Draft Report
Inquiry on Harvey Water Bulk Water Pricing

Preliminary Views and Issues for Further Consideration

14 December 2006

Economic Regulation Authority
WESTERN AUSTRALIA

A full copy of this document is available from the Economic Regulation Authority website at www.era.wa.gov.au.

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1 Introduction

On 5 October 2006 the Treasurer of Western Australia gave written notice to the Economic Regulation Authority (**Authority**) to undertake an inquiry into the most appropriate level and structure of water storage charges to the South West Irrigation Cooperative (**Harvey Water**).

1.1 Terms of Reference

This inquiry has been referred to the Authority under Section 32 of the *Economic Regulation Act 2003* (**Act**), which provides for the Treasurer to refer to the Authority inquiries on matters related to regulated industries (i.e. water, gas, electricity and rail industries)[1].

The Terms of Reference are provided in Appendix 1.

In accordance with the Terms of Reference, the Authority will make recommendations on the level and structure of water storage charges to Harvey Water, which will require consideration of:

- the cost of operating and maintaining the irrigation dams;
- the additional costs associated with maintaining and improving dam safety for the Water Corporation's South West irrigation dams;
- the beneficiaries of the South West irrigation dams;
- the ability of South West irrigation farmers and Harvey Water to meet their share of the costs [of dam safety improvements] and the impact on farmers of the rate of change of an increase in prices (if any); and
- the impact on State Government's net financial position associated with the recommended price level and structure.

In examining the water storage charges to Harvey Water, the Authority is required by the Terms of Reference to have regard to:

- the Government's social, economic and environmental policy objectives.

In undertaking the inquiry, the Authority recognises section 26 of the Act, which requires the Authority to have regard to:

- the need to promote regulatory outcomes that are in the public interest;
- the long-term interests of consumers in relation to the price, quality and reliability of goods and services provided in relevant markets;
- the legitimate business interests of investors and service providers in relevant markets;
- the need to promote competitive and fair market conduct;
- the need to prevent abuse of monopoly or market power; and

[1] Section 38 of the Act also provides for the Treasurer to refer to the Authority inquiries on matters related to other industries (i.e. not the regulated industries of water, gas, electricity and rail).

- the need to promote transparent decision making processes that involve public consultation.

The Authority invites interested parties to consider the Terms of Reference and the preliminary views and issues for further consideration that are discussed in this draft report and prepare a submission to the inquiry.

1.2 Background to the Inquiry

In October 1996, the Water Corporation (**Corporation**) transferred its South West irrigation distribution business to the South West Irrigation Management Co-operative (now trading as Harvey Water) and entered into a ten-year water storage agreement with the irrigation water supplier.[2]

The Corporation owns and operates the eight dams in the South West that are used to provide water to three groups of customers: farmers, via the distribution network owned and operated by Harvey Water; private industry, which is supplied via Harvey Water (although the Corporation recoups some of the revenue); and customers in Perth and elsewhere in the Integrated Water Supply System (**IWSS**). In addition, most of the dams (all except Stirling and Samson Brook dams) are used for a variety of recreational purposes.

While the Corporation owns and operates the dams, it does not have the rights to all of the water in the dams. Harvey Water was granted water access entitlements under the *Rights in Water and Irrigation Act 1914* to the majority of the water in the dams (the entitlements, which were for a period of five years, have recently expired and Harvey Water has applied to have the entitlements reissued). The Corporation does not charge for the water itself but only for the costs associated with storing the water (where the charges are based on the future costs of providing the storage service).

1.2.1 Description of System

Harvey Water owns and manages three separate irrigation systems (Waroona, Harvey and Collie), supplied by water from eight dams:

- Waroona Irrigation Scheme is supplied from Waroona Dam (which feeds into Drakes Brook Dam) and Samson Brook Dam;
- Harvey Irrigation Scheme is supplied from Harvey Dam, which is downstream of the Stirling Dam, and from Wokalup Dam and Logue Brook Dam; and
- Collie Irrigation Scheme is supplied from Wellington Dam (via Burekup Weir).

In 2005/06, Harvey Water had a total allocation of 152 GL, most of which is supplied from Wellington Dam (68 GL) and Harvey Dam (40 GL). Water trading between Harvey Water and the Corporation will reduce the allocation to Harvey Water to 136 GL by 2009/10.[3]

The Waroona and Harvey Irrigation Schemes are connected to the IWSS via the Stirling Trunk Main.

[2] In fact, the assets were transferred to the South West Irrigation Asset Co-operative which was established as a separate entity to the South West Irrigation Management Co-operative, and which owns the assets.

[3] Harvey Water will have a reduced allocation from both Samson Dam, Stirling Dam and Logue Brook Dam. A potential future trade could reduce it by at least a further 22 GL.

1.2.2 Bulk Water Supply Agreement

The Bulk Water Supply Agreement (BWSA) specifies the terms and conditions under which the Corporation provides the water storage service for Harvey Water.[4] The BWSA also provides for Harvey Water to meet a share of the costs of safety improvements on the South West irrigation dams.

Water storage charges to Harvey Water were set on the basis that 85 per cent of the future operating and renewal costs for dam headworks would be recovered from Harvey Water and other direct users with the remaining 15 per cent of costs, which are attributed to other beneficiaries such as recreational users, paid for by Government.

Water storage charges amounted to around $0.8 million in 2004/05, of which $0.39 million was for dam safety charges, $0.25 million was for storing water for Harvey Water and $0.16 million was for storing water for non-irrigation users. Water storage charges to non-irrigation users, which represents less than one per cent of the total volumes, attracts a higher per unit charge than the charge to Harvey Water.

The Government makes a Community Service Obligation (**CSO**) payment ($3.3 million in 2004/05) to the Corporation to cover the difference between its water storage costs and revenue raised from the storage charges. The CSO provides the Corporation with a return on the dam assets that were in place at the time of the transfer and pays for the estimated benefits to the public, such as to recreational users.

The BWSA expired on 30 June 2006 and has been extended in the same form by mutual agreement of the parties. A new agreement will be completed following this inquiry. The new agreement will be framed within a context that is different now to 1996 when the BWSA was initially endorsed. At the time of the original agreement, a long-term shortage of rainfall was not contemplated and neither was the prospect of trading water with the Corporation.

In addition, the original agreement did not contemplate the significantly higher expenditure on dam safety that would be required to meet the Australian National Committee on Large Dams (**ANCOLD**) guidelines.[5] The costs of improvements to the dams were estimated at around $16 to 18 million at the time of the transfer, but have since increased to around $128 million.[6] A review by Marsden Jacob Associates (**MJA**) in 2003 concluded that the Corporation compared favourably with current Australian best practice in dam safety management, but suggested several areas where the process could be improved.[7] The review concluded that the allocation of these costs to Harvey Water would be unaffordable, and recommended that Harvey Water pay 25-35 per cent of the dam safety costs for Waroona Dam and 40-50 per cent of the remainder of the dam safety program.

[4] While the agreement is called the “Bulk Water Supply” Agreement it actually refers to the terms and conditions associated with the Corporation storing water that Harvey Water has a licence to take (i.e. the Corporation does not “sell” water to Harvey Water).

[5] The ANCOLD Guidelines can be ordered at the ANCOLD website, www.ancold.org.au.

[6] Source: Water Corporation

[7] Marsden Jacob Associates (August 2003), *Review of Dam Safety Program Relating to South West Irrigation Dams: Final Report*, a report for Harvey Water and the Water Corporation. Suggested improvements in the Corporation’s process included more stakeholder involvement, greater use of expert reviews, greater use of detailed risk assessment; and achieving ANCOLD targets over a longer timeframe.

1.3 Review Process

The recommendations of this inquiry will be informed by the following public consultation process:

- The Authority published an issues paper on 13 October 2006 and invited comments. Six submissions were received in response to the issues paper. The issues paper and submissions are published on the Authority's website (www.era.wa.gov.au).
- Submissions on this draft report are invited from stakeholder groups, Government, industry and the general community. Submissions should be received by the Authority by 31 January 2007.
- The Authority's Consumer Consultative Committee will be consulted on the findings in the Draft Report.
- The final report for this inquiry is to be delivered to the Treasurer by 1 March 2007. Under the legislation, the Treasurer then has 28 days to table the report in Parliament.

In accordance with section 45 of the Act, the Authority will act through the Chairman in conducting this inquiry.

1.4 How to Make a Submission

Submissions on any matters raised in this draft report or in response to any matters in the Terms of Reference should be in written form and electronic form (where possible) and addressed to:

Inquiry on Harvey Water Bulk Water Pricing
Economic Regulation Authority
PO Box 8469
Perth Business Centre
PERTH WA 6849

Email: bulkwaterpricing@era.wa.gov.au
Fax: (08) 9213 1999

Submissions must be received by 31 January 2007.

In general, submissions from interested parties will be treated as in the public domain and placed on the Authority's website. Where an interested party wishes to make a confidential submission, it should clearly indicate the parts of the submission that are confidential. For more information about the Authority's submissions policy, see the Authority's website.

The receipt and publication of a submission shall not be taken as indicating that the Authority has knowledge either actual or constructive of the contents of a particular submission and, in particular, whether the submission in whole or in part contains information of a confidential nature and no duty of confidence will arise for the Authority in these circumstances.

Further information regarding this inquiry can be obtained from:

Mr Greg Watkinson
Director, References and Research
Economic Regulation Authority
Ph (08) 9213 1965

Media enquiries should be directed to:

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2 Method for Cost Recovery

2.1 Terms of Reference

The Authority is expected to consider and develop findings on:

> The cost of operating and maintaining the irrigation dams, based on:
>
> a. a "renewal costing" methodology which carries forward the model used for the 1996 Bulk Water Agreement;
>
> b. a "full costing" methodology, consistent with National Water Initiative pricing principles, including efficient operating costs and capital expenditure requirements and a suitable rate of return on past and future investment in storage and distribution assets owned by the Water Corporation.

2.2 Background

The BWSA was based on an assessment of the costs associated with providing a water storage service to Harvey Water. The following costs underpinned the contract price:

- the expected amount that needed to be put aside so that the assets that were in place at the time of the handover could eventually be replaced;
- the expected new capital expenditure (excluding dam safety expenditure); and
- the expected operating and maintenance expenditure.

After determining the expected costs for a period of 100 years, the Corporation calculated the annual amount of revenue that would cover those costs.[8] Eighty five per cent of this annual amount was charged to Harvey Water because it was assumed that 15 per cent of the benefits of the expenditure would accrue to third parties such as recreational users of the dams. The third party benefits were to be funded by CSOs from the State Government.

Dam safety expenditure was treated separately (that is, it was not used to determine the base contract prices). The agreement included a provision for Harvey Water to contribute to the costs of dam safety, and a payment was subsequently made by Harvey Water in 2004/05. Dam safety expenditure is discussed in Chapter 3.

2.3 Analysis

2.3.1 Clarification of Terms

Some of the terms used in the Terms of Reference require explanation.

"Renewal costing" is a term that is generally attributed to the method of making provision for capital costs that are expected to be incurred in the future.

[8] Harvey Water has indicated that the agreement was to exclude the new Harvey Dam from these contributions because the effect of building that dam was to free up higher quality water from Stirling Dam for potable purposes.

"Full costing" is a term that is generally attributed to the method of recovering all of the costs that are incurred in operating a business, including the operating costs, a return of the value of the assets invested in the business (often referred to as depreciation) and a return on the assets invested (recognising that the capital used to construct the assets could have been used on other projects).

The National Water Initiative includes other terms. Section 66v of the NWI Agreement requires:

> Full cost recovery for all rural surface and groundwater based systems, recognising that there will be some small community services that will never be economically viable but need to be maintained to meet social and public health obligations:
>
> 1) achievement of lower bound pricing for all rural systems in line with existing NCP commitments;
> 2) continued movement towards upper bound pricing for all rural systems, where practicable; and
> 3) where full cost recovery is unlikely to be achieved in the long term and a Community Service Obligation (CSO) is deemed necessary, the size of the subsidy is to be reported publicly and, where practicable, jurisdictions to consider alternative management arrangements aimed at removing the need for an ongoing CSO.

Under the NWI Agreement the State Government is required to ensure that lower bound pricing, at least, is applied to Harvey Water. Lower bound pricing has the following definition:

> To be viable, a water business should recover, at least, the operational, maintenance and administrative costs, externalities, taxes or TERs (not including income tax), the interest cost on debt, dividends (if any) and make provision for future asset refurbishment/replacement... Dividends should be set at a level that reflects commercial realities and stimulates a competitive market outcome.[9]

Lower bound pricing can be interpreted as charging the minimum amount to ensure ongoing commercial viability of the water business.

Harvey Water submitted that the prices under the BWSA, which were based on the renewal method, were consistent with lower bound pricing.

> The payments agreed to by Harvey Water under the first Bulk Water Supply Agreement (BWSA) 1996, meet the Lower Bound Condition for return on assets as set by COAG under NCP.
>
> Harvey Water believes that the renewals methodology is the most appropriate method of establishing the Water Corporation's costs of owning and operating dam infrastructure. (Harvey Water submission, p3)

The Authority considers that the renewal method calculates prices that are likely to be either at or above lower bound. This is because the renewal method implicitly assumes that a rate of return is applied to capital costs, which is not strictly consistent with lower bound pricing (as defined above) unless the assets are debt funded or dividend payments are made.

[9] Schedule B(i), Intergovernmental Agreement on a National Water Initiative.

The NWI Agreement envisages a move towards upper bound pricing, which has the following definition:

> To avoid monopoly rents, a water business should not recover more than the operational, maintenance and administrative costs, externalities, taxes or TERS (tax equivalent regime), provision for the cost of asset consumption and cost of capital, the latter being calculated using a WACC (weighted average cost of capital)…. The deprival value methodology should be used for asset valuation unless a specific circumstance justifies another method.[10]

The deprival value referred to in the definition above is calculated by estimating the present value of the future net income stream.

2.3.2 Implications for the New BWSA

The Authority has considered various alternative approaches to pricing for the new BWSA. In its assessment, the Authority has drawn upon advice from ACIL Tasman.[11]

The Authority's preliminary view is that it would not be appropriate to apply lower bound pricing to the new BWSA as it could potentially recover costs that are less than would be recovered under the renewals method, which has already been accepted by the parties to the BWSA. That is, lower bound pricing could result in the return on assets being excluded from costs.

The Authority also considers at this stage that it would be inappropriate to start afresh with a renewals method based on future costs only. The original BWSA assumed that Harvey Water would pay the opportunity value of (i.e. a rate of return on) the capital expenditure that has been incurred to date. It would be inconsistent with the original BWSA to ignore the return on this capital expenditure.

Another approach considered by the Authority is to base prices on a depreciated optimised replacement cost (DORC) valuation of the dam assets. This approach involves estimating the cost of replacing the dams, optimised for the latest engineering standards and depreciated to be consistent with the current service level. The Department of Treasury and Finance stated a preference for the application of a DORC methodology to determine the cost of the asset based for the South West dams:

> [T]he DORC asset valuation method (with straight line depreciation) has become a conventional approach of valuing existing infrastructure assets and it is utilised by most Australian and overseas regulators in industries such as gas, electricity, telecommunications and rail and water. For long-lived assets such as the Harvey Dam scheme, DORC is especially appropriate. (Department of Treasury and Finance submission, p3)

However, the Authority does not consider at this stage that the BWSA should be based on an estimate of the optimised replacement cost of the assets. The estimation of a DORC asset value for the South West dams would be a complex and expensive exercise (that could need to be repeated at the outset of each new BWSA) which involves a substantial amount of judgement with regard to the costing and optimisation process. The estimation would need to take into account the costs a new party would incur in providing the equivalent level of dam services. It is likely that a new party would incur less expenditure to meet the dam safety guidelines than the Corporation would spend in retrofitting the

[10] Schedule B(i), Intergovernmental Agreement on a National Water Initiative.

[11] For a full discussion of the cost recovery methodologies discussed in this section, see ACIL Tasman (November 2006), *Harvey Water Supply System: Notes on Pricing Frameworks*, Paper 3 of 4 for the Authority, published on the Authority web site.

dams. However, how much less a new party would spend would be a matter of contention (this matter is discussed further in the next chapter).

The Authority is of the view that the deprival value method offers advantages over the DORC method. The deprival value method is consistent with the pricing principles of the NWI; it is consistent with the original BWSA; it avoids the cost and complexity of a DORC valuation; and it offers flexibility in dealing with the allocation of dam safety costs (rather than incorporating the amount a new party would spend on dam safety into the DORC asset value, the dam safety costs can be allocated to users or the Government in a more flexible way (as is discussed in Chapter 4)).

The Authority's preliminary view is that the BWSA should be based on the upper bound pricing principle, using an appropriate estimate of the (deprival) asset value.

Under the original BWSA, the implicit assumption was that the initial asset value was zero. In hindsight, this may have been an appropriate estimate of the initial asset value under the deprival value method given the uncertain magnitude of the future dam safety expenditure. The Authority's preliminary view is that there is merit is assuming that the initial asset value at the time of the original BWSA is zero because this is not only consistent with the BWSA but it enables the rolled forward asset value to define an appropriate upper pricing bound that recognises efficient costs incurred since 1996 and is consistent with deprival value principles.

The 30 June 2006 asset value can be calculated by starting with a zero initial asset value at the commencement of the BWSA in 1996, adding the capital expenditure that has been incurred by the Corporation over the period of the agreement, subtracting depreciation and adjusting for inflation.

This calculation is influenced by the assumption regarding the amount of dam safety capital expenditure already incurred being added to the regulatory asset value. The advantage of the approach suggested by the Authority is that it makes this decision explicit and transparent. As indicated above, this issue is discussed further in Chapter 3.

Harvey Water noted in its submission that it considers the dam safety contribution that it made in 2004/05 to be a capital contribution. Such contributions are typically deducted either from the regulatory asset value or from the cost of service to ensure that the owner does not receive a return on assets it has not funded. The Authority understands that there is some disagreement between the parties about whether the contribution was a capital contribution and will be investigating this matter further.

The maximum asset value (i.e. the value obtained from adding all of the dam safety capital expenditure into the asset base) as at 30 June 2006 is $205.6 million (in real dollar values of 30 June 2006). It should be noted that this is the value for the portfolio of South West dams, including the dams from which Harvey Water accesses little or no water.

The Authority's preliminary view is that there may need to be a transition to upper bound pricing if Harvey Water's current charges are significantly below the upper bound level. A transition period of 10 years (the length of the current BWSA) is suggested. This issue is discussed further in Chapter 5.

Preliminary Views

1) It would be appropriate to apply the NWI upper bound pricing principle for the purpose of determining the costs of operating and maintaining the irrigation dams.

