorded in WMS for this asset, was undertaken in 2009. No correlation could be established between the condition assessment and the work undertaken in 2009 as described in the above paragraph. The maximum score, recorded in SAP WMS, is a 5 (Major deterioration with minor refurbishment required to ensure ongoing reliable operation) assigned to General Concrete Condition with the following comment: "*Erosion at U/S Batters Main Wall*". This work has been scheduled in the WSP for 2014 with the following description: "*Refurbish Place Rock and Profile U/S Batter of Main Wall. Place Rock in Eroded Area d/s of wall*." There are similarities between the work proposed for 2014 and the scope of works proposed in the business case prepared in March 2006.

It is to be noted that the condition assessment interval is every year for a WESP object type and not 10 (ten) years as the SunWater report, referenced above, indicates. This difference is ascribed to the object type being recorded incorrectly as an EMBK and not as a WESP as discussed above. In this respect SunWater has not conformed to the Asset Management procedures.

On the assumption that SunWater's procedures for condition assessment have been followed, based on this condition assessment score, we consider that the timing for refurbishment of this annuity item is prudent.

Options Evaluation

The proposed refurbishment operation of placing rock and re-profiling of the existing rock to the upstream batter of the main wall and placing rock to the eroded areas downstream is appropriate for this asset and no options evaluation is required. SunWater has advised that the information to their disposal indicate that a similar solution than that used at Kolan Barrage could be used. The solution as recorded is as follows: *"Engineering Services undertook the refurbishment work. This entailed jack hammering the existing holes out so 'Block Fill' could be vibrated into the voids." SunWater advised that this is a Category 2*[11] *project and that the site hasn't been inspected recently to determine the scope and therefore the scope could potentially change.*

Timing of Renewal/Refurbishment

Based on the 2009 condition assessment and in accordance to SunWater's policies the refurbishment of the upstream batter protection and downstream scour infill is due at the date projected (2014). We therefore consider the timing of this replacement to be prudent.

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[11] Category 2 relates to SunWater's refurbishment prioritising process based on risk, ie consequence and probability of failure of an asset. Category 2 refurbishment works are programmed behind Category 1 works as they are determined to have a lower risk and consequence score that projects that are prioritised as Category 1.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.12.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

For asset refurbishment works where the planned refurbishment date is less than five years hence from the planning date, SunWater's Planning Team draw on actual costs for similar activities undertaken recently. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We have not sighted as built drawings for the weir nor have we had access to dimensions of the area affected. As such, we have been unable to develop a bench mark costs for refurbishing the upstream embankment and infilling of the scoured downstream areas from first principles.

However, we note that SunWater has adopted a cost of $17,655 for the refurbishment annuity value which is based on the actual cost incurred by SunWater on a similar project at Kolan Barrage during the 2006/2007 fiscal year. The following table, Table 34, captures the 2006/2007 actual cost data, for the Kolan Barrage project and projects the 2011/12 costs by applying an indexation rate based on CPI, it further shows the cost that SunWater has listed for the works proposed at Allan Tannock Weir:

- **Table 34 Comparison between Kolan Barrage and Allan Tannock Weir Cost listed in SAP**

Cost Item	Kolan Barrage Cost 2006/2007 ($)	Kolan Barrage - SKM Projected 2011/2012 Cost ($)[12]	SunWater Cost Estimate for Allan Tannock Weir as listed in SAP ($2010)
Contractors	5,549	6,377	7,475
Internal Labour	5,763	6,623	912
Internal Overhead	5,512	6,335	1,627
Materials			7,000
Plant Equipment	320	368	

[12] The projected cost is based on the CPI for Brisbane for the period between Jun 2007 and Jun 2011. The CPI was calculated as 14.92%.

Cost Item	Kolan Barrage Cost 2006/2007 ($)	Kolan Barrage - SKM Projected 2011/2012 Cost ($)[12]	SunWater Cost Estimate for Allan Tannock Weir as listed in SAP ($2010)
Vehicles			
Service Charges	634	729	783
Total	**17,779**	**20,432**	**17,796**

From the table above it can be seen that the SKM projected cost is significantly higher, 13%, than what is recorded in the WSP. We have not had access to the scope of works for the 2006/07 refurbishment of Kolan Barrage and hence are not able to comment on the suitability of comparing the two.

SunWater has also supplied a list of materials, recorded in SAP WMS, that they deem will be required for the work as detailed in the table below:

- **Table 35 List of Materials for Allan Tannock Weir Refurbishment**

Description	Quantity	Unit	SKM Assumed Rate ($2011)	Total ($)
Excavator	30	hrs	150	4,500
Wire Mesh[13]	1		2,200	2,200
Rock [14]	40	m^3	400	16,000
Council Plant & Staff	25	hrs	100	2,500
Total				**25,200**

The total for materials and council plant/staff alone, excluding SunWater indirect and overhead costs as estimated by SKM, based on SunWater quantities for Allan Tannock Weir and shown in Table 35 above is 41% more that the total cost submitted by SunWater as the annuity item refurbishment value. If overhead and indirect costs are added, in line with SunWater's estimate, then our projected total cost is approximately $28,500. We therefore conclude that the annuity value submitted for Allan Tannock weir is understated.

We therefore consider the costs submitted to the Authority for this annuity item to be efficient, based on the limited information to our disposal. There may be merit in revisiting the cost of the project after the scope has been determined.

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[13] The rate is based on using SL92 mesh beneath the rock placed in a 300 mm deep layer and using the rate for WS3B - Reinforcement Fabric Supply and Place at $2925.37/tonne.

[14] The rate used is WS3J Concreted Rockfill at $399.15/m³.

SunWater has developed a planning order for this annuity item replacement which details the following breakdown of costs between contractors, overheads and materials as is shown in Table 36.

- **Table 36 SunWater Breakdown of Costs – Allan Tannock Weir Refurbishment**

Cost Item	Planned Costs
Contractors	$7,475
Internal Labour Transfer	$888
Internal Overhead Transfer	$1,644
Materials	$7,000
Service Charges	$648
Total	$17,655

SunWater has advised that Internal Overhead Transfer relates to corporate overhead costs that are allocated to this annuity item replacement activity

Conclusion on Efficiency Evaluation

The value submitted for this annuity item is efficient, based on the limited information to our disposal. There may be merit in revisiting the cost of the project once the scope has been determined.

B.12.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent.

SunWater has used costs incurred in a similar asset item refurbishment from 2006/07 in its submission of an annuity value for this asset refurbishment. We consider the cost of the refurbishment to be efficient. There may be merit in revisiting the cost of the project once the scope has been determined.

B.13 Jack Taylor Weir – Reinstatement of Outlet Works

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.13.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the reinstatement of the outlet works, replacement of both of the outlet valves, at the Jack Taylor Weir in 2012 at a projected cost of $273,511.

SunWater advises that both existing valve assets were installed in 1968 as part of the original construction of the weir.

B.13.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

- **Table 37 Documents Reviewed Specific to the Jack Taylor Weir – Reinstatement of Outlet Works**

Document No.	Document Name	Document Title	Date
1109920	1109910 – v1 – 17- QCA Justification Jack Taylor Weir – Outlet Works	Reinstatement of outlet works for ROP - $273,511 [2012] (SGA-JTW-SPWY-OWKS)	24 August 2011

B.13.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on data provided.

SunWater's SAP WMS has listed the asset at object type as a VLSLUI which has a standard run to failure life of 40 years and a standard refurbishment period of 13 years. We consider the applied run to failure asset life and refurbishment period for this asset to be appropriate for this asset type and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1968.

The existing risk evaluation, as recorded in SAP, determined that the asset's Stakeholder Relationship criterion risk is major with a consequence rating (score 40). The consequence rating together with a probability (likelihood of occurrence) score of 10 results in an overall risk score of 400 which places this asset in a 'Medium' risk category. For this asset type, an overall risk category of Medium reduces the run to failure asset life from 40 years to 35 years and the standard refurbishment period from 13 years to 12 years. We consider this reduction in run to failure asset life and refurbishment period based on this risk assessment for asset replacement and refurbishment planning purposes to be appropriate and in keeping with good industry practice.

The risk evaluation conducted did not include consequence ratings for WH&S and Environment. In this regard SunWater has not complied with their Procedures and Policies. The SunWater Report referenced above states that should the WH&S consequence rating of this valve have been evaluated as part of the risk evaluation it would have increased the overall risk rating for the asset from a Medium to a High risk. However omitting the WH&S risk criterion score has no impact on the annuity value. The only effect is that it would move the priority for undertaking the works from a C Priority, condition based, to a B Priority, risk based (safety and environment). Given the above we recommend that this task be listed as a B Priority.

The reduced run to failure life of the valve implies that it was to be replaced in 2003, making use of the existing Asset Management Planning Methodology Paper (AMPMP); in this regard SunWater is not complying with their existing Policy and Procedures.

The condition assessment interval is set at 5 years for this object type (VLSLUI). The latest condition assessment as recorded in WMS for this asset was undertaken in 2006. The maximum score, recorded in SAP WMS, is a 6 (Asset has failed and is not operable) assigned to External Coating/Surface/Bolts and Valve Internal Condition. The condition assessment also noted the following WH&S issues: *"Very bad access, no screens at front (Public Safety Issue) very hard to operate."*

SunWater's Asset Management Planning Methodology Paper states that an asset with an asset with a Asset/Business Risk rating of 'Medium' should be replaced or refurbished once the maximum condition score reaches 5. The maximum condition score has exceeded the score of 5 and the asset is therefore, according to SunWater's Policy and Procedures, due for replacement.

Options Evaluation

SunWater commissioned Infrastructure Development (ID) to undertake the design and detailed cost estimation for the replacement of the valve. It is to note that a like for like replacement was not considered due to the WH&S issues identified with the existing configuration. SunWater's decision to commission ID to undertake the study to design and cost a solution to best address the WH&S issues is in keeping with good industry practice. The scoping document lists the following four options that were to be considered by ID:

12) Abandon valves and releasing all water through the gates. This option would require that the existing conduits through the wall to be filled up with concrete. Issues that would need to be addressed are whether the Resource Operations Plan (ROP) conditions would be met, control of releases from Beardmore Dam and how would this impact the operation of St George Pump Station.
13) Replace existing valves complete with a hydraulic system that is operable from the river bank. Issues that would need to be addressed are whether the Resource Operations Plan (ROP) conditions would be met, requirement for screens upstream and ensuring the control centre was places at an appropriate level.
14) Abandon existing valves and install a new larger outlet closer to the Town end of the weir. This option would require that the existing conduits through the wall to be filled up with concrete.
15) Enlarge the existing outlet work with a hydraulic system that is operable from the river bank. Issues that would need to be addressed are whether the Resource Operations Plan (ROP) conditions would be met, requirement for screens upstream and ensuring the control centre was places at an appropriate level.

From the information provided we understand that the design solution proposed by ID is a combination of options 3) and 4).

We have reviewed the list of options provided in the project scoping report and consider the options that were to be investigated appropriate. We have not viewed the design that ID is proposing. We are unable to provide comments regarding the suitability and effectiveness of the proposed design.

Timing of Renewal/Refurbishment

Based on the 2006 condition assessment and in accordance to SunWater's Policy and Procedures the valve has been due for replacement since 2003. The condition assessment that was conducted in 2006 confirmed that the valve has deteriorated past a score of 5 (Major deterioration such that asset is virtually inoperable). SunWater is exposed to explicit risk by not replacing the valves. We therefore consider the timing of this replacement to be prudent.

Conclusion on Prudency Evaluation

SunWater identified that the existing valve arrangement has a WH&S risk and therefore commissioned ID to design and cost an alternative arrangement. We recommend that this task of replacement be listed as a B Priority based on risk (Safety and Environment) as opposed to the current 'C' priority allocated. On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for replacement of this annuity asset has been demonstrated

B.13.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

SunWater has commissioned ID to undertake the design and costing of the replacement of this annuity item. This replacement did not consider a like for like replacement as this would not meet WH&S requirements. A unique design is required to address the WH&S issue and we consider this approach reasonable and in accordance with good industry practice.

Renewal/Replacement Project Cost Evaluation

The detailed costing was undertaken by ID as part of their scope. The information contained in the SunWater Report referenced above contains the following costing information give in the table below.

Table 38 Summary of SunWater's Cost Estimate

No.	Description	Total Cost ($)
1	Contractors	26,000
2	Internal Labour	29,970
3	Internal Overhead	40,069
4	Materials	113,000
5	Plant Equipment and Vehicles	42,000
6	Service Charges	22,472
7	**Total**	**273,511**

From the above cost estimate it is concluded that both of the valves are included for replacement. SunWater has not made the design drawings available for us to view. Based on the limited information available we have prepared a cost estimate based on installing a trash screen within a new concrete structure, installing two new 450 mm diameter outlet pipes complete with a gate valve equipped with electric actuators and proving control equipment. Our cost estimate is shown in the table below.

Table 39 SKM Cost Estimate

No.	Description	Total Cost ($)
1	Contractors and Material	
1.1	DN450 Gate Valve (USDM22) x 2	23,712
1.2	Install DN450 Gate Valve (USMD51)	1,852
1.3	Rotork Actuators x 2 (11A) – (ACT004)	10,790
1.4	Control Equipment (USMS98 S&I Actuator and Control Equipment – ACT004 Rotork Actuator 11A)	32,546
1.5	New 2 x DN450 conduits through weir wall (Allowed $23400 for coring through the wall and $5586 for the new MSCL pipe)	28,986
1.6	New Screen Structure (5m x 2.8m PS7C Trash screen with PS3C Concrete Intake Walls and PS3B Concrete Intake Base)	16,234
1.7	Temporary Works – Coffer Dam, pumping excess water	20,000
2	SUB-Total A	134,120
3	Preliminary and General Items (17% of Sub-Total A) Includes traffic management, environmental plans and Contractor's overheads	22,800
4	SUB-Total B	156,920
5	SunWater Overheads and Labour Component (45% of Sub-Total B)	70,614
6	**TOTAL**	**227,534**

The cost estimate prepared by SunWater is within our level 4 estimating range of +30%/-20 for our cost estimate and we therefore consider the annuity value submitted efficient.

Conclusion on Efficiency Evaluation

The value submitted for this annuity item is efficient, based on the information to our disposal.

B.13.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of replacement of an annuity item have largely been followed. Hence we conclude that the timing and need for replacement of this annuity item is prudent.

The annuity value that SunWater supplied to the Authority is substantiated and deemed efficient, based on the limited information to our disposal.

B.14 Coolmunda Dam Radial Gates Painting Gate 4

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.14.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment ie repainting of the downstream face of an existing dam spillway radial gate structure in 2012 and a projected cost of $48,333.

SunWater advises that the asset was initially installed in 1972 as part of the original construction of the dam.

The standard object type (asset type) for this infrastructure as a radial gate is GTRAD which SunWater has allocated a standard run to failure asset life of 100 years and a refurbishment period of 20 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.14.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 40 Documentation Reviewed Specific to Gate 4**

Document No.	Document Name	Document Title	Date
1108434	1108434 QCA Justification – Coolmunda Dam Radial Gates Painting – Gate 4	MacIntyre Brook Water Supply – Coolmunda Dam – Paint Downstream of Gate Structure (MAB-COOL – SPWY-GT04-GATE)	8th August 2011

B.14.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in

place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

It is noted that for this annuity asset, an incorrect object type has been allocated in SunWater's SAP WMS; that of a regulating gate at the functional level in the WMS. A regulating gate has a refurbishment period of 17 years; however at the equipment level the object type is listed as GTPSTG which has a refurbishment life of 20 years (and a standard run to failure asset life of 100 years).

SunWater has advised that the correct object type for radial gates is GTRAD. This error in data contained in the WMS does not impact on the annuity item value for this price reset as the refurbishment period is the same.

We consider the applied run to failure asset life and refurbishment period for this asset to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1972.

SunWater has applied its risk evaluation method to this asset and determined that it has a production/operations risk criterion consequence rating of critical (score 100). This, together with a probability (likelihood of occurrence) score of 1 results in an overall risk score of 100 which places this asset in a medium risk category. For this asset type, an overall risk category of Medium reduces the run to failure asset life from 100 years to 88 years and the refurbishment period from 20 years to 18 years.

We have not sighted any underpinning documentation to support this risk rating. However, from the WMS it is noted that the critical score is as a result of a potential catastrophic failure arising from the potential for the possibility of the 'gates falling off'. It could be argued that this failure mode could be applied to any asset of this type and, as such, the argument for allocation of a medium risk score is not sufficient robust on its own to justify a change in asset life or refurbishment period. However, given that the change in refurbishment period is only 2 years, risk rating will not materially alter the annuity amount arising from this annuity item value.

Two condition assessments are recorded in WMS for this asset. The first, in 2005 being a desk top review which gave a worst case criterion condition score of 3 (Moderate deterioration with minor refurbishment required) based on knowledge that painted surfaces exposed to sunlight would have deteriorated to that level since the last refurbishment. The most recent condition assessment was a field assessment undertaken in 2006 which gave a worst case criterion score of 4 (Significant deterioration with substantial refurbishment required to ensure ongoing reliable operation) for coating cracking/failure.

SunWater applies AS/NZS 2312:2002 as a basis for assessing the severity of corrosion on coated steel surfaces. This standard recommends refurbishment when greater than 2% of the surface coating has been damaged, exposing the steel surface. SunWater has calculated that there is a 20% reduction in refurbishment costs if refurbishment is undertaken with 2% surface coating failure rather than 50% surface coating failure. We consider this approach to be appropriate and based on good engineering practice as defined in the standard.

On the assumption that SunWater's procedures for condition assessment have been followed, based on this condition and risk assessment score, we consider that this annuity item (refurbishment) is prudent.

Options Evaluation

The proposed refurbishment operation of re-painting is appropriate for this asset and no options evaluation is required.

Timing of Renewal/Refurbishment

Based on the in operation date, SunWater has assumed (due to lack of records) that the last refurbishment was undertaken in 1992 (1972 plus 20 years). This places the next refurbishment date, assuming the asset condition score is appropriate for the years of operation since last refurbishment at 2012. This is the date of the planed refurbishment.

Although the last refurbished date is an assumed date, the condition score is consistent with the condition of an asset nearing the end of its refurbishment period and, as such, we consider the timing of this refurbishment to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.14.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For relatively minor works such as the refurbishment of this radial gate, SunWater's planning team draws on actual costs for similar activities undertaken recently. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We have sighted the as built drawings for the radial gates and reviewed the dimensions of the gates and consider that the costs projected by SunWater for refurbishing the gates are reasonable. From our experience and knowledge we would estimate costs as being in the region of $50-60k per gate for 12.8m x 11.5m gates when considering probable all up surface area, intricacy, mobilisation, access, preparation, in-situ work etc.

In addition, we note that the SunWater proposed cost of $48,333 for the refurbishment annuity value is based on the actual the cost incurred by SunWater in refurbishing radial gates 2 and 7 during 2009/10. The following table captures the 2009/10 cost data in SunWater's SAP WMS and projects a present value cost (2011) cost by applying an indexation rate based on CPI (June 2010 to June 2011) of 3.84% and compares this to the SunWater estimate for refurbishment of Gate 4:

- **Table 41 Gate 4 Refurbishment Cost Evaluation**

Cost Item	Gate 2, 7 Average Cost 2009 $	SKM Projected 2011 Cost $	SunWater Projected Cost $	Variance on SKM projected cost.
Contractors	43,110	46,480	32,000	
Internal Labour	2,349	2,533	6,600	
Internal Overhead	5,013	5,402	9,533	
Materials	1,784	1,993	0	
Plant Equipment Vehicles	550	593	0	
Service Charges	2,384	2,570	0	
Total	**55,189**	**59,504**	**48,333**	**-19%**

Although we have not had access to the procurement method for the 2009/10 refurbishment and hence are unaware whether or not the contract for the refurbishment work was competitively tendered, based on the above, a refurbishment cost of sub $59,000 is considered reasonable for refurbishment of this type of asset. As such we consider the costs submitted to the Authority for this annuity item of $48,333 to be efficient. However we note that in its cost estimate for these 2014 works, no allowance has been made by SunWater for Materials, Plant Equipment Vehicles or Service Charges and hence the actual outturn costs are likely to be higher than then annuity item value as submitted to the Authority. We also note that post submission of the Network Service Plans to the Authority, SunWater has increased the estimate for this works to $56,000.

Conclusion on Efficiency Evaluation

Given that the costs are based on recent actual refurbishment costs as outlined above, we consider that the value submitted for this annuity item is efficient.

B.14.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent.

Given that SunWater has used costs incurred in a similar asset item refurbishment from 2009/10 in its submission of an annuity value for this asset refurbishment, we consider the cost of the refurbishment to be efficient.

B.15 Coolmunda Dam Radial Gates Painting Gate 5

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.15.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment ie repainting of the downstream face of an existing dam spillway radial gate structure in 2012 and a projected cost of $48,333.

SunWater advises that the asset was initially installed in 1972 as part of the original construction of the dam.

The standard object type (asset type) for this infrastructure as a radial gate is GTRAD which SunWater has allocated a standard run to failure asset life of 100 years and a refurbishment period of 20 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.15.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 42 Documentation Reviewed Specific to Gate 5**

Document No.	Document Name	Document Title	Date
11084441	1108441 QCA Justification – Coolmunda Dam Radial Gates Painting – Gate 5	MacIntyre Brook Water Supply – Coolmunda Dam – Paint Downstream of Gate Structure (MAB-COOL – SPWY-GT05-GATE)	8th August 2011

B.15.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we

have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

It is noted that for this annuity asset, an incorrect object type has been allocated in SunWater's SAP WMS; that of a regulating gate at the functional level in the WMS. A regulating gate has a refurbishment period of 17 years; however at the equipment level the object type is listed as GTPSTG which has a refurbishment life of 20 years (and a standard run to failure asset life of 100 years).

SunWater has advised that the correct object type for radial gates is GTRAD. This error in data contained in the WMS does not impact on the annuity item value for this price reset as the refurbishment period is the same.

We consider the applied run to failure asset life and refurbishment period for this asset to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1972.

SunWater has applied its risk evaluation method to this asset and determined that it has a production/operations risk criterion consequence rating of critical (score 100). This, together with a probability (likelihood of occurrence) score of 1 results in an overall risk score of 100 which places this asset in a medium risk category. For this asset type, an overall risk category of Medium reduces the run to failure asset life from 100 years to 88 years and the refurbishment period from 20 years to 18 years.

We have not sighted any underpinning documentation to support this risk rating. However, from the WMS it is noted that the critical score is as a result of a potential catastrophic failure arising from the potential for the possibility of the 'gates falling off'. It could be argued that this failure mode could be applied to any asset of this type and, as such, the argument for allocation of a medium risk score is not sufficient robust on its own to justify a change in asset life or refurbishment period. However, given that the change in refurbishment period is only 2 years, risk rating will not materially alter the annuity amount arising from this annuity item value.

Two condition assessments are recorded in WMS for this asset. The first, in 2005 being a desk top review which gave a worst case criterion condition score of 3 (Moderate deterioration with minor refurbishment required) based on knowledge that painted surfaces exposed to sunlight would have deteriorated to that level since the last refurbishment. The most recent condition assessment was a field assessment undertaken in 2006 which gave a worst case criterion score of 4 (Significant deterioration with substantial refurbishment required to ensure ongoing reliable operation) for coating cracking/failure.

SunWater applies AS/NZS 2312:2002 as a basis for assessing the severity of corrosion on coated steel surfaces. This standard recommends refurbishment when greater than 2% of the surface coating has been damaged, exposing the steel surface. SunWater has calculated that there is a 20% reduction in refurbishment costs if refurbishment is undertaken with 2% surface coating failure rather than 50% surface coating failure. We consider this approach to be appropriate and based on good engineering practice as defined in the standard.

On the assumption that SunWater's procedures for condition assessment have been followed, based on this condition assessment and risk assessment score, we consider that this annuity item (refurbishment) is prudent.

Options Evaluation

The proposed refurbishment operation of re-painting is appropriate for this asset and no options evaluation is required.

Timing of Renewal/Refurbishment

Based on the in operation date, SunWater has assumed (due to lack of records) that the last refurbishment was undertaken in 1992 (1972 plus 20 years). This places the next refurbishment date, assuming the asset condition score is appropriate for the years of operation since last refurbishment at 2012. This is the date of the planed refurbishment.

Although the last refurbished date is an assumed date, the condition score is consistent with the condition of an asset nearing the end of its refurbishment period and, as such, we consider the timing of this refurbishment to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.15.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For relatively minor works such as the refurbishment of this radial gate, SunWater's planning team draws on actual costs for similar activities undertaken recently. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We have sighted the as built drawings for the radial gates and reviewed the dimensions of the gates and consider that the costs projected by SunWater for refurbishing the gates are reasonable. From our experience and knowledge we would estimate costs as being in the region of $50-60k per gate for 12.8m x 11.5m gates when considering probable all up surface area, intricacy, mobilisation, access, preparation, in-situ work etc.

In addition, we note that the SunWater proposed cost of $48,333 for the refurbishment annuity value which is based on the actual the cost incurred by SunWater in refurbishing radial gates 2 and 7 during 2009/10. The following table captures the 2009/10 cost data in SunWater's SAP WMS and projects a present value cost (2011) cost by applying an indexation rate based on CPI (June 2010 to June 2011) of 3.84% and compares this to the SunWater estimate for refurbishment of Gate 5:

SINCLAIR KNIGHT MERZ SKM

- **Table 43 Gate 5 Refurbishment Cost Evaluation**

Cost Item	Gate 2, 7 Average Cost 2009 $	SKM Projected 2011 Cost $	SunWater Projected Cost $	Variance on SKM projected cost.
Contractors	43,110	46,480	32,000	
Internal Labour	2,349	2,533	6,800	
Internal Overhead	5,013	5,402	9,532	
Materials	1,784	1,993	0	
Plant Equipment Vehicles	550	593	0	
Service Charges	2,384	2,570	0	
Total	**55,189**	**59,504**	**48,332**	**-19%**

Although we have not had access to the procurement method for the 2009/10 refurbishment and hence are unaware whether or not the contract for the refurbishment work was competitively tendered, based on the above, a refurbishment cost of sub $59,000 is considered reasonable for refurbishment of this type of asset. As such we consider the costs submitted to the Authority for this annuity item of $48,333 to be efficient. However we note that in its cost estimate for these 2012 works, no allowance has been made by SunWater for Materials, Plant Equipment Vehicles or Service Charges and hence the actual outturn costs are likely to be higher than then annuity item value as submitted to the Authority. We note that post submission of the Network Service Plans to the Authority, SunWater has increased the estimate for these works to $56,000.