2) The appropriate asset value as at 30 June 2006 is consistent with a zero asset value as at 30 June 1995, rolled forward by adding appropriate dam safety and other capital expenditure, subtracting depreciation and adjusting for inflation.

3) It may be appropriate to phase-in the upper bound charges over a reasonable period, such as ten years.

Issues for Further Consideration

4) Should Harvey Water's dam safety payments be treated as capital contributions?

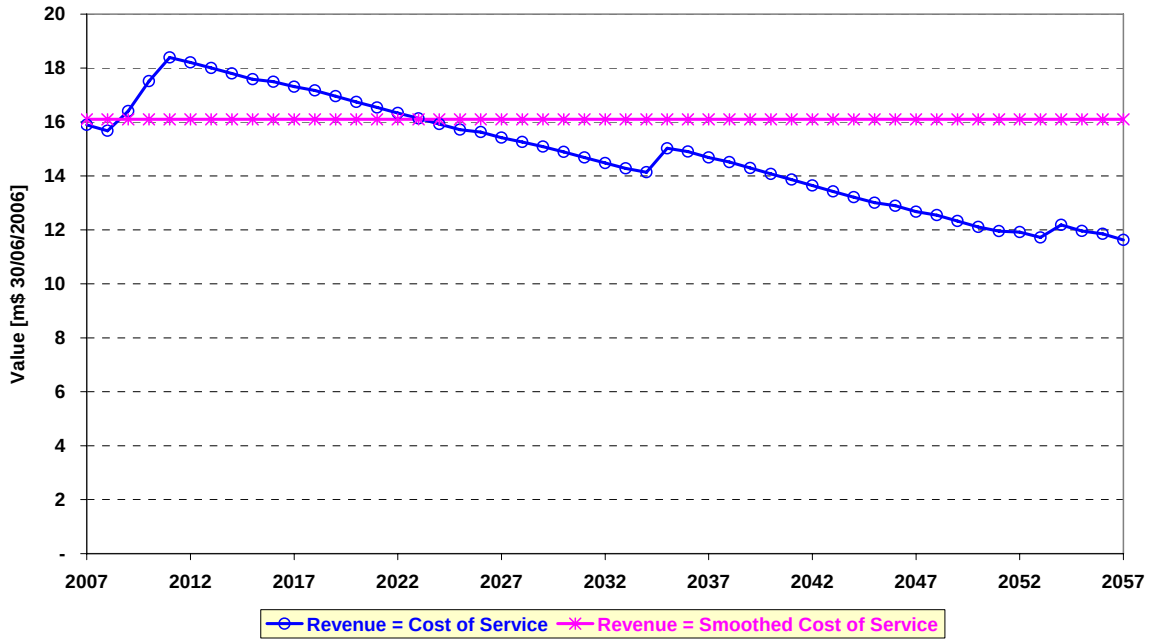
5) To what extent should the dam safety expenditure incurred since 1996 be rolled into the regulatory asset value?

2.3.3 Alternative Approaches to Determining the Annual Revenue Requirement

A related issue is whether the payment schedule should be smoothed or not (i.e. whether the revenue requirement should be constant from year to year or vary). Figure 2.1 illustrates the implications of smoothing the Corporation's annual revenue requirements over the next 50 years.[12] Both the smooth and unsmooth approaches have the same net present value.

[12] The figure is based on the scenario discussed in Appendix 2.

Figure 2.1 Alternative Approaches to Determining the Annual Total Revenue Requirement



Source: Economic Regulation Authority analysis

In situations where significant capital expenditure is expected at some relatively distant time, smoothing of this future outlay provides security that there will be sufficient revenues to fund the capital expenditure and to ensure the financial viability of the company. However, as can be seen in the figure above, smoothing does not confer this advantage when the capital expenditure (i.e. the dam safety program) is impending. Instead, smoothing would allow customers to defer their payments.

There are drawbacks associated with the smoothing approach, including that it does not encourage efficiency. Annuities based on long-range forecasts of future expenditure may be highly uncertain, which can lead companies to conservatively over-estimate expenditure requirements. It is difficult for regulators, who are at an informational disadvantage, to determine the efficiency of long-range capital expenditure programs, or to regulate against imprudent over-spending or under-spending on a year-to-year basis.

A further problem with the smoothing approach is that it can commit a company to a particular capital works program (since this is what customers have paid for) even if the economic case for a portion of this program weakens. Also, customers may prefer to spend their income today in other ways than in funding future investments.

The alternative unsmooth approach places greater discipline on companies to achieve efficient expenditure. The merits of each investment are evaluated before that investment is made, and the investment costs are included in prices only after the costs have been incurred.

Irrigation cooperatives have considered this issue, with an outcome that:

- Colleambally Irrigation Co-operative in NSW charges an annual asset renewals levy to its members to provide funding to maintain its infrastructure. Consultants

are engaged every five years to assess the 50-year asset replacement profile and to determine a suitable renewals annuity.

- SunWater in Queensland also uses a smoothing approach, based on a 30-year rolling period.
- In Victoria, the Water Industry Regulatory Order requires that water businesses apply the unsmooth approach to their urban activities, but that they may adopt either approach in respect of their rural activities. Of the five rural water businesses:
  - two businesses have moved to an unsmooth approach (Goulburn-Murray Water and GWMWater). An independent consultant's review in 2005 of Goulburn-Murray Water's policies recommended a move to an unsmooth approach, primarily on the grounds of improved incentives for efficiency in capital expenditure;[13] and
  - three businesses have elected to retain a smoothing approach for their rural activities (First Mildura Irrigation Trust, Lower Murray Water and Southern Rural Water). However, Lower Murray Water uses a pay-as-you-go approach for its urban activities.

Given the size of the dam safety capital expenditure program, the Authority is of the view that the whether to smooth the revenue requirement or not is best left to the Corporation and Harvey Water to agree.

Preliminary Views

6) Whether the new agreement is based on a smoothed revenue requirement or not is a matter for the Corporation and Harvey Water to agree.

[13] Frontier Economics (March 2005), *Review of Pricing Policies*, a report prepared for Goulburn-Murray Water.

3 Dam Safety Expenditure

3.1 Terms of Reference

The Authority is expected to consider and develop findings on:

> The additional costs associated with maintaining and improving dam safety for the Water Corporation's South West Irrigation Dams. This should include consideration of:
>
> a. the requirements of the current Australian National Committee on Large Dams (ANCOLD) dam safety guidelines and the requirement for the Water Corporation to manage their dams to these guidelines; and
>
> b. the overall merits, for all parties, of alternatives to the ANCOLD dam safety guidelines.
>
> These considerations should utilise existing studies, including:
>
> a. Marsden Jacob Associates August 2003 *"Review of Dam Safety Program Relating to South West Irrigation Dams";*[14] and
>
> b. Snowy Mountains Engineering Corporation July 2006 "*Evaluation of Alternative Risk Management Strategies*".[15]

The purpose of this chapter is to identify the appropriate method for determining the level of dam safety expenditure to be included in the Corporation's revenue requirement for the duration of the new BWSA. Consideration is given to the merits of ANCOLD versus alternative arrangements.

3.2 Background

3.2.1 Previous Work

Prior to 1995, the (then) Water Authority was aware of the issues regarding the safety of the South West dams, but no detailed review of the costs of upgrading the dams had been carried out.[16] Following the establishment of the Corporation in 1995, the Corporation reviewed its dam safety requirements. In the absence of State-based regulations on dam safety, the Corporation adopted the framework of guidelines and risk standards set by ANCOLD.

The BWSA, signed in October 1996, required safety upgrades in accordance with the ANCOLD *Guidelines on Dam Safety Management 1994*. An estimate of $17 million for dam safety upgrades was included in the BWSA, although it was acknowledged that this estimate was highly uncertain, pending a thorough review of the dams.

The Corporation commenced a dam safety review in 1997, with a portfolio risk assessment to identify dams with the highest safety risk. Six South West dams were included in the high priority list for design reviews. These reviews were carried out in 1997-98, followed by concept designs, detailed designs and customer consultation

[14] This document is available on the Authority web site at www.era.wa.gov.au.

[15] This document will be available on the Authority's web site when the final report is completed (it is currently only a draft report).

[16] Water Corporation, personal communication, 25 August 2006.

(although not with Harvey Water), with detailed business cases by 2001. In 2002, dam safety upgrade costs for the South West irrigation dams were estimated at $102 million.

In 2002, the Corporation and Harvey Water commissioned MJA to conduct a review of the expenditure on dam safety for the South West irrigation dams.[17] The MJA review examined best practice dam safety management in Australia and concluded that:

> Water Corporation currently utilises a process that compares favourably with current Australian best practice in dam safety management. They have adopted risk-based decision-making and a stated objective of eventually reaching compliance with modern ANCOLD dam engineering standards. (MJA, 2003, p122).

However, MJA identified some opportunities for improvements in the Corporation's process, including greater stakeholder involvement in the development of the dam safety program; more use of expert reviews; greater use of detailed risk assessment techniques; and consideration of interim risk reduction works (i.e. achieving ANCOLD targets over a longer period).

In May 2004, the Western Australian Government appointed a working group on dam safety, chaired by the Water Services Planning Branch of the Department of Environment, to examine the merits of developing State-based regulations on dam safety. The working group included representatives from the Department of Treasury and Finance, the Corporation and Harvey Water. The working group published a draft report in 2006 on the evaluation of alternative risk management strategies for dam safety.[18]

The draft report by the working group recommended that there be a greater acceptance of interim measures (upgrading over time) and risk mitigation measures such as monitoring, early warning systems and evacuation procedures.[19] It also recommended that the State Government develop methods to assess and compare risks so that the principles applying to expenditure on safety are consistently applied across government agencies.

Western Australia is not alone in its increased focus on dam safety. Dam safety management in the United States became more formal and pro-active following legislation and guidelines enacted in the decades following the failure of the Titon Dam in 1976. Since the corporatisation of State government organisations in Australia in the 1990s, the boards of dam-owning corporations have moved to assess the risks of dams and implement remedial works in accordance with the relevant standards (either ANCOLD or State-based standards, where they exist).[20]

3.2.2 ANCOLD

ANCOLD was established in 1937, as the national branch of the International Commission on Large Dams. ANCOLD produces guidelines, for example, on:

- environmental management of dams;
- the selection of acceptable flood capacity for dams;
- assessment of the consequences of dam failure;
- dam design;

[17] Marsden Jacob Associates (August 2003), op.cit.

[18] Snowy Mountains Engineering Corporation (June 2006), *Evaluation of Alternative Risk Management Strategies Draft Report*, prepared for the Department of Environment.

[19] Snowy Mountains Engineering Corporation (June 2006), ibid.

[20] Ibid, p8.

- dam safety management; and
- management of risk for dams.

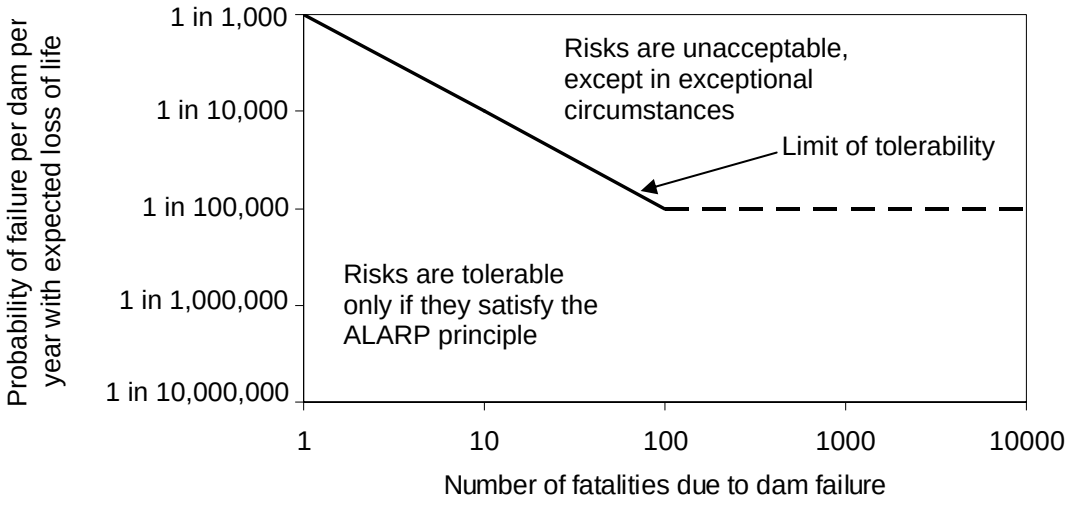
ANCOLD Guidelines are not compulsory standards but include a range of measures for consideration when undertaking dam safety works. These measures include alternative means such as risk management as well as engineering solutions.

The ANCOLD Guidelines have been developed in the light of international dam safety standards and wider risk-based approaches such as that of the Health and Safety Executive in the UK.[21] Underpinning the Guidelines are defined limits of tolerability of the risks of dam failure. The Guidelines require that all risks above the limits of tolerability be reduced to the limits of tolerability, except in exceptional circumstances. Below the limits of tolerability, risks are considered tolerable, but must be further reduced to "As Low As Reasonably Practicable" (the **ALARP** principle).

Figure 3.1 shows the ANCOLD limits of tolerability for risks of dam failure for existing dams. The figure shows that:

- no single individual should face a risk greater than 1:1,000 of death from dam failure in any one year;
- the expected (risk weighted) number of fatalities in any one year must not exceed 1:1,000 for an established dam; and
- the limits of tolerability are capped for any number of deaths above 100 (1:100,000 for existing dams).[22]

Figure 3.1 ANCOLD Societal Risk Reference Guidelines – Existing Dams



Source: ANCOLD Guidelines on Risk Assessment (2003), p47.

The limits of tolerability are more stringent for new dams and major augmentations than for existing dams, ranging from a risk of 1 in 10,000 for a single individual to a cap of 1 in 1,000,000 for 100 lives or more. The less stringent tolerability limits for existing dams

[21] For example, ICOLD (International Committee on Large Dams) standards; Health and Safety Executive (2001), *Reducing Risk, Protecting People: HSE's Decision-Making Process.*

[22] This truncation is an Australian variation on international standards, reflecting the view that any large loss of live, whether it is 100 lives or 500 lives, is equally intolerable to society.

recognises that the costs of upgrading old dams to meet safety standards is much higher than for new investments.

The framework of the ANCOLD Guidelines addresses three key objectives in relation to public policy on safety:

- ***equity*** – the principle that all members of a society face equal levels of risk. This principle is encapsulated in the limits of tolerability of risk, which are set without reference to the costs or benefits of investment in safety;
- ***efficiency*** – ensuring that investments in improving safety are cost effective, in that they achieve the greatest reduction in risk per unit of expenditure. Efficiency considerations can have a bearing on the timing and sequencing of investments. The ANCOLD Guidelines support the use of portfolio risk assessment, in which risks are assessed and addressed across a portfolio of assets (e.g. dams) to prioritise expenditure so that each step achieves the greatest possible reduction in risk; and
- ***protecting dam owners against liability***. Dam owners are protected from liability by the ANCOLD requirement that risks be further reduced below the tolerability limits provided that the costs are not disproportionate to the benefits of risk reduction.

3.3 The Corporation's Dam Safety Program

The following table summarises, in the Corporation's order of priority, the potential consequences of a dam failure (in terms of loss of human life) for those South West Irrigation dams that remain in the Corporation's safety program.[23] The population at risk are those people that would be directly affected by floodwater in the event of dam failure, and the probable loss of life is an estimate of how many lives would be lost in such an event.[24]

[23] Waroona Dam has been included for reference even though its work program is now complete.

[24] The probable loss of life is considered highly prone to error. An actual event could result in loss of life an order of magnitude on either side of the estimate. Pers. com. Michael Somerford, Water Corporation, December 5, 2006.

Table 3.1 Characteristics of Each Dam in the Corporation's South West Dam Safety Program

Dam	Population at Risk	Probable Loss of Life[25]		
		Under Flood Loading	*Under Normal Loading*	*Under Earthquake Loading*
Wellington Dam	6000	200	-	600
Stirling Dam	3200	50	50	-
Drakes Brook Dam	335	4	4	-
Logue Brook Dam	240	4	10	-
Samson Brook Dam	380	7	10	-
Waroona Dam	580	6	14	-

Source data: Water Corporation

It should also be noted that all of the dams, apart from Wellington Dam, are earthwork dams. Earthwork dams are more prone to being undermined by water seepage, but are resistant to earthquake damage, hence the listing of probable loss of life under 'normal' rather than 'earthquake' loading in the table. The opposite is true for Wellington Dam, being of concrete construction.

The planned remedial works for the dams include:[26]

- for Wellington Dam, the installation of post tensioned anchors through the dam along with other minor works on instrumentation and decommissioning of the high level outlet;
- for Stirling Dam, the construction of a spillway crest to increase dam capacity, the placement of downstream filters, raising of the embankment and the upgrading of instrumentation;
- for Drakes Brook Dam, the excavation and rebuilding of the top three meters of the dam, raising the dam by one meter, the construction of a new main spillway and upgrade of instrumentation. There is also the possibility of work to be conducted on the outlet pipe;
- for Logue Brook Dam the construction of a new spillway, the extension of a chimney filter, work on the outlet conduit, the replacement of the intake tower with a submerged valve, an upgrade of dam instrumentation, the installation of

[25] The Corporation has provided the following advice in relation to the assumptions underlying the figures in this table, using Wellington Dam as an example: " The Probable Loss of Life (PLL) estimate for Wellington Dam was determined through the application of the method outlined in "A Procedure for Estimating Loss of Life Caused by Dam Failure" by Wayne Graham, (USBR 1999). A spreadsheet model was developed to apply the "Graham method" consistently across the portfolio. The model applied different warning times assigned to each of four time categories corresponding to likely emergency preparedness at different times of the day and weekday/weekend. The assumptions made with relation to the warning time have a significant influence on the PLL figures. The assumed warning time for flood failure was between 0.5hr and 2hr before the failure of the dam depending upon the time of day and week. The assumed warning time for earthquake failure was between 0.25hr and 2hr (depending upon the time of the day and week) after the flood wave has reached the South West Hwy. The PLL figures were weighted according to the time of day and weekday/weekend to give an estimated total PLL of 200 for the flood failure scenario and 600 for the earthquake failure scenario."

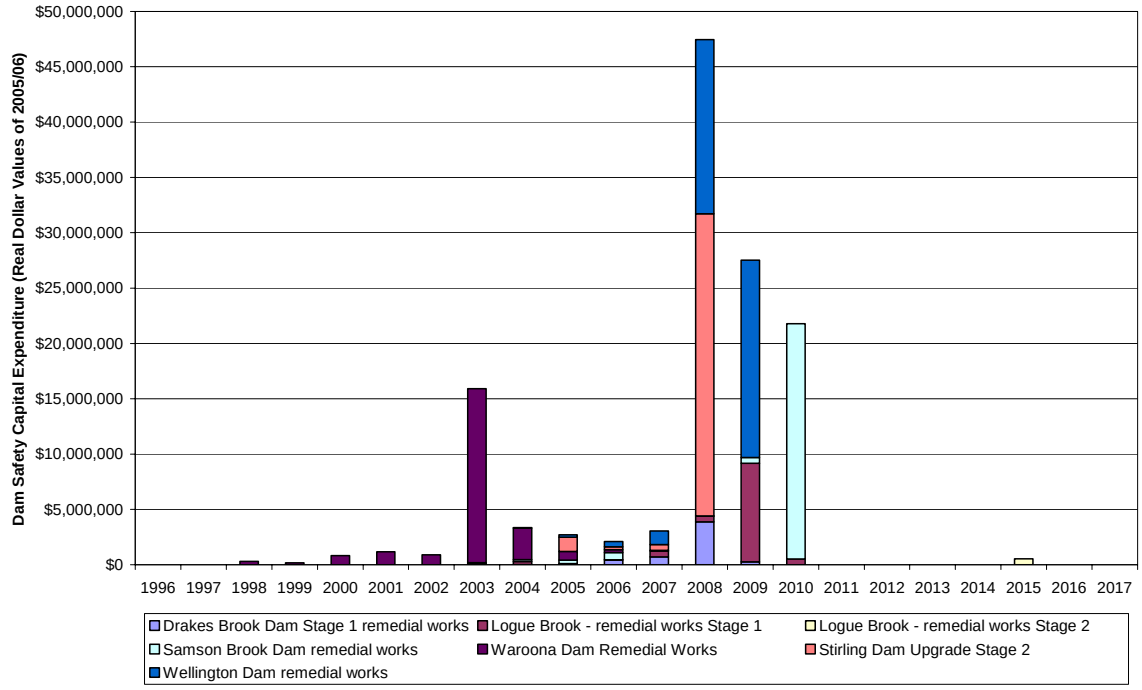
[26] For a detailed description of proposed works see Water Corporation (2006), *Dam Safety Remedial Works Program*.

guardrails and the construction of a chimney filter and downstream berm on the saddle dam.[27]

- for Samson Brook Dam, the construction of a new spillway, the decommissioning of the glory hole spillway, the excavation of downstream rockfill, upgrade of the access track and upgrade of dam instrumentation.[28]

The Corporation's expenditure on dam safety is shown in Figure 3.2 below. This shows that the Corporation is proposing to largely complete its dam safety program within the next three years. Waroona Dam remedial works have been completed.[29] The Corporation intends to complete the upgrade to Stirling Dam in 2007/08 and the works on Wellington Dam by 2008/09. Remedial works on Logue Brook Dam would be largely completed in 2008/09 while works on Samson Brook Dam would be completed in 2009/10.

Figure 3.2 Corporation Dam Safety Capital Expenditure



Source: Water Corporation

3.4 Analysis

Since 1995, Corporation risk assessments have been based largely upon dam safety or design reviews conducted by engineering consultants. Figure 3.3 below describes the framework under which these reviews are conducted. Probabilities are attached to various types of failure for each dam and compared to a probable loss of life should that failure occur. The figure shows the highest risk associated with each dam. All the points along the limit of tolerability line are considered of equal risk. Therefore, the further the

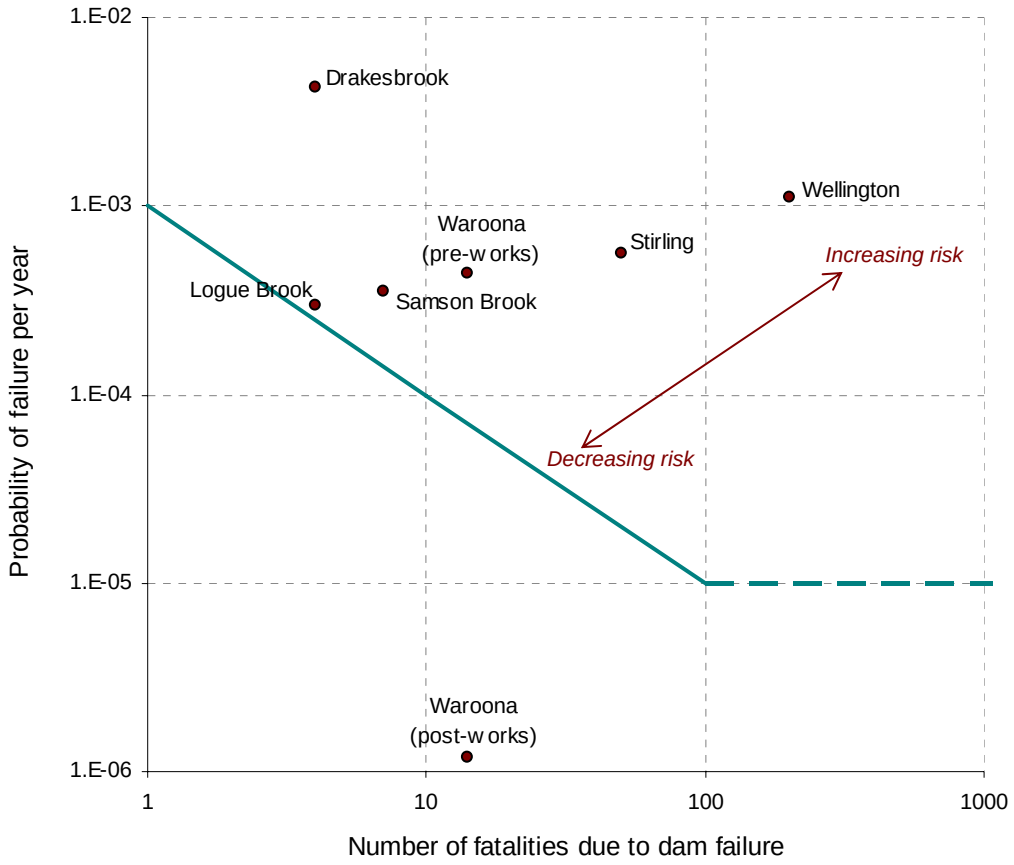
[27] A berm is low earthen wall adjacent to a ditch. A saddle dam is an auxiliary dam that confines the primary reservoir.

[28] A glory hole spillway is a vertical flared funnel.

[29] Prior to the most recent dam safety reviews conducted on behalf of the Corporation, Waroona Dam was considered the highest priority dam in the Corporation's portfolio.

highest risk point for a particular dam is above and to the right of this line, the higher priority ANCOLD attaches to the associated dam safety work. Similarly, the further a highest risk point is below and to the left of this line the lower the priority given.

Figure 3.3 Highest Cumulative Probability of Loss of Life Scenario by South West Irrigation Dam Based on Dam Safety Reviews and ANCOLD Guidelines



Source: Water Corporation data with Authority analysis

The current risks that Wellington, Stirling and Drakes Brook dams face are higher than the risks that Waroona faced prior to the commencement of work on that dam. As such, historically, the Corporation has not allocated resources in the ANCOLD order of priority. The reason for this is that, prior to 1995, less robust assessments of dam safety were conducted by the Corporation. At that time, Waroona was considered the highest risk dam in the portfolio and so it was the first dam to undergo the more robust method of a dam safety review. When this was completed in 1997, however, no other dam safety reviews had been conducted in the portfolio to enable comparison and prioritisation along ANCOLD guidelines. Therefore work began on Waroona prior to the revelation that three of the other dams were actually at higher risk.

The following table provides the completion years of dam safety reviews for each of the relevant dams and Corporation risk prioritisation (based on the timing and sequencing of their dam safety program) compared to ANCOLD risk prioritisation (based on the dam safety reviews).

Table 3.2 Dam Safety Review Completion years and Corporation Risk Prioritisation Compared to ANCOLD Risk Prioritisation

Dam	ANCOLD Risk Prioritisation (prior to work on Waroona)	Corporation Risk Prioritisation	Dam Safety Review Completion Year
Waroona Dam	3rd Lowest	Highest	1997
Wellington Dam	Highest	2nd Highest	2002
Stirling Dam	2nd Highest	3rd Highest	2000
Drakes Brook Dam	3rd Highest	3rd Lowest	2001
Logue Brook Dam	Lowest	2nd Lowest	1999
Samson Brook Dam	2nd Lowest	Lowest	1999

Source Data: Water Corporation

The table shows that the Corporation is intending to undertake remedial work on Logue Brook Dam ahead of work on Samson Brook Dam even though the ANCOLD risk prioritisation indicates Samson Brook Dam is the priority. According to the Corporation, this reordering of priority has been influenced by operational requirements. Specifically, there would be water supply disruptions to irrigators if the work went ahead in the ANCOLD specified order of risk.[30]

The Authority, at the time of this report has not yet completed its analysis of the Corporation's dam safety program and will be undertaking further analysis for the final report. The Authority has, however, undertaken a qualitative assessment of the proposed expenditure. The discussion below considers the following issues:

- the cost of improving dam safety in comparison to the costs of improving safety elsewhere;
- the basis for spending more on the management of some risks than on other risks; and
- alternative regulatory arrangements that could guide the timing and sequencing of expenditure on dam safety.

This chapter concludes with a consideration of the implications of these issues for the BWSA.

3.4.1 Comparison with Other Risks

The first consideration is how the standards which underpin ANCOLD (such as in the limits of tolerability on risk), and the expenditures required to meet those standards, compare with risk standards and expenditures in other areas of public health and safety.

Harvey Water reinforced the appropriateness of undertaking this analysis:

> For example, if $21 million is spent to save the potential loss of 3 lives in the unlikely event of flood event causing a dam failure in the SW, how much should be spent to save the roughly 200 lives which are lost on WA roads each year? Simple comparative maths says at least $1400 million (200 lives x $7 million per life). But the community doesn't spend

[30] Pers. com. Michael Somerford, Water Corporation, December 7, 2006.

> anything like that amount, so is it that road safety spending is too low or that dam safety costs are too high? The application of ANCOLD Guidelines might suggest that road safety funding is too low but common sense would probably say that dam safety costs are too high. (Harvey Water submission, p7)

The Department of Treasury and Finance support the view that compliance with ANCOLD could lead to higher safety expenditures than in other areas of risk.

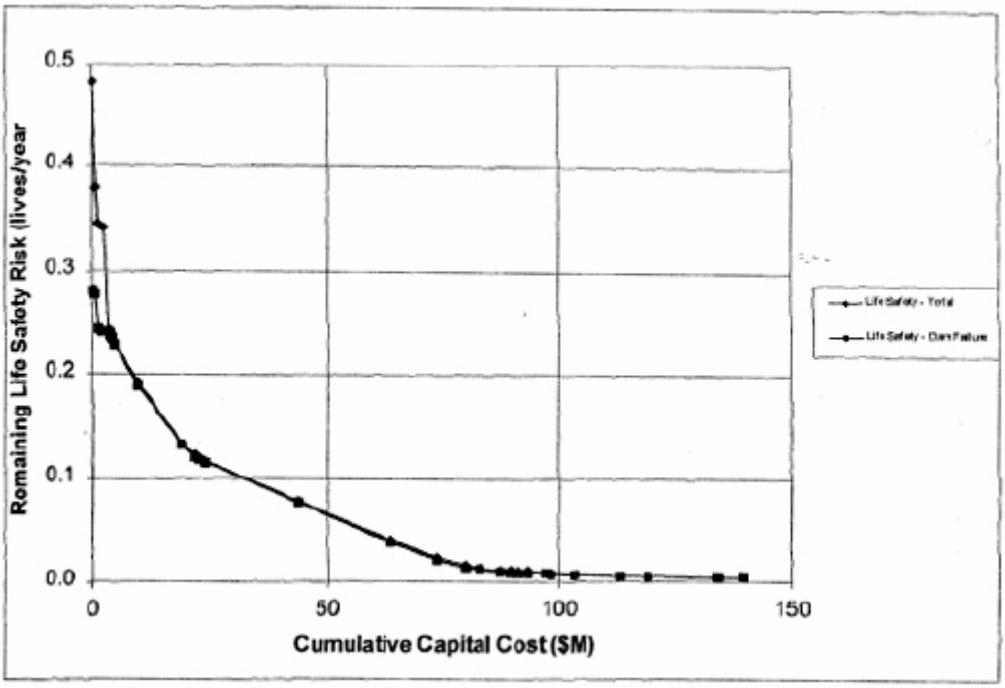
> Dam owners in Australia plan, design and construct dam safety upgrades to meet current engineering standards. In the case of Western Australia, these are set by the ANCOLD guidelines. As these standards require the reduction of risk to given levels that are independent of the cost of the works required, this can lead to much higher expenditure on reducing dam safety risks compared to other types of risk reduction expenditure undertaken in the community. (Department of Treasury and Finance submission, p3)

Harvey Water also questioned the assumptions about the potential for loss of life which underpin the ANCOLD Guidelines, which they suggest leads to an over-investment on dam safety for the South West dams:

> The ANCOLD Guidelines are applied to ultimately determine the potential Loss of Life (LOL) in the event of a dam failure, which has a direct relationship on the Hazard Rating of the dam and the funds that need to be spent to bring the risk down to a level known As Low As Reasonably Possible (ALARP).
>
> For general information it is worth noting that ANCOLD hydrologists currently say that in respect of South West dams, they must be constructed and managed such that they can cope with 1500 mm of rainfall in 72 hours. Perth's annual rainfall is currently about half of this and rapidly decreasing under the effects of apparent climate change. These levels of storm and flood risk are difficult for even the moderately informed person to come to terms with.
>
> LOL calculations are critical to determining the level of risk and cost of fixing dams. It is our understanding that in the case of a South West dam the flood level in case of failure would reach only about 1 metre but that 3 lives were reckoned to be lost as a consequence of flooding of homes. This result was obtained from a desk top study. Actual on-ground investigations of the Population At Risk showed that building standards require that homes are built on a pad at least 600 mm high and more in some cases. This feature was apparently not taken into account in the desk top study. Therefore the effect of the supposed flood is actually very much less than used in the risk assessment, the LOL would be much lower (possibly nil) and so the cost of the dam safety works is inflated by an unknown but considerable amount to the detriment of those who are expected to pay for them. In this case, irrigators at Harvey Water. (Harvey Water submission, p6)

The Authority has noted the analysis by Bowles (2001) of the Corporation's dam safety program, shown in Figure 3.4 below.

Figure 3.4 Risk Reduction Profile for Prioritised Base Case from Bowles (2001)



Source: Bowles (2001), Review of Water Corporation Dam Safety Program

Figure 3.4 (based on 2001 and 2003 data) shows a strongly diminishing relationship between expenditure and risk reduction. This implies that some substantial improvements in safety can be achieved at relatively low cost, but that further safety improvements become increasingly more expensive. The figure shows that approximately half of the safety gains from the Corporation's then planned dam safety program appear to be available from about three per cent of the budget, and about 85 per cent of the gains from about a third of the budget.

However, the last $90 million (about 70 per cent of the then package of measures considered) appeared to offer safety reductions with an implied cost per fatality avoided of the order of $65 million.

ACIL Tasman has provided comparative indicators, utilising the concept of Cost Per Statistical Life Saved (**CPSLS**). To calculate the CPSLS of an expenditure on safety improvement, the expenditure is divided by the number of statistical lives it is expected to save.[31] These costs and impacts are spread over time, so discounting is applied to determine a present value estimate. Comparison of CPSLS can then be made across different areas of public safety expenditure to assess cost effectiveness. Some comparisons are as follows:[32]

- UK Health and Safety Executive (**HSE**) guidelines have a CPSLS threshold of $2.5 million (based on a straight exchange rate conversion)[33]

[31] The term "statistical life" is used to denote the averaging of risk statistics across a population – the risk of fatality due to a particular cause will vary from person to person.

[32] ACIL Tasman (2006), *Harvey Water Supply System: Safety Standards & Compliance*, Paper 1 of 4 prepared for the Authority, published on the Authority web site.

[33] The HSE uses an equivalent concept of the Value of Preventing a Fatality (VPF), and adopted a VPF of £1 million in 2001, based on HM Treasury Guidelines.

- The National Road Safety Strategy, issued by the Council of Australian Transport Ministers in 2001, cites figures supporting a CPSLS, again calculated at a 5 per cent discount rate, as follows:
  - from general investment in road improvements – $2.5 million; and
  - from investment targeted at 'black spots' – $0.25 million.
- The Federal Department of Health and Aging has published guidelines for assessing environmental health interventions, including guidance for the conduct of cost-benefit assessments involving differences in risk of death and morbidity.[34] The guidelines support, based on assessment of a wide range of studies, an indicative figure for the average value of a statistical life in Australia of $2.5 million, suggesting that public health measures with a CPSLS greater than $2.5 million would not be deemed cost effective under these guidelines (unless justified by other injury and damage benefits, that could be significant for dams, as they would be for car accidents etc).
- The results of a Monash University Centre for Health Program Evaluation assessment of the consistency of Australian pharmaceuticals approval processes across the period 1991-1996 suggest an implicit value of a statistical life underpinning decisions on pharmaceutical approvals in the order of $2 million.[35]

Based on this analysis, the ANCOLD Guidelines appear to lead to a substantially greater amount spent on dam safety than on other areas of safety improvement.

Preliminary Views

7) Dam safety expenditure is subject to significant diminishing returns (i.e. as expenditure progressively increases, the reduction in risk progressively decreases).

8) The application of the ANCOLD Guidelines gives rise to a substantially greater amount of expenditure on dam safety in comparison to expenditure on safety elsewhere in the economy.