Conclusion on Efficiency Evaluation

Given that the costs are based on recent actual refurbishment costs as outlined above, we consider that the value submitted for this annuity item is efficient.

B.15.5 Summary and Conclusions

We are satisfied that SunWater’s robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent.

Given that SunWater has used costs incurred in a similar asset item refurbishment from 2009/10 in its submission of an annuity value for this asset refurbishment, we consider the cost of the refurbishment to be efficient.

B.16 Coolmunda Dam Radial Gates Painting Gate 3

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.16.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment ie repainting of the downstream face of an existing dam radial gate structure in 2013 at a projected cost of $63,545.

SunWater advises that the asset was initially installed in 1972 as part of the original construction of the dam.

The standard object type (asset type) for this infrastructure, a radial gate, is GTRAD which SunWater has allocated a standard run to failure asset life of 100 years and a refurbishment period of 20 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.16.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedure. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater for this review and SunWater asset management policy documents:

Document No.	Document Name	Document Title	Date
1108378	1108378 v1A Coolmunda Dam Radial Gates Painting – Gate 3	MacIntyre Brook Water Supply – Coolmunda Dam – Paint Downstream of Gate Structure (MAB-COOL-SPW-GT03-GATE)	8 August 2011

B.16.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on data provided.

It is noted that for this annuity asset, an incorrect object type has been allocated in SunWater's SAP WMS; that of a regulating gate at the functional level in the WMS. A regulating gate has a refurbishment period of 17 years; however at the equipment level the object type is listed as GTPSTG which has a refurbishment life of 20 years (and a standard run to failure asset life of 100 years).

SunWater has advised that the correct object type for radial gates is GTRAD. This error in data contained in the WMS does not impact on the annuity item value for this price reset as the refurbishment period is the same.

We consider the applied run to failure asset life and refurbishment period for this asset to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1972.

SunWater has applied its risk evaluation method to this asset and determined that it has a production/operations risk criterion consequence rating of critical (score 100). This, together with a probability (likelihood of occurrence) score of 1 results in an overall risk score of 100 which places this asset in a medium risk category. For this asset type, an overall risk category of Medium reduces the run to failure asset life from 100 years to 88 years and the refurbishment period from 20 years to 18 years.

We have not sighted any underpinning documentation to support this risk rating. However, from the WMS it is noted that the critical score is as a result of a potential catastrophic failure arising from the potential for the possibility of the 'gates falling off'. It could be argued that this failure mode could be applied to any asset of this type and, as such, the argument for allocation of a medium risk score is not sufficient robust on its own to justify a change in asset life or refurbishment period. However, given that the change in refurbishment period is only 2 years, risk rating will not materially alter the annuity amount arising from this annuity item value.

The last condition assessment, as recorded in WMS for this asset, was undertaken in 2006. The maximum condition rating was a 4 (Significant deterioration with substantial refurbishment required to ensure ongoing reliable operation) for coating cracking/failure.

SunWater applies AS/NZS 2312:2002 as a basis for assessing the severity of corrosion on coated steel surfaces. This standard recommends refurbishment when greater than 2% of the surface coating has been damaged, exposing the steel surface. SunWater has calculated that there is a 20%

reduction in refurbishment costs if refurbishment is undertaken with 2% surface coating failure rather than 50% surface coating failure. We consider this approach to be reasonable and based on good engineering practice as defined in the standard.

On the assumption that SunWater's procedures for condition assessment have been followed, based on this condition assessment score, we consider that this annuity item (refurbishment) is prudent.

Options Evaluation

The proposed refurbishment operation of re-painting is appropriate for this asset and no options evaluation is required.

Timing of Renewal/Refurbishment

Based on the in operation date, SunWater has assumed (due to lack of records) that the last refurbishment was undertaken in 1992 (1972 plus 20 years). This places the next refurbishment date, assuming the asset condition score is appropriate for the years of operation since last refurbishment at 2012. The planned refurbishment date within the WMS is recorded as 2013. The painting of Gate 3 should coincide with the painting of Gate 4.

Although the last refurbished date is an assumed date, the condition score is consistent with the condition of an asset nearing the end of its refurbishment period and, as such, we consider the timing of this refurbishment to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.16.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

For relatively minor works such as the refurbishment of this radial gate, SunWater's planning team draw on actual costs for similar activities undertaken recently. Given the volume of annuity items that SunWater's Planning Team are engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

As noted above, the timing of the project should coincide with the timing for Gate 4. There are cost benefits that could be expected by tendering and administering the two gates as one tender.

Renewal/Replacement Project Cost Evaluation

We have sighted the as built drawings for the radial gates and reviewed the dimensions of the gates and consider that the costs projected by SunWater for refurbishing the gates are reasonable. From our experience and knowledge we would estimate costs as being in the region of $50-60k per gate for 12.8m x 11.5m gates when considering probable all up surface area, intricacy, mobilisation, access, preparation, in-situ work etc.

In addition, we note that the SunWater proposed cost of $63,545 for the refurbishment annuity value which is based on the actual cost incurred by SunWater in refurbishing radial gates 2 and 7 during 2009/10. The following table captures the 2009/10 cost data in SunWater's SAP WMS and projects a present value cost (2011) cost by applying an indexation rate based on CPI (June 2010 to June 2011) of 3.84% and compares this to the SunWater estimate for refurbishment of Gate 3:

- **Table 44 Gate 3 Refurbishment Cost Evaluation**

Cost Item	Gate 2,7 Average Cost 2009 $	SKM Projected 2011/2012 Cost $[15]	SunWater Projected Cost $	Variance on SKM projected cost.
Contractors	43,110	46,480	53,400	
Internal Labour	2,349	2,533	3,450	
Internal Overhead	5,013	5,405	6,695	
Materials	1,784	1,993		
Plant Equipment Vehicles	550	593		
Service Charges	2,384	2,570		
Total	**55,189**	**59,504**	**63,545**	**+6.8 %**

We have not had access to the procurement method for the 2009/10 refurbishment and hence are unaware whether or not the contract for the refurbishment work was competitively tendered. It is also unclear to us how SunWater arrives at a cost of some $63k for refurbishing gate 3, yet it has proposed costs for gates 4, 5 and 6 of circa $48k, $438k and $44k respectively, given that they are all identical structures. However, from our experience, we consider the costs submitted to the Authority for this annuity item to be within 7% of our estimate and hence efficient.

Conclusion on Efficiency Evaluation

Given that the value submitted for this annuity item is efficient. There could be cost benefits in tendering Gate 3 and 4 within the same tender.

[15] The projected cost is based on the CPI for Brisbane for the period between Jun 2010 and Jun 2011. The CPI was taken as 3.84%.

B.16.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent.

Given that SunWater has used costs incurred in a similar asset item refurbishment from 2009/10 in its submission of an annuity value for this asset refurbishment, we consider the cost of the refurbishment to be efficient.

SINCLAIR KNIGHT MERZ SKM

B.17 Coolmunda Dam Radial Gates Painting Gate 6

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.17.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment ie repainting of the downstream face of an existing dam spillway radial gate structure in 2014 and a projected cost of $43,625.

SunWater advises that the asset was initially installed in 1972 as part of the original construction of the dam.

The standard object type (asset type) for this infrastructure as a radial gate is GTRAD_ which SunWater has allocated a standard run to failure asset life of 100 years and a refurbishment period of 20 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.17.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

- **Table 45 Documentation Reviewed Specific to Gate 6**

Document No.	Document Name	Document Title	Date
11084441	1108457 QCA Justification – Coolmunda Dam Radial Gates Painting – Gate 6	MacIntyre Brook Water Supply – Coolmunda Dam – Paint Downstream of Gate Structure (MAB-COOL – SPWY-GT06-GATE)	8th August 2011

B.17.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

It is noted that for this annuity asset, an incorrect object type has been allocated in SunWater's SAP WMS; that of a regulating gate at the functional level in the WMS. A regulating gate has a refurbishment period of 17 years; however at the equipment level the object type is listed as GTPSTG which has a refurbishment life of 20 years (and a standard run to failure asset life of 100 years).

SunWater has advised that the correct object type for radial gates is GTRAD. This error in data contained in the WMS does not impact on the annuity item value for this price reset as the refurbishment period is the same.

We consider the applied run to failure asset life and refurbishment period for this asset to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1972.

SunWater has applied its risk evaluation method to this asset and determined, in 2005, that it "Does Not Require Risk Assessment" giving it a risk category of Low. Hence for this asset the refurbishment frequency has not been adjusted from the standard for this asset of 20 years.

This risk rating, is at odds with the risk assessments for identical gates 4 and 5 which assess the risk consequence as 'Critical' and likelihood as low giving an overall risk assessment of "Medium". This difference in assessment rating does not impact on the prudency of the timing of the refurbishment but it does suggest that SunWater's procedures are not being applied consistently across all assets which may result in some asset replacement/refurbishment being brought forward earlier than should be the case, or, vice versa, later than should be the case. Given the large portfolio of assets, it may be argued though that then net effect on the annuity value will be zero, provided this inconsistency doesn't result in a skew in the overall assessments.

SunWater applies AS/NZS 2312:2002 as a basis for assessing the severity of corrosion on coated steel surfaces. This standard recommends refurbishment when greater than 2% of the surface coating has been damaged, exposing the steel surface. SunWater has calculated that there is a 20% reduction in refurbishment costs if refurbishment is undertaken with 2% surface coating failure rather than 50% surface coating failure. We consider this approach to be appropriate and based on good engineering practice as defined in the standard.

On the assumption that SunWater's procedures for condition assessment have been followed, based on this condition assessment score, we consider that this annuity item (refurbishment) is prudent.

Options Evaluation

The proposed refurbishment operation of re-painting is appropriate for this asset and no options evaluation is required.

Timing of Renewal/Refurbishment

Based on the in operation date, SunWater has assumed (due to lack of records) that the gate has not been refurbished during its 40 year operating history. As such, according to SunWater's policies, refurbishment is long overdue. We therefore consider the timing of this refurbishment to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.17.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For relatively minor works such as the refurbishment of this radial gate, SunWater's planning team draws on actual costs for similar activities undertaken recently. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We have sighted the as built drawings for the radial gates and reviewed the dimensions of the gates and consider that the costs projected by SunWater for refurbishing the gates are reasonable. From our experience and knowledge we would estimate costs as being in the region of $50-60k per gate for 12.8m x 11.5m gates when considering probable all up surface area, intricacy, mobilisation, access, preparation, in-situ work etc.

In addition, we note that the SunWater proposed cost of $43,625 for the refurbishment annuity value which is based on the actual the cost incurred by SunWater in refurbishing radial gates 2 and 7 during 2009/10. The following table captures the 2009/10 cost data in SunWater's SAP WMS and projects a present value cost (2011) cost by applying an indexation rate based on CPI (June

2010 to June 2011) of 3.84% and compares this to the SunWater estimate for refurbishment of Gate 6:

- **Table 46 Gate 6 Refurbishment Cost Evaluation**

Cost Item	Gate 2, 7 Average Cost 2009 $	SKM Projected 2011 Cost $	SunWater Projected Cost $	Variance on SKM projected cost.
Contractors	43,110	46,480	34,429	
Internal Labour	2,349	2,533	3,450	
Internal Overhead	5,013	5,402	5,746	
Materials	1,784	1,993	0	
Plant Equipment Vehicles	550	593	0	
Service Charges	2,384	2,570	0	
Total	**55,189**	**59,504**	**43,625**	**-27%**

Although we have not had access to the procurement method for the 2009/10 refurbishment and hence are unaware whether or not the contract for the refurbishment work was competitively tendered, based on the above, a refurbishment cost of sub $60,000 (2011) is considered reasonable for refurbishment of this type of asset. As such we consider the costs submitted to the Authority for this annuity item of $43,625 to be efficient. However we note that in its cost estimate for these 2014 works, no allowance has been made by SunWater for Materials, Plant Equipment Vehicles or Service Charges and hence the actual outturn costs are likely to be higher than then annuity item value as submitted to the Authority.

Conclusion on Efficiency Evaluation

Given that the costs are based on recent actual refurbishment costs as outlined above, we consider that the value submitted for this annuity item is efficient.

B.17.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent.

Given that SunWater has used costs incurred in a similar asset item refurbishment from 2009/10 in its submission of an annuity value for this asset refurbishment, we consider the cost of the refurbishment to be efficient.

B.18 Leslie Dam Replacement of Cables

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.18.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of cables at Leslie Dam.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1985 and was installed as part of the original construction works of the dam. SunWater has submitted an annuity item value of $1,376,784 for replacement of the existing cables in 2019.

B.18.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 47 Documentation Reviewed Specific to Replacement of the LV Underground Cable at Leslie Dam**

Document No.	Document Name	Document Title	Date
1109920	1109920-QCA Justification paper H15 Leslie Dam Cables and Cableways	UCO-LES-ELEC-CWAY – Replace Cables	23rd August 2011

B.18.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is CALVUG – Low Voltage UnderGround cable. In SunWater's Whole of Life Maintenance Planning Tool (Master), SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 5 years. Currently, in Australia, electrical distribution network services providers are allocating undergrounded XLPE (cross linked polyethylene) low voltage cable a run to failure asset life of 60 years. We therefore consider the standard run to failure asset life applied by SunWater to this asset class of 35 years to be conservative for this asset type. We note that this asset has been allocated to an incorrect asset type in SAP WMS of CAWAY – Cableway. An asset type of CAWAY has a run to failure asset life of 60 years. SunWater has identified this misallocation and the planning team has allocated the correct (per SunWater's systems) run to failure life of 35 years in assessing a projected required replacement date.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1985.

SunWater has applied its risk evaluation method to this asset and determined that, during the most recent risk assessment in 2005, this asset resides in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. An overall risk category of Low does not trigger any reduction in the standard run to failure asset life of this type of asset and we confirm this to be the case for this asset.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment, a field assessment, was undertaken in 2010 which yielded a condition score of 3 (moderate deterioration with minor refurbishment required to ensure ongoing reliable operation) being allocated for the following criteria: Conduits/Ducts/Hat Sections, Cable Pits and Lids, Cable Way (based on age as a percentage of replacement life). From this assessment, Sunwater's assessor projected a remaining life of 10 years for this asset.

A condition score of 3 in 2010 indicates that the asset is in a better condition than the standard asset condition decay curve would suggest. Applying this score to SunWater's condition based replacement asset life adjustment tool yields a projected run to failure life of 67 years and a projected replacement date of 2052. This projected run to failure asset life is of a similar order to the standard run to failure life adopted by power network distribution entities.

In its asset replacement report, SunWater states:

"The assessor has determined that the asset has a remaining life of 10 years. If this is the case the asset is performing well against the standard decay curve and if further evidence from future condition assessments backs up this view we may be able to push the replacement of the cable out some years.

While the current system is not giving any apparent trouble we have never employed anyone to actually test/challenge the electrical system and it is likely that this will occur over the next 2/3 years. We will be comparing the decay curve with other cabling assets to see if the decay curve is correct for this class of assets. Electrical assets may have different characteristics [to the] standard curve [and] this needs to be continuously challenged"

We agree that the standard decay curve adopted may not be appropriate for electrical assets which tends to have a different failure mode than civil and mechanical assets in that failure is often sudden and catastrophic as opposed to a consequence of gradual deterioration. We also consider that it would be prudent for SunWater to benchmark standard asset lives for electrical assets against standard asset lives adopted by power utility companies, particularly distribution network service providers. SKM generally would adopt a longer asset life for these assets than SunWater has adopted for this asset type.

Options Evaluation

SunWater has advised that an option analysis will need to be carried out 2 years before any planned works are commenced and that this option analysis would focus on the optimum time for replacement of the asset and each of the components.

We concur that the key aspect of the option analysis will be in relation to the determination of the timing of asset replacement and we believe it would be appropriate to conduct condition assessments to include electrical testing of the infrastructure such as insulation breakdown testing, earth impedance testing and similar to determine the condition of the cable installation.

SunWater has also advised that:

"At this stage of planning there is no obvious alternative to like for like replacement that would reduce costs by more than 30%.

We agree with this statement as unless an alternative means of supply provision is identified it is highly likely that an option study would conclude that a like for like replacement of the cables would be the preferred option. SunWater has also advised that, "*as it is likely that the options study would suggest that only the cables would need replacement and not the cableways then the estimate for this annuity value would reduce to approximately $1.1m*".

Given that and that there will be at least one further price reset prior to the proposed replacement date is 2019 we believe that it would be appropriate to conduct a condition assessment of both the cable and cableways prior to establishing a planned replacement date. We also agree that the cable ways, having a standard run to failure life of 60 years (per SunWater's systems) would most likely not need replacing at the same time as the planned replacement of the cables and hence agree that, if the cables were to be replaced in 2019 that the costs would be less than that submitted to the Authority for this annuity item.

Timing of Renewal/Refurbishment

We consider that the standard asset run to failure life for this asset class adopted by SunWater to be conservative and not in keeping with industry practice for this asset type. If a run to failure standard life of 60 years is adopted, per standard power distribution industry practice, then the projected replacement date would be 2045 which is beyond this current price setting annuity period.

Conclusion on Prudency Evaluation

We do not consider that the proposed replacement date of 2019 is prudent as the run to failure asset life adopted by SunWater for this asset class is significantly below the run to failure asset life adopted by power distribution utilities and the condition of the cable indicates that it is deteriorating less rapidly than the standard condition decay curve adopted by SunWater would predict.

We recommend that SunWater conducts a condition assessment of the cable together with undertaking a benchmarking of asset life for this class of asset prior to determining a projected replacement date.

B.18.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+43.62%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 43.62%. Whilst this is at the upper end of the range of multipliers used by SunWater to capture asset item specific costs such as location, project management, engineering we have insufficient information to determine its reasonableness.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%. We have compared our cost estimate against SunWater's cost estimate in Table 48 below:

- **Table 48 Leslie Dam Replacement of Cables Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
1,376,784	1,247,000	+10.4%

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the typical estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $1,376,784 to be efficient on the assumption that, if SunWater adopts a 60 year replacement life, the cableways will be replaced at the same time as the cable.

B.18.5 Summary and Conclusions

We do not consider that the timing and need for replacement of this annuity item is prudent. As such we do not consider it to be prudent to include the annuity value for replacement of this annuity item in this current price setting annuity value.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.19 St George Pump Station – Replace Suction line

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.19.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of the suction line of the St George Pump Station in 2013 at a projected cost of $335,081.

SunWater advises that the asset was constructed in 1957 as part of the original construction of the pump station.

B.19.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

- **Table 49 Documents Reviewed Specific to the St George Pump Station – Intake Pipework Replacement**

Document No.	Document Name	Document Title	Date
1109920	1109920 – v1 – QCA Justification St George Pump Station – Intake Pipework Replacement	St George Pump Station - QCA Justification	24 August 2011
1116936	1116936 Report St George Pump Station Pipes	St George Irrigation Project Pump Station Suction Line – Condition Report	30th August 2011
1116938	1116938 Analysis Report – Analysis of Options for Replacement of St George Pump Station	The Analysis of Options for Replacement of St George Pump Station – St George Irrigation Scheme	30th August 2011

B.19.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in

place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on data provided.

SunWater's SAP WMS has listed the asset at object type as PIMSCL which has a standard run to failure life of 80 years and a standard refurbishment period of 27 years. We consider the applied run to failure asset life and refurbishment period for this asset to be appropriate for this type of asset and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1957.

SunWater has applied its risk evaluation method to this asset. The risk evaluation determined that the asset's Production/Operational criterion risk is major with a consequence rating (score 40). The consequence rating together with a probability (likelihood of occurrence) score of 20 results in an overall risk score of 800 which places this asset in a 'High' risk category. The SunWater SAP contains a justification with the following comment: "*Extensive work required for repairs if inlet failure occurs.*" We consider this a reasonable justification. For this asset type, an overall risk category of 'High' reduces the run to failure asset life from 80 years to 50 years and the standard refurbishment period from 27 years to 17 years. We consider this reduction in run to failure asset life and refurbishment period based on this risk assessment for asset replacement and refurbishment planning purposes to be appropriate and in keeping with good industry practice.

Three different condition assessments were undertaken in 2005/2006. The condition assessments undertaken are: General Concrete Structures, Structures – Steel and Pipelines – Ferrous Above and B assessments. The items that were identified that have a condition score of 4 and above is listed in Table 50 below.

Table 50 Summary of Items with a Condition Score 4 and above

No	Component	Condition Score	Comments
1	GENERAL CONCRETE STRUCTURE CONDITION ASSESSMENT		
1.1	Operational Performance	4	
1.2	Safety Fittings	4	
1.3	Other Components	6	
2	STRUCTURES – STEEL CONDITION ASSESSMENT		
2.1	Steel Bolts/Coatings/Surfaces	5	Significant Deterioration
2.2	Operational Performance	5	Pitting may cause loss of suction
2.3	Safety Fittings	6	Walkway unsafe – do not use
3	PIPELINE – FERROUS ABOVE & B		

No	Component	Condition Score	Comments
	CONDITION ASSESSMENT		
3.1	Pedestals	4	
3.2	External Coating / Surfaces/ Bolts	5	
3.3	Pipe Wall	5	

SunWater's Asset Management Planning Methodology Paper states that an asset with an Asset/Business Risk rating of 'High' should be replaced or refurbished once the maximum condition score reaches 4. The maximum condition score has exceeded the score of 5 and the asset is therefore, according to SunWater's Policy and Procedures, due for replacement.

Options Evaluation

SunWater commissioned a dive condition assessment in 2006 that concluded that the suction pipeline would be fit for use for another 5 year period. The condition report was made available for our viewing.

An options analysis was conducted in November 2005 to replace the St George Pump Station. This report was made available for our viewing. The options investigated included the construction of a new inlet works further upstream, differing only in size between the options. The Options Analyses Report recommends that the existing St George Pump Station be decommissioned and a new submersible pump station be constructed at an estimated cost of $1.6 million (Estimated in 2005).

SunWater has not provided us with any other information regarding options investigated to replace the existing suction pipeline.

We have not sighted any documentation that documents an implementation plan should the existing suction pipeline fail between now and the commissioning of the proposed pump station. There may be merit in developing such a plan as this asset has been identified as a high risk asset. Options to be considered could include, but not limited to, the following:

16) Internal polyethylene sleeving
17) Purchase and stock close to site sections of similar diameter pipe to enable the cutting out of a failed section and replacing with new section, fixed in place with gibaults or by welding.
18) Manufacture sections of steel plate already bent to fit over the various outside diameters to use as a "patch". Consider welding it into place or by means of strapping.

Timing of Renewal/Refurbishment

Based on the 2005/2006 condition assessments and in accordance to SunWater's Policy and Procedures the replacement of the pump station suction line was due for replacement since 2006.

The condition assessments that was conducted in 2005/2006 confirmed that the suction pipeline has deteriorated past a score of 4 (Significant deterioration with substantial refurbishment required to ensure ongoing reliable operation). SunWater is exposed to business risk by not replacing the suction pipeline. We therefore consider the timing of this replacement to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for replacement of this annuity asset has been demonstrated.

B.19.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

For asset refurbishment works where the planned refurbishment date is less than five years hence from the planning date, SunWater's planning team draw on actual costs for similar activities undertaken recently or alternatively compile a price from first principals. Given the volume of annuity items that SunWater's Planning Team are engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We have been provided with as built drawings for the suction pipeline. As such, we have been able to develop bench mark costs for the replacement of the suction pipe from first principles.

Although the annuity item is due for implementation, SunWater has not developed an annuity value based on a 'bottom up' costing or alternate previous recent project costing approach in line with SunWater's stated processes and practice. Instead SunWater has adopted a replacement cost of $350,238 based on the 1997 BOM rates and adjusted making use of the values derived from the 2008 Cardno Report. We have used the quantities from the replacement cost to undertake a bottom up calculation. The calculation is shown within the table below.

Table 51 SKM Cost Estimate

No	Description	Qty	Rate	Total ($)
1.	MATERIALS AND CONTRACTOR			
1.1	257 mm MSCL 6 mm	46.5 m	$260/m* (for pipe material only)	12,090
1.2	420 mm MSCL 5 mm	47.1 m	$650/m* (for pipe material only)	30,615
1.3	660 mm MSCL 6 mm	46.4 m	$900/m* (for pipe material only)	41,760
1.4	Timber Piles	315.6 m	$7500* for establishment	47,607

No	Description	Qty	Rate	Total ($)
			and $127/m	
1.5	Support Structures (1.25 times Timber Piles)			59,509
4	SUB TOTAL A			191,581
5	Contractors Preliminary and General Item (17% of Sub Total B)			32,569
6	**Total**			**224,150**

*Based on rates extracted from Rawlinsons – Australian Construction Handbook 2011

A cost comparison showing the breakdown of both SunWater and SKM is shown in the table below:

- **Table 52 Comparison between SunWater and SKM Costing**

Description	SunWater Cost ($)	SKM Cost ($)
Contractors and Material	250,000	224,150
Internal Labour and Overheads	85,081	100,868 (Based on 45% of Contractors and Materials)
Total	**335,081**	**325,018**

From the above table it can be seen that the cost differs by 3% between the SunWater and SKM costing.

We consider the costs submitted to the Authority for this annuity item to be efficient, based on the information to our disposal.

SunWater has developed a planning order for this annuity item replacement which details the following breakdown of costs between contractors, overheads and materials as is shown in Table 53.

- **Table 53 SunWater Breakdown of Costs – St George Pump Station – Replace Suction Line**

Cost Item	Planned Costs
Contractors	$150,000
Internal Labour Transfer	$33,500
Internal Overhead Transfer	$51,581
Materials	$100,000
Service Charges	
Total	$335,081

SunWater has advised that Internal Overhead Transfer relates to corporate overhead costs that are allocated to this annuity item replacement activity

Conclusion on Efficiency Evaluation

The value submitted for this annuity item is efficient, based on the information to our disposal.

B.19.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for replacement of this annuity asset has been demonstrated. We consider that the inclusion of this annuity item in the annuity value is prudent.

We consider the cost of the replacement to be efficient, based on the information provided.

B.20 Gattonvale Offstream Storage – Stabilise Embankment

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.20.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment, over a four year period, of the embankment of the Gattonvale Offstream Storage starting in 2012 at a projected cost of $90,000 per year.

SunWater advises that the asset was constructed in 2005 as part of the original construction of the distribution system.

B.20.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

- **Table 54 Documents Reviewed Specific to the Gattonvale Offstream Storage Refurbishment**

Document No.	Document Name	Document Title	Date
1108555	1108555 – v1 – 25 – QCA Justification H16 GOSS Embankment Stabilisation	Bowen-Broken Water Supply – Gattonvale Offstream Storage – Stabilise Embankment (BBR-GOSS-STOR-EMBK)	19 August 2011

B.20.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on data provided.