3.4.2 The Basis for Spending More on Some Types of Risks

The view that some risks justify a higher level of public expenditure than others has support in submissions:

> The Issues Paper suggests a possible approach involving the establishment of a benchmark for the level of expenditure that is required to prevent a fatality. This approach appears to be very narrow and ignores a number of fundamental issues associated with contemporary societal risk….(S. Fox, p1)

One such factor is a possible aversion to multiple fatality risk. On this, the same submission suggested that:

[34] enHealth (January 2003), *Guidelines for Economic Evaluation of Environmental Health Planning and Assessment. Volume 1 – The Guidelines.*

[35] See ACIL Tasman (November 2006), *Harvey Water Supply System: Safety Standards and Compliance*, Paper 1 of 4 prepared for the Authority, published on the Authority web site, pp18-19

> In general society has a bias against rare events with high consequences compared to more common events with lesser consequences. To illustrate compare the attention given to improving and maintaining an impeccable aircraft safety record in Australia to the tolerance of our current road safety record… (S. Fox, p1)

However, the Authority notes the review of societal risks commissioned by the HSE from Ball and Floyd, who concluded that:

> Though the documented evidence is sparse, nowhere have we found any compelling support or arguments for an ex-ante stance other than risk neutrality in societal decision making.[36]

A second factor suggested as justifying a higher level of public expenditure on some risks is that:

> Australians appear to have a higher tolerance for risk that is self imposed compared to a risk that is imposed upon them by others. For example people often choose to engage in high risk activity (such as smoking cigarettes) knowing that they have a statistically greater risk of reduced lifespan, but would react strongly against the construction of a hazardous waste incinerator adjacent to their homes if an absolute guarantee of zero health impacts cannot be given. (S. Fox, p2)

The Corporation makes a similar point:

> Communities do not generally take a simple equivalent cost of life approach to safety expenditures. Consideration is given to factors such as the choice the individual has in exposing themselves to the risk and the size of the potential loss of life. (Corporation submission, p8)

MJA have noted in their preliminary advice to the Authority the work of Dutch safety experts. Vrijling suggests that risk of fatality varies along a spectrum and are highest for those risks that are self-imposed or where the activity provides a direct benefit (such as mountaineering or bungee jumping) and lowest for those risks that are less voluntary and provide less direct benefit.[37] Vrijling proposes that the relativities between these risks reveal community preferences for different risks and that these relativities are relevant to safety policy. MJA notes in its advice to the Authority that, in addition to preferences, such relativities will reflect much more than community preferences towards risk; in particular they will reflect the costs and technological possibilities for risk reduction.

More generally, the Authority is interested in establishing whether the views raised in the submissions above are supported by empirical evidence. To the Authority's knowledge, there has been only one major empirical study into community perceptions of dam safety in Australia.[38] The respondents of this survey indicated that, when compared to 19 other risks such as traffic accidents, medical error and bushfires, dam failure was the lowest of concern in both the short and the long term. Similarly, respondents indicated that dam safety was the lowest priority area for government spending. These results were particularly strong for Western Australia, where the level of expenditure was described by respondents as approaching "too much".[39] The study concluded that "…dam safety is not a highly salient issue in the community, even where upgrades have been discussed"[40],

[36] Ball, D.J and Floyd, P.J (1998), "Societal Risks", Final Report, Report Commissioned by the Health and Safety Executive, United Kingdom.

[37] Vrijling J.K. (2001), "Probabilistic design of water defence systems in the Netherlands", Reliability Engineering and System Safety, Vol. 74, No. 3, pp. 337-344.

[38] SYME, G.J. and Bishop, B.J. (1992), "Community Perceptions of Dam Safety Issues: A Preliminary Study. CSIRO Division of Water Resources Consultancy Report 92/32 to the NSW Dams Safety Committee.

[39] ibid p. 19

[40] ibid p. 71

this being despite the fact that respondents saw dam safety as a involuntary risk affecting a large number of people.[41]

The ANCOLD Guidelines require dam owners to reduce risk to the point where costs are disproportionate to benefits. MJA cite documentation from the UK HSE which advise that for risks in the intolerable region, a cost to risk factor of less than ten is likely to be unacceptable, and for hazards with large consequences, the factor may need to be larger.[42] This means that, in reducing risks to tolerable limits, costs of ten or more times the risk may not be considered disproportionate. ANCOLD Guidelines have applied this ratio to derive the $100 million upper limit to CPSLS beyond which further expenditure would not be warranted.

ANCOLD Guidelines are consistent with the principle of protecting liability of dam owners under common law in Australia. The high threshold of the ANCOLD Guidelines relative to other areas of public safety, such as roads, is due to the presence of tort liability of dam owners.

The Corporation notes in its submission that:

> The Water Corporation has a duty of care to maintain dams to current community standards. Community standards in this case have been based on guidelines produced by [ANCOLD]. (Corporation submission, p4)

The Department of Treasury and Finance note that management liability is a key driver for compliance with ANCOLD.

> There is no legal requirement for the Water Corporation to adopt ANCOLD guidelines but in the absence of State legislation stipulating alternate standards this is the de facto standard for the Water Corporation.
>
> The Board of the Water Corporation choose to meet such standards because it will be held personally liable for any loss of life in the case of dam failure. (Department of Treasury and Finance submission, p3-4)

The limits of tolerability of risk in the ANCOLD Guidelines are absolute and make no reference to the costs or benefits of investment in safety. The application of tolerability limits is moderated in a few ways, as follows.

- The less stringent tolerability limits for existing dams as opposed to new dams and augmentations recognises that the costs of upgrading old dams to meet safety standards is much higher than for new investments.
- The truncation of the tolerability limits for levels of life loss above 100 people places a limit on the amount of expenditure to meet tolerability limits;
- The Guidelines contain an “exceptional circumstances” clause, which allows for the exercise of discretion by the Government regarding the application of tolerability limits in situations where the costs of reducing the risks are grossly disproportionate to the benefits;
- The Guidelines provide the Corporation with flexibility to adopt a portfolio approach across all its dams, or even across all types of infrastructure or sources of risk

[41] Ibid p. 25

[42] For further discussion, see Marsden Jacob (2006), “Equity, efficiency and protection against tort liability under ANCOLD Guidelines: the case of the South West irrigation dams”, paper prepared for the Authority, on the Authority web site.

managed by the Corporation, to optimise the sequencing of expenditure to achieve the most efficient reduction in risk.

Despite these caveats, the requirement for dam owners to meet ANCOLD limits of tolerability with regard to dam safety, in the absence of a Government decision to exercise the exceptional circumstance provisions, is absolute and does not have regard to costs[43].

The Authority acknowledges that it is legitimate for the Corporation to take the management of legal liability into account in its management of the South West dams. However, levels of risk vary with interpretations of legal liability (as discussed further in Section 3.4.3).

The Authority also accepts that society's aversion to particular types of risk (such as dam failure) may justify additional expenditure to reduce those risks, relative to expenditure on other hazards with similar risks of loss of life.

While expenditure to meet the standards in the ANCOLD Guidelines might be considered as necessary (in the absence of alternative standards), this does not address the issue of whether such expenditure is efficient. It is possible that the gains (in terms of reduced loss of life) that can be made by shifting safety expenditure away from low return areas compared to high return areas would outweigh these social preference considerations. This raises questions of the regulatory arrangements and of the timing and sequencing of expenditure, which is discussed in the next section.

Preliminary Views

9) Although the costs of protecting management liability, through compliance with ANCOLD Guidelines, could be viewed as a legitimate cost of doing businesses, levels of risk vary with interpretations of legal liability.

Issues for Further Consideration

10) The suggestion by interested parties that society's aversion to particular types of risk could justify additional expenditure to reduce those risks is a matter that requires verification.

3.4.3 Regulatory Arrangements

In considering alternative regulatory arrangements in relation to dam safety in Western Australia, the Authority has examined the absence of competitive pressure as well as legislative and institutional arrangements.

Absence of Competitive Pressure

Harvey Water raised the point in its submission that the absence of competition (or effective regulation) means the costs incurred by the Corporation might not be based on best practice methods:

[43] The ANCOLD Guidelines allow for the Government or a statutory dam safety regulator to alter the level and sequencing of expenditure on dam safety if there is reason to believe that the costs are disproportionate to the benefits (through the use of "exceptional circumstances" clauses).

> Also relevant to this question is the principle of pricing on the basis of best practice costs. Even renewals costs need to be subject to the rigor of best practice. Again the Agreements of the 1990's (the Competition Principles Agreement) provide some guidance. One of the issues raised in the context of the Agreement was the pricing behaviours of monopolies, and particularly government monopolies. There is an absence of competitive pressures that would otherwise keep costs to an efficient minimum. In the absence of such competitive pressures, it has to be the role of regulators to ensure that pricing reflects costs that are based on best practice methods. (Harvey Water submission, p19)
>
> The corporatised government entity is in a different situation from either of these types of organisation. The Directors of the Board of management of a government corporation are subject to the same requirements as directors of a private firm. While they are subject to the same potential legal sanctions, they are not subject to the same expenditure constraints. (Harvey Water submission, p9)

Harvey Water's submission suggests that an ANCOLD compliant program would differ if it were undertaken in a competitive market. The MJA review noted that both the Corporation and Harvey Water have an incentive to meet set standards rather than adopting risk-based approaches, in order to minimise legal liabilities. However, they noted that Harvey Water differed from the Corporation in that it has a small annual turnover, limited funding and charging bases, a limited capital expenditure budget, and a limited ability to secure additional funding from its shareholders. These constraints would lead to Harvey Water adopting a different approach to the Corporation on dam safety, including, for example, moving towards ANCOLD standards more slowly over time, adopting interim and staged solutions, and more extensive customer consultation. MJA cited Goulburn-Murray Water, SA Water and Melbourne Water as examples of water utilities where capital constraints had an impact on the prioritisation and timing of dam safety improvements.

One option in the Issues Paper, raised for the purpose of identifying whether it would lead to a more efficient sequencing of dam safety expenditure, is to transfer the ownership of the dams to Harvey Water. However, neither the Corporation nor Harvey Water supported a transfer, primarily because of the capacity of Harvey Water to fund a dam safety program, which indicates that it could lead to a sub-optimal amount spent on dam safety:

> Transferring ownership of the dams to the irrigators may artificially reduce the rate of expenditure to meet the ANCOLD Guidelines due to Harvey Water's limited financial capacity. Harvey Water would still be required to meet the same standards in the long term. However, consideration would need to be given to Harvey Water's appropriate rate of expenditure given that the Water Corporation would then become a customer of dam storage services from Harvey Water, increasing their capacity to deliver the works.
>
> Additionally, Harvey Water would need to deal with the dam safety issue from a lower knowledge base. Six of the irrigation dams, are the highest dam safety risks in the Corporation's portfolio of dams. Transferring ownership of the six highest risk dams in Western Australia to an owner with no experience in dam safety management would not be prudent.
>
> (Corporation submission, p8)
>
> An alternative is that Harvey Water could own the dams. This has appeal in that it removes the problem of a highly financial government entity being responsible for the safety program. As discussed later, the irrigators would adopt a quite different mix of management and capital expenditure strategies to address the issues of risk. However, its capacity to fund the dam safety program, even at a level more in keeping with its perception of risk, and to manage a DSP for the remaining dams is very limited with its current funding and structure. Although there is logic in the beneficiaries accepting responsibility for the risks associated with the dams it is not really a practical option.
>
> (Harvey Water submission, p11)

The Department of Treasury and Finance acknowledged that Harvey Water would proceed differently to the Corporation on moving towards ANCOLD standards, but favoured development of State-based legislation rather than changes to the ownership of the dams:

> If Harvey Water owned the dams, they would proceed with a dam safety program with the objective of meeting the same ANCOLD guidelines. The Water Corporation's dam safety expenditure on the South West dams will be expensed over a period of 8 years. However, Directors of Harvey Water could allow the works to proceed at a slower rate due to Harvey Water's reduced financial capacity to undertake the works relative to the Water Corporation's so long as safety standards were maintained. This could result in a different optimal staging strategy of the works. For instance, according to Marsden Jacob, dam owners such as Goulburn-Murray Water indicated clearly that they are more capital constrained and are staggering their upgrade programs over periods of fifteen years and in some cases longer. However, a change in the ownership of the dams may only indirectly change the level of dam safety expenditure as it would be a short term solution, where as putting in place State based legislation which stipulates the levels of acceptable risk would be a more sensible and long term solution. (Department of Treasury and Finance submission, p5)

Even though it may not be a practical option given the lack of support from the parties involved, the Authority intends to investigate further the impacts of assuming that the dams are owned by Harvey Water. This analysis is likely to be important because it could indicate a more efficient sequencing of expenditure, even though the total amount spent in order to comply with the ANCOLD Guidelines might be the same under either ownership option.

Legislation

Western Australia does not have legislation on dam safety. A benefit of State-based legislation is that it could allow for prioritisation of risk reduction expenditure across a broader portfolio of risks in other areas of public health and safety (this point is discussed further in the context of institutional arrangements).

In comparison to Western Australia, other jurisdictions have used legislation or directions to specify alternative risk-based measures (for example, supporting the application of the ALARP principle), particularly in cases where achieving set limits of tolerability would be unreasonable. New South Wales, Queensland, Victoria, the ACT and Tasmania have all developed and enacted State-based legislation on dam safety, based largely on the ANCOLD Guidelines and principles.

- In the ACT, the Independent Competition and Regulatory Commission has established the Dam Safety Code 2003, as one of its Water and Sewerage Technical Codes. The Code applies to water and sewerage utilities and covers the operation and maintenance of dams. It is based on ANCOLD Guidelines and NSW Dam Safety Committee Technical Guidelines.
- In Queensland, dam safety matters fall under the Water Act 2000, administered by the Chief Executive of the Department of Natural Resources and Mines. The Department produces guidelines for dam owners to assist them in complying with the dam safety conditions of the Water Act 2000, largely based on, but not identical to, the ANCOLD Guidelines.[44] Under the legislation, the owners of the dams remain liable for dam safety failures. A recent report commissioned by the Queensland Government concluded that the ANCOLD Guidelines are an

[44] For example, Department of Natural Resources and Mines, *Queensland Dam Safety Management Guidelines for Referable Dams* and *Guidelines for Failure Impact Assessment of Water Dams*.

appropriate defacto standard for flood safety, and should be used as benchmarks, but that it was appropriate for Queensland to develop its own specific guidelines.[45] In particular, the report recommended State-specific guidelines in relation to spillway upgrade programs, since improvements in meteorological models indicate that the probability of major floods is higher than previously thought.

- Dam safety in Victoria is covered by the Water Act 1989, administered by the Department of Sustainability and Environment, Catchment and Water Division. Under the Act, the Minister for Water issues a Statement of Obligations to each of the water authorities, which includes obligations on dam safety. The Statements to individual authorities can be tailored to reflect individual circumstances; however, the generic Statement of Obligation requires that the authorities must have regard to the ANCOLD Guidelines in their management of dam safety.
- In Tasmania, the Water Management Act 1999 establishes the Assessment Committee for Dam Construction, operating under the Minister for the Department of Primary Industries and Water. The Department produces regulations on dam safety, which are largely based on ANCOLD Guidelines, but allow for variation away from the ANCOLD Guidelines.[46]
- In NSW, dam safety is governed by the Dam Safety Committee, established under the *Dam Safety Act 1978*. While the standards adopted by the Committee are generally in line with ANCOLD Guidelines, there are some qualifications.[47]

In its submission, the Corporation supported consideration of legislation to allow for the Corporation's expenditure on dam safety to be prioritised against other expenditure on safety:

> The Water Corporation manages a large capital program with competing claims for limited funds. Currently, risk profiling assigns a high need to complete the Dam Safety Program across the State, and capital funding has been allocated to ensure dams and other referrable structures are upgraded to meet current ANCOLD Guidelines.
>
> If legislation could limit the Corporation's liability , the priority assigned to dam safety would fall, freeing up funds for other capital works with higher priority, potentially including those outside the Water Corporation. Whether Western Australia would benefit from such a reprioritisation is dependent on assessments being made that the current level of expenditure is too high. (Corporation submission, p8-9)

Further, the Corporation's submission emphasised the Corporation's continued reliance on ANCOLD unless or until alternative safety standards are supported by Government:

> ANCOLD Guidelines are the only standards that prevail in Western Australia. The Water Corporation, and other dam owners, must therefore manage their dams in a manner that is consistent with the ANCOLD Guidelines.
>
> …

[45] Blackmore, D. J. AM, FTSE (August 2004), *The Draft Guidelines on Selection of Acceptable Flood Capacity for Dams*, Report to the Queensland Government.

[46] For example, the Tasmanian dam safety regulations require that the operation and maintenance manual "comply substantially with section 4.3 of the *Guidelines in Dam Safety Management* published in 2003 by ANCOLD, as amended from time to time" (Water Management (Safety of Dams) Regulations 2003, Part 3, section 12).

[47] For example, current Dam Safety Committee requirements for acceptable flood capacity for dams (publication DSC11) are based on the ANCOLD "Guidelines on Design Floods for Dams 1986", subject to qualifications in regard to hazard ratings, acceptable flood capacity, quantitative risk assessment, base safety conditions, flood emergency plans, screening procedures for spillway adequacy on existing dams and diversion capacity.

> If the ERA forms the view that complying with the ANCOLD Guidelines results in "economically inefficient" levels of dam safety expenditure, the appropriate response would be to recommend the implementation of alternative dam safety regulations. This would allow the Government to make a policy decision on the appropriate levels of community safety. (Corporation submission, p7,8)

The Department of Treasury and Finance suggested that State-based alternatives to ANCOLD be further investigated:

> There is potential for regulations to be adopted in Western Australia that replace the ANCOLD guidelines and impose a more rational dam safety program in line with the accepted risks for other public infrastructure. The prime objective of State-based regulations would be to reduce the cost of dam safety upgrades with only a minor reduction in safety standards.
>
> …Whilst, it is acknowledged that there would need to be money spent on dam safety, an assessment should be made of what amount would be saved if the Water Corporation reduced the risk of dam breaks from one in 1,000,000 years to one in 100,000 years. (Department of Treasury and Finance submission, p4)

Harvey Water also supported the development of State-specific legislation on dam safety standards.

> Harvey Water suggests that the government reviews the different approaches taken by other states to find sensible common ideas which have application in WA. (Harvey Water submission, p12)

Harvey Water noted that the Government could provide indemnity for the Water Corporation, but suggested that this approach could introduce problems regarding competitive neutrality with private sector competitors.

> The government could provide the Water Corp with some form of indemnity which would not be much different from the government self insuring for roads, bridges, railways and other public infrastructure. Harvey Water understands that this is the situation in other jurisdictions, such as Queensland. It was also the situation in WA before corporatisation of the Water Authority.
>
> …
>
> One of the problems with an indemnity arises where there are private sector providers or the prospect of private sector providers. These alternative providers would be placed at a competitive neutrality disadvantage if the indemnity or legislation is limited to the government entity. Of course, there are further problems if the indemnity or legislation extends to private sector providers. This would create the unusual and unacceptable position of the government providing an open-ended protection against some of the risks for a private sector organisation. (Harvey Water submission, p10-11)

The establishment of State-specific legislation on dam safety, based on the ANCOLD Guidelines, would enable the Government to access the exceptional provisions within the Guidelines, which provide for a degree of discretion on the part of dam owners. The ANCOLD Guidelines allow for the Government or a statutory dam safety regulator to alter the level and sequencing of expenditure on dam safety if there is reason to believe that the costs are disproportionate to the benefits (through the use of "exceptional circumstances" clauses).