SunWater's SAP WMS has listed the asset at object type as EMBK which has no refurbishment life listed (and a standard run to failure asset life of 200 years).

We consider the applied run to failure asset life for this asset to be reasonable and in keeping with good industry practice. However we consider that not allocating a refurbishment period is not in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 2005.

SunWater has applied its risk evaluation method to this asset. The material used to construct the earth embankment was identified as being prone to piping failures. The risk evaluation determined that the asset has a Production/Operations and Financial risk with a 'Critical' consequence rating (score 100). The consequence rating together with a probability (likelihood of occurrence) score of 3 results in an overall risk score of 300 which places this asset in a 'Medium' risk category. For this asset type, an overall risk category of Medium reduces the run to failure asset life from 200 years to 175 years. We consider this reduction in run to failure asset life based on this risk assessment for asset replacement planning purposes to be appropriate and in keeping with good industry practice.

The SunWater report, as referenced above, makes comment as to how refurbishments for this Asset Type, EMBK, are scheduled. The refurbishments are based on issues identified and are programmed based on known condition and risk. We do not consider this to be an effective way of scheduling refurbishments as this is reactive and not proactive. There may be merit in breaking down the Embankment (EMBK) asset type into sub-categories based on the type of embankment. This will provide opportunity to determine run to failure and refurbishment periods, in line with industry standards, that is specific to the type of embankment and its composition. The risk evaluation method could then be applied to the asset and the refurbishments can be scheduled based on risk.

The latest condition assessment, as recorded in WMS for this asset, was undertaken in 2010. The following general note was recorded: *"Very dispersive soil. Historically spending $80-$100K/year on stabilisation of embankment/crest"*. The asset was constructed in 2005 and this note has identified that this asset is not performing as expected. The maximum asset condition score, recorded in SAP WMS, is a 4 (Significant deterioration with substantial refurbishment required to ensure ongoing reliable operation) assigned to Grass Cover and Batter Condition. The following comments to note were made: *"Erosion due to dispersive soil"* and *"Slumping due to dispersive soil."* SunWater commissioned an Engineering Investigation to determine the extent of the erosion to the batters and to make recommendations to address the concerns raised. Abstracts from this Engineering Investigation and photos were made available for our perusal.

The decay curve was used to determine the refurbishment date based on the asset condition rating. The date for refurbishment was determined as 2012.

Options Evaluation

The proposed refurbishment method is as recommended in the Engineering Investigation. The construction method is to move the slumped material back into place, tie and place a geofabric cloth over the material by keying in at the top of the embankment and then placing angular rock mulch over the geofabric. The site visit conducted in April 2011 includes photos indicating the areas that has been treated with the proposed method in the past. The photos do indicate that no significant failure has occurred since placement of angular rock. We have reviewed the refurbishment method proposed and do not consider it appropriate and or in keeping with current industry practice. Based on a preliminary investigation, we would recommend that the following alternatives be investigated to the various areas of concern:

Downstream face:

- Planting of proper grass.
- Treatment of the soil with gypsum/lime.
- Installation of an intermediate berm and or a table drain.

Upstream Face

- Investigate upgrading the embankment to current "best practice" by providing a sand layer/gravel layer/ properly designed riprap layer to counteract the wind action and natural dispersion.

Cracking at the Crest

- Obtain a second opinion to the cause of the formation of the cracks. From our review of the information provided, the cause could also be ascribed to slope instability rather than drying shrinkage viewed in light of the other information. It is to be noted that should the cause be due to slope instability that with the ingress of water, such as rain, the bank could experience a sudden failure.

Dam Embankment

- Investigate providing sand filters within the wall and at the dam-foundation interface, or alternative ways of monitoring piping.
- Investigate providing a foundation cut-off and a cut-off within the dam to limit seepage.
- Investigate the details regarding the inlet and outlet pipes to ensure that these meet current best practice in relation to dispersive soils.

Based on the above we do not consider that all the options have been investigated and therefore do not consider that the proposed method is the optimal solution. We recognise that SunWater's processes necessitating the undertaking of a detailed options analysis prior to carrying out the work and we therefore recommend that consideration is given to alternative solutions.

Timing of Renewal/Refurbishment

Based on the 2010 condition assessment and in accordance to SunWater's policies, by adjusting the decay curve, the refurbishment of the batter slopes is due at the date projected (2012). We therefore consider the timing of this replacement to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment of this annuity asset has been demonstrated. Whilst we consider it prudent to include an annuity item refurbishment value in the overall annuity value, we do not consider that the method proposed will be effective in addressing the issues identified and recommend that, in line with SunWater's procedures, a more detailed options assessment is undertaken, taking into consideration alternative approaches as discussed above.

B.20.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

For asset refurbishment works where the planned refurbishment date is less than five years hence from the planning date, SunWater's planning team draws on actual costs for similar activities undertaken recently or alternatively compile a price from first principals. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We have sighted as built drawings for the earth embankment and had access to dimensions of the area affected. We have developed a bench mark costs for the maintenance works to re-grade the internal batter slopes of the embankment, place a geofabic cloth and placement of angular rock from first principles.

We note that SunWater has adopted a cost of $90,000 per year, averaged, over a four year period for maintenance as an annuity value which is based on internal deliberations. We have back calculated the total area of the internal embankment batter that can be refurbished with the $90,000 based on the cost breakdown contained within WMS. The back calculation is shown in Table 55 below.

- **Table 55 Cost Breakdown of SunWater including SKM Quantity Back Calculation**

Cost Item	Cost ($)	SKM Cost Rate ($)	Quantity
Rental & Hire – Plant and Equipment	40,000	$150/hr	267 hrs
Materials Non Inventory, made up of the following components:	35,000	$18/m²	1950m²
- Rip-rap 300mm thick (PS4A)		$12/m²	
- Geofabric (270 g/sqm), including key in at top of bank.*		$6/m²	
Preliminary and General Items (Includes Internal Overheads and Labour)	15,000	20%	
Total	**90,000**		

* Rates based on the Rawlinsons Australian Construction Handbook 2011 rates

SunWater is proposing to undertake the work to 2 metres below full supply level (FSL) and include a wave action buffer. We have made the assumption that the wave action buffer is 0.5 metres above the FSL. The drawings indicate that the internal embankment batter gradient is 1:2.5. Based on the information it is calculated that 290 metres of the internal embankment batter can be addressed within each year. The overall length that can be addressed within the four years total 1,200 metres, of the approximately 1,500 metres length of the embankment identified or only 80%. The extent of the bank erosion has been identified during a site visit in April 2011; the extent of erosion is indicated on a drawing with supporting photos taken at 200 metre intervals. Please refer to the Options Evaluation Section above as SKM does not consider the method proposed effective and recommends an alternative solution.

Our cost estimate making use of first principals is summarised in the table below.

- **Table 56 SKM Cost Estimate from First Principals**

No.	Description	Quantity	Rate	Cost ($)
1	Contractor and Materials			
1.1	Cut and fill material (0.3 m average thickness x 1500 m x 6.73 m)	3028 m³	$15/m³	45,420
1.2	Level and grade to falls (1500 m x 6.73 m)	10,100 m²	$3.40/m²	34,340
1.3	Rip-rap (PS4A)	10,100 m²	$12/m²	121,200
1.4	Geotextile	10,100 m²	$6/m²	60,600
2	SUB-TOTAL A			261,560
3	Preliminary and General (17% of Sub-Total A)			44,465
4	SUB-TOTAL B			306,025

No.	Description	Quantity	Rate	Cost ($)
5	SunWater Overheads and Labour Component (45% of Sub-Total B)			137,711
6	**TOTAL**			**443,736**

* Rates based on the Rawlinsons Australian Construction Handbook 2011 rates

From the information presented in Table 55, our cost estimate is 23% higher than the annuity value submitted.

We consider the costs submitted to the Authority for this annuity item to be efficient, based on the information to our disposal.

Conclusion on Efficiency Evaluation

The value submitted for this annuity item is efficient, based on the information to our disposal.

B.20.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for refurbishment of this annuity item is prudent. SKM does however deem that the method of refurbishment is not effective and recommends that issues raised within the Options section above are investigated by SunWater.

We consider the cost of the refurbishment to be efficient.

B.21 Kinchant Dam

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.21.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for a comprehensive 5 yearly dam safety inspection of Kinchant Dam in 2013 at a cost of $100,000.

SunWater advises that the Kinchant Dam was constructed in 1977 and has a 5km long embankment wall.

The standard object type (asset type) for this infrastructure as a dam is DAM which SunWater has allocated a standard run to failure asset life of 200 years. SKM considers the run to failure asset life to be appropriate for this asset type.

This report does not cover the proposed spillway upgrade works in 2012 and 2013.

B.21.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 57 Documentation Reviewed Relating to the Kinchant Dam Safety Inspection**

Document No.	Document Name	Document Title	Date
1105743	1105743-v1-26__Kinchant_Dam_5yearly_Inspection	Eton Water Supply – Kinchant Dam – Study: 5yr Comprehensive Inspection (ETO-KD)	24th August 2011

B.21.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in

place to determine annuity item replacement/refurbishment dates and costs for such.   Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

We note that for dams there is are legal requirements for inspections. The maintenance table indicates the 1 year, 5 year and 20 year inspections are required.

The Kinchant Dam has been assessed as having a failure impact assessment category of 2, with a population at risk (PAR) of 2244. Category 2 dams are referable under the Water Act 2000.

Section 3 of the Queensland Dam Safety Management Guidelines states that dams are regulated through safety conditions imposed on referable dams under the *Water (Reliability & Safety) Act 2008* (which are partly based on the failure impact rating of the dam). SunWater, as the dam owner, is legally required to comply with the condition schedules for the Kinchant Dam.

We understand that condition DS 11 of the March 2010 Dam Safety Condition Schedule for Kinchant Dam states: “The dam owner must carry out a Comprehensive Inspection of the dam in accordance with the *Queensland Dam Safety Management Guidelines* on or before the first day of November 2012 and or before every fifth anniversary of that date thereafter”.

As the inspection is a legal requirement for the dam’s owner, SunWater, the works are considered to be prudent.

SunWater will also be required to undertake comprehensive surveillance and comprehensive dam safety as per the regulations, as the PAR is greater than two.

Options Evaluation

SunWater is legally obliged to undertake a five year inspection of the dam. No options evaluation is required.

Timing of Renewal/Refurbishment

SunWater is legally obliged to undertake a five year inspection of the dam, therefore we consider the timing of the works to be prudent.

We note that there is a 20 year Dam Safety Review proposed prior to 1 December 2017. This may be another condition set by the March 2010 Dam Safety Condition Schedule for Kinchant Dam, however we have not sighted this document and are not able to verify the need for this review.

It is recommended that SunWater provides supporting evidence for the need for the 20 year Dam Safety Review.

Conclusion on Prudency Evaluation

The completion of a 5 yearly dam safety inspection is a legal requirement for the dam's owner, SunWater. The timing of this inspection is set by the March 2010 Dam Safety Condition Schedule for Kinchant Dam. As such the inclusion of this annuity item in the annuity value is prudent.

B.21.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For relatively minor works such as dam inspections, SunWater's planning team draws on actual costs for similar activities undertaken recently. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We understand that the estimated cost of $100,000 has been based on the 2008 5 yearly inspection for Kinchant Dam of $72,000. The 2008 cost has been escalated to $84,000 in 2011 dollars, using a rate of 5.25%. We understand that the reason behind the further increase in costs is due to a full EAP training exercise and the need to review additional assets added to the program during 2013 and not inspected during the 2008 inspection.

We have reviewed SunWater's SAP records and can confirm that there is a record of $72,015 spent in 2008 for a five yearly inspection of the Kinchant Dam.

SunWater has advised that it includes for the following items when undertaking a dam inspection:

- Hire of divers if required
- Hire of plant such as pumps and transport to site
- Time of operators to pump out spill way stilling basin
- Removal of trash racks
- Full functional test of all equipment on site
- Civil, mechanical and electrical engineers present on site to cover all areas
- Cost of operators before and during inspection
- Min o f 5 days on site and min of 5 days prep work by operators

Whilst we consider that the above activities are greater than would be typically expected for a 5 year dam inspection, we recognise that there will be a custom and practice expectation in respect of the dam safety inspectorate. Also, we consider that it is appropriate for SunWater to include activities that enable it to undertake a detailed condition assessment of the dam at the same time as the dam inspection for reasons of efficiency.   Therefore we conclude that the costs are efficient.

Conclusion on Efficiency Evaluation

Given the scope of works included in the dam safety inspection by SunWater and the historical costs available we consider that the value submitted for this annuity item is efficient.

B.21.5 Summary and Conclusions

The completion of a 5 yearly dam safety inspection is a legal requirement for the dam's owner, SunWater. The timing of this inspection is set by the March 2010 Dam Safety Condition Schedule for Kinchant Dam. As such the inclusion of this annuity item in the annuity value is prudent.

Given the scope of works included in the dam safety inspection by SunWater and the historical costs available we consider that the value submitted for this annuity item is efficient.

B.22 Dumbleton Weir – Replace Control Equipment

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.22.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of electrical control equipment at Dumbleton Weir in the Pioneer Water Supply area which has been in operation since 1998.

SunWater has submitted an annuity item value of $308,000 for replacement of this annuity item in 2019.

B.22.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 58 Documentation Reviewed Specific to Replacement of Electrical Control Gear at Dumbleton Weir**

Document No.	Document Name	Document Title	Date
1110257	1110257 27 -QCA Justification paper H18 – Replace Dumbleton Weir Controls	Pioneer Water Supply – Dumbleton Weir – Replace Control Equipment (PIO-DUMB-EMBK-CNTRL)	26th August 2011

B.22.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) allocated for this infrastructure in SAP WMS is ELECONG – Electrical Control Gear.

We note that SunWater has allocated a standard run to failure asset life of 20 years and a maximum condition assessment frequency of every 2 years. We have not been provided with a detailed description of this asset and, since the asset was installed post the 1997 valuation, a bill of materials (BOM) is not available from SunWater's SAP WMS. We assume, however, that the equipment is related to low voltage, non PLC or SCADA based electrical control gear in the form of actuators and relay based controllers. As such, we consider an asset life allocation of 20 years and a condition inspection period to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1998.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has a Production/Operations and Stakeholder/Relations criterion consequence rating of minor (score 8). This, together with a probability (likelihood of occurrence) score of 3 results in an overall risk score of 24 which, under SunWater's risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. An overall risk category of Low should not trigger any reduction in the standard run to failure asset life of this type of asset and we confirm this to be the case for this asset. Hence the risk adjusted run to failure asset life for this asset is 20 years (as per the standard asset life).

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment, a Field assessment, was undertaken in 2007 with the highest scoring condition criteria; Internal Components - Age, Internal Components – Availability and Functionality, each being allocated a score of 3 (Moderate deterioration with minor refurbishment required to ensure ongoing reliable operation). As we discuss in the main body of this report, we question the use of age as a criterion for assessing condition given that asset age is implicit and inherently built into the standard asset condition decay curve. A well maintained asset, operating within its design parameters may exhibit a condition that is superior to that which its standard asset condition decay curve may predict at any point in time. By using age as a criterion for a particular asset precludes the option of extending the run to failure asset life of that asset in circumstances where its condition is superior to that which the decay curve would predict. The net result of this, applied across the asset base, would be to skew the replacement date of those types of assets for which an age criterion is used to asses condition to an, on average, earlier date than the standard run to failure replacement date.

However, inputting a 2007 condition score of 3, a risk adjusted run to failure life of 20 years and in operation date of 1998 into SunWater's condition based replacement life adjustment modelling tool yields a projected run to failure asset life of 24 years and a recommended condition based replacement date of 2022.

SunWater has stated that this demonstrates that its planned replacement date of 2019 is *'reasonable'*. Given that one of the assessment scores relates to functionality and recognising that the failure mechanism for electrical equipment is different to civil or mechanical equipment in that sudden catastrophic failure can occur without prior warning we consider that SunWater's proposal to maintain a standard asset life based replacement date of 2019, rather than extend the asset life by 3 years, as the planning tool would suggest, is reasonable. We accept that this is very subjective though, and it would be equally as justified to argue that SunWater should adopt the asset age extension suggested by the planning tool.

However, if the replacement date were deferred to 2022, it would still occur in this price set annuity period and the additional 3 years of discounting that would ensue from deferring replacement by 3 years would not make a material difference to the calculated overall annuity value.

Options Evaluation

SunWater has advised that, as per its standard procedures:

"No options study has been completed as this project [is] *not scheduled for another 8 years."*

This is in keeping with SunWater's procedures for asset replacement and with industry good practice.

Timing of Renewal/Refurbishment

SunWater has planned for replacement of this asset based on a standard run to failure asset life of 20 years in 2019. Whilst SunWater's condition based asset life adjustment tool would indicate that the asset life could be extended by 3 years, given that the failure mechanism for electrical equipment is different to civil or mechanical equipment in that sudden catastrophic failure can occur without prior warning we consider that SunWater's proposal to maintain a standard asset life based replacement date of 2019 is reasonable.

As such we consider the replacement date of 2019 to be prudent.

Conclusion on Prudency Evaluation

We agree with SunWater's planned replacement date for this annuity item of 2019. We therefore consider that inclusion of the replacement value of this annuity item in the current price reset period annuity value to be prudent.

B.22.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier to take account of annuity item replacement specific factors such location, project management costs etc.

However, as this asset was installed post the 1997 valuation, no BOM has been developed and stored in SAP WMS for this asset. Therefore SunWater has based its asset replacement value on the original installed costs incurred in 1998. From SAP WMS we understand the original installed cost to be $152,216 ($2008).

Renewal/Replacement Project Cost Evaluation

As there is no BOM in SAP WMS we have been unable to benchmark the replacement costs for this annuity item. However we note that the original installed cost of $152,216 was re-valued during the 2008 revaluation to $308,584. During the 2008 revaluation, a standard multiplier of 2.13 for all electrical equipment was developed by SunWater's consultants. Applying this multiplier would yield a replacement value of $324.2k.

However, and as is discussed in the main body of the report, in our comparison of the Cardno developed escalators with other indices for the period 1997 to 2008, such as those produced by the Australian Bureau of Statistics (ABS), we generally find the Cardno multipliers to be overstated. For example, for electrical equipment the ABS derived multiplier is 1.53 as compared to 2.13 for Cardno. If the ABS multiplier is used then the replacement value ($2008) becomes $233k. Escalating to 2010 money terms results in a replacement cost of circa $250k. We have compared this cost estimate against SunWater's cost estimate in Table 59 below:

- **Table 59 Dumbleton Weir Replacement Control Equipment Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
$308,584	250,000	+23.2%

SunWater's replacement cost is approximately 23% higher than our estimate which is within the +30%/-20% estimating range of our level 4 estimate.

A Planning Order has not yet been developed for this asset, as such; SunWater has not developed a breakdown of direct and overhead costs.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost. As such we consider the SunWater proposed annuity item value of $309k to be efficient.

B.22.5 Summary and Conclusions

We agree with the timing of the replacement of this asset and consider it prudent to include this asset's replacement value in this current price set annuity value.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.23 Brightly Pump Station Low Voltage Cable Replacement

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.23.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of low voltage aboveground cable at Brightley Pump Station in the Eton Irrigation Area.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1980. SunWater has submitted an annuity item value of $21k for replacement of the existing cable in 2012.

B.23.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 60 Documentation Reviewed Specific to Replacement of the LV Cable at Brightley PSTN**

Document No.	Document Name	Document Title	Date
1108993	1108993-v1 Brightley PSTN 2 replace cables	Eton Irrigation Area – Brightley PSTN 2 Replace Cable	8th August 2011

B.23.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is CALVAG – Low Voltage above ground cable. We note that in SunWater's Whole of Life Maintenance Planning Tool (Master), SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 5 years. We consider the standard run to failure asset life to be towards the low end of what may be expected for above ground LV cable. For example, most electrical distribution utilities in Australia would apply an asset life of 45 to 60 years for above ground LV cable depending on whether it is operated in dry or wet (tropical) conditions. We consider the condition assessment frequency applied to this asset type to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1980.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has a financial risk criterion consequence rating of moderate (score 18). This, together with a probability (likelihood of occurrence) score of 1 results in an overall risk score of 18 which should, under SunWater's risk assessment method, place this asset in a Low risk category. An overall risk category of Low should not trigger any reduction in the standard run to failure asset life of this type of asset. However, we note that in SunWater's report (1108993-v1 Brightley PSTN 2 replace cables), SunWater has stated that the resultant risk rating is Medium and not Low and that the standard run to failure asset life should be reduced to 31 from 35 in keeping with this risk rating. We also note that in the SAP WMS, the run to failure asset life for this asset has been reduced to 31. Neither of these is in keeping with SunWater's procedure for risk based adjustment of asset life in that, on this risk assessment of Low, the asset life should be the standard run to failure asset life of 35 years, not 31 years. However, given that the difference between the two is only four years, it does not have a material impact on the inclusion of the replacement annuity item value in the overall annuity value determination.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment was undertaken in 2009 and SunWater advises that the condition assessment was "*within date at the time the NSPs were compiled.*". The worst case criterion score condition assessment in 2009 is 5 based on the age criterion. As we discuss in the main body of this report, we question the use of age as a criterion for assessing condition given that asset age is implicit and inherently built into the standard asset condition decay curve. A well maintained asset, operating within its design parameters may exhibit a condition that is superior to that which its standard asset condition decay curve may predict at any point in time. By using age as a criterion for a particular asset precludes the option of extending the run to failure asset life of that asset in circumstances where its condition is superior to that which the decay curve would predict. The net result of this, applied across the asset base, would be to skew the replacement date of those types of assets for which an age criterion is used to asses condition to an, on average, earlier date than the standard run to failure replacement date.

We note that the worst score of the other condition assessment criteria is a 2 (cabling insulation and sheathing and cable support and fixing). Applying this score to SunWater's method for determining run to failure asset life and hence asset replacement timing results in a projected replacement date of 2146 and 2125 respectively for a risk score of Low and Moderate. For an asset of this type, neither of these dates is realistic and hence, in this case, the method for determining run to failure fails as it would be unreasonable to expect an exposed above ground LV cable to last over one hundred years.

In this instance, and taking a pragmatic approach, we consider that it would be prudent for SunWater consider extending their standard life for this cable by 10 years and plan to replace this cable in 2025, ie within this price reset annuity period. This would make the asset life in keeping with the lower of the standard lives adopted by network utilities for this asset type of 45 years.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item, however, given that this is a low cost asset, it is appropriate that a like for like replacement is adopted as standard.

Timing of Renewal/Refurbishment

As discussed above, the timing of the replacement of the asset is driven by the use of an age criterion in the condition assessment method for this type of asset. Putting age aside, the score of the next work condition criterion indicates that the cable is in good condition. We consider that it would be prudent for SunWater consider extending their standard life for this cable by 10 years and plan to replace this cable in 2025, ie within this price reset annuity period. .

Conclusion on Prudency Evaluation

We conclude that it is prudent to extend the standard asset life by 10 years, placing it in line with power distribution utility industry norms and for SunWater to plan for replacement of this asset at or around 2025. As such the inclusion of this annuity item in the annuity value is prudent.

B.23.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

Normally, for assets that are planned to be replaced within 5 years of the planning date, SunWater uses a bottom up approach to determine the asset replacement annuity value, or draws on recent experience of pricing/outturn costs of replacing similar annuity items. However, in this case, given the low cost of the annuity item and in absence of recent project data, SunWater has applied its annuity item replacement cost method that it applies to annuity items that are planned to be replaced more than 5 years hence of the planning date.

As such, SunWater's Planning Team has applied SunWater's method for calculating replacement annuity values for those assets replaced more than five years after the start of the annuity period. In this method, the annuity item replacement value is calculated by applying 1997 unit rates for the components making up the asset to as installed bill of materials quantities, escalated by a multiplier determined by Cardno to provide 2008 costs and then adjusted by an 'Indirect' multiplier to capture annuity item specific cost factors relating to location, project management etc. Given the volume of annuity items that SunWater's Planning Team is engaged with at any point in time and given the relatively low value of this asset and its impact on the overall annuity value, this approach is considered reasonable and in accordance with good industry practice.

Renewal/Replacement Project Cost Evaluation

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. We have compared our cost estimate against SunWater's cost estimate in Table 61 below:

- **Table 61 Brightley PSTN Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
21,435	24,240	-11.6%

Conclusion on Efficiency Evaluation

Based on this estimated cost of a modern equivalent asset and given that the asset standard run to failure life is 35 years, we consider the proposed annuity item value of $21,435 to be efficient.

B.23.5 Summary and Conclusions

We are satisfied that the timing and need for replacement of this annuity item is prudent, albeit we would suggest that the timing for replacement should be moved out to 2025.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.24 Mt Alice Pump Station Pump Unit 3 Overhaul

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.24.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the refurbishment (overhaul) of a large centrifugal pump at (Pump Unit No. 3) at the Mt Alice Pump Station. The pump has been in operation since 1988 and was last overhauled in 2002.

SunWater has submitted an annuity item value of $25,000 for refurbishment of this annuity item in 2013.

B.24.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 62 Documentation Reviewed Specific to Refurbishment of Mt Alice Pump Station Pump Unit 3 Overhaul**

Document No.	Document Name	Document Title	Date
1110122	1110122 QCA Justification – Mt Alice Pump Station – Refurbish PUN3	Mt Alice Pump Station: Pump Unit 3 Overhaul	26th August 2011

B.24.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) allocated for this infrastructure in SAP WMS is PUCENTL – Centrifugal Pump Large.

We note that SunWater has allocated a standard refurbishment life of 15 years and a maximum condition assessment frequency of every 2 years for this asset type. We consider the refurbishment life and condition assessment frequency to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1988.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2007, that it has a Production/Operations and Stakeholder/Relations criterion consequence rating of minor (score 8). This, together with a probability (likelihood of occurrence) score of 10 results in an overall risk score of 80 which, under SunWater's risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. An overall risk category of Low should not trigger any reduction in the standard run to failure asset life of this type of asset and we confirm this to be the case for this asset. Hence the risk adjusted run refurbishment life for this asset is 15 years (as per the standard refurbishment life).

The next stage of SunWater's method for determining asset refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment, a Field assessment, was undertaken in 2008 with the highest scoring condition criterion: Pump Unit (Age (% of refurbishment life) being allocated a score of 3 (Moderate deterioration with minor refurbishment required to ensure ongoing reliable operation). As we discuss in the main body of this report, we question the use of age as a criterion for assessing condition given that asset age is implicit and inherently built into the standard asset condition decay curve. A well maintained asset, operating within its design parameters may exhibit a condition that is superior to that which its standard asset condition decay curve may predict at any point in time. By using age as a criterion for a particular asset precludes the option of extending the run to failure asset life of that asset in circumstances where its condition is superior to that which the decay curve would predict. The net result of this, applied across the asset base, would be to skew the replacement date of those types of assets for which an age criterion is used to asses condition to an, on average, earlier date than the standard run to failure replacement date. We note that all of the other condition assessment criteria have been scored 2 (Minor Defects only).

Inputting a 2008 condition score of 2, a risk adjusted refurbishment life of 15 years and last refurbishment date of 2002 into SunWater's condition based refurbishment life adjustment modelling tool yields a projected refurbishment life of 34 years and a recommended condition based refurbishment date of 2036. This date is beyond the planned replacement date for the pump and it can be assumed that the planning tool is not reliable for adjusting refurbishment life against such a condition score.

SunWater has advised that a 'strip down' condition assessment on pump unit no. 2 in 2008 which has the same operating environment as pump number 3 indicated that a condition score of 4 is appropriate for pump number 3. On this basis, and having viewed the condition inspection report for pump unit No 2, we concur that the standard refurbishment life of 15 years should be maintained.

Options Evaluation

The planned refurbishment costs are based on the refurbishment requirements for pump number 2; as such no option analysis has been undertaken by SunWater.

We have reviewed the work proposed for pump number 2, and although we consider this to be a reasonable proxy for the likely refurbishment work required for pump no. 3 we believe that not all of the refurbishment items are required:

We recommend that the bearings be replaced, the end cap replaced, the packing gland be cleaned and the packing replaced, gaskets and O-rings be replaced, then the assembly be balanced, both statically and dynamically. As the gland packing seals were replaced with mechanical seals in 2002 in pump unit No 3 we do not consider it appropriate to include for these to be replaced or the shaft machined in the planned refurbishment. The pump unit (pump unit No. 2) for which the refurbishment report was used as a proxy for pump unit No 3 had packed glands and hence the work and costs associated with replacing these with metal seals is not relevant or appropriate for pump unit No. 3.

Timing of Renewal/Refurbishment

SunWater has planned for refurbishment of this asset in 2013 based on a standard refurbishment life of 15 years in 2019 which we consider to be appropriate as set out above.

Conclusion on Prudency Evaluation

We agree with SunWater's planned refurbishment date for this annuity item of 2013. As such we consider the refurbishment timing to be prudent.

B.24.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item refurbishment costs are detailed in the main body of this report.

For this asset SunWater has relied on the costs provided by an external contractor for refurbishing an identical pump (pump unit No 2) that has experienced a similar, if not identical, operating history and is located at the same pump station as Pump Unit Number 3.

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Refurbishment Cost Evaluation

The contractors quote for refurbishing Pump Unit No 2, based on a strip down inspection is $17,168. SunWater has used this quote as a proxy quote for determining the cost of refurbishment Pump Unit No 3 and included a contractor's cost item of $15,500 for refurbishment of Pump Unit No 3. SunWater has added a further $9,606 to cover internal labour and overhead costs, resulting in a total annuity value of $25,106 (See Table 63 below). The annuity value submitted to the Authority is $25,000.

As discussed above, the contractor quote for pump unit No 2 includes for replacement of packing gland seals with mechanical seals and for machining of the pump shaft. As the gland packing seals were replaced with mechanical seals in 2002 for pump unit No 3we do not consider it appropriate to include for these to be replaced or the shaft machined. We estimate that this will reduce the contractor's cost of the refurbishment by approximately $6,000.

We have compared our cost estimate, in which we have maintained the same level of SunWater internal costs to contractor costs as SunWater's cost estimate, against SunWater's cost estimate in Table 13 below:

- **Table 63 Mt Alice Pump Station Pump No 3 Refurbishment Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
$25,000	$19,100	+31%

SunWater's replacement cost is approximately 31% higher than our estimate which is just outside the +30%/-20% estimating range of our level 4 estimate.

SunWater has developed a planning order for this annuity item replacement which details the following breakdown of costs between contractors, overheads and materials as is shown in Table 64.

- **Table 64 SunWater Breakdown of Costs – Mt Alice Pump Station Pump No 3 Refurbishment**

Cost Item	Planned Costs
Contractors	$15,500
Internal Labour Transfer	$4,076
Internal Overhead Transfer	$5,530
Materials	$0
Service Charges	$0
Total	$25,106

SunWater has advised that Internal Overhead Transfer relates to corporate overhead costs that are allocated to this annuity item replacement activity.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is just outside the estimating range of our estimated cost. As such, given the uncertainty in contractor costs arising from the fact that the actual refurbishment requirements can only be determined when the pump is stripped down for inspection we consider the SunWater proposed annuity item value of $25k to be efficient.

B.24.5 Summary and Conclusions

We agree with the timing of the replacement of this asset and consider it prudent to include this asset's replacement value in this current price set annuity value.

From our benchmarking of the replacement costs, we are satisfied that the annuity item refurbishment value submitted by SunWater is efficient.

B.25 Callide Dam Replacement of Cables and Cableways

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.25.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of cables and cableways at Callide Dam in the Three Moon Creek Water Supply area.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1965 and was installed as part of the original construction works of the dam. SunWater has submitted an annuity item value of $871k for replacement of the existing cable in 2017. We note that in SunWater's report (Table 65), a value of $862,600 is stated, however this is not the value captured in SAP WMS, nor in the submission to the Authority.

B.25.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 65 Documentation Reviewed Specific to Replacement of the LV Underground Cable at Callide Dam**

Document No.	Document Name	Document Title	Date
1110067	1110067 34 QCA Justification paper H19 – Callide Dam Cable and Cableways	CVA-CDAM-ELEC-CBLE Replace Cables and Cableways - $862,600	5th September 2011

B.25.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we

have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is CA – Cables and Cableways. SunWater has advised that this is a high level object type that is no longer in use and to which asset lives are not attributed. The asset details are held in SAP WMS at a lower level in the hierarchy and the object types at the lower levels include:

- ELPOLE – Power Pole
- CALVUG – Low Voltage (LV) underground cable.

We note that in SunWater's Whole of Life Maintenance Planning Tool (Master), SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 5 years. We consider the standard run to failure asset life to be towards the low end of what may be expected for underground LV cable. Currently, in Australia, electrical distribution network services providers are allocating undergrounded XLPE (cross linked polyethylene) low voltage cable a run to failure asset life of 60 years. However, as this cable was installed in 1965, the insulation may not be XLPE and hence we consider it would be appropriate to assume a 45 year life. We consider the condition assessment frequency of every 5 years applied to this asset type to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1965.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has production/risk and Stakeholder Relations criteria consequence ratings of Major (score 40). This, together with a probability (likelihood of occurrence) score of 3 results in an overall risk score of 120 which, under SunWater's risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. Under SunWater's asset life adjustment policies, where an asset scores a Low or Medium risk and where the worst business criterion consequence score is greater than 8 (ie a Major consequence or above), SunWater reduces the run to failure asset life to a risk adjusted run to failure life of 88% of the asset type standard run to failure life, in this case 31 years.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment was undertaken in 2005 and SunWater advises that the condition assessment was *"incomplete but noted that the cabling needed to be assessed."*. The condition score allocated in 2005 was a 2 (Minor defects only).

Inputting a condition score of 2, a standard run to failure life of 35 years, a Medium business risk rating (to take account of the consequence score of greater than 8) and in operation date of 1965 into SunWater's condition based replacement life adjustment modelling tool yields a recommended condition based replacement date of 2180. It would be unrealistic to plan a replacement in 2180 and it is concluded that the modelling tool becomes unreliable for low condition scores, which SunWater acknowledges.

However, even if a 45 year operating life is adopted, risk adjusted down to 40 years, the asset should have been replaced by 2005 (by 1996 on a 31 year life). Given the major consequence for in service failure, it would appear to us that replacement of the cable is something that should be addressed promptly.

We note, however, that SunWater has advised that:

"At the time of the 2005 field condition assessment, the assessor, an experienced engineer, estimated that the asset had a remaining life of approximately 10 years".

We assume that this was a visual assessment given that the condition score was applied to cabling (which has assessment criteria of colour/brittleness/cracking/fraying). Given the consequence of failure score, we consider that it would be more appropriate to assess the cables condition on electrical tests such as insulation breakdown testing, earth impedance testing etc.

Given that the asset is beyond its nominal life and that the cable condition assessment was only just within the allowed frequency of every 5 years when the Network Service Plans were developed, it is not clear to us why SunWater has departed from its standard risk policy and planned for replacement in 2017 rather than earlier.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item, however SunWater has advised that:

"An options analysis will need to be carried out before any planned works. This would revolve around the optimum time for replacement of the asset and each of the components.

At this stage of planning there is no obvious alternative to like for like replacement that would reduce costs by more than 30%".

Given that the planned replacement date is 2017 and that there will be at least one further price reset prior to 2017, in 2015, we consider this approach to be reasonable as it is unlikely that an alternative option to cable replacement will be available unless the load can be supplied from an alternative source.

Timing of Renewal/Refurbishment

Given the in operation date of this asset and the risk criterion production/operation consequence rating of Major we would recommend that, if it were possible, an earlier replacement date than the 2017 date planned should be adopted.

Conclusion on Prudency Evaluation

We conclude that it is prudent to plan for replacement of this asset within this annuity period and consider that an earlier date than the 2017 date planned by SunWater would be appropriate and in keeping with good industry practice.

B.25.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+47.35%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 47.35%. Whilst this is at the upper end of the range of multipliers used by SunWater to capture asset item specific costs such as location, project management, engineering we have insufficient information to determine its reasonableness. We note that the Callide dam is approximately 100km west south west of Gladstone and, whilst this is not the most remote of locations of SunWater's assets, this location may go some way to explaining the high Indirect Cost uplift.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%.

We have compared our cost estimate against SunWater's cost estimate in Table 66 below:

- **Table 66 Callide Dam Cable Replacement Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
870,895	793,759	+9.7%

SunWater has developed a planning order for this annuity item replacement which details the following breakdown of costs between contractors, overheads and materials as is shown in Table 67.

- **Table 67 SunWater Breakdown of Costs – Mt Alice Pump Station Pump No 3 Refurbishment**

Cost Item	Planned Costs
Contractors	$812,420
Internal Labour Transfer	$8,240
Internal Overhead Transfer	$50,234
Materials	$0
Service Charges	$0
Total	$870,894

SunWater has advised that Internal Overhead Transfer relates to corporate overhead costs that are allocated to this annuity item replacement activity.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $870,894 to be efficient.

B.25.5 Summary and Conclusions

We consider that it is prudent to plan for replacement of this asset within this annuity period and consider that an earlier date than the 2017 date planned by SunWater would be appropriate and in keeping with good industry practice.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.26 Theodore Weir – Replacement of Weir

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.26.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of the anabranch weir at Theodore Weir in 2034 at the existing replacement cost of $532,181.

SunWater advises that the timber pile weir was constructed in 1929 as part of the original construction of the water distribution system. SunWater also advises that the weir underwent refurbishment in 1993 including steel piling installed to the right abutment and concrete capping of the timber piles.

B.26.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

- **Table 68 Documents Reviewed Specific to Theodore Weir – Weir Replacement**

Document No.	Document Name	Document Title	Date
1110316	1110316 – v1 – 36- QCA Justification H21 Replace Theodore Weir Anabranch 2034	Dawson Valley Water – Theodore Weir Anabranch Replace Conc/Steel Piled Weir (DVA-DAWR-THW-ANAB-WEIR)	6 September 2011

B.26.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on data provided.

SunWater's SAP WMS has listed the asset object type as a steel pile weir, WESP. SunWater advises that the weir is in fact partly a timber piled weir, with WETIMBP object type, and a steel piled weir, object type WESP. The SunWater report, referenced above includes the following statement: *"The 1993 refurbishment deferred the full replacement but was not expected to provide a full standard life for a sheet pilled structure. It was expected that the remaining timber would necessitate a full replacement at some stage."* We consider the steel piling installed in 1993 to form part of the refurbishment since only part of the weir was equipped with the steel piling. Taking the remaining unprotected timber weir portion as the 'weakest link' in respect of weir reliability we believe it more appropriate to classify the weir as a timber piled weir object type. SunWater's SAP WMS indicates that the standard run to failure life for a timber piled weir is 50 years and the standard refurbishment period is 17 years.

We consider the applied run to failure asset life and refurbishment period for this asset to be appropriate for this asset type and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1929.

The existing risk evaluation, as recorded in SAP, determined that the asset's WH&S criterion risk is 'Critical' with a consequence rating (score 100). The consequence rating together with a probability (likelihood of occurrence) score of 1 results in an overall risk score of 100 which places this asset in a 'Medium' risk category. For this asset type (WETIMBP), an overall risk category of "Medium" reduces the run to failure asset life from 50 years to 44 years and the standard refurbishment period from 17 years to 15 years. We consider this reduction in run to failure asset life and refurbishment period based on this risk assessment for asset replacement and refurbishment planning purposes to be appropriate and in keeping with good industry practice.

The reduced run to failure life of the weir implies that it should have been replaced in 1973. If it is assumed assuming that the 1993 refurbishment acted as a full replacement and the object type to be WETIMBP the expected replacement is due in 2037 in accordance with SunWater's policy and procedures.

The condition assessment interval is set at 1 year for this object type (WESP). The latest condition assessment as recorded in WMS for this asset was undertaken in 2010. The maximum score, recorded in SAP WMS, is a 4 (Significant deterioration with substantial refurbishment require to ensure ongoing reliable operation) assigned to foundations. The condition assessment also includes the following note regarding the foundation: "*Need work on protection works.*"

SunWater's Asset Management Planning Methodology Paper states that an asset with a Asset/Business Risk rating of 'Medium' should be replaced or refurbished once the maximum condition score reaches 5 (Major deterioration such that asset is virtually inoperable).

Options Evaluation

SunWater has not provided any options for replacing the weir. The reason stated for not doing so is that the replacement is planned to take place 23 years in the future. The SunWater report, referenced above states that the next comprehensive inspection is scheduled for 2014 and that a detailed assessment of the structure will take place at this time. There may be merit in determining the suitability of investigating the following options as part of the detailed assessment of the structure:

- Completing the steel piling for the full length of the weir and removing the affected concrete sections and replacing with new,
- Completing the steel piling for the full length of the weir and replacing all of the existing concrete capping, could include a new design of concrete capping, and
- Demolish existing weir and replace with new structure, the type of structure to be determined based on cost and site restrictions.

Timing of Renewal/Refurbishment

SunWater has not supplied sufficient information to us as to how they have determined the replacement to be due in 2034. It is speculated that the standard decay curve was used in determining the replacement date making use of the standard run to failure life of the WESP of 75 years and adjusting the curve based on the maximum condition score of 4 attained in 2010. The SunWater report, as referenced above, includes the following statement: "*However current indications are that 2034 may be optimistic.*" This date would change considerably should the decay curve be applied to a standard run to failure life of a WETIMBP of 50 years. From the above it can be concluded that the weir will be due for replacement either by 2034 or earlier, based on the result of the detailed structural assessment. We therefore consider the timing of this replacement to be prudent and would argue that there is merit in considering bringing this timing forward given that part of the weir is still a timber based structure.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for replacement of this annuity asset has been demonstrated.

B.26.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments cost is detailed in the main body of this report.

For major works such as the replacement of a weir, SunWater's planning team applies a unit rate against bill of materials quantities for the asset in question should the replacement be scheduled more than 5 years hence from the planning date. Given the volume of annuity items that SunWater's Planning Team are engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice, where the management of a large portfolio of assets is concerned.

Renewal/Replacement Project Cost Evaluation

We have not sighted as built drawings for the anabranch weir at Theodore Weir nor have we had access to dimensions of the weir. As such, we have been unable to develop a bench mark cost for replacing the weir.

The WMS includes 9 BOM items. The quantities could not be verified. We have made use of rates in Rawlinsons 2011 to calculate a rate for each of the 9 items. The cost estimate that we have prepared compared to that of SunWater is presented in the table below.

- **Table 69 SunWater – SKM Cost Estimate Comparison**

No.	Description	SunWater Cost Estimate ($)	SKM Cost Estimate ($)
1.1	Clearing and Grubbing – Works Area	223	185
1.2	Zone 1 – Supply, place and compact	108,047	103,879
1.3	Rock fill in Trenches	527	404
1.4	Supply sheet piling	76,326	63,972
1.5	Driving sheet piling	76,326	63,972
1.6	Reinforcement Fabric – Supply and Place	2,925,	2,540
1.7	Concrete in Slabs	33,646	50,810
1.8	Backfill Concrete	4,509	2,294
1.9	Concreted Rock fill	42,389	27,410
2	SUB-TOTAL A	344,918	315,196
3	Contractors Preliminary and General		53,583
4	SUB-TOTAL B	344,918	368,779
5	SunWater Indirect Cost (53.99%)	186,222	199,104
6	**Total**	**531,140**	**567,883**

From the above comparison it can be concluded that the SunWater cost estimate is within our Level 4 estimating range of +30%/-20%. We therefore consider the annuity value submitted efficient.

Conclusion on Efficiency Evaluation

The value submitted for this annuity item is efficient, based on the information to our disposal.

B.26.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of replacement of an annuity item have largely been followed. Hence we conclude that the timing and need for replacement of this annuity item is prudent.

The annuity value that SunWater supplied to the Authority is substantiated and deemed efficient, based on the limited information to our disposal.

B.27 Lower Mary Water Supply – Tinana Barrage

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.27.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the placement of a concrete skin over rock protection in 2012 and a projected cost of $56,600. The ground level of the rock bed on the left hand side of Tinana Barrage has been observed to be dropping/ sinking in height. The rock bed has also suffered loss of rock over the years and it is suspected that under-mining has begun in the rock bed. The proposed solution has been developed to rectify the effects from under-mining.

SunWater advises that the asset was initially installed in 1982 as part of the original construction of the distribution system.

The standard object type (asset type) for this infrastructure as protection works is PWKS. SunWater has allocated a standard run to failure asset life of 80 years and a refurbishment period of 27 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.27.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater and provided options analysis:

Table 70 Documentation Reviewed Specific to the Tinana Barrage Refurbishment

Document No.	Document Name	Document Title	Date
1106723	1106723-v1-6__ Tinana_Barrage_Concrete_ Skin_over_rock_protection	Lower Mary Water Supply – Tinana Barrage – Place Concrete Skin over Rock Protection (MVA-TCK-BARR-PWKS)	24th August 2011
1113998	PRODUCTION-#1113998-v1-Options_Analysis_for _Tinan_Barrage_- _Downstream_ Left_Bank_ Rock_Bed	Options Analysis for Tinana Barrage Downstream Left Bank Rock Bed	14th November 2008

B.27.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1982.

SunWater has applied its risk evaluation method to this asset. A desk top risk assessment was undertaken in September 2005. The assessed risk was "*Erosion due to flood may lead to storage undermining and failure*" and the assessed risk was low. The risk was re-reviewed on 29th October 2009. The risk was increased to a 'high' for the environment and stakeholder relations for all categories with the following comment: "*risk is increased due to current condition of protection works / repair before next flood event*".

Risk is determined by two factors; consequence and likelihood of occurrence. Whilst it is expected that the likelihood (or probability) of failure will be influenced by the condition of the asset, it could be argued that the consequences of the failure will remain unchanged. We note that the probability has been increased from 'Rare' (3) to 'Unlikely' (20), as expected; however there are also changes in the consequence scores. Whilst a change to the consequence score is not expected to be changed as a result of the condition assessment, it may have occurred due to an improved interpretation of the risk scenario.

We recommend that the risk assessment is reviewed following the upgrade works, to ensure that it is adequately reflects the probability of failure and does not unnecessarily result in reduced refurbishment periods.

Based on SunWater's processes, application of a risk based asset life of 50 years and a refurbishment period of 17 years is appropriate.

Three condition assessments have been undertaken by SunWater; the first occurred in October 2004, the second in May 2008 and the latest in June 2010. This is within SunWater's condition assessment frequency of every ten years.

These assessments show the condition deteriorating from a score of two in 2004, to a score of four in 2008 (with recorded scores of three and four). The associated comment states that: "*Wire gabions L/H bank upstream and downstream damaged through fire and silt coverage. Rockwork has moved D/S off protection works, about 50m from L/H bank.*" It should be noted that the assessment categories did change over this period.

The condition assessments show the condition improving from an overall score of four in 2008 to an overall score of two in 2010. We note that the overall score is not used in the planning methodology. In addition, we note that the associated comment remains generally identical and a maximum condition score of four remains for the deterioration of the wire/gabion mattresses, which is the key item under consideration in this review. Whilst the improvements in condition are not typically expected, we note that the scoring process contains a certain amount of subjectivity and could reflect the conditions on site during the inspection. We agree that the condition assessment supports works to the existing rock bed on the left hand bank.

SunWater's Asset Refurbishment Planning Guidelines states that high risk assets should not be permitted to deteriorate beyond condition four. This supports the inclusion of the project within 2012.

Options Evaluation

We note that this project is currently within the scoping stage, which is the second tier of SunWater's planning process to determine an investment view. As such we note that preliminary design has not yet been undertaken. This review is based upon the information as available at the time of the review. We recognise that some of our recommendations may be implemented during the future stages of project development.

Four options have been identified within *Options Analysis for Tinana Barrage Downstream Left Bank Rock Bed* (SunWater 2008), as follows:

- Option one consists of adding a concrete skin over the existing rock bed section of protective works.
- Option two consists of filing any voids with concrete and using a crane positioned on the bank of the barrage to place rocks on the downstream rock bed to improve the integrity of the structure.
- Option three consists of filing any voids with concrete and using bobcats to place rocks on the downstream rock bed to improve the integrity of the structure. The bobcats would drive out along the crest of the barrage to put the rocks into place.
- Option four – Do nothing. It is considered that deciding to do nothing regarding the possible under-mining would not be beneficial due to the loss of revenue, customer requirements and public perception of SunWater in the event of a failure of the barrage.

Option 1 is the recommended option. SunWater state that "applying a concrete skin over the existing rock protection will eradicate any further undermining that is expected to recur. The option of filling the voids with concrete does not remove the source of the original erosion – it merely fills the existing voids."

The key driver for the project is to prevent undermining, which is the suspected cause of the ground level dropping. The above solutions are proposed to prevent suspected undermining in the rock bed. In this case, we understand that the undermining process is when the flowing water goes through the voids and lift the rocks and sand. It may be that ground level of the rock bed on the left hand side of Tinana Barrage is dropping or sinking in height as the soil slope is not stable itself. We recommend that the underlying cause of the dropping of the soil slope is investigated prior to adoption of the preferred solutionWe understand from conversations with SunWater that this will be further investigated during the following design stages. We have undertaken a high level review of the four options. Whilst a 'do nothing' option has been identified and considered, the consequences of the failure of the barrage have not been well defined. We would expect further background and justification on the key risks identified of damage to the surrounding environment, loss of revenue and effects on customer relations.

We understand that Option 1, the placement of a concrete skin over the existing rock bed section of protective works, is the preferred solution based on Sunwater's experience. However, we recommend that several issues are investigated prior to the implementation of this option, as follows. Whilst the placement of a concrete skin would stop water getting into the existing rock bed section and lifting the slabs, if the skin cracks due to the on-going settlement of the bank, we believe that it is unlikely to survive for the proposed 40 years as suggested within the *Options Analysis for Tinana Barrage Downstream Left Bank Rock Bed* (SunWater 2008). If the water level drops suddenly after a flood, the concrete skin would prevent the relief of pressure from behind the skin and the skin would fall into the creek possibly with the slope material. In order to avoid this scenario, a drainage system would be required.

Based on conversations with SunWater, we understand that the standard design would be applied, which include no fines foundation drains. In addition, we understand that the concrete skin is designed to crack, and therefore no reinforcing steel is proposed.

Whilst design of a proposed solution is outside of the scope of this review, we recommend that alternative solutions are considered and documented, including filling the voids with graded sand/gravel/bidim and then placing a properly-designed rock screen and / or geotextile suitable for the velocities expected. If rocks cannot resist the hydrodymanic forces, it may be that a properly designed slab, as adopted for spillway/tilling basins, may be required.

Timing of Renewal/Refurbishment

As documented above, the condition score is consistent with the condition of an asset nearing the end of its refurbishment period and, as such, we consider the timing of this refurbishment to be prudent.

We note that in 2014, it is planned to undertake refurbishment - regular maintenance of the concrete skin over the barrage protection works, and that this is to be confirmed with condition assessment in 2012/3. Given that the intended works are due to be installed within 2012, based on SunWater's standard procedures at least a 17 year refurbishment period is expected.

On this basis we conclude that regular maintenance within two years of installation appears excessive and is not prudent. It is recommended that the timing of future refurbishment works is calculated based on the risk of failure of the barrage with the updated assets. Following discussions with SunWater, we understand that this item has been removed from the live SAP system.

Conclusion on Prudency Evaluation

We recognise that there are currently problems with the ground level dropping on the left hand side of Tinana Barrage. The suspected cause of this is undermining, however this does not appear to have been confirmed by investigation. We understand from conversations with SunWater that this will be further investigated during the following design stages. The solutions are proposed to prevent suspected undermining in the rock bed, they may not address any underlying issues associated with slope stability.

Whilst we accept the need for an inclusion of an annuity item to resolve the current problem, we recommend that options are further investigated to ensure they are fit for purpose. We further recommend that the justification for the project is strengthened through further description of the consequences of not completing the works.

B.27.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

We understand that the project costs are based on the *Options Analysis for Tinana Barrage Downstream Left Bank Rock Bed* Report (SunWater 2008). This options report refers to the Kolan Barrage maintenance project within 2006. We have reviewed SunWater's SAP WMS and identified actual cost data for the Kolan Barrage Rockfill Maintenance undertaken in July 2006 for $17,779 (order 5063610). This supports the cost estimates for options two and three. No comparable project costs are provided for the preferred option, the application of a concrete skin.

The following table presents a cost estimate for the installation of the skin rock protection to the downstream left bank of Tinana Weir:

Table 71 Refurbishment Cost

Cost Item	SunWater Projected Cost
Internal Labour Transfer	1,920
Internal Overhead Transfer	4,740
Materials	50,000
Service Charges	0
Total	**56,660**

Renewal/Replacement Project Cost Evaluation

As discussed above, we believe the selected solution may not be adequate to address the problems with slope stability. However, in reviewing the efficiency of the proposed solution, we believe that the proposed costs are low compared to market rates and are therefore efficient.