Consideration of legislation as well as a government indemnity to the Corporation, alongside the invocation of one of the exceptional circumstance clauses, would be one way for the Government to align expenditure on dam safety with expenditure elsewhere in the economy.

Institutional Arrangements

In addition to clarifying an owner's dam safety obligations, legislation could be used to implement institutional arrangements that could achieve an efficient, or at least more efficient, level of dam safety expenditure.

One of the first developments of a generic risk management framework across statutory bodies was by the HSE in the United Kingdom. The framework originated after the 1987 inquiry into the safety breaches at the Sizewell B nuclear power plant, and was developed over 13 years through extensive public comment and debate. It has since been extended to all other areas of health and safety. The current framework sets out the HSE's decision process for risk management, including a generic framework for the tolerability of risks to society and individuals.[48]

In New South Wales, there are moves towards a whole-of-government approach to risk assessment. The NSW Dam Safety Committee has recently reviewed the regulatory policy framework for dam safety in NSW (the final report is soon to be considered by Government). The draft framework revised some standards-based approaches and recommended the progressive introduction of risk assessment practices consistent across government agencies. It draws on the risk regulation framework established by the UK HSE, which it cites as being a good model. For long-term safety improvements, the draft framework incorporated the criteria developed by the NSW Department of Infrastructure, Planning and Natural Resources on tolerability of life safety risks.

A whole-of-government approach was supported by the Department of Treasury and Finance:

> The priorities and timetables for dam safety could be set within a whole of government risk assessment and management framework. The framework could prioritise all the Government's risk reduction expenditures to get the 'biggest bang for its buck' i.e. spending each dollar where it is most effective in reducing loss of life throughout the community, across a whole range of hazards. Also, there should be consistency in the valuation of loss of life in case of public safety. There is no reason why there should be much more money spent on dam safety than road safety in order to save a life. (Department of Treasury and Finance submission, p4)

The implications for Western Australia are that there may be a case for establishing a separate body to oversee dam safety standards in Western Australia. It would develop dam safety guidelines specific to Western Australia, based on ANCOLD Guidelines, but adapted for the Western Australian setting. Such guidelines could include, for example, alternative assessments of the tolerability of dam safety risks, guidance on the invocation of the exceptional circumstances clauses in ANCOLD, and the scope for developing portfolio approaches to dam safety programs.

In view of the advantages of a cross-government approach to the assessment of risk there may also be a case for extending the scope of such an independent review body to oversee all public safety standards, including dam safety standards (e.g. an Office of Safety). The body could provide independent assessment of expenditure across all areas of public safety to determine where it can most effectively be spent.

Several submissions provided tentative support to a whole-of-government approach to safety expenditure, but noted that models based on such approaches to risk are still in the development stage:

[48] Health and Safety Executive (2001), *Reducing Risk, Protecting People: HSE's Decision-Making Process.*

> …[I]t is understood that it is apparently very difficult to develop standard approaches to community risk although this is being attempted in the UK. The models, assumptions and methods are yet poorly developed although the logic of the need is well accepted.
>
> (Harvey Water submission, p8)
>
> From a theoretical point of view, expenditure on risk should be comparable through the economy. Such a comparison should include consideration of whether the levels of expenditure on other risk reduction measures are sufficient. The Corporation would only support such an exercise being undertaken at a whole-of-Government level.
>
> (Corporation submission, p9)
>
> In the absence of alternative risk management regimes (whole-of-government or state-based guidelines are likely to be impractical in the short term), ANCOLD Guidelines may remain the preferred means of determining dam safety standards.
>
> (Department of Water submission, p2)
>
> A number of people have expressed the view that the relative cost of risk reduction required under ANCOLD is greater than the risk reduction expenditure in other parts of the economy. However, unless alternative safety regulations are put in place, the Corporation is required to continue to use the ANCOLD Guidelines to determine the dam safety requirements for the South West dams. (Corporation submission, p7)

The Department of Treasury and Finance supported the approach adopted by the UK Health and Safety Executive:

> A similar approach could be adopted in Western Australia to that of the whole of government approach to risk assessment and management as currently taken in the United Kingdom (UK), where every major government department has a risk management policy that is consistent with a common framework. Co-ordination of approaches to risk management is undertaken through a strategy unit in the Cabinet Office. (Department of Treasury and Finance submission, p4)

Preliminary Views

11) It is likely that a company operating in a competitive market would implement the dam safety program in a different manner to that of the Corporation.

12) There is merit in the State Government developing regulatory instruments that incorporate comparable measures for expenditure on life safety throughout the WA economy.

13) There may be a case for establishing a separate body to oversee dam safety standards in WA, such as an equivalent to the NSW Dam Safety Committee, or a wider Office of Safety to oversee safety standards more generally.

3.4.4 Implications for the BWSA

On the basis of the discussion above, the Authority's preliminary view is that the issue of substance is not the *level* of the dam safety program, as it is based on principles that are firmly embedded within dam safety guidelines in Australia and the UK. However, the timing and sequencing of the dam safety expenditure could be better aligned with opportunities to improve life safety elsewhere in the economy. Issues of legislative and

institutional reform may need to be considered, as well as an indemnity to the Corporation for deferring expenditure on dam safety.

Such regulatory considerations would take some time to be fully considered. If implemented, the alternative arrangements would be expected to reduce the net present value of the dam safety costs. Pending these wider considerations, the Authority's preliminary view is that it would be appropriate to base the new BWSA on an assumption that a certain proportion of the dam safety costs is passed on to users. The Authority has asked MJA to provide advice on this matter ahead of the final report.

Preliminary Views

14) Given that the proposed expenditure on dam safety is subject to significant diminishing returns, it is likely that the timing and sequencing of the dam safety programme could be better aligned with opportunities to improve life safety elsewhere in the economy.

15) Pending wider considerations about the regulatory arrangements that could be implemented to guide expenditure on safety, the new BWSA could be based on an assumption that a certain proportion of the dam safety costs are passed on to users.

Issues for Further Consideration

16) What information should be taken into account for the purpose of determining the amount of dam safety costs that should be passed on to users?

4 Cost Allocation

4.1 Terms of Reference

The Authority is expected to consider and develop findings on:

> The cost sharing arrangements between beneficiaries of the South West irrigation dams, including:
>
> a. customers that benefit from the water stored in the dams and how this may change over time with water trading;
>
> b. the recreational and other social benefits to the community of the dams; and
>
> c. the beneficiaries of dam safety expenditure, including an assessment of those who benefit from the use of the dams and those that benefit from a reduced risk of flooding.

4.2 Background

This chapter considers how the total costs of operating and maintaining the dams (including dam safety expenditure) should be recovered from Harvey Water and other beneficiaries.

The charges in the original BWSA were based on the assumption that 85 per cent of the projected operating and renewal costs for the dams storing the water (excluding dam safety expenditure) would be recovered directly from users. The remaining 15 per cent of costs were attributed to recreational and other social benefits, and were paid for by Government through a CSO.

The 85:15 split was based upon a study by Lucas (1991) who applied a travel cost method to evaluate dam use for recreational purposes.[49] The travel cost method involves a statistical study describing the frequency of visits to a valued site. By taking into account the costs of reaching the site, which incorporates direct travel expenses as well as time-associated costs (forgone wages), recreational demand can be derived.

The BWSA foreshadowed future dam safety upgrades and specified that the water storage charge could be increased as a result of such expenditures but did not specify what share of upgrade costs should be borne by Harvey Water. A one-off payment in the order of $0.4 million was subsequently made in 2004/05, which represented 30 per cent of the dam safety cost for that year. This contribution was agreed to by Harvey Water pending the resolution of issues surrounding dam safety expenditure.

4.3 Classes of Beneficiaries

The Terms of Reference requires the Authority to consider the beneficiaries of maintaining and operating the dam infrastructure as well as how costs should be apportioned among these beneficiaries.

[49] Lucas, S. (1991), "An estimation of the economic benefits of recreation activities occurring at Waroona and Logue Brook reservoirs, Phase 2", Supplementary Paper No. 1, *South West Irrigation Strategy Study*, Water Authority of Western Australia, Perth. The Corporation was unable to provide a copy of this study to the Authority.

There are three classes of beneficiaries of dams:

1) *Identifiable private beneficiaries*. These beneficiaries are the customers who make a payment to the Corporation for their private use of water.[50] They are called private beneficiaries because property rights over who owns the resource are clear and because one person's use prevents another person's use. Markets can work well to allocate the private benefits provided the price is allowed to adjust freely to supply and demand. In the case of South West irrigation dams, the identifiable private beneficiaries include:

   a) farmers using irrigated water (64.7 per cent of the volume in 2005/06);[51]

   b) Corporation customers in the IWSS (34.0 per cent of the volume);

   c) Corporation customers in the region (0.6 per cent of the volume); and

   d) other purchasers of water (0.7 per cent of the volume).

2) *Identifiable public beneficiaries*. These beneficiaries typically include the recreational users of the dams such as water skiers, bush walkers and picnic goers. The public benefits generated have the main characteristic that their enjoyment does not fully diminish the value that accrues to others using the dam (e.g. the recreational use of the dam by one person can also be enjoyed by another). Public goods are typically underprovided by markets. Nevertheless, when public beneficiaries are identifiable they could, potentially, be excluded from using the dams (i.e. fences can be erected to keep people out that are unwilling to pay for amenity) and so could, in principle, be charged for the benefits they receive. In practice however, the recreational users of South West irrigation dams have not been charged for their public usage – i.e. they have either been allowed access to recreational areas without charge, or have been fully excluded from areas for purposes of water quality.[52]

3) *Non-identifiable public beneficiaries*. These beneficiaries are those who gain from the existence of the dam in such an indirect communal sense that they cannot be charged by the owner of the dam. This relates to the strongest type of public consumption: people cannot be excluded from their enjoyment of the good, and the value that one person receives does not diminish the value that others receive. It is a lack of property rights, combined with communal usage, that prevents a private company from capturing a financial reward through the provision of these non-excludable public goods. Therefore, without government provision, these goods will be undersupplied by markets. In the case of the South West dams, the non-identifiable public beneficiaries include:

   a) local residents who benefit from the presence of the dam because of the reduced risk of natural flooding;

   b) those who enjoy the aesthetic attributes of the local countryside that result from the dams (although there will be others who prefer the aesthetic attributes of non-irrigated land where rivers are not dammed);

[50] Note that some of the rights to the water in the dams are owned by Harvey Water, and some by the Corporation. See Figure 4.2 in the next chapter for the allocation of rights to the water in the dams.

[51] The data in this dot-point has been sourced from the Corporation.

[52] It should also be noted that recreational use is not a pure public good in that: (a) congestion can diminish the value of use to other public beneficiaries; and (b) in the case of potable water, contamination can reduce the value of the resource to private beneficiaries.

c) those local communities, tourists or passers-by who value the protection that accrues from maintaining the structural integrity of the dams; and

d) in the case where land is set aside to protect dam water quality; those people who see value in a healthy environment (i.e. the preservation of natural vegetation, habitat and biodiversity).

It is worth noting that the economic value of agricultural production made possible by the dams is represented in the value of the water sold. Therefore, the local employment generated via increased agricultural productivity is accounted for in the value of economic benefits produced by the dams.

Harvey Water sought a distinction between the beneficiaries of dams and the beneficiaries of dam safety.

> - Benefits of dams are distributed in a quite different way from benefits of dam safety.
> - The beneficiaries of dams are mainly the irrigators, other water consumers, and the people and industries that provide services to them, the industries that process their products, and the final consumers of those products. As we have argued, the imposition of water charges on the irrigators is a proxy for charging all of these beneficiaries. Economic theory tells us that the water charge will be shared up and down the production chain in accordance with supply and demand elasticities. However, given the nature of those elasticities, the major part of the share falls on the irrigators because they are unable to pass the costs on – they are largely price takers, especially since deregulation of the dairy industry.
> - The other beneficiaries of the dams are visitors and tourists and the industries that service them.
> - The beneficiaries of dam safety are largely the public at large.
> - Irrigators receive only a small share of the benefits of dam safety, by virtue of the reduced risks of disruption to their water supply and hence production activities.
>
> (Harvey Water submission, p19)

Harvey Water also submitted that dam safety should be treated as a public good:

> Dam safety is a public good, just like road safety. For the irrigation dams, the irrigators are just one of many groups of beneficiaries. As a public good, the safety of irrigation dams is a public responsibility and should be funded from the public purse.
>
> We accept, however, that irrigators do obtain a direct benefit from dam safety in the form of a more guaranteed supply of water. This is a production benefit, as distinct from the wider community benefit of having a less risky living environment. In recognition of this production benefit, the irrigators accept that they should make a direct financial contribution towards the cost of the dam safety upgrades. (Harvey Water submission, p16-17)

Harvey Water's point that dam safety costs should be allocated differently to other dam costs is reflected in the discussion in Chapter 3, which concluded that a portion of the dam safety costs should not be recovered from customers. The issue of whether the customer portion of dam safety costs should be allocated differently to other costs is discussed in the next section.

4.4 Cost Allocation Issues

4.4.1 Method

In considering the allocation of costs to Harvey Water, the Authority has given consideration to the following issues:

1) the efficient amount of revenue required by the Corporation to operate and maintain the dams;

2) the costs that are attributable to past users or decisions (legacy costs);

3) the value that recreational users receive from using the dam surroundings;

4) any net value that the community receives from the aesthetic and natural flood mitigation benefits associated with having the dams beyond increased flood risk from dam failure; and

5) the method for allocating costs that are attributable to the identifiable private beneficiaries.

Each of these issues is discussed below.

4.4.2 Efficient Revenue

The efficient revenue requirement required by the Corporation to provide the storage service for all customers (the Corporation included) is to be discussed more fully in Chapter 5. The revenue requirement includes the return on the regulatory asset value, depreciation and operating costs. The efficient level of dam safety costs and other capital costs are added to the asset value, which is the basis for the return on assets and depreciation.

4.4.3 Legacy Costs

Legacy costs are costs that resulted from the activities of past users and could be considered unfair if they are charged to current and future users.[53] For a full discussion of the issues surrounding legacy costs, see ACIL Tasman's Paper 2.[54]

The Corporation re-iterated in its submission that the BWSA assumed no legacy costs in relation to the dams.

> The renewals price in the original 1996 Bulk Water Supply Agreement assumed there were no legacy costs associated with the dams. Explicit payments were made for the assessed legacy cost of deferred maintenance associated with channels, along with transition subsidies for distribution operations. Prices in the Bulk Water Supply Agreement were set to achieve lower bound prices immediately. (Corporation submission, p10)

[53] The legacy cost approach was originally developed to apply to asset valuation issues rather than pricing issues. The legacy approach was required where assets were valued using a line in the sand approach, which is where an asset value is determined as the value that delivers a revenue profile that matches expected costs. In the situation where future costs are the result of activities in the past (such as non-compliance with environmental standards), these costs can be treated separately, and possibly paid for by the Government, rather than be treated as a cost that will influence the asset value calculation.

[54] ACIL Tasman (November 2006), *Harvey Water Supply System: Cost Sharing Issues*, Paper 2 of 4 prepared for the Authority, published on the Authority web site, section 2.5.

There is a possible view that the agreement in the original BWSA would override any legacy cost argument, but this may not be valid given the likely information asymmetry and the possibility that contingent liabilities may not have been subject to good due diligence.

While the BWSA did not specifically incorporate any legacy costs, the agreement allowed for the Minister of Water Resources to decide on the amount that Harvey Water would pay for dam safety upgrades, which implies a potential legacy cost approach.

Harvey Water maintains that the costs of restoring the dams to ANCOLD standards, which prevailed at the time of the signing of the BWSA in 1995, should be viewed as legacy costs.

> [A]dopting a legacy cost approach implies that not all of the costs associated with the South West dams are "avoidable costs". The legacy approach recognises that some of these costs arise from any number of past factors, including for example poor policy decisions of government or poor commercial decisions of its agencies, past standards or community values, and past inactions to known problems – such as environmental or health consequences that could be foreseen but were not attended to.
>
> As such, governments accept responsibility for these past actions and, appropriately, bear their cost.
>
> …
>
> [L]egacy costs are the costs of restoring the dams to the community standards (the ANCOLD standards) as they were known in 1995. That the cost of this was estimated by the Water Corporation at $17 million and that cost has subsequently blown out to much more is not relevant to the issue of legacy costs. The principle of legacy costs says that the dam safety standards of the time should be re-established, and the full cost borne by the government.
>
> Harvey Water firmly believes that the Bulk Water Supply Agreement cannot be interpreted to expunge the generic principle of legacy costs. The BWSA was entered into in good faith by the irrigators at the time, in recognition that the Water Corporation was to restore the working condition of the irrigation assets, and the safety upgrades was a mechanism whereby the irrigators could make a contribution to the total work needed – but that was affordable to them. (Harvey Water submission, p21-22)

The latest ANCOLD Guidelines provide greater flexibility than the guidelines in place at the time of the BWSA.[55] The increase in expenditure is not therefore a result of increased standards, as this has had little significant impact.

Overall, the Authority considers that the dam safety expenditure that is appropriate when considered along with wider opportunities for improvements in life safety could possibly be regarded as legacy costs. However, a separate issue is the extent to which these legacy costs should be paid for by users or by the Government. In the case of dam safety expenditure, these costs are, at least in principle, avoidable costs. That is, the decision to use the water from the irrigation dams (whether by Harvey Water or the Corporation) needs to be based on the costs of accessing that water, which appropriately includes the efficient costs of dam safety. Given that the application of the legacy argument could result in inefficient outcomes, the Authority's preliminary view is that charges should not be reduced by a legacy component.

[55] For example, in the case of small dams where few lives are at risk, the new ANCOLD Guidelines include a greater allowance for the limit of tolerability on the risk to a single life, dropping as low as 1:1,000 per annum, compared to the earlier 1:1,000,000. Also, the limits of tolerability in the current guidelines are capped at a probability of 1:100,000 for 100 or more fatalities due to dam failure, while the cap in 1998 guidelines was at 1:1,000,000 for 1,000 or more fatalities.

Preliminary Views

17) While the dam safety expenditure can be regarded as a legacy cost, it would not be appropriate to exclude this expenditure from charges to current and future users because it is a cost that will influence decisions to access water from the dams.