Conclusion on Efficiency Evaluation

Based on the proposed solution, we consider the costs to be efficient. However, it is recommended that the options for this project are reviewed, including investigating the causes of the ground level dropping on the left hand side of Tinana Barrage, and that costed solutions are developed. These cost estimates should include a consideration of risk based on engineering calculations.

B.27.5 Summary and Conclusions

We recognise that there are currently problems with the ground level dropping on the left hand side of Tinana Barrage. The suspected cause of the ground level sinking is undermining, however this does not appear to have been confirmed by investigation. We understand from conversations with SunWater that this will be further investigated during the following design stages.

SunWater has proposed solutions to prevent the suspected undermining in the rock bed. Whilst we accept the need for an inclusion of an annuity item to resolve the current problem, we believe that further options investigation and design is required to confirm the validity of the proposed solution. Based on SunWater's proposed solution, we consider the costs to be efficient.

We recommend that this project is further investigated to ensure that the developed solution is fit for purpose, including investigating the causes of the ground level sinking, and that costed solutions are developed. We further recommend that the justification for the project is strengthened through further description of the consequences of not completing the works.

B.28 Cania Dam Replacement of Cables and Cableways

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.28.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of cables and cableways at Cania Dam in the Three Moon Creek Water Supply area.

According to SunWater's SAP Works Management System (WMS), the asset has been in operation since 1982 and was installed as part of the original construction works of the dam. SunWater has submitted an annuity item value of $254k for replacement of the existing cable in 2018.

B.28.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's WMS, and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following annuity item specific replacement/refurbishment report produced by SunWater for this review:

- **Table 72 Documentation Reviewed Specific to Replacement of the LV Underground Cable at Cania Dam**

Document No.	Document Name	Document Title	Date
1108611	1108611-QCA Justification H24 – Cania Dam – Replace Cable and Cableways	Three Moon Creek Water Supply – Cania Dam – Replace Cables and Cableways (TMC-CNIA-ELEC-CBLE)	6th August 2011

B.28.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The process by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has largely followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such. Where we have found exceptions to this, and or data entry errors, we have highlighted these below together with other observations on the data provided.

The standard object type (asset type) for this infrastructure is CALVAG – Low Voltage above ground cable. We note that in SunWater's Whole of Life Maintenance Planning Tool (Master), SunWater has allocated a standard run to failure asset life of 35 years and a maximum condition assessment frequency of every 5 years. We consider the standard run to failure asset life to be towards the low end of what may be expected for above ground LV cable. For example, most electrical distribution utilities in Australia would apply an asset life of 45 to 60 years for above ground LV cable depending on whether it is operated in wet (tropical) or dry conditions respectively. We consider the condition assessment frequency of every 5 years applied to this asset type to be reasonable.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1982.

SunWater has applied its risk evaluation method to this asset and determined, during the most recent risk assessment in 2005, that it has a financial risk criterion consequence rating of minor (score 8). This, together with a probability (likelihood of occurrence) score of 10 results in an overall risk score of 80 which, under SunWater's risk assessment method, places this asset in a Low risk category. We have viewed the WMS record for this asset and confirm that it has been allocated a Low risk rating. An overall risk category of Low does not trigger any reduction in the standard run to failure asset life of this type of asset and we confirm this to be the case for this asset.

The next stage of SunWater's method for determining asset replacement/refurbishment timing is by means of adjusting the risk adjusted run to failure asset life according to the variance of the condition score of the asset, at the time the last condition assessment was undertaken, with the condition that the standard asset condition decay curve predicts at that time.

The last condition assessment was undertaken in 2004 and SunWater advises that the condition assessment was *"out of date and has insufficient information to change from the standard life of 35 years."*. We note that more than the standard condition assessment period has elapsed since the last assessment and concur with SunWater's evaluation that there is insufficient condition based information to warrant changing the run to failure life of this asset from the standard run to failure asset life for this class of asset and agree with their decision *"... not to change the replacement year until a new condition assessment is undertaken"*.

We do not agree with the standard run to failure asset life applied by SunWater to this asset class and consider that 45 years would be a more appropriate run to failure asset life. An asset life of 45 years is in line with the asset type life adopted by power network utilities in Queensland for this asset type. We therefore do not consider that the timing for replacement of 2018 is prudent.

However, and taking a pragmatic approach, we consider that it is appropriate to include an annuity item replacement value in this current price setting annuity value as for a 45 year life, the planned replacement date will be 2028, ie within this price reset annuity period.

Options Evaluation

SKM has not sighted any option analysis for replacement of this item, however SunWater has advised that:

"Cania Dam is scheduled to undergo a comprehensive dam safety inspection during 2014 during which time a condition assessment of the cables will occur to refine the scope of works of this project.".

Given that the planned replacement date is 2018 and that there will be at least one further price reset prior to 2018, in 2015, we consider this approach to be reasonable on the assumption that the 2014 condition assessment and scope definition will be taken into account in the annuity value submitted for this asset in the 2015 price reset.

We also recommend that SunWater conducts electrical condition tests on the cable at this time such as earth impedance testing, insulation breakdown testing rather than rely on visual inspections.

Timing of Renewal/Refurbishment

Given the nature of the asset and in absence of a recent condition assessment, it is prudent to plan for replacement within this annuity period. However, we believe that the run to failure asset life adopted by SunWater is not in line with industry practice. If an industry standard 45 year asset life is adopted, then the planned replacement date should be 2028, ie 45 years from the in operation date of 1982. This still places replacement within this price setting annuity period. We recognise though that a new condition assessment may reveal accelerated condition deterioration which may make it appropriate to bring forward the replacement date in due course.

Conclusion on Prudency Evaluation

We conclude that it is prudent to plan for replacement of this asset at or around the date of the end of the run to failure asset life, however we believe that the standard asset life should be 45 years, in line with industry norms, and not 35 years. Nevertheless, with a 45 year life, it is appropriate to plan for replacement within this annuity period. As such the inclusion of this annuity item in the annuity value is prudent.

B.28.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For assets that are planned to be replaced 5 years or more hence of the planning date, SunWater uses a valuation method based on a bill of materials (BOM) for the asset. The BOM has been developed from as built drawings and a 1997 value (determined from a 1997 valuation) attached to each item making up the BOM based on a 1997 valuation. The 1997 value for each line is then escalated by a multiplier determined by Cardno in a 2008 valuation. This multiplier varies according to the component type being escalated. For example, all electrical equipment should be escalated by a 2.13 multiplier. The sum of costs is then adjusted by an indirect multiplier (in this case (1+45.9%) to take account of annuity item replacement specific factors such location, project management costs etc.

This approach (including the indirect uplift multipliers) has been audited by Arthur Anderson in 2000 and found by Arthur Anderson to be robust and appropriate. Given the large portfolio of assets that SunWater is required to determine a replacement value for over a 25 year asset replacement/refurbishment cycle, we agree with Arthur Anderson's conclusions and consider the approach to be appropriate.

Where we have concerns over the quantum of the 1997:2008 escalators, or the Indirect Cost multipliers, we have highlighted them in the analysis of individual annuity item proposed replacement costs.

Renewal/Replacement Project Cost Evaluation

We have reviewed SunWater's calculation for determining a replacement cost and confirm that it has applied the Indirect Cost multiplier contained in the BOM for this asset item in its SAP WMS of 45.9%. Whilst this is at the upper end of the range of multipliers used by SunWater to capture asset item specific costs such as location, project management, engineering we have insufficient information to determine its reasonableness. We note that the Three Moons Creek Water Supply System is approximately 250km west of Bundaberg and, whilst this is not the most remote of locations of SunWater's assets, this location may go some way to explaining the high Indirect Cost uplift.

We have benchmarked the annuity item replacement costs proposed by SunWater as submitted to the Authority against our database costs for a modern equivalent electrical asset. A full description of our method for benchmarking costs for electrical assets, which utilises unit rates and labour rates derived from a number of sources is provided in the body of the main report. We categorise our estimates based on our modern equivalent asset unit rate database as a class 4 estimate, having an accuracy of +30%/-20%.

We have compared our cost estimate against SunWater's cost estimate in Table 73 below:

- **Table 73 Cania Dam Cable Replacement Comparison of SunWater and SKM Cost Estimates**

SunWater Estimate $2010	SKM Estimate $2010	Variance
254,414	216,121	+17.8%

A Planning Order has not yet been developed for this asset, as such, SunWater has not developed a breakdown of direct and overhead costs.

Conclusion on Efficiency Evaluation

The annuity value submitted by SunWater for replacement of this annuity item is within the estimating range of our estimated cost for a modern equivalent replacement asset. As such we consider the SunWater proposed annuity item value of $254,414 to be efficient.

B.28.5 Summary and Conclusions

Whilst we do not agree with the timing of the replacement of this asset due to a lower than industry standard asset life being adopted by SunWater we are satisfied of the need for replacement of this annuity item within this annuity period. As such inclusion of this annuity item in the overall annuity value for this annuity period is prudent.

From our benchmarking of the replacement costs, we are satisfied that the annuity item replacement value submitted by SunWater is efficient.

B.29 Selma Main Channel – Concrete Lining Replacement

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.29.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of the concrete lining of the Selma Main Channel in 2032 at a projected cost of $4,435,424.

SunWater advises that the asset was constructed in 1981 as part of the original construction of the distribution system.

The standard object type (asset type) for this infrastructure, concrete lined irrigation channel, is CHCONCL_ which SunWater has allocated a standard run to failure asset life of 80 years and a refurbishment period of 20 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.29.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

- **Table 74 Documentation reviewed specific to Selma Main Chanel – Concrete Lining Replacement**

Document No.	Document Name	Document Title	Date
1107592	1107592 v1 Selma MC Concrete Lining Replacement 2032	Emerald Irrigation Area – Selma Main Channel – Concrete Lining Replacement	8 August 2011

B.29.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater not fully followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs as such. Where we have found exceptions to SunWater's procedure, and or data entry errors, we have highlighted these below together with other observations on data provided.

We consider the applied run to failure asset life and refurbishment period for this asset to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset and confirmed that the asset has been in service since 1981.

SunWater has applied its risk evaluation method to this asset and determined that it has a financial risk criterion with a moderate consequence rating (score 18). This, together with a probability (likelihood of occurrence) score of 3 results in an overall risk score of 54 which places this asset in a medium risk category. Under SunWater's asset management method, for this asset type, an overall risk category of Medium reduces the run to failure asset life from 80 years to 70 years and the refurbishment period from 20 years to 18 years. There is no commentary on SunWater's SAP WMS as to why a financial risk consequence score of 18 has been applied. However, since this is a major piece of SunWater's infrastructure, it is reasonable to argue that a failure of the asset would have appreciable financial consequences to the company. We therefore consider the risk related run to failure asset life adjustment to be reasonable.

The last condition assessment, as recorded in WMS for this asset, was undertaken in 2000.

The high level score, recorded in SAP WMS, is a 3 (Moderate deterioration with minor refurbishment required to ensure ongoing reliable operation). It is to be noted that the WMS stipulates that a condition assessment for this asset type should be conducted at a maximum of 10 (ten) year intervals. This implies that the asset condition assessment was due in 2010.

SunWater has advised SKM that:

"The condition assessment was in date at the time the NSPs (Network Service Plans) were developed"

Whilst we accept this assertion to be accurate, we note that the maximum allowable period between conditions assessments had all but elapsed at the time of development of the NSPs. This brings into doubt the validity of the 2000 condition assessment in terms of it being representative of the current condition of the asset and hence its usefulness in triggering any adjustment to the standard run to failure asset life.

We also note that the 2000 condition assessment recorded in SAP WMS was a conversion. As such there is no data that underpins and provides a reason for a score of 3 and there is no way of assessing which of the four condition criteria for this asset (concrete surface, foundation earthworks, joints or water loss) triggered the score of 3.

Applying a score of 3 in 2000 reduces the run to failure asset life by 26 years over the risk adjusted standard run to failure asset life. Had the score been a 2 (the next available lowest score), then, under SunWater's systems, the risk adjusted asset life would have been extended by 25 years. This represents a potential 51 years difference in asset life between a score of 2 and 3 for a high level condition assessment conducted 10 years ago. Given the relatively coarse adjustment to asset life that a condition assessment can have, we believe it is important that for significant assets such as the Selma Main Chanel, a condition assessment is undertaken not more than five years prior to a price reset.

Thus, and given that the latest condition assessment was conducted some 10 years ago and was of a "high level" that does not identify the reason for the lower than expected score, we consider that the prudency of this annuity item (replacement) cannot be determined until such time that a further asset condition assessment has been undertaken.

Options Evaluation

SunWater has included a preliminary options evaluation. The preliminary options evaluation investigated two options:

- Replacing like for like, and
- Installing an HDPE Liner

The preferred SunWater replacement option is replacing "like for like" in accordance with SunWater's method for determining replacement costs for annuity asset items which are to be replaced more than five years from the current planning date. The information supplied in the SunWater report specified above highlights the technical and financial challenges of installing an HDPE liner. It is difficult to establish the impact of each of the challenges at the preliminary options stage. We therefore consider the options investigated reasonable and in keeping with good industry practice, given the timing of the replacement (2032). However, we note that, on a discounted cashflow analysis basis, the HDPE liner option is cheaper than the like for like option of using concrete. As such, and as is discussed below, we believe that annuity item value for this asset replacement should adopt the cost of a modern equivalent option of use of an HDPE, rather than concrete, unless and until it is demonstrated that HDPE is not a viable option.

Timing of Renewal/Refurbishment

Applying SunWater's risk and condition based method for determining run to failure asset life and hence projecting asset replacement timing, a risk score of Medium, reduces the run to failure asset life of this type of asset from 80 to 70 years. Assuming that the asset condition decay was in accordance with the standard condition decay curve, this would put the replacement date at 2051.

SunWater assessed the condition of the asset in 2000 as rating a condition score of 3. This indicated that the asset had deteriorated more rapidly than the standard asset condition decay curve would predict to that point. Realigning the risk adjusted asset decay curve to pass through this premature condition rating of 3 results in a projected run to failure life (under SunWater's method) of 2025. Had the condition score been a 2 in 2000, then the asset life would have been extended out to 2076, a difference in run to failure life of some 51 years, which would extend the risk adjusted run to failure asset life significantly beyond this current annuity period.

However, the SunWater WMS indicates that the replacement date is to be brought forward to 2032 (not 2025 as their SunWater's method would dictate). It is not clear why SunWater has adopted a replacement date of 2032 given that this is not consistent with SunWater's processes. Given that the annuity item value is discounted to present value terms to develop the total annuity value, this seven year difference in timing is not considered to be material given that both dates fall within this annuity value assessment period. Nevertheless, the impact of the shift of the asset condition decay curve, based on the 2000 condition assessment is that the asset needs replacement after only 44 years instead of the expected 70 years, a reduction of 26 years on the risk reduced standard run to failure asset life.

Given that the condition rating is based on a high level assessment that was conducted at least 10 years ago, the condition rating, and particular its use in bringing forward the replacement date for the asset is questioned by SKM. We therefore do not consider the timing of this replacement to be justified and hence consider it not to be prudent.

Conclusion on Prudency Evaluation

We consider that SunWater's policies for adjusting replacement periods and assessing asset condition have not been followed. We also consider that reliance on a high level, ten year old condition assessment for determining asset replacement date, whilst strictly speaking allowable under SunWater's procedures, is not in keeping with good industry practice for a major asset of this type. We note that the elapsed time from the last condition assessment is just within the maximum allowable time interval between assessments. We therefore conclude that the need for replacement of this annuity asset has not been demonstrated. As such the inclusion of this annuity item in the annuity value is not prudent.

B.29.4 Efficiency Evaluation

The process used by SunWater to establish future annuity item replacements/refurbishments costs is detailed in the main body of this report.

For major works such as the replacement of the main channel concrete lining, SunWater's planning team applies a unit rate against bill of materials quantities for the asset in question. Given the volume of annuity items that SunWater's Planning Team are engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice.

Renewal/Replacement Project Cost Evaluation

We have not sighted as built drawings for the main channel nor have we had access to dimensions of the channel. As such, we have been unable to develop a bench mark cost for replacing the main channel lining.

The preliminary options investigation includes a cost estimate for two options, like for like replacement and HDPE liner (modern equivalent replacement). We have compared the cost of both options on both a Total Cost basis (ie summed present and future costs) and on a Present Value (PV) cost basis (where future costs are discounted to current day costs recognising the time dependent value of money). We have applied a real discount rate of 8.54% in accordance with the Authority's guidelines. The PV and Total Cost for both options were calculated for two cases: Case 1 made use of a standard 80 year asset life period and Case 2 made use of 44 year life basis. The reason for investigating a 44 year period is that in replacing like for like it is reasonable to expect the same life span as for the original on the assumption that the accelerated decline in asset condition would not be rectified by a replacement of the lining eg it is related to fundamental issues such as ground movement. The summary of the values is given in the table below.

- **Table 75 Comparison of PV and Total (absolute) Costs for 'Like for Like' and HDPE Options**

	44 Years		80 Years	
Option	**PV (2010$)**	**Total Cost (2010$)**	**PV (2010$)**	**Total Cost (2010$)**
Like for Like (Concrete Lining)	4,476,631	4,587,424	4,477,768	4,717,424
HDPE Liner	2,595,842	5,121,314	2,613,571	7,161,803
% Difference	-42%	+12%	-42%	+52%

The present value (PV) sums are in 2010 dollar terms and represent lifecycle costs (which include both capital and operating expenditure) from the replacement date of 2032 to the end of life of a replacement concrete channel discounted back to 2032 using a real discount rate of 8.54%.

The HDPE Liner option is estimated to cost some $2m to install in 2032 (2010 $ terms), thereafter, it needs to be replaced every 20 years at a cost of approximately $890k. Hence it the HDPE needs to be replaced three times during an 80 year life (ignoring the replacement at the end of 80 years) and twice during a 44 year life assumption.

Whilst on an absolute cost basis, the like for like replacement represents a cheaper option, when the time dependent value of money is taken into account, and future costs depreciated to present day costs, the HDPE option becomes preferable, being some 42% cheaper, on both a 44 year and 80 year life assessment, than a like for like replacement of concrete.

As such we consider the costs submitted to the Authority for this annuity item not to be efficient. .

Conclusion on Efficiency Evaluation

On the basis of the above analysis, the HDPE option is considered to be the most efficient replacement option.

B.29.5 Summary and Conclusions

We are not satisfied that SunWater's robust procedures for determining the timing of refurbishment of an annuity item have been followed and hence that the timing and need for replacement of this annuity item is not prudent. In particular, the timing of the replacement is driven by a high level condition assessment conducted 10 years ago. This has a significant impact, under SunWater's systems on timing of asset replacement. We recommend that an additional condition assessment is undertaken to determine whether it is appropriate to include the cost of this asset replacement in this current annuity value determination. In absence of this we consider that, given the uncertainty, a replacement value should not be included in this current annuity valuation.

We recognised that, in line with SunWater's Asset Refurbishment Planning Guideline a detailed options investigation will not be conducted until between 1 and 5 years prior to the replacement work being undertaken. Hence at this stage of the timing of asset replacement, SunWater adopts an automatic 'like for like' replacement assumptions and determines the value of that annuity item replacement by escalating as installed costs. However, given that the replacement value for this annuity item is significant (in excess of $4m) we consider that it is appropriate to undertake a high level option analysis. From this analysis, we consider that the cost of a like for like replacement not to be efficient.

B.30 South Walsh Main Channel – Concrete Replacement

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement Items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

B.30.1 Introduction

The annuity item for which an annuity value has been submitted to the Queensland Competition Authority (Authority) is for the replacement of a concrete flume in 2026 and a projected cost of $1.957 million.

SunWater advises that the asset was initially installed in 1956 as part of the original distribution system.

The standard object type (asset type) for this infrastructure is Concrete Works is CTWK which SunWater has allocated a standard run to failure asset life of 80 years and a refurbishment period of 40 years. SKM considers both the run to failure asset life and refurbishment period to be appropriate for this asset type.

B.30.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In particular, we have drawn on the following Annuity Item specific replacement/refurbishment report produced by SunWater:

Document No.	Document Name	Document Title	Date
1107443	1107743 QCA Justification – South Walsh Main Channel – Concrete Replacement	Mareeba Irrigation Area – South Walsh Main Channel – Concrete Replacement.	8th August 2011

B.30.3 Prudency Review

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

In our review of the data in SAP and the information contained in the SunWater report specified above, we consider that SunWater has followed the policies and procedures that it has in place to determine annuity item replacement/refurbishment dates and costs for such.

We consider the applied run to failure asset life and refurbishment period for this asset to be reasonable and in keeping with good industry practice.

We have viewed the WMS record for this asset confirmed that the asset has been in service since 1956.

SunWater applied its risk evaluation method to this asset and determined that it has a Moderate (Score 54) rating for both Productions/Operations and Stakeholder Relationship. This together with a probability (likelihood of occurrence) score of 1 results in an overall score of 54 which places this asset in a medium risk category. For this asset type, an overall risk category of medium reduces the run to failure asset life from 80 years to 70 years and the refurbishment period from 40 years to 35 years. We consider this reduction in run to failure asset life and refurbishment period based on this risk assessment for asset replacement/refurbishment planning purposes to be appropriate and in keeping with good industry practice.

The condition assessment, as recorded in WMS for this asset, undertaken in 2002 scored a maximum “high level” condition rating of 3 (Moderate deterioration with minor refurbishment required to ensure ongoing reliable operation). This condition rating predates SunWater’s current detailed condition assessment method. This condition rating is not in line with the expected decay curve and indicates, under SunWater’s asset management methods that the expected replacement date should be moved out to 2063. That is the condition assessment revealed the asset to be in better condition than the standard asset condition decay curve would predict at that time.

In 2008 a further condition assessment was conducted, making use of SunWater’s current and more detailed asset condition assessment methods. The maximum condition rating scored was a 4 (Significant deterioration with minor refurbishment required to ensure ongoing reliable operation) for Foundation Earthworks. This condition rating is in line with the standard asset condition decay curve and indicates that the expected replacement date is 2029.

The more recent condition assessment has been used to determine the annuity replacement date. This reliance on the most recent condition assessment report is in accordance with SunWater’s asset management method and is considered to be in keeping with good industry practice. However, this case illustrates how sensitive the replacement/refurbishment date is to the timing and outcome of a condition assessment. There is therefore merit in SunWater considering the age of the most current condition assessment and scheduling a new condition assessment before the run to failure asset age is adjusted where the latest condition assessment was conducted outside the maximum condition assessment frequency for that asset. There may also be merit in requiring a further condition assessment at half the recommended period to confirm an earlier indication of a more rapid asset deterioration than expected before the run to failure asset life is reduced for that long term asset, particularly for high value assets.

On the assumption that SunWater's procedures for condition assessment have been followed, based on this condition assessment score, we consider that the timing for replacement of this annuity item is prudent.

Options Evaluation

The report as referred above stipulates that two options were investigated as part of the preliminary options investigation. The two options investigated are as follow:

- Replace like for like (Concrete lining)
- Replace with HDPE Lining.

The preferred SunWater replacement option is replacing "like for like. We consider the options investigated reasonable and the level of analysis conducted at this stage of the asset life (some 15 years before the projected replacement date) appropriate and in keeping with good industry practice.

Timing of Renewal/Refurbishment

Based on the 2008 condition assessment, the as expected performance of the main channel, in relation to the asset condition decay curve, and in accordance to SunWater's policies the replacement of the concrete main channel is due at the date projected (2026). We therefore consider the timing of this replacement to be prudent.

Conclusion on Prudency Evaluation

On the understanding that SunWater's policies for adjusting refurbishment periods and assessing asset condition have been followed, we conclude that the need for refurbishment of this annuity asset has been demonstrated. As such the inclusion of this annuity item in the annuity value is prudent.

B.30.4 Efficiency Evaluation

The processes used by SunWater to establish future annuity item replacement/refurbishment costs are detailed in the main body of this report.

For asset works where the planned replacement date is more than five years hence from the planning date, SunWater's planning team applies a unit rate against bill of materials quantities for the asset in question. Given the volume of annuity items that SunWater's Planning Team are engaged with at any point in time, this approach is considered reasonable and in accordance with good industry practice.

Renewal/Replacement Project Cost Evaluation

We have not sighted as built drawings for the main channel nor have we had access to dimensions of the main channel. As such, we have been unable to develop a bench mark cost for replacing the concrete main channel from first principles.

We have, however, checked the unit rate for the various items as listed in the WMS. The unit cost of a single layer of reinforced concrete is calculated at $2,346.57/m³, based on the 1997 unit rate multiplied by the 2008 Cardno adaption rate and multiplied by the indirect cost factor that SunWater applies to this asset. SKM has also conducted a "bottom up" calculation based on the 2011 Rawlinson's figures. The figure was based on 12% for preliminary and general items, a 15% contingency and assuming a 2 m x 2 m channel with 200 mm thick walls and floor. The calculated rate is $2,134.44; this is only 9% less than the figure that the WMS makes use of. It is therefore deemed that the unit rate used is efficient.

The preliminary options investigation includes a cost estimate, Present Value (PV) and Total Cost for both options. SKM made use of a discount rate[16], equivalent real rate, of 8.54% to calculate the PV and Total Cost for both options as summarised in the table below. SKM made use of the same costs and maintenance periods as applied by SunWater given that the costs and maintenance periods are deemed to be reasonable and in line with industry standards. The summary of this life cycle costing evaluation is given in the table below. Note that the Actual Total Cost figures takes into consideration maintenance and refurbishment during the lifetime of the asset to allow a lifecycle PV cost analysis to be undertaken. The 20 year life replacement cost for the HDPE lining is taken into account to provide an 80 year operating life comparison. As such it is not possible to directly compare the Actual Total Cost with the annuity item value submitted by SunWater as the annuity item value ($1,957m) only captures capital costs for the concrete channel replacement (not on-going maintenance costs).

- **Table 76 Comparison of Costs for Like for Like and Modern Equivalent Replacement Options**

Option	PV ($)	Actual Total Cost ($)
Like for Like (Concrete Lining)	1,841,758	2,236,700
HDPE Liner	1,468,001	3,078,342
% Difference	-20%	+38%

From the above table it can be seen that there's a 20% difference between the present values of the two options with HDPE liner being 20% less on PV cost terms than a like for like concrete replacement. Since the timing of the project is more than 5 years ahead a detailed options investigation has not yet occurred. The difference in the PV is not significant to trigger the 30% materiality criteria suggested by the Authority. Equally, at 20%, the preferred cost option is just within the materiality criteria that SKM normally applies when undertaking regulatory capital expenditure forecast reviews of this type. As such we consider it is prudent to make use of the

[16] As per the QCA review of irrigation prices – Renewals annuity Background Paper, January 2010.

concrete lining option for costing purposes until a more detailed options investigation has been completed.