4.4.4 Recreational Benefits

With the exception of Stirling and Samson Brook dams, which supply water to the IWSS, the dams in the South West are open to recreational use. The two most popular dams for recreational use are Waroona and Logue Brook, which offer a wide range of activities including cycling, bushwalking, sightseeing, horse riding, picnics, camping, water skiing, canoeing, windsurfing, swimming and fishing.

In June 2006, ACIL Tasman was employed by the Department of Water to conduct a reassessment of these benefits specific to Logue Brooke dam, but did not conduct primary research, instead basing its analysis on the original (Lucas, 1991) study.[56] ACIL Tasman expressed "reservations" about Lucas' (1991) findings but stated that in "the absence of any other studies, the Lucas standard estimate… is the best available estimate of the recreational value of Logue Brook Dam."[57]

Similarly, Harvey Water has queried the origins of the 15 per cent estimate of costs allocated to non-irrigation beneficiaries:

> The public good component of the irrigation dams has in the past been assessed at 15 per cent. The origins of this number were always questionable, but were related to the value of the tourism and recreation value of the dams. The number has gained some credibility over time because it has been used so frequently over the years; not because it is based on any robust analysis.
>
> It is beyond the capacity of the Harvey Water to conduct a more robust analysis to gain a more robust measure of the value of these public benefits. However, we consider that such an analysis is needed, if only in recognition that the 15 per cent is a very old and very imprecise estimate and there have been significant changes since then in the growth of the tourism and recreation markets in the South West of the State. (Harvey Water submission, p19-20).

It is apparent that a more robust method for calculating the benefits is needed. The Authority's preliminary view is that there are three scenarios that imply different recreational benefits:

- the water in the dam is used entirely by Harvey Water and recreational use is permitted (the status quo);
- the water is used by Harvey Water and the Corporation and recreational use is not permitted (on the basis that recreational use compromises the quality of potable water); and

[56] ACIL Tasman then went on to convert this estimate into 2005 dollars for the purposes of their conclusion; ACIL Tasman (June 2006), "The value of recreation at Logue Brook Dam", prepared for the Department of Water,.

[57] Ibid, p.16

- the water is used by Harvey Water and the Corporation and recreational use is permitted, which implies that some form of water treatment is required.

For the first scenario, preliminary advice from ACIL Tasman[58] is that the value of recreational benefits could be based on:

- a recreational value, obtained from the Lucas study, in the order of $10 per ML; and
- the value of temporary trades, as an indicator of the (net) market value of the water services supported by the dams, in the order of $13 per ML.

This suggests a ratio of recreational value to irrigation value of 43:57. To illustrate a possible application of this ratio, Logue Brook Dam has a maximum asset value of $0.12 million as at 30 June 2006, and an annual cost of $0.14 million in 2006/7 increasing to $0.67 million in 2009/10 following additional capital expenditure as part of the dam safety program. The application of the 43:57 ratio indicates an annual recreational value (paid for by a CSO) associated with Logue Brook dam of approximately $0.29 million in 2009/10 and annual costs that are attributable to Harvey Water of $0.38 million.

The second scenario is currently the subject of public consultation in relation to the ongoing recreational use of Logue Brook dam[59]. Under this scenario, recreational use would be prohibited. In this case (and indeed in advance of any decision to ban recreational use) it would seem appropriate for the Corporation to consider whether a ban on recreational benefits is cost effective, at least from a Corporation perspective, relative to the feasible alternatives. This would including taking into account the fact that eliminating recreational use also eliminates access to infrastructure cost sharing by recreational users (via the CSO payment). This loss of cost contribution for recreational benefits is an avoidable cost (via investment in water treatment or by accessing other water sources), so that it may be most efficient if this cost were to be attributed to the Corporation. Should the decision be to ban recreational use, Harvey Water's contribution to costs, on a per ML basis, would then remain unchanged from the first scenario (implying a lower aggregate cost as a result of the sale of water to the Corporation). The Corporation would then be responsible for all of the remaining dam cost, without any CSO payment, implying a higher unit cost contribution by the Corporation relative to Harvey Water.

Under scenario three, recreational use continues, even though the water is used for potable purposes and some form of additional water treatment is required. In this case the Corporation would have decided that it is cheaper to purchase the water from Harvey Water, even though it would incur a cost in treating the water, than obtain water from another source. Again, a balanced assessment of whether a ban on recreational use would be better than upgraded treatment requires, as a minimum, that the Corporation be able to compare the cost of the extra treatment to the cost contribution lost as a result of banning recreational use. This would suggest that the CSO continue to be paid as in the first scenario, but the Corporation be fully responsible for the costs of additional treatment. This would have the same implications for Harvey Water's cost contribution as would the second scenario. The two key differences would be that the Corporation would face the heightened treatment cost, and recreational users would retain their recreational benefits.

[58] See ACIL Tasman (November 2006), *Recreational Value of the South West Irrigation Dams*, Paper 4 of 4 prepared for the Authority, published on the Authority web site.

[59] Further information is available on the Department of Water's web site at the following location: http://portal.water.wa.gov.au/portal/page/portal/dow/drinking_water/Projects/Logue_Brook.

The Authority welcomes submissions indicating support or otherwise for the framework presented above.

Issues for Further Consideration

18) Is a comparison of the recreational benefits (derived from the Lucas study) with the irrigation benefits (derived from the value of temporary trades) an appropriate means of allocating the costs of Logue Brook Dam to Harvey Water, or are there alternative approaches that should be considered?

19) Should the ratio of recreational to irrigation benefits derived for Logue Brook Dam be applied to the other dams with recreational benefits?

4.4.5 Other Community Benefits

As was stated in section 4.3, the aesthetic costs and benefits attributable to dams are largely a matter of individual tastes and preferences. There will be those who enjoy the aesthetic attributes of the green pastures that result from the dams' presence, and there will be those who prefer a more natural environment. Special techniques (e.g. contingent valuation or travel costs methods) could be employed to estimate the relative strengths of each set of preferences; however, these methods are not robust and can be expensive to undertake. Moreover, preferences can change over time, so a correct estimation in the current period may not hold for future periods. In any case, the Authority's preliminary view is that, once aggregated, the opposing sets of aesthetic preferences could more or less cancel out. Therefore, the Authority proposes not to attribute any net aesthetic benefits to dams at this time but welcomes submissions on this matter.

The Authority has taken a similar view on the community costs and benefits of flood mitigation and risk. This is because damaging floods can occur with or without the presence of dams. Dams provide some protection from *natural* flood events and in this sense provide a benefit to the community.[60] At the same time, the large stock of water behind a dam represents an *unnatural* flood risk. In general, these two values act in opposite directions to each other and may cancel out. Analysis in this area would also be highly prone to error due to the uncertainties involved. There is, for example, a requirement to multiply the uncertainty associated with climate change against the estimated probabilities associated with each type of flood risk. On balance, climate modelling points towards an increased likelihood of extreme natural events. At the same time, climate change has resulted in an overall decrease in average rainfall and thus a lower risk from unnatural flood events due to the resulting lowering of water levels in dams – although this might be offset by an increase in the propensity for more extreme floods. ACIL Tasman notes:

> The data, science and engineering on which the risk assessments are being based may have come a long way – but a very large uncertainty remains. Estimating the nature of extreme events with the limited available data, and the ranges that still apply to the climate change modelling, is subject to very large uncertainty. Given the evidence….of rapidly diminishing returns to investment in dam safety, this strongly suggests that the efficient costs, and the other components of incremental cost, are likely to be highly susceptible to

[60] Note that dams in WA have largely been built for water supply not flood mitigation.

> deeper probing and the progressive accumulation of better data – especially if active investment is made in these processes.[61]

Moreover, the further away these changes in risk occur in time, the less impact they will have on the Authority's present value calculations. In all, these considerations have led the Authority to the view that the best position to take on natural flood mitigation benefits at this time is a neutral one.

Preliminary Views

20) There may be no net benefits associated with aesthetic and natural flood mitigation but the Authority welcomes submissions on these matters.

4.4.6 Customer Costs

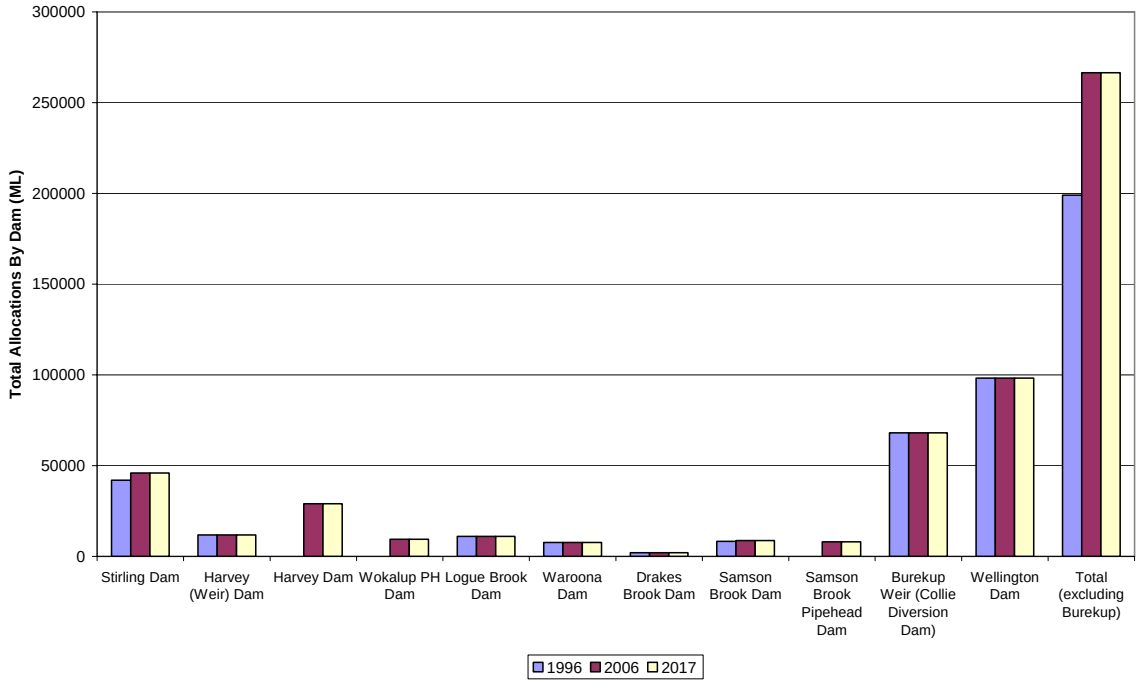
Once the matters of legacy costs, recreational benefits and other community benefits have been resolved, the issue becomes how to allocate the remaining revenue requirement between the customers of dam services. An obvious method is to simply allocate costs on the basis of water allocations, which is a method supported by the Corporation:

> The Water Corporation supports an allocation process where an assessment is made of the value of the dams to non-consumptive beneficiaries, with the remainder of the costs being split on the basis of water allocations. (Corporation submission, p10)

The total volume of water from each dam is shown in Figure 4.1 below. The increase in the allocation from Stirling Dam was a result of the construction of Harvey Dam, which was commissioned in 2001 and freed-up water in Stirling Dam.

[61] ACIL Tasman (November 2006), *Harvey Water Supply System: Cost Sharing Issues*, Paper 2 of 4 prepared for the Authority, published on the Authority web site, p10.

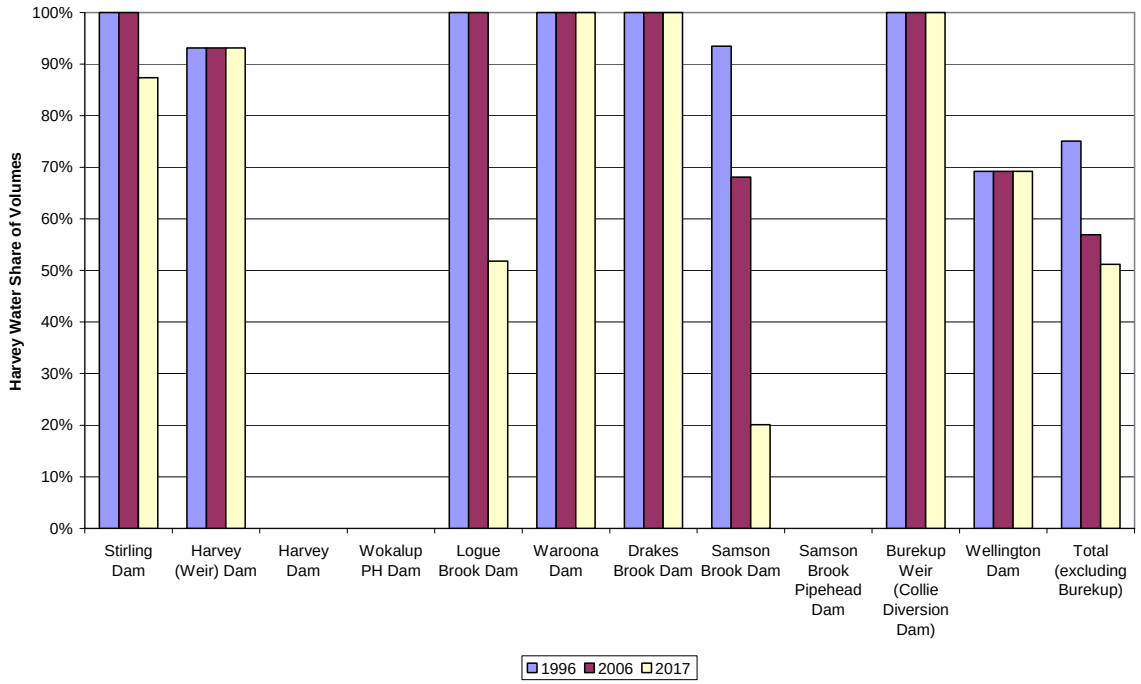
Figure 4.1 Total Allocations By Dam



Source: Water Corporation

Figure 4.2 shows the changes to the volume of water in each dam allocated to Harvey Water for the periods 1997, 2007 and the assumption for 2017. The total allocation was reduced from 75 per cent to 57 per cent over the course of the first BWSA and is projected by the Corporation to reduce further to 51 per cent by 2017.

Figure 4.2 Harvey Water Share of Volumes In Each Dam



Source: Water Corporation

Harvey Water's reduced allocation from Stirling Dam between 1996 and 2006 was due to the Corporation's "purchase" of water from Stirling Dam for its IWSS customers in exchange for the construction of the Harvey Dam.

The water trade between the Corporation and Harvey Water commenced in 2006 with a reduction in Harvey Water's allocation from Samson Brook dam and will continue until 2009/10 with further reductions from Samson Brook and reductions from Stirling and Logue Brook.

A complicating factor, raised by Harvey Water (see section 4.3), is whether the portion of dam safety costs attributable to customers should be allocated on a basis other than by water allocation. Efficient pricing principles indicate that a customer should at least pay the cost that could be avoided by no longer providing the service to that customer. A pertinent issue, therefore, is whether the Corporation would incur the dam safety expenditure even if did not have Harvey Water as a customer.

It is likely that it would be uneconomic to decommission the dams given that either Harvey Water or the Corporation would value the water more highly than the costs associated with the dam safety program. However, it is probable, if the Corporation did not have Harvey Water as a customer, that the storages could be either run down or optimised across the Corporation's storages to reduce the pressure on the dam walls and provide a greater ability to manage floods (although the ability to manage floods is impacted as much by the outlet capacity as it is the headroom in the dams). The reduction in storages has in fact been used as an interim measure for Logue Brook Dam. Such approaches would have some impact on the timing and sequencing of dam safety expenditure. For some dams, however, such as Wellington Dam, it may be the case that the dam safety program would not be affected by a reduction in storages, in which case the costs may not be avoidable. Overall, it would be appropriate for Harvey Water to at least pay the dam safety costs that are directly attributable to it. Beyond this point, the allocation of dam safety costs is largely a matter of equity rather than efficiency.

The implications of using a measure other than water allocations to allocate the dam safety costs is that the Corporation could end up incurring a cost that it is not matched by an immediate benefit. In this situation, presuming the Corporation wishes to proceed with the dam safety expenditure, the cost would reflect the value to the Corporation of preserving the option of a possible future trade with Harvey Water to access water for the IWSS. This would have implications for the incentives for trade between the two parties.

The allocation of dam safety costs among customers is a matter that the Authority is intending to explore further for the final report. ACIL Tasman has considered some theoretical aspects to this issue in its Paper 2, which is available on the Authority's web site. MJA has been asked to consider the technical aspects of this issue.

Non-irrigation customers

Harvey Water's operating and surface water licences allow it to sell water to non-irrigation customers. In addition, the BWSA incorporates a provision for Harvey Water to sell water to non-irrigation customers at a specified price.

Both Harvey Water and the Corporation commented in their submissions on the current arrangements for charging to commercial customers. Harvey Water noted that non-irrigation customers should pay more for high security water:

> The licences issued to Harvey Water explicitly include the ability to supply water to customers other than irrigators. Given their need for high security water at all times a

> different pricing regime is applied which is consistent with that used by other major water utilities. (Harvey Water submission, p30)

The Corporation considers that the price to non-irrigation customers should be consistent with the charges applied to their major customers throughout the State:

> The differential price structure for irrigation and non-irrigation use provides a disincentive for trading to non-irrigation customers. However, the Corporation would be concerned in terms of competitive neutrality if prices to non-irrigation customers were reduced, providing a subsidy to major consumers just because they chose to located in an irrigation district.

The Authority's preliminary view on this matter is that, for the purposes of allocating the costs of providing dam services, non-irrigation customers should be treated as if they are purchasing water directly from the dams. Once the costs have been appropriately allocated to non-irrigation customers, this amount would be charged to Harvey Water. Harvey Water would then pass on this cost, along with the costs of distributing the water, to the non-irrigation customers.

The approach suggested by the Authority would be consistent with the Corporation's charging approach for its major customers, which involves charging major customers the full cost of providing water.

In relation to Harvey Water's point that commercial customers require greater security, the Authority considers that this is a commercial issue for Harvey Water given that in on-selling water to non-irrigation customers it would be foregoing its own water security.

Overall, the Authority's preliminary view is that that the dam service charges that would be recovered from non-irrigation customers should cover the full costs of providing them with water.

Preliminary Views

21) The allocation of dam safety costs is complicated by the likelihood that some of these costs may not be directly attributable to Harvey Water.

22) There would not appear to be any reason why non-irrigation customers should pay water storage charges that are higher than the costs attributed to them.

Issues for further consideration

23) Should the allocation of dam safety costs to Harvey Water be on the basis of water allocations or some other approach, such as the costs directly attributable to Harvey Water?

5 Level of Water Storage Charges to Harvey Water

5.1 Terms of Reference

The Authority is to consider and develop findings on:

> the most appropriate level and structure of water storage charges to the South West Irrigation Cooperative (Harvey Water).