In the above analysis we have not taken into account the increased numbers of supply interruptions that would ensue with an HDPE liner given that an HDPE liner requires to be replaced every 20 years as compared to every 80 years for a concrete liner.

Conclusion on Efficiency Evaluation

Given that the value submitted for this annuity item is within 20% on PV terms of a modern equivalent alternative option and that the unit rate used for the preferred option is representative of current day costs, we consider the annuity value submission for this annuity item to be efficient.

B.30.5 Summary and Conclusions

We are satisfied that SunWater's robust procedures for determining the timing of replacement of an annuity item have been followed and hence that the timing and need for replacement of this annuity item is prudent.

We also consider the cost of the replacement to be efficient.

Appendix C Past Renewal Projects

This appendix contains the sub-reports on the past projects reviewed.

C.1 Fairbairn Dam – Upgrade of Outlet Capacity

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

C.1.1 Introduction

This project concerns the upgrade of the Fairbairn Dam outlet capacity by installing a siphon within the Selma Pump Station on the true left bank. The upgrade was necessitated by a mandate made when the Department of Natural Resources and Mines (NRM) published the Fitzroy Basin Resource Operations Plan (ROP) requiring an increase of the outlet capacity from 600 Ml/d to between 1,500 Ml/d and 1,600 Ml/d at EL 199.0m within 3 years. Clarification on the requirement was sought by SunWater from NRM who indicated that the flow rate required was to pass the first post winter flow. This response indicated that this flow rate was additional to the peak customer demand requirements.

This review concerns a review of costs incurred between 2007 and 2011, specifically it comments on the prudency and efficiency of the costs associated with the upgrade of the outlet components of the dam.

C.1.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In addition, the following information was available for this review:

19) 1110591 v1B –FBD-RBO – Fairbairn Dam Right Bank Outlet Upgrade – Justification. Titled: Fairbairn Right Bank Outlet (RBO) upgrade – river release capacity - $2m over a number of years from 2007 onwards,
20) Excel Spreadsheet documenting the cash flow/expenditure from August 2006 to March 2011,
21) List of Materials Procured and External Labour Expenses for the Project,
22) SunWater River Release Diversion Siphon at Fairbairn Dam, Meeting of Directors – November 2007,
23) SunWater, HSE Risk Management Form, dated 24 July 2006,
24) SunWater, Safe Design Review, not dated or signed,
25) SunWater, Engineering Services, Registration Form – Internal,
26) Fairbairn Dam Upgrade, River Releases, Selma Submersible Pump Station – Proposal, August 2006,

27) Fairbairn Dam Outlet Upgrade, letter from Department of Natural Resources and Water, dated 10 November 2006,
28) Internal correspondence, E-mail dated 2 October 2006 in regard to the Selma Pump Station – Upgrade for ROP requirements,
29) SunWater Project Brief – Nogoa MacKenzie Water Supply Scheme 2006/07, dated 21 November 2006,
30) SunWater Projects Details Sheet – Fairbairn Dam Right Bank Outlet – Upgrade River Release Capacity, dated 24 July 2006,
31) SunWater Memorandum, Submersible Pump/s, Fairbairn Dam to Meet ROP Requirement for Post Winter Flow, dated 18 July 2006,
32) River Releases from Fairbairn Dam Report – COMMERCIAL IN CONFIDENCE, dated June 2006,
33) Briefing Note for Information, Upgrade of Fairbairn Dam Outlet to Meet First Flush ROP Requirements, dated 3 April 2006,
34) SunWater Project Brief - Nogoa MacKenzie Water Supply Scheme 2006/07, dated 22 March 2006,
35) SunWater Progress Report 2, Fairbairn Dam, Right Bank Outlet Upgrade, COMMERCIAL IN CONFIDENCE, dated December 2005,
36) Fitzroy ROP - Fairbairn Dam Outlet Capacity, letter from Natural Resources and Water, received 27 September 2005,
37) Fitzroy ROP - Fairbairn Dam Outlet Capacity, letter to Department Natural Resources and Water, dated 7 September 2005,
38) SunWater Progress Report, Fairbairn Dam, Right Bank Outlet Upgrade, COMMERCIAL IN CONFIDENCE, dated August 2005,
39) Minutes of Fairbairn Dam Outlet Upgrade Workshop, dated July 2005,
40) Fitzroy ROP - Fairbairn Dam River Outlet resizing, letter to Department Natural Resources and Water, dated 5 May 2005,
41) SunWater, Fairbairn Dam, Outlet Upgrade Option Report, dated November 2004,
42) Fairbairn Dam Outlet Upgrade, Meeting of Directors – December 2004,
43) Fitzroy ROP - Fairbairn Dam River Outlet Resizing, letter from Natural Resources and Water, dated 1 November 2004,
44) Fitzroy Basin, Resource Operation Plan, Chapter 3 – Assessment,
45) Fairbairn Dam, Feasibility Study Into Upgrading, River Outlet Capacity, dated May 2003,
46) Brief for Engineering Services, Increase of River Discharge Capability at Fairbairn Dam, Feasibility and Cost estimate, dated 16 January 2003,

47) Internal correspondence, E-mail dated 1 August 2002 in regard to the Right Bank Tower discharges into River and Weemah Channel,
48) Fitzroy Basin, Preliminary Cost Estimation Study for Compliance to Current Draft WAMP Objectives, dated March 1999,
49) Determination of Future River Release Requirements from Fairbairn Dam, An Addition to 'Preliminary Design report on Augmentation of Fairbairn Dam River Outlet, March 1998', dated July 1998.

C.1.3 Prudency Review

Project History

In our review of the documents listed above we have compiled the following timeline showing major decisions and findings.

- The Department of Natural Resources developed a Water Allocation Management Plan (WAMP) for the Fitzroy Basin during the 1990's. The WAMP contemplated a significant increase in the outlet capacity/release from the Fairbairn Dam to improve environmental outcomes.
- In 2003 SunWater undertook a feasibility study to increase the river outlet capacity at Fairbairn Dam. The preliminary capital cost estimates for the options investigated ranged between \$2.6 million and \$6.6 million. SunWater indicated that they would be seeking Government Funding for the upgrade.
- In January 2004 the Department of Natural Resources and Mines (NRM) published the Fitzroy Basin Resource Operation Plan (ROP). The ROP mandated the following: "*The discharge capacity of the outlet of Fairbairn Dam will be increased from its current (approximately) 600 ML/day limit to up to about 1,500 ML/day to achieve the first post winter flow objectives at Bedford and Bingegang Weirs*." The ROP further imposes a time limit of three years in which SunWater has to achieve this increase of flow rate.
- During 2004 and 2005 SunWater undertook a series of option studies to determine the most cost effective solution. The option studies centred on upgrading the right bank outlet works (RBO) The preferred option of installing an additional outlet pipe and valve passing through the diversion tunnel on the true right bank was tested with a call of tenders.
- In August 2005 a recommendation within a progress report is made to establish the magnitude of the losses in the Bull-Ring riser and orifice plate before any further design is undertaken.
- In September 2005 a cost blowout to \$4 million is indicated by the tendering exercise. SunWater's estimate was \$2.4 million.
- In December 2005 testing is complete that determines that the RBO is inlet controlled and the extent of the vibration of the Bull-Ring is determined. The recommendation is made that the Bull-Ring is to be modified and that an alternative arrangement be sought to deliver the

environmental releases. Significant modification to the Inlet Tower would be required to ensure that the flow rate could be reached.

- In April 2006 a new strategy is outlined in a briefing note to the CEO. The first step of this strategy was to undertake a probabilistic analysis of flows to determine the gap between the current situation and the compliance requirements.
- In July 2006 a new project was initiated to undertake an options investigation to make use of the Selma Pump Station, situated on the true left bank, to augment the release from the RBO.
- In September 2006 a site investigation records three viable options for further investigation as to how the Selma Pump Station can be modified to augment the releases from the RBO. One of these includes the constructed option of installing a siphon.

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

From the previous section the project came about to ensure that SunWater complies with a mandate made within the Fitzroy Basin ROP. The mandate gave a three year period for SunWater to comply. The date that the mandate was printed is January 2004. This implied that SunWater had until December 2006 to comply. In this regard SunWater did not comply. The documentation provided by SunWater does make reference that NRM was informed of the issues and time constraints that SunWater was facing and that an extension of time was applied for.

Options Evaluation

This review specifically focuses on the costs incurred between 2007 and 2011 associated with the upgrade of the Selma Pump Station to augment the environmental release from the RBO.

The system capacity curve of the right bank outlet (RBO) prepared by the designers determined that the RBO can deliver a maximum of 1,470 Ml/d at EL 199.0m. The peak customer demand for Weemah is 300 Ml/d. Therefore a minimum of 1,170 Ml/d can be released from the RBO to pass the first post winter flow. The documentation available to SKM shows a difference in the flow rate that had to be achieved to augment the flow of the RBO. The SunWater, River Releases from Fairbairn Dam Report, dated June 2006, states: *"The maximum shortfall in the required capacity of the outlet is 343 ML/day if the Weemah irrigators and the environmental flows are made simultaneously."* The SunWater Projects Details Sheet containing the Project Brief, dated 24 July 2006, states: "*Preliminary design for a 250 ML/d capacity pumping facility*...." The following statement is included within a Memorandum prepared by SunWater in relation to the Submersible Pump/s, Fairbairn Dam to Meet ROP Requirements for Post Winter Flow, dated 18 July 2006: "*Current maximum capacity of the Right Bank Tower, Tunnel and River Outlet is approximately 1585 megalitres per day. This is with Fairbairn Dam above EL 199.50 and utilising two siphon breakers, the river outlet gate and the 100 megalitres per day valve at the base of the diversion* *tunnel.*" SKM is not privy to the design information and therefore cannot comment on the validity of the last statement. There may be merit in investigating the nature of the three statements and confirm that the post winter flow release imposed by the ROP can be achieved.

As discussed in the Project History Section above the project has had various options investigated. The original options revolved upgrading the RBO by installing an additional pipe through the diversion tunnel; these options were discarded due to the inlet tower being the control and therefore limiting the flow. It was determined that extensive work would be required to increase the flow rate of the inlet tower.

The second set of options concern adapting the Selma Pump Station to augment flow in order to achieve the environmental releases required. It is worth noting that the three options provided additional options for further investigation from the site visit conducted in September 2006, they were as follow:

- Option 1 – 250 Ml/day siphon to river,
- Option 2 – 250 Ml/d to the spillway via an existing pump set, and
- Option 3 – 250 Ml/d to the channel via a new pump station.

The first option has been constructed due to its simplicity and cost effectiveness. In assuming that the as constructed system does deliver the flow at the set level we consider the option constructed to be the most cost effective. We do not consider there to be an alternative that would be cheaper to construct and maintain.

The last phase of ensuring the full flow rate can be realized, per the documents provided by SunWater, by the upgrade work planned for the RBO Bull-Ring. This component does not form part of this reports' scope and is addressed separately within a separate sub-report contained in Appendix B.

Timing of Renewal/Refurbishment

This project was initiated to fulfil a mandate by NRM that stated that SunWater had 3 years to comply. The three year period had lapsed and SunWater had applied for extension of time. The installation of the siphon at Selma Pump Station is only the first phase of complying with this mandate. The second phase is the upgrading of the RBO Bullring structure, this is scheduled for 2012. We therefore consider the timing of the installation of a siphon at the Selma Pump Station to have taken place in a timely manner.

Conclusion on Prudency Evaluation

On the basis that a regulatory mandate has been placed on SunWater and that this installation is key to fulfilling this mandate, we conclude that it was prudent to undertake this project.

C.1.4 Efficiency Evaluation

Renewal/Replacement Project Cost Evaluation

The first design was tested in the market and enables a rethink of the optimum solution to ensure compliance. Procurement of the constructed siphon option followed a process by which SunWater acted as the Principal Contractor making use of sub-contractors and specialists to undertake the various components. SunWater documents the reasons for choosing this method as follows:

- The relative small scale of the construction works,
- The risk of interruption to works due to flow conditions,
- The complex nature of the works, and
- The internal engineering knowledge held within SunWater.

SunWater further states that they made use of procurement processes that conform to the State Purchasing Policy. The total amount spent to date for labour and materials is $688,875.42.

In determining the efficiency of the cost spent to date we have compared the total spent to date by SunWater with what would be expected should SunWater not have decided to act as the Principal Contractor and rather made use of the method of appointing a Principal Contractor. The table below summarizes what we would expect the costing for project implementation by appointing a Principal Contractor to be compared to the method implemented by SunWater.

- **Table 77 Traditional Procurement vs Cost Expended**

No.	Description	Traditional Expected Cost ($)	SunWater Actual Cost to date ($)
1	Construction Cost		
1.1	Materials and Labour	688,875	688,875
1.3	Contractors Profit (10% of Materials and Labour)	68,888	
1.4	Contractors Overheads (10% of Materials and Labour)	68,888	
1.5	Contractors Preliminary Items (10%)	68,888	
1.6	SunWater Management of Sub-Contractors Cost (Including setting up an environmental management plan, traffic management plan and safety plan and implementation thereof)		509,692
2	Sub-Total A	895,539	1,198,564
3.1	SunWater Design Cost		148,320
3.2	SunWater Project Management Cost and Internal Labour Components		135,514
3.3	SunWater Indirect Cost (45% of Sub-Total A)	402,993	
	Risk (10% of Materials and Labour)	68,888	
4	**Total**	**1,367,420**	**1,482,398**

From the above table it can be seen that the method that SunWater implemented resulted in an 8.4% increase compared to a Principal Contractor procurement method. We also note that there is some uncertainty in regard to whether the normal project completion cost (cost associated with commissioning, rectifying defects during the defect liability period, continuing work through the defects liability period, etc) is included in the actual cost to date.

The overall cost of the works is within range of what we would expect the price to be should the traditional method of procuring a Principal Contractor have been followed, and we therefore consider SunWater's incurred cost's to be efficient.

Conclusion on Efficiency Evaluation

We conclude that the overall costs are within range of our cost estimate and we therefore consider that the overall cost is efficient.

C.1.5 Summary and Conclusions

We consider that the installation of a siphon at Selma Pump Station was prudent.

We consider the overall cost of the installation of a siphon at Selma Pump Station to be efficient, based on the information to our disposal.

C.2 Intersafe Safety Modernisation Programme

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

C.2.1 Introduction

This project review concerns a past annuity item, the supply and installation of staff and public protective infrastructure in the form of handrails, walkways, steps, ladders, safety screens pit covers, control gates and associated metal work. The work was undertaken as an implementation of a risk assessment and modernisation program.

The works consist of several projects across SunWater's distribution infrastructure in each of SunWater's regions in order to remove extreme and high risk hazards in accordance with SunWater's workplace health and safety standards.

In 2005 SunWater engaged consultants, the Intersafe Group Pty Ltd (Intersafe) to undertake a pilot study in Mareeba to review distribution infrastructure to identify work place health and safety (WH&S) risks. Intersafe identified 43 potentially damaging tasks with 27 considered high risk. In 2007 SunWater's Mareebe region identified an $800,000 8 year program to rectify all high risk assets. The SunWater Board decided to compress the program to 3 years owing to the nature of the risks.

In 2007 Intersafe was again engaged to identify WH&S risks in SunWater's other regions.

Following this SunWater management instructed the Regions to include in the 2008/09 budget and financial model a preliminary estimate of asset modifications necessary to remove extreme and high risk hazards.

This report reviews the processes employed by SunWater in procuring services to address the identified WH&S risks.

C.2.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In addition, the following SunWater documentation was available for this review:

Table 78 Documents Reviewed on the Intersafe Past Annuity Project

Document No.	Document File Name	Document Title	Date
829817	GHD Peer Review of Kick off Meeting.pdf	Peer Review of WHS Hazard Reduction Project Schedule Kick-off Meeting	1st July 2009
831000	09SW3615 Final Tender Report.doc	Tender Assessment and Recommendation for Contract No. 9SW3615 Supply and Installation of Channel Control Gates For Intersafe Risk Assessment and Modernisation Program	Not dated
846974	GHD review of tender process.pdf	Peer Review of WHS Hazard Reduction Project Review of Tender Evaluation Process for Gate Contract	31 July 2009
8793698	GHD Peer Review Report.pdf	Peer Review of WHS Hazard Reduction Project Schedule Close-off Report	24 November 2009
883278	09SW3678 Final Tender Report.doc	Tender Assessment and Recommendation for Contract No. 09SWS3678 Supply and Installation of Handrails, Walkway Modification and Associated Items for Intersafe Risk Assessment and Modernisation Program - Mackay	Not dated
883285	09SW389 Final Tender Report.doc	Tender Assessment and Recommendation for Contract No. 10SWS3689 Supply and Installation of Handrails, Walkways, Steps, Ladders, Safety Screens and Associated Items for Intersafe Risk Assessment and Modernisation Program - Bundaberg	Not Dated
883933	09SW3621 Draft Tender Report.doc	Tender Assessment and Recommendation for Contract No. 09SWS3621 Supply and Installation of Walkways, Handrails Steps, Screens and Pit Covers for Channel Structures for Intersafe Risk Assessment and Modernisation Program	Not Dated
912747	Tender report - signed.pdf	Tender Assessment and Recommendation for Contract No. 09SWS3621 Supply and Installation of Walkways, Handrails Steps, Screens and Pit Covers for Channel Structures for Intersafe Risk Assessment and Modernisation Program	Not Dated

Document No.	Document File Name	Document Title	Date
916831	Signed Tender Report.pdf	Tender Assessment and Recommendation for Contract No. 09SWS3678 Supply and Installation of Handrails, Walkway Modifications and Associated Items for Intersafe Risk Assessment and Modernisation Program	Not Dated

C.2.3 Prudency Review

As described in the introduction, the works carried out under the 'Intersafe' project related to works deemed necessary to address high and extreme WH&S risks associated with SunWater's distribution system.

The works included modifications and installation of handrails, walkways, steps, ladders, safety screens pit covers, control gates and associated metal work.

In addition to commissioning a specialist consultant to review SunWater's distribution infrastructure with a view to identifying WH&S risks, SunWater's Asset Management group developed an internal procedure for identifying, ranking and developing solutions to infrastructure related WH&S risks. The major tasks in the program were:

- Develop a standardized risk assessment template
- Train Regional staff in risk assessments
- Engage regional staff to undertake risk assessments
- Engage regional staff to select solutions to reduce high and extreme risk hazards
- Upload risk assessments and maintenance items into WMS Planning
- Establish procurement contracts for standardised solutions.

Options Evaluation

Whilst we have not had the opportunity to review in depth each program of works and the solutions developed to address identified WH&S risks, we have reviewed the procedures established by SunWater to develop, where possible, standard solutions to different risks types.

We consider that these systems are robust and hence will have lead to the development and implementation of efficient solutions, in that, by developing standard infrastructure, implementation costs will have been reduced through economies of scale.

Timing of Renewal/Refurbishment

SunWater's Board initiated a program of work to take place over three years to address WH&S risks associated with SunWater's distribution infrastructure.

Given that the risks have been identified through a two part process: appointment of specialist consultants and through a formal internal mechanism as described above, we consider the timing of the works to be prudent.

Conclusion on Prudency Evaluation

We conclude that the works were required to address WH&S risk issues that have been identified through a robust process in keeping with good industry practice.

We consider that the development of standard solutions is also in keeping with good practice and is efficient.

Given the nature of the works, to address identified WH&S issues, we consider it appropriate for SunWater to develop a program of works to implement the identified solutions as swiftly as reasonably possible.

Therefore we consider both the works and the timing of the works to be prudent.

C.2.4 Efficiency Evaluation

Renewal/Replacement Project Cost Evaluation

We have not had the opportunity to undertake a detailed review of program implementation costs for the Intersafe project and as such are not in a position to benchmark the costs incurred by developing comparative budget costs. Also, and given the unique nature of the program, we do not have access to similar programs, conducted by other utilities that would allow direct comparison of costs incurred with a comparable project.

In absence of benchmarking information, we have reviewed the procurement process undertaken by SunWater in implementing the program of works. The procurement process adopted for most of the works was via an open tender process, although in one region, three selected tenderers were invited to bid against a detailed scope of works. SunWater evaluated tender returns received against a number of criteria including cost. The procurement process adopted for the different regions is summarised briefly below:

Bundaberg Region:

The work scope: Supply and installation of handrails, walkways, steps, ladders, safety screens and associated items for channel structures excluding those contacting gates which are subject to a separate contract.

Tender Invitation Process: Open tender via an invitation released on the Queensland Government e-Tender web site.

Tender Return Review Process: Tenders initially reviewed against pre-determined non-price evaluation criteria: conformity of tender, capability to provide supply, other factors contributing to the effectiveness of delivery of SunWater's requirements.

The total cost to utilise each tender was also calculated and a cost effectiveness ration calculated to determine a rating of non-priced attributes against the total cost for each tenderer.

The preferred tendering party was selected from those tenderers considered capable of performing the contract satisfactorily. Selection was on the basis of both cost effectiveness and of providing a higher degree of certainty in terms of progress and completion of the works and hence providing best value for money.

SunWater then entered into a one on one negotiation with the preferred tendering party to agree the scope of works and fixed price cost.

Ayre, Biloela and Mareeba Regions

The work scope: Supply and installation of walkways, handrails, screens and pit covers for channel structures excluding those containing gates which were the subject of a separate contract.

Tender Invitation Process: Open tender via an invitation released on the Queensland Government e-Tender web site.

Tender Return Review Process: All eligible tendering parties (ie those whose tender returns were compliant with the terms of the tender invitation) were assessed against pre-established evaluation criteria to determine the preferred tender for each of the parts (Ayre, Biloela and Mareeba).

The preferred tenderer for each region was then selected on a best value for money basis.

Mackay Region

The work scope: Upgrade of walkways on channel over flow structures and to supply and install handrails, steps and gates for channel regulator gates.

Tender Invitation Process: Invitation to tender issued to three selected tenderers.

Tender Return Review Process: Two tenders were received and these were assessed by a desk top review. As both tendering parties were deemed capable of undertaking the works, the lowest priced tender was accepted.

In addition to the three regional contracts, a pan regional contract was issued as follows:

The work scope: Design, supply and installation of prefabricated modular gate assemblies including walkways (both Combination Lay-flat/leaf type gates) to replace the existing check and drop board type structures for the following regions:

- Ayre
- Biloela
- Mackay
- Mareeba
- Toowoomba
- Bundaburg

Tender Invitation Process: Open tender via an invitation released on the Queensland Government e-Tender web site together with an invitation to tender advertisement placed in the Courier Mail.

Tender Return Review Process: SunWater prepared a Tender Evaluation Plan to assess tender returns and select the preferred tendering party. This included the formation of an evaluation committee consisting of senior technical and procurement staff. Tenders were subjected to a detailed analysis via an assessment matrix which contained assessment criteria and weightings to enable structured comparison and evaluation. The selection criteria being:

- Commercial conformity of tender
- Demonstrated capacity to provide the works
  - Financial
  - Management
  - Technical
- Suitability of gates and associated equipment
- Any other factors.

This assessment yielded a weighted score for each tendering party. SunWater deemed that two tenderers scored sufficiently high to allow progress to the next stage of the selection process. These tenderers were invited to interview.

A risk assessment was then undertaken on both conforming tenders and, using risk adjusted total cost amounts, a Cost Effectiveness Ratio analysis was undertaken (total cost/total score of non-priced criteria) to select the winning tendering party.

In addition to issuing, for the most part, open tender invitations and conducting structured tender return analysis, SunWater also commissioned external consultants (GHD) to review the tender evaluation process for the gate contract.

Although GHD's review identified a number or areas where SunWater's tender review process could be improved, overall, GHD's review is supportive of SunWater having undertaken a robust tender evaluation process.

Conclusion on Efficiency Evaluation

The majority of the works under this project has been implemented by contractors that have been selected through either an open invitation to tender process or through invitation to a number of selected contractors.

The individual contracting parties have been selected using a robust tender evaluation process that evaluated tendering parties against capability and value for money.

Whilst we consider that there may have been merit in SunWater adopting a standard tender return assessment process for all regions and all work packages, we consider that the costs incurred by SunWater in implementing the works have been subjected to competitive forces and hence can be considered as market costs. As such we conclude that the costs incurred for implementing the works are efficient.

C.2.5 Summary and Conclusions

We conclude that the project is prudent as the need to undertake the WH&S related improvements have been identified by either an appointed external consultant or through a structured internal infrastructure review process.

We conclude that the costs incurred in implementing the works are efficient as the majority of the works have been undertaken by contractors selected through a competitive tendering process.

C.3 Whetstone Weir – Refurbishment

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

C.3.1 Introduction

This project concerns the refurbishment of the Whetstone Weir by concrete capping the timber structure, concrete works to the banks, driving a steel pile curtain upstream of the timber weir structure and replacing the outlet works. The Whetstone Weir was constructed in 1949 as a timber crib weir. With the completion of the Coolmunda Dam in 1972 an asset management decision was made to let it run to failure resulting in no maintenance scheduled from thereon.

The drought that the surrounding area experienced in the 90's highlighted the value of this weir and its use to be managed as part of the McIntyre Brook Water Supply Scheme. The weir was by that time in a rundown condition and SunWater commissioned a Structural Stability Analysis and Inspection in 2004/2005 to determine the structural capacity, condition of the weir and make recommendations as to the suitability for being refurbished.

This review concerns a review of costs incurred between 2007 and 2011, specifically it comments on the prudency and efficiency of the costs associated with the refurbishment of the various components of the weir.

C.3.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In addition, the following information was available for this review:

50) 1116524 V1 Whetstone Weir Refurbishment Document prepared by SunWater. The document contains the following Appendices:
    - Project Brief – Whetstone Weir –Analysis of Structural Stability
    - Structural Stability Analysis and Inspection Report
    - Memo requesting additional funding – July 2005
    - Business Case – Modernisation of SunWater Infrastructure in the Murray Darling basin – December 2008
    - Memo requesting additional funds for cost escalation – June 2009
    - Request for approval of expanded project to SunWater Board.
    - SAP Governance Records

- Revised costed SAP PM asset list for the refurbished weir

C.3.3 Prudency Review

Project History

A brief history of the project, showing the cash flow, is presented in the table below:

- **Table 79 Project History with Cash Flow**

No.	Date	Description	Budget ($)	Actual Cost to Date ($)
1	July 2005	Adds Project to 07/08 Program of Works (Estimated Cost) after completing a structural stability analysis and inspection.	600,000 – Original Allowed (Not included in Total)	
2	June 2007	Complete Detail design of Weir Refurbishment	45,000	41,484
3	Jun 2007	Update Cost Estimate for Weir Refurbishment (Includes for Steel piling and main wall capping) – Included in the Annuity Value	799,064	
4	07/08	Expenditure		
4.1		Procure Steel Piling		368,753
4.2		SunWater Construction Monitoring Cost		21,751
4.3		SunWater Procurement Cost[1]		27,864
4.4		Additional Design Works		7,748
5	08/09	Expenditure		
5.1		Installation of Steel Piling		117,555
5.2		Concrete capping of Weir (Estimated at 60% complete at end of fiscal year)		463,177
5.3		SunWater Construction Monitoring Cost		108,048
5.4		SunWater Procurement Cost[1]		6,393
5.5		Sundry Cost[2]		(37,623)
6	June 2009	Memorandum requesting approval for over expenditure (Current Commitments)	276,000	
7	July 2009	Request for approval of additional funds to complete concrete works and to refurbishing the outlet works	1,230,000	
8	09/10	Expenditure		
8.1		Final 40% of concrete capping of weir		216,401
8.2		SunWater Construction Monitoring Cost		87,306
8.3		Outlet Works		425,822
8.4		Design and Drafting		9,968
9	10/11	Expenditure		
9.1		Drafting (SunWater)		2,748
10		Total	2,350,064	1,867,395

1 From the cash flow presented the procurement cost is assumed to be attributed to both procuring the steel piling and getting a Contractor on site by July 2008.

2 A total of $43,687 was back charged in 2008/09, predominantly associated to the design of the capping of the weir.

From the above table it can be seen that the project cost at completion is $1,867,395 and that this value is more than double of the annuity value submitted for the 2007/2008 fiscal year (being $799,064). The documentation that SunWater has provided to SKM details some of the factors that contributed to the final project cost being more than double the original annuity value. The sections below will detail the relevant contributing factors.

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines a replacement/refurbishment date for an annuity item is described and discussed in the main body of this report.

SunWater commissioned a structural stability analysis of the weir in 2005. The findings of the site inspection and discussions with the Operations Personnel highlighted the fact that in the five years preceding 2005 the weir had two separate incidents of piping (circular breaches in the wall). The piping was detected by vortices that formed in the storage. The last, of the two, occasions required 60 m^3 of fine sand/gravel material on the upstream side to stop the piping.

The Structural Stability Analysis & Inspection Report, dated May 2005, prepared states the following: "*The weir is in a poor state of repair and is considered to have a limited remaining service life unless significant refurbishment work is undertaken.*" The report goes further to recommend the following: "*There is an urgent need for a study to prepare conceptual designs and estimates for refurbishing the weir"*

On these recommendations SunWater commissioned the design of the weir refurbishment. The design commenced in February 2007.

No SAP records have been presented to us recording neither any condition assessments nor the asset risk. We have made use of the Structural Analysis and Investigation Report to draw conclusions to the asset condition and asset risk. Based on a condition rating of 5 (Major deterioration such that the asset is virtually inoperable) and the decision to not let the weir run to failure, according to Sunwater's Policies and Procedures, we consider it was due for replacement or refurbishment.

In our review of the information presented to us, we consider that SunWater has followed the policies and procedures that it has in place, although the standard document trail was not viewed.

Options Evaluation

This review specifically focuses on the costs incurred between 2007 and 2011 associated with the refurbishment of the Whetstone Weir.

In accordance with SunWater's Policies and Procedures the Whetstone Weir was due for refurbishment. SunWater did not present to us any other options that they may have investigated as part of the design process. We consider the option of installing a concrete capping over the top of the timber crib wall and providing a steel cut-off wall on the upstream side to be an appropriate solution. It is to note that the Outlet Works did not form part of the original scope. The Outlet Works were only included in the scope of this project in 2008 as part of an unsuccessful application for Commonwealth funding. Our review therefore encompasses the full scope of the project, including the Outlet Works. We consider the Outlet Works to be necessary to allow for inclusion of the required flow meter.

Timing of Renewal/Refurbishment

The timing of the replacement was driven by the recommendations and findings of the Structural Stability Analysis and Inspection Report and the requirement of water users to be able to make use of the weir. On the assumption that the maximum asset condition score is 5 (Major deterioration such that the asset is virtually inoperable) has been reached and the change of the asset management plan for the weir to not let it run to failure, we therefore consider the timing of this refurbishment to have been prudent.

Conclusion on Prudency Evaluation

We conclude that although SunWater did not present us with the documentation as required by their Policy and Procedures that the reports and other information presented support the case in evaluating the prudency and timing of the project. We consider that it was prudent to undertake this project. It is also considered to have taken place in a timely manner.

C.3.4 Efficiency Evaluation

Renewal/Replacement Project Cost Evaluation

Based on documentation provided and summarized in Table 78 above, we understand that approximately $1,867,000 has been spent to date since 2007 on the refurbishment of the Whetstone Weir.

From Table 1 it can be seen that the original annuity value was a mere $799,064 compared to the final cost of $1,876,000 more than double the original value. In our review of the documents presented by SunWater we have come to the conclusion that some of the attributing factors to the escalating cost can be ascribed to the following:

- The original budget included for only the Contractors cost and not for the indirect cost incurred by SunWater. For future projects SunWater allows between 38% and 45% of the contractors cost to cover indirect costs.
- The budget included for only the concrete capping and steel piling component. No allowance was made for the outlet works refurbishment.
- Rise in material cost.
- Additional cost associated with a contractor not performing and not having leverage from a contractual aspect.

The above attributing factors will be discussed in more detail in the sections following.

The total spent by component is presented in the table below as well as our cost estimate per component, based on 2011 rates, to use as reference.

Table 80 Cost Breakdown by Component and SKM Estimated Cost

No.	Description	SunWater Total Expenditure ($)	SKM Cost Estimate (2011 Base Year)	Difference from SKM Estimate (%)
1	SunWater Overheads and Labour Component[1]		459,780	-40%
1.1	Procurement	34,257		
1.2	Construction Monitoring	217,105		
1.3	Design and Drafting	24,325		
2	Contractor Construction Cost by Component			
2.1	Concrete Capping	679,578	635,640	+7
2.2	Steel Piling	486,308	386,093	+26
2.3	Outlet Works[2]	425,822	430,628	-1.1
3	**Total**	**1,867,395**	**1,912,141**	**-2.3**

1 Our cost estimate is based on 45% of SKM's construction cost of the concrete capping and steel piling component being 45% of (635,640 + 386,093)

2 Our cost estimate is based on the SunWater valuation contained in SAP. The scope of work in regard to the outlet works could not be determined.

From the above table it can be seen that the overheads and internal labour cost of SunWater is only 23.6% of the construction cost. This figure is roughly half of the figure used for costing purposes. For costing of future projects SunWater makes use of a figure between 38% and 53% to make provision for indirect cost. Our cost model allowed for the median of 45%.

The SunWater Construction Monitoring cost for the steel piling component is only 6% of the components construction cost; this is considerably less than the 25% attributed to construction monitoring for the concrete capping component. SunWater documentation states the following:

"*...due to the transition of the majority of the Ipswich SunWater staff to SEQ Water in June 2008, external labour and project managers had to be sourced.*" This is considered to be one of the attributing factors to the jump in cost as a percentage of the overall. Other factors include, but not limited to, that more time was spent on site by SunWater Site Monitoring Staff and that unaccounted time was spent on construction monitoring using internal staff for the steel piling project.

The total cost incurred on the project excludes the original design fees. Refer to Note 2 of Table 80 above. The design and drafting cost, Item 1.3, shown in Table 2 above includes for remedial works design and drafting of the "As-constructed" details.

The steel piling cost estimate prepared by us is based on driving 12 metre lengths of 74.0 kg/m steel sheet piles to the back of the weir for the full crest length of 56.7 metres and allowing 17% for the Contractors Preliminary and General Items. The steel piling component actual cost is within our level 4 estimating range of +30%/-20%. The additional cost can partly be attributed to the following issue, as described in the documentation made available to us:"*Significant delays were experienced in the driving of the sheet piling, due to on site conditions, inadequate hammer size and inexperience of the driving contractor", "...agreed that a larger driving hammer would be sourced" and "The Contractor agreed to pass on actual costs only for the additional hammer hire and transportation"* The actual cost passed on to SunWater consist of the following, as referenced in the documentation:

- Additional hire of pumps and diesel - $45,000, and
- Additional Contract Labour, accommodation and travel costs of $85,000 due to the extended contract duration and loss of internal labour.
- Rise in Steel Cost - $90,000. A 40% rise of steel prices within two years

The above figures can be attributed to a contract that did not protect the interest of SunWater.

The SunWater documentation made a recommendation to revise the contract conditions to include clauses that will protect its interest. The following aspects were not documented within the contract documentation and are proposed to be included in future contracts:

- Contractor's experience level or performance results, being able to terminate the contract should the contractor fail to attain set performance results,
- Extended timeframes to completion, being more clear on what grounds an extension of time would be warranted,
- Penalty clauses for late completion, and

- Having a provision that no additional cost would be incurred by SunWater due to late completion attributed to the contractor's fault.

The additional cost incurred for the pump hire and diesel is considered to be not efficient. The concrete capping contractor made use of a siphon to transfer the flow instead of diesel pump/s. This can be ascribed to the inexperience of the contractor.

SunWater did not provide us with a cost breakdown for the Outlet Works. We are therefore unable to provide comments on the makeup of the cost. It is to be noted that the assumption has been made that the cost submitted include for SunWater's indirect cost and design cost components.

The overall cost of the project is within range of our cost estimate and we therefore consider it to be efficient. There are inefficient aspects of the project, as detailed above but these are not considered material when the project is viewed as a whole. It is important to note that the deficiency within the contract document is to be appropriately addressed to limit the risk to SunWater's future projects.

Conclusion on Efficiency Evaluation

We conclude that the overall costs are within range of our cost estimate and we therefore consider that the majority of the costs are efficient, However we consider that the costs arising from the additional works relating to driving of the sheet piling, some $220,000 are not efficient as they arise from additional contractor costs that were passed on to SunWater as a result of insufficient risk being passed to the contractor in the contract between SunWater and the contractor.

C.3.5 Summary and Conclusions

We consider that the refurbishment of the weir was prudent and timely.

We consider the overall cost of the refurbishment to be efficient, with the exception of the additional sheet steel pining costs of $220,000 which arose as a result of insufficient protection for SunWater and risk transfer to the contractor being built into the contract with the contractor.

C.4 Marion Weir – New Outlet Works

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

C.4.1 Introduction

The Marian Weir is the oldest weir on the Pioneer and is situated between Mirani and Dumbleton Weirs. Marian Weir has a small outlet to pass water through the weir and at times when there is high demand in the lower reaches of the system, water needs to pass over Marian Weir due to the small outlet.

The Pioneer Valley Resource Operations Plan (ROP) requires that Marian be lowered below fixed crest at certain times of the year to capture any small flow events that occur. This is not possible with the current outlet capacity. This project is to enlarge the outlet works at Marian Weir for compliance with the ROP.

Marian Weir's current outlet consists of two 450mm diameter ductile iron pipes controlled by downstream gate valves, with a calculated capacity of 121ML/day. The enlargement of the outlet would enable the delivery of water to meet demands downstream of the weir whilst drawing the weir pool down to enable the "Water Allocation Security Objectives" to be met.

According to SunWater, modification to the outlet is needed to increase the capacity to not less than 500 ML/day with the water storage at 70% to satisfy downstream requirements set by the ROP, which can currently only be met by over topping the weir.

C.4.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In addition, the following information was available for this review:

- Pioneer River Water Supply – Marian Weir – New Outlet Works Project 07PIO02 (including attachments).

C.4.3 Prudency Review

Project History

A brief history of the project is presented below:

- 1952 – Miriam Weir constructed

- 2003 –SunWater's Infrastructure Development Group completed the conceptual investigations into the outlet works upgrade. Documentation associated with this activity was not provided for this review.
- 2005 –SunWater's Infrastructure Development Group completed the feasibility investigations into the outlet works upgrade. Documentation associated with this activity was not provided for this review.
- June 2005 – Revised ROP issued. It is assumed that this version and similar previous versions had a similar requirement for downstream flows as the 2007 version of the ROP provided for this review.
- June 2006 – SunWater's Implementation Program states that the "*design for the upgrade of the Marian Weir commenced in 2006/07, site works and commissioning planned for 2007/08/09*."
- July 2006 – Letter from DERM to SunWater states that "*SunWater needs to ensure that due priority is given to these works and aim for commissioning that is sooner than 2009*"
- 2008 – Based on conversations with SunWater, design was underway at this stage. The original budget for the works was $1.173M.
- September 2009 – The procurement plan for the works is altered due to deferral of the modifications to the Dumbleton Weir. Instead of construction by a single contractor, a mix of contracts and day-works is selected. Eight individual contracts are identified. An updated budget of $2.27M was approved based on a revised design and construction program.
- 24 September 2009 – the contract for the installation of a cofferdam and excavation within a cofferdam was let. These works were due for completion in October 2009.
- 30 November 2009 – a stop work order was issued to the contractor installing the cofferdam due to difficulties relating to higher than anticipated rock foundation levels being encountered during the installation of the upstream sheet pile coffer dam. Agreement was reached with the contractor for works to be suspended until after the wet season (December 2009 to April 2010). Some additional works were required to make the site safe for wet season flows, but SunWater states this was considered to be a more cost effective solution than removal of the partially completed works. At this point completion was scheduled for October 2010, after recommencement in May 2010.
- March 2010 – a revised forecast budget of $3.84M was produced.
- June 2010 – a WHS incident occurred which resulted in loss of life. This incident resulted in the suspension of all works on site. This incident is the subject of an ongoing legal investigation and is outside the scope of this report.
- September 2011 – SKM was presented with documentation, presenting an increase in project costs to $4.85M. Conversations with SunWater indicate that the actual costs could be higher still, as these revised costs do not include any allowance for additional legal fees resulting from the outcomes of the ongoing investigation. We understand that a revised cost estimate is

currently being established and is due to be presented to the board for approval within the next two months.

Asset Replacement/Refurbishment Date Determination

The driver for this project is the need to meet the conditions set out within Section 83 of the ROP, which states that the demands downstream of the Marian Weir must be satisfied through the outlet works at a level of EL 31.0m. No information has been provided on the current level of the outlet. In addition, SunWater has stated that there is a requirement to provide 500ML/d during winter months. Based on our review of the ROP, there is no specific requirement for the Marian Weir to provide 500ML/d during winter months, however, the ROP does provide specifications for the whole system and according to the Design Report (Suwater, April 2010) "*the existing outlet capacity of 121ML/d needs to be increased to not less than 500ML/d with the weir storage at 70% of capacity to satisfy the Water Resource Plan based on IQQM modelling carried out by Water Services in 2007*". Documentation on the modelling carried out in 2007 was not provided for our review.

Based on conversations with SunWater, we understand that following the WHS incident the need to undertake the project was reviewed. This reinvestigation included determination of the water demand below Marion Weir, review of water supply arrangements, stream hydrology and model development, including Mirani, Mirian and Dumbleton Weirs to verify the supply and demand conditions. The outcome of this investigation has not been presented for this review, however, we understand from conversations with SunWater, that the resulting outcome of the investigation was a recommendation to undertake the construction project as proposed.

We note that Pioneer Valley Water has raised concerns regarding the costs of the project. Based on its estimates lowering the Marian Weir to 1.9m below fixed crest level will only yield an increase in 2000 ML (or 1.2% of the storage of the system).

According to Pioneer Valley Water "*SunWater holds some 12,500 ML of High Priority A water allocation in the Pioneer WSS. This supply has been held since Teemburra Dam and Dumbleton Weir Stage 3 were completed in the late 1990's. An alternative to engineering solutions for the above works is for SunWater to surrender part of the reserve allocation to replace supply reliability lost as a result of the two matters above*".

Pioneer Valley Water recommend that hydrological modelling is undertaken to ascertain volume etc required to implement this option and determine the impact of leaving Marian Weir as it is, followed by consultation with DERM and stakeholders. Based on our conversations with SunWater, it appears that some modelling has already occurred, including a consideration of the other dams in the system. As this documentation was not provided for this review, we are unable to ascertain whether the above option was considered and is valid.

We recommend that SunWater reviews the modelling already undertaken to determine if this modelling included an analysis of the proposed suggestions of Pioneer Valley Water. If so, we believe that there would be merit in SunWater communicating the results of this modelling to stakeholders. If the modelling did not investigate the suggestions of Pioneer Valley Water, we believe that there would be merit in SunWater revisiting its modelling to include a review of this option and communicating the results of the modelling, ie whether this option is viable or not and reasons why, to stakeholders.

Options Evaluation

As described above, questions have been raised regarding the prudency of this project. Whilst we understand that some modelling has been undertaken to assess whether the project is required, this has not been presented for this review. As such, we are unable to conclude that the no build solution has been investigated and is not feasible.

The options considered for increasing the downstream flow, included a siphon over the weir and a 'hole in the wall'. It was concluded that the 'hole in the wall' was the best option given the likelihood of the flood damage to a structure mounted on the weir crest.

The adopted arrangement consists of a rectangular hole cut though the weir, which removes completely the two existing pipes. The width of the outlet is greater than required to avoid the two existing outlet pipes during the concrete cutting operation. The outlet is controlled by a fixed wheel gate operated by a hydraulic ram located in the inlet structure and discharges to the existing weir apron. The inlet structure is an L-shaped reinforced concrete wall positioned to limit silt build up at the outlet. The concrete structure is designed for hydraulic and silt loads to AS 3600-1988 for Class B1 exposure conditions. Concrete 28 day strength 32 Mpa, reinforced grade N500 Mpa. Both water and silt loads were factored by 1.5 for ultimate conditions.

Given the flooding at the site and that similar arrangements have been used at other dams (Bedford and Bingegang Weirs) we believe the adopted arrangement is suitable.

Regarding the design standards used, we suggest that a consideration of AS3735 or similar with limited crack width, be undertaken for any detailed design with regards to determining whether durability is sufficient.

We understand that foundation conditions were inferred from original drawing to be at or about the level of the weir monoliths. A design and constrict (D&C) contract was let for a sheet pile cofferdam to be installed from a hardstand in the apron. The cofferdam would be internally braced relying on minimum toe support and supported off the upstream face of the dam. Discussions regarding the adequacy of the design of the cofferdam are assumed to be part of the ongoing legal investigation and are therefore considered outside of the scope of this review.

Timing of Renewal/Refurbishment

As discussed above, the project can be established as prudent if SunWater can establish that the no-build solution has been adequately considered and discussed with all stakeholders, including DERM. It may be that DERM has effectively mandated that the works be installed to meet the ROP but we have seen no documentation to this effect.

Conclusion on Prudency Evaluation

We conclude that whilst SunWater has undertaken some works to determine the prudency of this project, these have not been provided for this review, and as such, we are unable to conclude that the no build solution has been investigated and is not feasible.

We recommend that SunWater produces documentation to establish that the no-build solution has been adequately considered and discussed with all stakeholders, including DERM. If the no-build solution is found not to be feasible through hydraulic modelling or not found to be acceptable by DERM, we would conclude that the proposed project is prudent.

C.4.4 Efficiency Evaluation

Renewal/Replacement Project Cost Evaluation

As discussed in the project history section of this report, the costs of this project have escalated over time and have increased from $1.1M in 2008 to $4.8M currently. This includes $1.01M associated with legal and incident costs relating to the WHS incident. In addition, we understand that a revised and likely higher cost estimate is currently being established and is due to be presented to SunWater's Board for approval within the next two months.

This report documents our review of the historical costs associated with this project, therefore the following commentary focuses on the costs to date and the reasons for these cost increases.

We understand that the delivery model has changed for this project, from initially a single contract to be awarded combined with works with Dumbleton Weir, to a number of individual contracts. All specialised contracts terminated at the time of the WHS incident. The future works are proposed to be awarded as a single contract. From conversations with SunWater, we understand that it is their preference to manage works internally using separate contracts with suppliers as necessary, as from previous experience, they have found this to be a more cost effective method of delivery. The reason for the proposed change in delivery mechanism is due to a lack of suitable internal resources to manage the project.

The increase in project costs can be attributed to key reasons:

- Delays to the project commencement resulted in construction starting late on site, and in combination with an early start to the wet season, resulted in the need to de-establish and then re-establish works on site.

- A fatality on site has caused further delay to the works and also resulted in unforeseen legal fees.

WHS Incident

A breakdown of these costs associated with the WHS incident are presented below:

Item	Cost ($000s)
External Legal Costs	$732
Internal Legal Costs	$152
Other Internal Costs	$128
Total	**$1,012**

Nearly 90% of the costs are associated with legal fees, which are the result of the ongoing legal investigation. The determination of culpability for the failure of the cofferdam incident is outside the scope of this report. Until responsibility for the incident is established, we are unable to conclude whether the above costs were avoidable or whether there is an opportunity to recover any of these costs from an alternative party. As such, we consider the costs associated with the incident to be outside the control of SunWater and recommend that these costs are re-examined following the outcome of the current investigation.

Site delays

As stated above, delays to the project resulted in construction starting late on site, and in combination with an early start to the wet season, resulted in the need to de-mobilise and then re-establish works on site. This has had an impact on the project costs. With hindsight, it is likely that SunWater would have delayed the construction works until the following year, to prevent this need to abandon and make safe the cofferdam and the access road. Although there may have been penalties for delaying contracts, this would have resulted in lower project costs. Whilst we do not have actual costs relating to the need to de-mobilise and then re-establish works on site, we have been provided with the March 2010 Board Report, which provided an update cost forecast, based upon this requirement.

The key changes to the project costs are shown below.

Item	Cost ($000s)		
	Sept 2009 Budget	Feb 2010 Forecast	Variance
Project management	$68	$178	$110
Design	$228	$420	$192
Procurement	$35	$124	$89
Construction management and supervision	$215	$371	$156
Access and cofferdam	$600	$865	$265

Item	Cost ($000s)		
	Sept 2009 Budget	Feb 2010 Forecast	Variance
Demolition	$157	$101	-$56
Construction directs and other	$967	$1,520	$553
Risk	$0	$263	$263
Total	**$2,270**	**$3,842**	**$1,572**

Source: Pioneer River Water Supply – Marian Weir – New Outlet Works Project 07PIO02

Whilst a further breakdown of costs was provided, we have had difficulties reconciling the totals within the breakdown, to the table above. For example, within the cost breakdown the costs for civil construction management and supervision equate to $606.6k, one and a half times the recorded $371k above.

Comments on the key cost variance items are presented below:

Construction directs and other

SunWater was contacted to provide further information on the reason behind this cost increase. The following response was received: "*As per the March 2010 Board Report (#903478) "Additional costs of $553,000 are due to the suspension of the works and an extension of the construction period by one month. Also includes additional provision for labour and crane hire for day works. However the bulk of this budget increase was not realised since the works were not completed. The budget increase was due to reforecasting of cost to completion in parallel with reprogramming of the remaining work.*"

Based on the comments above, we assume that at least a portion of these costs could have been avoided by delaying the works to the following dry season.

Access and cofferdam

SunWater was contacted to provide further information on the reason behind this cost increase. SunWater provided the following response: "*The bulk of the additional budget of $265k was allowed for contractual costs related to the deferral of the work over the wet season from Dec 2009 to May 2010. The costs under this budget which were expended on the contract are shown in the table below. The work under Item PV003/002 was not completed.*"

Item	Description	Rate	Qty	Amount
PV003/001	Option B - Trimming of sheet piles	7,277	100%	7,277
PV003/002	Option B - Reinstatement of trimmed sheet	21,600		0

Item	Description	Rate	Qty	Amount
	piles in workshop upon removal from site			
PV003/003	Option B - Retention cost for piling/bracing (until 1st May 2010)	73,700	100%	73,700
PV003/004	Option B - Weekly retention cost for piling/bracing beyond 1st May 2010	3,350	5	16,750
PV003/005	Option B - Removal/reinstatement of fabric/gravel to hardstand	16,435	100%	16,435
PV003/006	Option B - Reinstatement of access road (if required)	27,500	100%	27,500
PV003/007	Option B - Removal/reinstatement of access road culvert (if required)	2,980	100%	2,980
PV003/008	Delay charges - Cost recovery for employee standby (Commencing 25/11/09 until date of Sunwater acceptance of Option A or B)	2,124	7	14,868
PV003/009	Removal/reinstatement of silt curtain	6,400	100%	6,400
PV003/010	Removal of steel from hardstand to compound area	1,495	100%	1,495
PV04	Re-establishment to site in June 2010	18,786	100%	18,786
PV05	Relocate steel from compound to hardstand (included in PV04)	-	-	0
PV06	Replace rock to downstream hardstand	133	441	58,653
PV07	Reinstall fish ladder access platform and access ladder	3,493	100%	3,493
	TOTAL			248,337

Based on the information provided above, the bulk of these cost increases could have been prevented by delaying the start of the construction until the following dry season. In particular, there would have been no need to pay a retention cost for the piling/bracing, as this would have not been installed on site, and there would have been no need to reinstate the access road. As noted above, with this option there are likely to have been cost increases with postponed contracts, however this is likely to be significantly less than the costs of establishing and the de-establishing the site.

Design

The design costs appear high, particularly as cofferdam was awarded as a D&C contract. Within the March 2010 Board Report, the reason for the increase was the insufficient provision made for design support and documentation during construction. However, we note that within the cost breakdown there are separate allowances for supervision.

Risk

The risk allowance was generated from a costed risk register dated July 2010. The largest risk ($225k) is associated with difficulties encountered in completing an excavation dam down to a specified level. We agree that this is a large risk and that contingency should be made to cover this risk.

The table below identifies the costs associated with the construction delays. It is difficult to quantify the exact extent of the impact of the delay. As such the following review is highly subjective.

Item	Cost increase ($000s)	Attributable to delays	Cost
Project management	$110	100%	$110
Design	$192	0%	$0
Procurement	$89	0%	$0
Construction management and supervision	$156	100%	$156
Access and cofferdam	$265	100%	$265
Demolition	-$56	0%	$0
Construction directs and other	$553	100%	$553
Risk	$263	0%	$0
Total	**$1,572**		**$1,084**

Benchmarking

This project is a unique construction project and therefore there are no available similar projects to provide benchmarks. In addition, we have been provided with no drawings for this site, making it difficult to develop even a high level cost estimate for the site.