5.2 Analysis

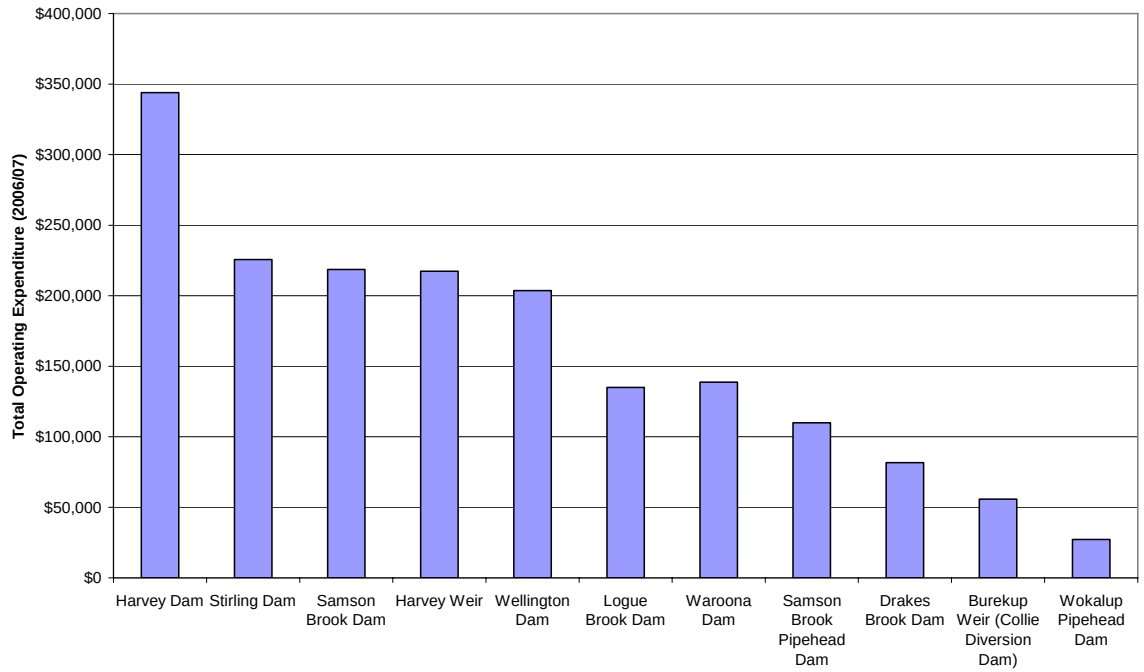
The purpose of this chapter is to provide an indication of the implications of the preceding discussion on the charges that could apply to Harvey Water. This chapter first considers other factors that influence the charges to Harvey Water, such as operating costs, asset lives and the rate of return.

5.2.1 Other Expenditure Considerations

Operating Expenditure

Total operating expenditure amounted to $2.053 million in 2005/06 and was attributed to each dam as indicated in Figure 5.1.

Figure 5.1 Operating Expenditure by Dam (2006/07, Real Dollar Values of 2005/06)



Source: Water Corporation

MJA has been employed to examine the appropriateness of the operating expenditure directly incurred and allocated to the South West dams. The Authority has noted MJA's preliminary advice that:

- the overhead rate applied to the South West dams should be the same as is applied to the Corporation's major consumers (53 per cent of direct costs);
- the same productivity rate that has been applied to the Corporation generally should also be applied to the South West dam operations (a real annual reduction of 1.8 per cent).

According to MJA, the Corporation's operating expenditure appears similar to, or lower than, the costs of other providers of dam storage services.

MJA is undertaking further analysis of the level of direct operating costs for the final report.

Non-Dam Safety Capital Expenditure

The Corporation has advised that the only significant capital expenditure that is not related to dam safety is an amount of $32 million in 2011 for outlet works on Stirling Dam. As this cost is for the purpose of servicing the IWSS, it has not been assessed and has been allocated entirely to the Corporation.

Asset Lives

The Corporation has assumed that the remedial works for dam safety will last for 80 years. This is likely to be an appropriate assumption for the purposes of determining depreciation allowances in the Corporation's revenue requirement.

Rate of Return

The Authority has assumed the same real pre-tax rate of return that is applied to the Corporation's urban and country water prices is also applied to the new BWSA. The rate of return is 5.6 per cent (pre-tax real) as at 30 October 2006.

Preliminary Views

24) In examining the impacts of the preliminary views above, the following assumptions have been made:

- The Corporation's projected operating expenditure for the South West irrigation dams has the same overhead rate applied as for the Corporation's major consumers.
- The productivity rate that applies to the Corporation has been applied to the operating expenditure on the dams.
- The Corporation's assumptions of asset lives for new capital expenditure (80 years) has been applied for the purposes of determining depreciation allowances in the Corporation's revenue requirement.
- A rate of return of 5.6 per cent (pre-tax real) has been applied in determining the Corporation's revenue requirement.

5.2.2 Scenarios

The purpose of this section is to provide an indication of the implications of the discussion in the preceding chapters and the parameters discussed above on the charges that could be applied to Harvey Water.

As was discussed in Chapter 3, it may be possible to better align the timing and sequencing of the dam safety expenditure with opportunities to improve life safety elsewhere in the economy. Given that issues of legislative and institutional reform may need to be considered, and that these may take some time to be fully considered, it may be appropriate to base the new BWSA on an amount of dam safety costs that is less than the total amount. This is an issue that the Authority will be considering in detail for the final report, and it is the issue that has the greatest implication for the charges to Harvey Water.

The other issue that has significant implications for the charges to Harvey Water, discussed in Chapter 4, is whether the costs that are allocated to customers should be recovered on the basis of water allocations or by using some other method (such as avoidable costs).

In addition, as discussed in Chapter 4, the proportion of costs allocated to recreational users will have a substantial impact.

The charges to Harvey Water will therefore vary substantially depending on the position that the Authority takes in the final report on the matters indicated above. Depending on the assumptions that are made, the total charges (including dam safety payments) to Harvey Water could range from around $6 per ML (similar to the total payment in 2004/05) to around $40 per ML, as shown in Table 5.1. This table is for illustrative purposes only and is based on the following assumptions:

- The recreational value assigned to Waroona and Logue Brook dams is 43 per cent of the cost of providing the dam service (with the Corporation being assigned the cost of foregone recreational benefits at Logue Brook Dam from 2007/08);
- The costs are allocated to customers on the basis of water allocations.

The table is interpreted in the following way. If the alternative regulatory or institutional arrangements were to determine that the amount spent on dam safety is to be deferred, then the net present value of this expenditure would be lower. The table indicates a range of reductions in the net present value of the capital expenditure, from 0 per cent, which assumes that all of the dam safety costs are recovered from users, through to 100 per cent, which assumes that none of the dam safety costs are recovered from users. The greatest impact on Harvey Water's charges results from all of the dam safety costs being passed on to users.

Table 5.1 Impact on Harvey Water of Varying the Assumption About the Present Value of the Dam Safety Capital Expenditure (Real Dollar Values of 30 June 2006)

	Variation in Present Value of Dam Safety Capital Expenditure						
	-0%	-25%	-33%	-50%	-67%	-75%	-100%
Average charge in 2016/17 ($ per ML)	24.17	19.71	18.28	15.25	12.21	10.78	6.32
Total Payment in 2016/17 ($ million)	3.2	2.6	2.4	2.0	1.6	1.4	0.8

In addition to indicating the effect on Harvey Water's charges, Table 5.1 also indicates that the annual costs attributable to Harvey Water could vary from $0.8 million if none of the dam safety costs are passed through to users to $3.2 million if all of the costs are passed through. In comparison, the charge to Harvey Water in 2004/05 was $0.6 million (inclusive of the dam safety payment)[62].

It should be noted that the figures in Table 5.1 will be impacted, in particular, by the assumptions about recreational benefits or the allocation of costs among customers. If recreational benefits are assigned a higher value, or if some costs are allocated to the Corporation even though the Corporation is not using the water, there will be less impact on Harvey Water.

A detailed description about how these total payments and average charges are determined is presented in Appendix 2.

[62] This figure excludes the payments made for non-irrigation use.

6 Structure of Charges

6.1 Terms of Reference

The Authority is to consider and develop findings on:

> the most appropriate level and structure of water storage charges to the South West Irrigation Cooperative (Harvey Water).

6.2 Background

The water storage charge to Harvey Water has a fixed component (in the form of a fixed charge) and a variable component (a price per ML of water used). In 2005/06, the fixed charge accounted for 30 per cent of the total charge.

Harvey Water comments on the origin of the current price structure:

> The 1996 BWSA agreed that the payment would be structured such that there was a fixed component (about 50%) and a component related to the volume of water drawn from the dam (about 50% but varying each year according to the amount taken). This structure arose because there was lack of clarity at the time of the agreement about whether or not Water Corporation was a bulk water supplier to Harvey Water and, if so, then it made logical sense to charge on the basis of volume of water drawn.
>
> However this is not actually the case and Water Corporation only provides water storage services to Harvey Water in which our water is stored in their dams, and naturally a fee is payable. The problem with the original structure is that it has led far too many people to conclude that Harvey Water is buying water off Water Corporation when this has never been the case.

The structure of water storage charges to irrigators has been considered as part of reviews in other States. For example, IPART reviewed the prices of bulk water services provided by the State Water Corporation (State Water) and the Department of Natural Resources (DNR).[63] As part of the review, IPART assessed the appropriate balance between entitlement charges (fixed fees per ML of water entitlement) and usage charges. Submissions to the IPART inquiry raised various issues regarding tariff structures, including the price signals to users through the usage charges, and the sharing of volumetric risk between users and the community:

- environmental groups were in favour of making the usage component as large as possible;
- some irrigators favoured a move towards a larger usage component on the grounds that it would provide better signals for water conservation;
- other users argued that a larger usage component would increase the variability in State Water's revenue and impact on its infrastructure maintenance.

[63] IPART (May 2006), *Bulk Water Prices for State Water Corporation and Water Administration Ministerial Corporation from 1 August 2006 to 30 June 2010*. State Water provides mainly river operation activities such as water delivery, asset management of dams and weirs, and flood mitigation. DNR carry out water resource management activities and licensing activities. The DNR administers the Water Administration Ministerial Corporation, which is the legal entity that provides these services.

For regulated rivers, State Water's Operating Licence requires it to move from a ratio of 50:50 to a ratio of 40 per cent fixed fee to 60 per cent usage.

In June 2006, the Essential Services Commission of Victoria released its final decision for its review of rural water prices.[64] The review covered the prices to be levied by the five Victorian rural water businesses for the two years from 1 July 2006.[65] However, as this was the first independent review of rural water prices, it was limited to the determination of efficient revenues for the service providers, and did not address the structure of prices, which will be covered in the next price review.

6.3 Analysis

Water storage costs incurred by the Corporation are by nature largely fixed and therefore the costs of operating a dam are generally independent of the volume of water. Indeed, once the dam and catchment are established, the cost of producing an additional megalitre of water is dependent on rainfall rather than any significant production process (therefore marginal costs are very low).

The Corporation's submission reflects this view and considers that the water storage charges should be largely fixed.

> The current structure of the water storage charge between the fixed and volumetric component was determined to match Harvey Water's tariff structure to their customers. The objective of this structure was to minimise the risk to Harvey Water in the case where water sales fell due to low water demand or availability. This should be considered as a transition measure that is no longer required. The services provided by the Corporation are largely fixed cost in nature. The structure of the water storage charge should, therefore, be predominantly fixed. The call for a greater volumetric component to encourage water conservation in misdirected in this case. Water that is not consumed does not become available to other customers and either augments Harvey Water's future entitlements or results in storages overtopping. A greater volumetric charge would transfer volumetric risk to the Water Corporation and to the Government without a corresponding increase in revenue. The potential for water trading is a greater incentive to encourage water use efficiency. (Corporation submission, p11)

Harvey Water submitted that charges should relate to the capacity shares of water held in the dams:

> One point of view is that if it is a storage charge then it should be a fixed charge because the costs of operating the dams are essentially the same if the dams are full or empty. Another point of view is that the charge should relate to the maximum volume of water stored in the dam by Harvey Water as a percentage of the total storage.
>
> This cost relates to the capacity share arrangement with Water Corporation which has been developed in Stirling dam and is now developing in Samson dam. In future it may also apply to Logue Brook dam and Wellington dam. Harvey Water believes that the costs of water storage in the dams should be related to the capacity sharing of water approach and would like to work with ERA and others to develop this. (Harvey Water submission, p28-29)

It is likely that the structure of water storage charges is not relevant for ensuring water is allocated to its most valued use because an effective water trading market will achieve

[64] ESC (June 2006), *Rural Water Price Review: Rural and Urban Water Businesses' Water Plans 2006-07 to 2007-08, Final Decision*.

[65] The five regional water providers are Goulburn-Murray Water, Grampians Wimmera Mallee Water (GWMWater), Lower Murray Water, First Mildura Irrigation Trust (FMIT) and Southern Rural Water.

this result. In other words, an effective water trading market would signal the value of the water and Harvey Water would decide whether it is in its best interest to utilise it themselves of transfer it to others.

While the water trading market operating within the co-operative appears to be working well, the market operating between the co-operative and other potential purchasers, such as the Corporation, could be more effective. For example, the trade under negotiation between the Corporation and Harvey Water is administratively cumbersome because it requires the Department of Water to reduce Harvey Water's water allocation and to increase the Corporation's allocation, rather than a straight forward exchange of water rights. In addition, the water entitlements are held by the co-operative rather than individual water users, which limits the potential for individuals to trade water outside of the co-operative. The Government has announced that it intends reviewing the current water trading legislation.[66]

Given that the water trading market is being enhanced, it is unlikely that the Government would need to prescribe the structure of the charges that the Corporation applies to Harvey Water. Rather, the structure of charges could be left to the Corporation and Harvey Water to negotiate commercially, given that the mix of fixed and variable charges is primarily an issue to do with managing the risk of uncertain annual inflows.

In relation to environmental considerations, the need to provide an adequate flow of water for environmental purposes is currently a factor that affects the amount of water allocated to irrigation use. Increasing the usage charge relative to the fixed charge would affect the amount of water used by farmers because the cost-effectiveness of implementing on-farm measures to save water would increase. However, if there is an effective water trading market operating, a farmer's decision to implement water efficiency measures will be influenced by the price on the water trading market and not just the price of the water from the dams.

It should be noted that the BWSA currently allows non-irrigation customers to be charged at a higher rate. This revenue is currently collected by Harvey Water and recouped by the Corporation. This issue was considered in Chapter 4 where it was concluded that non-irrigation parties should pay for their share of the costs of providing the water.

Preliminary Views

25) Given that the mix of fixed and variable charges is primarily a commercial issue to do with managing the volume risk of uncertain annual streamflows, it is unlikely that there is any reason for the Government to prescribe the structure of charges that the Corporation applies to Harvey Water.

[66] Water Reform Implementation Committee (July 2006), *A Draft Blueprint for Water Reform in Western Australia: Discussion Paper.*

7 Impact on Harvey Water

7.1 Terms of Reference

The Authority is expected to consider and develop findings on:

> The ability of South West irrigation farmers and Harvey Water to meet their share of the costs determined from 1 and 2 above, and the impact on customers of the rate of change of an increase in prices (if any).

7.2 Background

Given that the Authority has not yet come to a view on a range of key issues, the information provided in this chapter is only intended to illustrate the method that the Authority is considering using to identify the impacts on Harvey Water and the irrigators. The Authority welcomes submissions on the appropriateness of the assumptions used in the analysis that follows.

There are 771 shareholders in the South West Irrigation Area (SWIA) with a total irrigation entitlement of 152 GL, which represents around 65 per cent of the volume in South West irrigation dams. Around 50 per cent of these shareholders are in the Harvey area and have a total entitlement of 68 GL (equates to an average entitlement per shareholder of 173 ML).

Water use in the SWIA is primarily directed towards dairy and beef pasture production.[67] In comparison, the total south-west region, around 65 per cent of on-farm water use is directed to horticulture production.[68]

The major water shares in the SWIA in 2005/06 were 48 per cent for dairy, 30 per cent for beef and 11 per cent for horticulture/viticulture. Irrigation per hectare for the major industries amounted to 11 ML for dairy, 9 ML for beef and 14 ML for vegetable production.[69]

7.3 Analysis

The Authority has undertaken a preliminary investigation of the dairy industry in Western Australia to assist in this preliminary impact assessment using the scenario developed in Chapter 5. Some background information on the dairy industry in the South West is provided below:

- There were an estimated 270 dairy farms in Western Australia in 2006. The number of dairy farms has significantly decreased since deregulation in 2000. However, given an increase in average herd size and productivity, milk production has remained relatively constant.[70] The two major regions for dairy production in

[67] Brennan, D. (2006), "Current and future demand for irrigation water in Western Australia", Department of Agriculture and Food Western Australia, May 2006.

[68] Brennan, D. (2006), op cit.

[69] Harvey Water data.

[70] Dairy Australia (June 2006), *Dairy 2006: Situation and Outlook*.

WA are the Harvey and Boyanup regions, which together provide around 70 per cent of WA's milk production, respectively.

- Studies on estimated water values indicate that the asset value of water to the dairy industry in Western Australia to be in the range of $300-600 per ML. In contrast, the asset value for horticulture in southern regions of Western Australia is around $7,600 per ML. On average, returns to beef production Australia-wide from irrigation are marginal.[71]
- Harvey Water dairy irrigators (currently around 50 farms) primarily use flood irrigation techniques, with estimated average annual return (net profit) to water of $35 per ML. In comparison, Boyanup dairy irrigators which utilise underground water supplies, predominately use the more water-efficient sprinkler system and have higher pasture productivity. Returns to dairy production in the Boyanup region were estimated at around $100 per ML.[72,73] There is potential for Harvey dairy farmers to significantly increase milk production per ML and improve net profits. However this outcome would require enlarging the average size of farms and a substantial capital outlay (e.g. on sprinkler irrigation, larger sheds).[74]
- Recent data on the cost structures of dairy farms in the South West is limited. Only two years (ending June 2001 and 2002) of post-deregulation data is available from the Department of Agriculture survey, with only 17 dairy farms surveyed.[75] This data indicated that water costs for an average irrigated dairy farm (196 cows, using 434 ML) was $17,717. Average irrigation costs (fixed plus variable) were then $40.78 per ML or 5.2 per cent of operating costs.
- In comparison, ABARE statistics for 2004-05 indicate that water costs for dairy farms in Australia (with 193 dairy cows) average 5.6 per cent of costs, a figure which is consistent with the ABARE average for Western Australia (202 cows, water costs 5.4 per cent).[76]

The relative impact of a change in water charges will depend on a number of factors, including the ratio of water costs to total farm costs and efficiency gains from price responses.