We have compared the costs to replace each of the storages within the system (based on replacement costs from SAP) with the volume of water available. Based on these costs it is noted that the cost per ML of storage are higher for this project then for the overall storage system.

Dam	Cost to Replace ($)	Storage Volume (ML)	Cost ($/ML)
Teemburra Dam	64,522,817	147,500	437.44
Miriani Weir	32,662,644	4,660	7,009.15
Marian Weir	6,103,434	3,980	1,533.53
Dumbleton Weir	12,601,474	8,840	1,425.51
Total	**115,890,369**	**164,980**	**702.45**
Marian Weir Project	4,846,000	2,000	2,423.00
	4.2%	1.2%	

As stated above, the costs reviewed are based on the costs presented in the documentation provided. We understand that the project is now due for completion in the 4th quarter 2012. The planned delivery method is an AS 2124 contract with the contractor as Principal Contractor and being responsible for completion of all remaining works, with the exception of the hydraulic electrical, which has already been completed. We understand that a provisional lump sum price will be tendered and final risk adjusted lump sum amount negotiated. The tenders are currently out but are not yet agreed. A presentation to board was expected in August 2011, but this has been delayed by approximately two months. SunWater has stated that the revised project costs of $4.8M (as presented in the September 2011 documentation) does not include legal fees or revised contract fees and are therefore is subject to change. A review of the future costs for this project is outside the scope of this review.

Conclusion on Efficiency Evaluation

Costs for this project have escalated for two key reasons.

- A fatality on site resulted in a number of legal fees. As this incident is the subject of an ongoing legal investigation, we are unable to state whether this incident was outside the control of SunWater. We recommend that these costs are re-examined following the outcome of the current investigation.
- Delays to the project resulted in construction starting late on site, and in combination with an early start to the wet season, resulted in the need to de-mobilise and then re-establish works on site. The majority of the $1.57M cost increase (approximately $1M) can be associated with this delay and could therefore have been avoided if work had been started sooner (and completed prior to the wet season) or not commenced until the start of the following dry season.

Overall the project costs are high compared to the overall cost of storage within the Pioneer system.

C.4.5 Summary and Conclusions

We recommend that SunWater produces documentation to establish that the no-build solution has been adequately considered and discussed with all stakeholders, including DERM. If the no-build solution is found not to be feasible through hydraulic modelling or not found to be acceptable by DERM, we would conclude that the proposed project is prudent.

We conclude that some of the project costs, approximately $1M, could have been avoided by SunWater through not commencing work until the start of the following dry season.

We are unable to comment upon the costs associated with the fatality on site, including whether the costs were avoidable or whether there is an opportunity to recover any of these costs from an alternative party. As such, we consider the costs associated with the incident to be outside the control of SunWater and recommend that these costs are re-examined following the outcome of the current investigation.

C.5 Palm Tree Creek Regulating Valve

This sub-report should be read in conjunction with SKM's main report entitled: SunWater Price Regulation: Review of Selected Annuity Values for Refurbishment and Replacement items.

This sub-report is also subject to the limitation statement provided in the above mentioned report.

C.5.1 Introduction

This project concerns the outlet regulating value to Palm Tree Creek. Water from Saddle Dam No 2 enters a 2 km long, 1,200 mm pipeline which discharges into Palm Tree Creek some 186 m below the dam. The outlet regulating value has a history of failures since installation in 2001. This report concerns a review of costs incurred between 2008 and 2010, specifically it evaluates and comments on the prudency and efficiency of the costs associated with the selection and installation of an AVK/Glenfield valve. This valve has since been replaced as it failed to solve the operational problems.

C.5.2 Available Information

This sub-report has been prepared by accessing and viewing SunWater's SAP Works Management System (WMS), and asset condition and risk assessment policy and procedures. Please refer to the body of the main report for a more detailed description of these information sources.

In addition, the following information was available for this review:

- Tender Document Contract No: 07SW3468 Volume No 2 of 3 Volumes (SunWater, April 2007)
- Palm Tree Creek Valve Purchase Plan (SunWater, 03/04/2007)
- Tender Report and Recommendation for Contract No. 07SW3468 (SunWater, undated)
- Palm Tree Creek Valve Tender Acceptance Letter (SunWater, 08/06/2008)
- Meeting of Executive Management Committee – minutes for meetings held on the 03/11/2009, 06/04/2010, 09/03/2010, 23/09/2010, 24/11/2010, 24/03/2011
- Briefing Note for Approval (SunWater, 07/12/2009)
- Palm Tree Creek Study: Options for Remedial Work on Pipeline (SunWater, undated)
- Peer Review of Waterhammer Analysis of the Palm Tree Creek Pipeline System for Sunwater, Queensland (Adelaide Research and Innovation Pty Ltd, May 2010)
- Palm Tree Creek Pipeline: Provision of a Peer Review of the Valve and System Selection (Glen Hobbs and Associates, August 2010)
- Briefing Note for Information (SunWater, 15/10/2010)
- Palm Tree Creek Risk Assessment (SunWater, April 2011)
- Record of Consultation – Consultation with PVCW, 02/06/2011

- Project Scope Definition: Palm Tree Creek Outlet Works (SunWater, undated)
- Minutes of Palmtree Creek Outlet Works Projects – minutes for meetings held on the 07/04/2011, 21/04/2011, 12/05/2011, 19/05/2011, 27/05/2011, 10/06/2011, 17/06/2011, 22/07/2011 recorded by G Kelly

C.5.3 Prudency Review

Project History

A brief history of the project is presented below:

- 1996 – GE Energy (then Kvaerner Energy) supplied the original valve as part of the Teemburra Dam Project. The valve failed to meet maximum flow requirements and was modified in situ and later in a workshop. Following modifications, excessive vibrations were noted.
- 2001 – Following failure of the value sleeve (attributed to fatigue) two temporary fixed 'pepper pot' dissipaters were fabricated and installed (only one is used at a time, selection being dependant on the selected flow rate of 100 or 150 ML/day).
- September 2003 – The GE Energy valve was repaired and reinstalled. After running for a period of time, a crack was discovered in the inner sleeve connection and the pepper pot was reinstalled. The 2007 Purchase Plan states that the modified valve was commissioned in September 2003 and no defects were detected until 15 months later (3 months after the defects liability period). Later documentation states that the valve was in place for five weeks prior to the defect being identified.
- April 2007 – SunWater issue a Purchase Plan. Within the plan, SunWater recommended approaching AVK/Glenfield for the supply of a replacement valve (the subject of this review).
- April 2007 – SunWater issued a tender document for the manufacture, design, supply, delivery and joint commissioning of a submerged vertical regulator valve.
- June 2007 – SunWater issue the *Tender Report and Recommendation for Contract No. 07SW3468* recommending that the tender from AVK is accepted.
- May 2007 – SunWater award the contract for the manufacture, design, supply, delivery and joint commissioning of submerged vertical regulator valve to AVK.
- March 2008 – An AVK/Glenfield valve was designed and manufactured to replace the GE Energy Valve with two pressure discs (these are purposely designed weak elements to relive high pressure). One pressure disc burst during initial filling of the outlet.
- April 2008 – There was a failure of the bronze ported body of the AVK/Glenfield value. According to *Palm Tree Creek Pipeline: Provision of a Peer Review of the Valve and System Selection* (Glen Hobbs and Associates, August 2010) the "*cause of the failure has never been fully resolved and agreed between SunWater and AVK… SunWater attributes the failure to*

casting defects combined with high stresses in the body. AVK considers the failure is a result of pressure surge in the pipeline".

- November 2008 – The outer sleeve of the valve was replaced with high tensile aluminum bronze, however, during re-commissioning the pressure discs failed again. The discs were replaced and subsequently failed a second time. According to the *Palm Tree Creek Study: Options for Remedial Work on Pipeline* (SunWater) "*the bursting discs were found to be unacceptably closely rated to pressures at the valve and would fail because of repeated cycling of surge conditions during normal stable operating conditions*".
- 2009 - The AVK/Glenfield valve was removed and the pepper-pot reinstalled with no internals. The flow is regulated by opening and closing the guard valve, a 900mm butterfly valve, which was not specifically designed for this operation. It is understood that this is the current operating condition.
- Unknown date – The report: *Palm Tree Pipeline Dissipater Value – Waterhammer investigations of alternatives to Rupture Discs* was prepared by SunWater. This report has not been provided for this investigation.
- Unknown date - The report: *Palm Tree Creek Study: Options for Remedial Work on Pipeline* prepared by SunWater (James Harrap). This investigation identified 14 possible options and associated costs. Three options were short listed for further investigation. The costs for these options ranged from $364,603 to $575,315.
- Unknown date – The report: *Options for Redesign of Pipeline Outlet* was prepared by SunWater (James Harrap) – Whilst not provided for this investigation, it is understood that the recommended option from this report was the installation of a 600mm Singer anti-cavitation globe valve and a parallel 350mm branch line with three orifice plates.
- May 2010 – The report: *Peer Review of Waterhammer Analysis of the Palm Tree Creek Pipeline System for Sunwater, Queensland* was prepared by Adelaide Research and Innovation Pty Ltd. The report recommendations include that the AVK/Glenfield valve be abandoned and replaced with a more suitable valve and that an alternative option be considered to the preferred option (600mm Singer valve and a 300mm Signer valve in parallel with an upstream strainer). No estimated costs were produced as part of this report.
- August 2010 - The report: *Palm Tree Creek Pipeline: Provision of a Peer Review of the Valve and System Selection* was prepared by Glen Hobbs and Associates. The report recommendations include that there are a number of viable valve solutions available, with the most cost effective solution being the retention of the pepper pot device and the installation of an extra isolation valve (however this option only provides limited flow control, with a manual change in the pepper pot required to change flow conditions). The estimated cost for this option is $330,000 with an estimated $4,000 a year for twice yearly flow control. It was also recommended to review the operation of the 900mm butterfly valve.

- April 2011 - The report: *Palm Tree Creek Risk Assessment* was prepared by SunWater. The report recommendations include that the actuator on the 900mm butterfly valve be upgraded for limited short term use only for a nominal period of 12 months (estimated cost $15,000), that a trash screen's spacing is reduced to prevent large debris entering the system (estimated cost $5,000) and that crack detection and fatigue analysis is undertaken at the dissipation chamber (estimated cost $18,000). This report also recommended that further consideration be given to the Tanalo system supplying the Pioneer Valley Water Board (PVWB).
- Unknown date – The report: *Project Scope Definition: Palm Tree Creek Outlet Works*, prepared by SunWater. This document outlines the following proposed works for the system including: the replacement of the 900mm guard valve with a new butterfly valve, the replacement of the pepper pot with a ported body, with the ability to have ports manually closed off to create a variety of flows, the modification of existing pipework to allow for the new valve and the fitting of water hammer mitigation devices. The cost estimate for these works is $769,950. This document provides a program, showing completion of the works due in June 2012. This document is supported by a series of design meeting minutes (latest dated 22 July 2011) which provide updates on the design of the major items.

Asset Replacement/Refurbishment Date Determination

The processes by which SunWater determines asset condition and therefore the replacement/ refurbishment date for an annuity item is described and discussed in the main body of this report.

SunWater has undertaken two condition assessments. In 2001, the first condition assessment was undertaken. The notes from this assessment state that "*Valve under repair during inspection. Excessive vibration was a concern. Modification underway*". The maximum score for the asset was one. We suggest that as the valve was under repair at the time of the condition assessment, we would have expected to see a high score against 'Valve operation', rather than a score of 'N/A'.

In 2006 a second condition assessment was undertaken. This is inline with SunWater's policy of a minimum recommended assessment frequency for valves as 5 years. In the 2006 condition assessment, it was noted "*Regulator valve and vanes have failed in service, unable to repair, must be replaced*". The score for the asset was six, with both categories of 'Operation' and 'Function' receiving maximum scores of six.

The recorded condition assessments support the project history as recorded above, and support the replacement of the AVK/Glenfield valve.

SunWater undertook a risk assessment of the valve in February 2009. The identified risk was "*Failure to control release from dam*". The assessment resulted in a low risk for all three asset/business risks.

No WH&S or environmental risks have been recorded for this asset.

In our review of the data in SAP, we consider that SunWater has followed the policies and procedures that it has in place.

Options Evaluation

This review specifically focuses on the costs incurred between 2008 and 2010 associated with the installation of the AVK/Glenfield valve, which failed to solve the operational problems. No comments are provided regarding the selection of the initial GE Energy valve or the solution currently under development.

We agree that the replacement or modification of the GE Energy valve was required. The failure of the original GE Energy valve resulted in reliance on a flow control system that results in an abrupt stop in pipeline flow. This could lead to water hammer and pipeline bursts. We note from the 2007 Purchase Plan that the modified GE Energy valve failed after the defects liability period had expired (in late 2004). As the valve was out of warranty the manufacturer refused to take responsibility for the failure of the valve and, as such, a new valve was required.

We note that following the repeated failure of the GE Energy valve, the temporary pepper pot arrangement was reinstalled. The *Palm Tree Creek Pipeline: Provision of a Peer Review of the Valve and System Selection* (Glen Hobbs and Associates, 2010) notes that the temporary pepper pot arrangement satisfactorily dissipates energy and that the resulting vibration is considered acceptable by SunWater operations. However, the continued use of the fixed pepper pot arrangement is an unacceptable long term solution due to the flow control limitations.

The selection of the AVK/Glenfield Valve is recorded in the 2007 Purchase Plan. Within the 2007 Purchase Plan, the options for valve suppliers were investigated. Three options are summarised, including GE Energy, AVK/Glenfield and an Italian valve (not named further). GE Energy was excluded as having “neither the capacity nor inclination to provide a suitable valve”. The Italian valve was assessed as “performance not known with limited technical details available”. Comments on the AVK/Glenfield included “the firm has supplied a proven valve with the same duty as the Palm Tree Creek Valve… the GM of Engineering Services has visited the site and confirmed that the valve is suitable”.

The 2007 Purchase Plan reviewed two procurement options: directly approaching a single supplier and calling for open tenders. The recommended option was to approach a single supplier. The reasons for adopting this solution included that it was a proven product, that the scope of work and specification can be developed jointly. The weaknesses of the open tender process were identified as longer delivery times and possibly costs, risk of failure in service not anticipated in testing and the potential need for a two stage process to select preferred tender and then jointly develop a suitable configuration for the site.

We note that the objectives of the Purchase Plan align well with best practice, including achieving value for money, secure delivery within the stated timeframe and budget, and ensure probity and accountability for outcomes. We also acknowledge that due to previous problems with the GE Energy valve, SunWater was very keen to use a proven product. However, we believe that by not approaching an open market and going down a single tender route, albeit after a preliminary vetting of suppliers, SunWater did not thoroughly explore all of the possible options for design and supply of a suitable valve.

Tender documentation was provided by SunWater, including a specification for the new valve. It is not known whether this specification was developed jointly with AVK/Glenfield as intended in the Purchase Plan. The specification for the new valve provides details of design pressure (head) and surge pressures on the valve. Based on conversations with SunWater, we understand that the water hammer results were calculated using available technology. A peer review of the water hammer modelling software (SURGE 2008) used by Sunwater (*Peer Review of Waterhammer Analysis of the Palm Tree Creek Pipeline System for Sunwater, Queensland*, Adelaide Research and Innovation Pty Ltd, 2010) recommends that SunWater should replace the computer package with an alternative water hammer modelling software due to concerns with the graphics capability of representing the hydraulic grade line along the pipeline, and the results for column separation and for calculated velocities.

We recognise that water hammer modelling is complicated, and that software packages are frequently updated and have varying levels of sophistication. We believe that SunWater's approach for developing the specification using the software they had available was reasonable.

In April 2007, there was a failure of the bronze ported body of the AVK/Glenfield value. We understand from conversations with SunWater that AVK/Glenfield replaced the outer sleeve at no additional cost, which supports SunWater's argument that there were casting problems with the initial valve. Following the continual failures of the pressure discs, the AVK/Glenfield valve was replaced. Calculations subsequently carried out on the valve show that the velocities generated by the ports are very high (Glen Hobbs and Associates, 2010) and will generate high turbulence leading to vibration. The Glen Hobbs and Associates peer review concludes that the AVK/Glenfield value was not suitable for this application in its present form and SunWater was correct to remove it.

Minutes of a meeting of the Executive Management Committee held on the 24/03/2011, records that there were a number of lessons learnt from this project, including the need for comprehensive design reviews to ensure the design is robust and fit for purpose, ensuring the specifications are clear and adequate, including peer review where necessary, and the need for performance clauses within the contract ensuring that the equipment supply is fit for purpose. The preferred option for cost recovery was identified as "returning the valve to the supplier as being unfit for purpose".

Based on conversations with SunWater, we understand that negotiations have been undertaken by SunWater, but that AVK/Glenfield has indicated that the initial information provided on water hammer was insufficient. Based on the information provided to us, we understand that SunWater is unable to obtain a refund for this valve from AVK/Glenfield. A thorough investigation, including legal investigation, of whether more could have been done to acquire a refund for the valve is considered outside of the scope of our review.

Following failure of the valve, the temporary arrangement was reinstated and a further three investigations were undertaken:

- Options assessment
- Peer review of water hammer analysis
- Peer review of the valve and system selection

We agree that there was a need to undertake these actions. The lessons learnt and recorded in the Executive Management Committee meeting minutes highlighted the need for suitable peer review and both peer reviews undertaken support the removal of the valve.

Timing of Renewal/Refurbishment

The timing of the replacement was driven by the failure of the original GE Valve. We note that a temporary pepper pot arrangement was successfully in place prior to replacement; however we acknowledge that this arrangement does not allow for the flow control required. We therefore consider the timing of this refurbishment to be prudent.

Conclusion on Prudency Evaluation

We conclude as follows:

- We believe it was prudent to replace the original GE Valve. The valve had failed and a temporary solution did not provide the flow control required.
- The selected procurement strategy was to contact only one valve supplier. We believe this did not thoroughly explore all of the options for this site.
- SunWater developed a specification for the valve using the software they had available at the time. We believe that this approach was reasonable.
- Following the failure of the valve SunWater investigated options for obtaining a refund from AVK/Glenfield. We believe that this approach was reasonable, although are unable to confirm whether more could have been done to follow through with this action.
- Following failure of the valve, SunWater reinstated the temporary arrangement and undertook investigations, including peer reviews. We agree that there was a need to undertake these actions. The lessons learnt as documented in the Executive Management Committee minutes

highlighted the need for suitable peer review and both peer reviews undertaken support the removal of the valve.

We recommend that the lessons learnt, as identified by the Executive Management Committee, are implemented, including:

- Comprehensive design reviews to ensure the design is robust and fit for purpose
- Ensuring the specifications are clear and adequate, including peer review where necessary
- Inclusion of a performance clause within the contract ensuring that fitness for purpose risk is transferred to the equipment supplier.

We believe that had these good practice measures been implemented at the commencement of the valve replacement project, some of the costs incurred by SunWater may have been avoided.

C.5.4 Efficiency Evaluation

Renewal/Replacement Project Cost Evaluation

Based on the provided documentation, we understand that approximately $1,875,000 has been spent to date since 2001 on the two valves plus additional work. The costs to date are as follows:

Work	Cost (Source: Meeting of Executive Management Committee, 24/11/2010)
Corrective work to the (GE Energy) Kvaerner valve and installation	$572,000
Investigation leading to the purchase of the Glenfield Valve	$159,000
Purchase/installation/commissioning of the Glenfield Valve	$337,000
Water hammer and options investigations to replace the Glenfield Valve	$569,000
Peer review and associated costs	$238,000
Total	**$1,875,000**

We note that the Briefing Note, 15/10/2010, states that only $1.52 million has been spent. We understand that this is an error and that some initial costs associated with the corrective work to the GE Energy valve and installation, were not captured within the earlier documents.

This review primarily concerns the installation of the AVK/Glenfield Valve. The costs presented above have been compared to the costs within SAP. Using the information within the Project Governance section of SAP, only data from 6th February 2007 to 17th September 2010 is available. Therefore it is not possible to confirm the costs for the initial stage of work relating to the corrective work to the GE Energy valve and installation. As such the costs associated with the GE Energy valve have not been considered.

Assuming that all costs associated with the AVK/Glenfield Valve investigations is captured with the above costs, the following comparison is made:

Work	Cost	
Source	Meeting of Executive Management Committee, 24/11/2010	SAP (6/02/2007 – 17/10/10)
Total	$1,303,000	$1,243,917

The difference may be due to costs incurred prior to February 2007, and this cannot be verified without complete financial records.

An analysis has been undertaken of the costs to date. The costs have been broken down as follows:

Cost Category	Cost	Percentage
Contractors	$ 345,979	28%
Overhead	$ 335,519	27%
Staff costs	$ 298,048	24%
Indirects	$ 104,925	8%
Prior Year Expenses	$ 78,178	6%
Consultants	$ 30,683	2%
Plant	$ 17,119	1%
Materials	$ 17,097	1%
Air Fare	$ 8,260	1%
Travel	$ 5,248	0%
Freight	$ 578	0%
Entertainment	$ 330	0%

The top four costs are contractors, overheads, staff costs and indirect costs.

The majority of the contractor costs are associated with the awarded tender to AVK/Glenfield for the manufacture, design, supply, delivery and joint commissioning of a replacement valve for $299k. These costs were obtained via a tendering process, although it is noted that it was not a competitive tender, as AVK/Glenfield was the only supplier approached. Given the highly site specific nature of this valve, it is difficult to find comparative benchmarks for this installation.

We note that the costs associated with overheads and indirect costs are high at over a third of the project costs. We understand that overheads and indirect costs are allocated to a project based on a percentage basis, depending on the type of project and the staff hours. A review of the application of overheads and indirect costs is outside of the scope of this review.

It is noted that almost 5000 SunWater man hours have been spent on the project between 2007 and 2010. We believe the number of hours is high for the installation of a valve of this type. We recognise that a number of factors have resulted in increased staff costs, including the difficulties experienced by SunWater, including numerous occasions of replacing the valve with the temporary arrangement and reviewing the failure of the valve. These actions were as a direct result of the failure of the valve and therefore outside the control of SunWater. In addition, we note that it is difficult to separate out the costs associated with the design of the future valve, which is outside of the scope of this review.

Whilst we believe that a number of staff hours could have been reduced by improved project management, including developing a more robust specification for the valve and incorporating 'fit for purpose' clauses in the contract, and that the project costs could have been reduced by using an open market tender process, it is difficult to quantify the extent of these cost reductions. As such the following review is highly subjective. The table below provides our best estimate of the project costs.

Work	Cost	SKM's Comments
Corrective work to the (GE Energy) Kvaerner valve and installation	$572,000	Outside the scope of the current review
Investigation leading to the purchase of the Glenfield Valve	$159,000	We understand that investigations included a Purchase Plan and tender documentation. Based on the production costs for these initial documents only, the costs appear high by about 40- 50%.
Purchase/installation/commissioning of the Glenfield Valve	$337,000	We understand that the majority of these costs are associated with the contractor costs for the supply and installation of the valve. The costs were obtained from the market but not under market conditions. Within its Purchase Plan, SunWater has acknowledged that not approaching the market results in a risk of higher costs. As such the cost savings achieved through a competitive tender could have been 10-20% of actual.
Water hammer and options investigations to replace the Glenfield Valve	$569,000	We understand that these costs are associated with the production of at least three studies, the first on water hammer analysis (*Palm Tree Pipeline Dissipater Value – Water hammer investigations of alternatives to Rupture Discs was* not been provided for this investigation) and two following options studies. Regarding the water hammer analysis, the later peer review identifies that "*a very detailed SURGE 2008 model of the entire Palm Tree Creek pipeline system and piles supplying the PVWB irrigation area was developed by SunWater. In my opinion too much detail has been included and the model could be simplified by including longer reaches of the same diameter pipeline*". This suggests that at least some of the initial water hammer analysis pipeline was inefficient. The first of the options studies was provided for this review. Within this report, 14 options were identified. It should be noted that of the three short listed options, following peer review, none of these are being progressed as the current design. This suggests that the time spent on this activity may have been inefficient. It is suggested that a more efficient approach to the options investigation would have been to approach the market to find suitably qualified consultants to

Work	Cost	SKM's Comments
		undertake a comprehensive review of the scenario and design of a new valve. As such we believe the cost savings achieved through a competitive tender of the water hammer analysis and concept design of the solution could be in the region of 25-35%.
Peer review and associated costs	$238,000	We have been provided with all of the itemised costs from SAP, however, have only been able to determine the direct costs of one of the peer review reports as follows: Adelaide Research and Innovation $28,068. The costs associated with the Glen Hobbs and Associates Report cannot be easily distinguished (apart for some minor costs associated with a meeting). No information has been provided on whether these reports were undertaken following a competitive tender for this work. In addition, we note that there may have been opportunities to undertake both reviews under a single contact, thus reducing any double up on work (it is noted that both reports provide an opinion on the developed solutions). As such we believe the cost savings potentially achieved through improved project management and competitive tendering could be in the region of 10-20%.
Total	**$1,875,000**	**Based on the above cost estimate, the overall costs could be reduced by 20 to 30%**

Conclusion on Efficiency Evaluation

The costs associated with the installation of the AVK/Glenfield Valve primarily consist of contractors, overheads, staff costs and indirect costs. Whilst the contractor costs were obtained from the market we note that it was not a competitive tender, and that further efficiencies may have been achieved through an open tender. Additionally we believe that some of the costs incurred could have been avoided if a more robust specification of the valve had been developed following more detailed studies as to its requirements, and if there had been a greater risk transfer to the valve manufacturer, putting the onus onto the valve manufacturer to ensure that the valve was fit for purpose and that they satisfied themselves that the data they had on its specification was adequate and correct.

The staff costs for this project are high; however, these are associated with the ongoing problems experienced at this site. The overheads and indirect costs are linked to the number of staff hours, which are also therefore higher than expected for a project of this type.

We conclude that whilst the costs are higher than would have been expected for the replacement of a valve of this type, a number of items contributed to these costs that were outside the control of SunWater.

C.5.5 Summary and Conclusions

We conclude that the project is prudent as the need to replace the failed valve has been established. However, the implementation of the project did not follow best practice. We conclude that the majority of the liability for this falls to the valve manufacturer but some liability is attributable to SunWater.

We conclude that some of the project costs could have been avoided by SunWater through:

- The development of a more robust specification for the valve and ensuring fit for purpose risk transfer to the manufacturer
- The timely use of specialist support, where strengths and capabilities are lacking in house
- The use of a competitive tender process for the valve

Whilst it is difficult to definitively determine cost overrun, our subjective estimate is that cost savings of 20 to 30% could have been achieved.