Regarding the affordability of price increases by irrigators, Harvey Water submitted that:

> …an increase of each $75,000 for [dam safety] costs applied to Harvey Water will have to be passed on to irrigators and will result in the increase of fixed costs for water of

[71] Brennan, D., Dunlop, M. and Foran, B. (2006), *Water Futures Workshop: Issues and Drivers: Report III of IV in a Series on Australian Water Futures.* (www.cse.csiro.au/publications/2001/wateruse-r3-01-04.pdf).

[72] Brennan, D. (2006), op.cit.

[73] These results are consistent with a Water & Rivers Commission Report (*South West Yarragadee Economic Issues Study – Dairy*), which estimated average farm profits (per litre of milk) for a large dairy farm (500 milkers) in the Harvey area to be around 40 per cent of those in the Boyanup region. The major water costs incurred by irrigators in the Boyanup region are the power costs for pumping underground water. The report estimated the irrigation power costs at $220/ha, which equate to around 50 per cent of the Harvey irrigators water cost. Even if further water charges were introduced in Boyanup to equate irrigators' total water costs across the two regions, net profits for Boyanup dairy farms would still be higher than Harvey dairy farms.

[74] Moore, K., Chester, D., Kuzich, R., Nandapi, D. and Rivers, M. (2006), *Changing Irrigation Systems and Management in the Harvey Water Irrigation Area: Final Report, Project daw45*, Department of Agriculture WA.

[75] An updated Department of Agriculture survey will be released in 2007.

[76] In comparison, the Water & Rivers Commission study with a larger herd size of 500 cows assumed irrigation charges were 9.6 per cent of operating costs. This is consistent with ABARE data which shows that while a higher herd size will increase feed and herd costs per cow, productivity gains result in net profit increasing with size.

> $1 per Megalitre. Irrigators currently pay $43.59 per Megalitre of which $22.05 per Megalitre is a fixed charge. The issue of whether this is a high or low price for water must be considered against the returns and profits made by irrigators from that water. Harvey Water believes that market conditions are such at present that profitability is low in irrigated agriculture and so further cost increases need to be kept to a minimum.
> …
> It needs to be clearly recognised and can be stated again that irrigators do not have the ability to simply pass on production cost increases down the supply chain as can occur in many other industries and businesses. They have to try to absorb them as the oligopoly in retail food prevents irrigators obtaining a reasonable share of profits in the supply chain. (Harvey Water submission, p24)

There are a number of issues to be considered in the assessment of the impact of water cost increases on Harvey irrigators. In WA the majority of milk is produced for consumption in the local WA market. In comparison, 70 per cent of Victorian dairy production is exported as manufactured milk products. Traditionally WA has engaged in more water-intensive all-year milk production to meet local demand, with associated higher production costs. Over recent years there has been an increase in productivity (associated with larger dairy herds) and a move to more seasonal production in the Harvey region.

ABARE analysis[77] indicated that in 2004-05 the bottom 25 per cent of Australian dairy farms (carrying less than 160 milkers) were not profitable. In contrast, the top ranked farms (more than 230 milkers had a net profit over $150,000 per annum. While larger dairy farms are profitable, given current milk prices and farm costs, around 50 per cent of all WA dairy farms are currently unprofitable.[78] With limited growth in domestic and export demand over the next five years, together with an expected fall in real export prices, average farmgate prices are not expected to increase.[79] ABARE predicts that rationalisation of the industry will continue.[80]

The analysis in Section 5.2.2 provided a range of scenarios that indicated that water storage charges to Harvey Water could range from $6 per ML to $24 per ML by 2016/17. On the assumption that Harvey Water continues to charge $40.95 per ML for its costs, the total cost of water to farmers would range from $47 to $65 per ML.[81]

The following scenarios assume total water efficiency gains of 5 per cent until 2016-17 and constant production levels, milk prices and costs (except water storage charges).

Figure 7.1 shows the effect of increasing water charges to $65 per ML over the ten year period to 2016/17, which would result in average water costs increasing to around $26,000 per farm (from around $17,000 presently, in real dollar values of 30 June 2006). Irrigation costs would increase from 5 to 8 per cent of operating costs. Under this scenario, farm business profit (net of operator earnings) would fall from $34,000 to $25,000.[82]

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[77] ABARE (October 2006), *Production Systems, Productivity, Profit and Technology, Australian Dairy 06.1*.

[78] ABARE (March 2006), *Australian Farm Survey Results 2003-04 to 2005-06*.

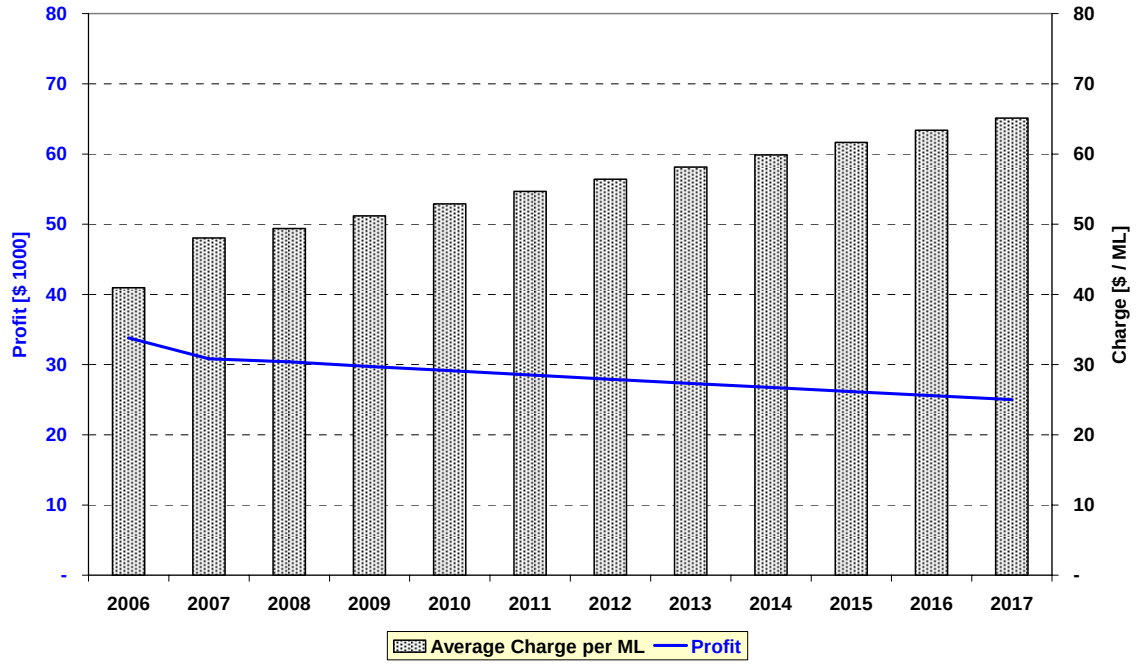
[79] ABARE (Jan 2005), *A Review of the Australia Dairy Industry, Report 04.25*.

[80] ABARE (October 2006), op.cit.

[81] Harvey Water has advised that $40.95 per ML is paid to SWIAC and SWIMCO (Harvey Water) for asset management, water distribution and research and development in the irrigation area.

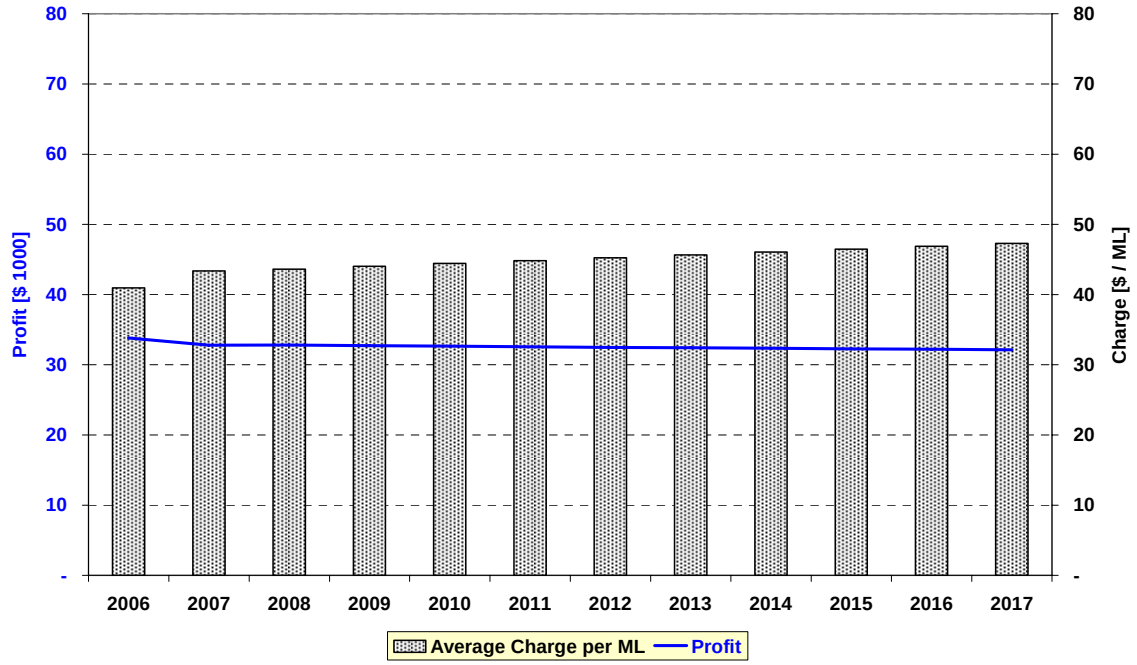
[82] Includes Dairy Structural Adjustment Program and Supplementary Dairy Assistance Scheme payments.

Figure 7.1 Net Profit to Harvey Dairy Farmers Under Constant Milk Price Assumption (28 cents per litre): Entire Dam Safety Capital Expenditure Passed on to Users (Real Dollar Values of 30 June 2006)



If none of the dam safety capital expenditure is passed on to users, then water prices and farm profits would not be significantly impacted (Figure 7.2).

Figure 7.2 Net Profit to Harvey Dairy Farmers Under Constant Milk Price Assumption (28 cents per litre): None of the Dam Safety Capital Expenditure Passed on to Users (Real Dollar Values of 30 June 2006)



Source: ABARE farm survey data, Department of Agriculture (WA) dairy farm survey data, with Authority analysis

The actual impact on Harvey Water is likely to be somewhere between the impacts shown in the two preceding figures. The Authority is interested in receiving feedback on whether the method and assumptions used by the Authority in undertaking this impact analysis are appropriate.

Issues for Further Consideration

26) Is the approach used by the Authority to estimate the impacts on Harvey Water and its shareholders appropriate or are there other approaches and assumptions that would improve the accuracy of the impact assessment?

APPENDICES

Appendix 1: Terms of Reference

HARVEY WATER BULK WATER PRICING INQUIRY
TERMS OF REFERENCE

I, ERIC RIPPER, Treasurer, pursuant to section 32(1) of the *Economic Regulation Authority Act 2003* (the ERA Act), request that the Economic Regulation Authority (the Authority) undertake an inquiry and make recommendations on the most appropriate level and structure of water storage charges to the South West Irrigation Cooperative (Harvey Water). In doing so the Authority is expected to consider and develop findings on:

1. The cost of operating and maintaining the irrigation dams, based on:

    a. a "renewal costing" methodology which carries forward the model used for the 1996 Bulk Water Agreement;

    b. a "full costing" methodology, consistent with National Water Initiative pricing principles, including efficient operating costs and capital expenditure requirements and a suitable rate of return on past and future investment in storage and distribution assets owned by the Water Corporation.

2. The additional costs associated with maintaining and improving dam safety for the Water Corporation's South West Irrigation Dams. This should include consideration of:

    a. the requirements of the current Australian National Committee on Large Dams (ANCOLD) dam safety guidelines and the requirement for the Water Corporation to manage their dams to these guidelines; and

    b. the overall merits, for all parties, of alternatives to the ANCOLD dam safety guidelines.

    These considerations should utilise existing studies, including:

    a. Marsden Jacob Associates August 2003 *"Review of Dam Safety Program Relating to South West Irrigation Dams"*; and

    b. Snowy Mountains Engineering Corporation July 2006 "*Evaluation of Alternative Risk Management Strategies*"

3. The cost sharing arrangements between beneficiaries of the South West irrigation dams, including:

    a. customers that benefit from the water stored in the dams and how this may change over time with water trading;

    b. the recreational and other social benefits to the community of the dams; and

    c. the beneficiaries of dam safety expenditure, including an assessment of those who benefit from the use of the dams and those that benefit from a reduced risk of flooding.

4. The ability of South West irrigation farmers and Harvey Water to meet their share of the costs determined from 1 and 2 above, and the impact on customers of the rate of change of an increase in prices (if any).

5. The impact on the State Government's net financial position associated with the recommended price level and structure.

The Authority is to have regard to the Government's social, economic and environmental policy objectives.

The Authority will release an issues paper as soon as possible after receiving the reference. The paper is to facilitate public consultation on the basis of invitations for written submissions from industry, government and all other stakeholder groups, including the general community.

A draft report is to be made available by 30 November 2006 for further public consultation on the basis of invitations for written submissions.

A final report is to be completed by no later than 1 March 2007.

Appendix 2: Scenario

The purpose of this appendix is to provide a scenario to show Harvey Water's charges are derived. It is for indicative purposes only and no weight should be placed on the particular assumptions chosen.

The main assumptions used in this scenario are:

- the present value of the dam safety capital expenditure that is added to the regulatory asset value has been reduced by 33 per cent (this issue is discussed in Chapter 3);
- the dam safety and other costs attributed to customers are allocated on the basis of water allocations (as discussed in Chapter 4);
- the value placed on recreational benefits at Waroona Dam is assumed to be 43 per cent of the revenue required to provide the dam service (as discussed in Chapter 4);
- the value placed on recreational benefits at Logue Brook Dam is assumed to be 43 per cent of the revenue required to provide the dam service in 2006/07 and 0 per cent thereafter on the assumption that recreational use is prohibited once the water is traded with the Corporation. The foregone recreational benefits are assigned as a cost to the Corporation (as discussed in Chapter 4);
- the productivity rate applied to the Corporation's dam safety operations is 1.8 per cent (as discussed in Chapter 5);
- the rate of return is 5. 6 per cent (pre-tax real) (as discussed in Chapter 5);
- the average charge for Harvey Water transitions smoothly to upper bound prices by 2016/17 (as discussed in Chapter 2).

Total Revenue Requirement

The revenue requirement equates to a present value (at a discount rate of 5.6 per cent) of $138.5 million over the period from 2006/07 to 2016/17.

The derivation of this revenue requirement is summarised in the following table.

Table A2.1 Corporation Total Revenue Requirement from Operating the South West Irrigation Dams (Assuming the Alternative Dam Safety Scenario)

Value ($ million, real dollar values of 30 June 2006)											
Asset Account	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**
Opening Asset Value	200.1	198.6	209.3	225.5	238.3	235.5	232.3	229.2	226.0	224.5	221.6
Capital Expenditure	1.2	13.3	19.1	15.8	0.5	0.1	0.2	0.0	1.7	0.4	1.1
Depreciation	-2.6	-2.6	-2.8	-3.1	-3.3	-3.3	-3.3	-3.3	-3.3	-3.3	-3.3
Closing Asset Value	198.6	209.3	225.5	238.3	235.5	232.3	229.2	226.0	224.5	221.6	219.4
Cost of Service	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**
Operating Expenditure	2.1	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.6	1.6
Depreciation	2.6	2.6	2.8	3.1	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Return on Assets	11.2	11.1	11.7	12.6	13.3	13.2	13.0	12.8	12.7	12.6	12.4
Total Revenue Requirement (unsmooth)	15.9	15.7	16.4	17.5	18.4	18.2	18.0	17.8	17.6	17.5	17.3
Cost of Service	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**
Total Revenue Requirement (smoothed over 51 years)[83]	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1

[83] The smoothed revenue requirement assumes that the residual value of the assets at the end of the period will be recovered thereafter.

Cost Allocation

In this scenario, the allocation of the revenue requirement among the beneficiaries of the Corporation's dam services assumes that costs are allocated according to the volumes used from each dam, after an allowance for recreational benefits has been made. The derivation of the total cost of service attributed to Harvey Water is shown in the following table.

Table A2.2 Derivation of Total Cost Attributed to Harvey Water

	Value ($ million, real dollar values of 30 June 2006)										
Customer	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**
Total Revenue Requirement	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
Less CSO payment for recreational benefits	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Less costs attributed to Corporation local and IWSS customers	12.7	13.1	13.1	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Less costs attributed to non-irrigation customers	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total cost attributed to Harvey Water	2.7	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

The costs attributed to Harvey Water for dam safety and other services are shown in the following table.

Table A2.3 Costs Attributed to Harvey Water

	Value ($ million, real dollar values of 30 June 2006)										
	06/07	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**
Dam safety	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Other services	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Total cost attributed to Harvey Water	2.7	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

The dam safety cost of $1.7 million in 2006/07 compares to the payment for dam safety made by Harvey Water in 2004/05 of $0.4 million (in real dollar values of 30 June 2006). The other services cost of $1.0 million in 2006/07 compares to the payment for other services by Harvey Water in 2004/05 of $0.25 million.

Price Path for Harvey Water

Consistent with the discussion in Chapter 2, the revenue requirement from Harvey Water transitions to upper bound prices by 2016/17. The total revenue requirement from Harvey Water under this scenario is shown in the following table.

Table A2.4 Derivation of Revenue Requirement from Harvey Water

	Value ($ million, real dollar values of 30 June 2006)										
Customer	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**
Total cost attributed to Harvey Water	2.7	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Less CSO payment for subsidy	1.9	1.6	1.4	1.2	1.0	0.9	0.7	0.5	0.3	0.2	-
Total revenue requirement from Harvey Water	0.8	0.9	1.1	1.2	1.4	1.6	1.7	1.9	2.1	2.3	2.4

Under this scenario, the average charge per ML is projected to increase in the manner shown in the following table.

Table A2.5 Average Charge to Harvey Water

	Average Charge ($ per ML)										
Irrigation District	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**
Harvey	4.25	5.24	6.26	7.20	8.22	9.25	10.27	11.30	12.32	13.34	14.37
Waroona	21.56	25.57	30.65	35.73	40.81	45.89	50.97	56.05	61.12	66.20	71.28
Collie	3.98	4.96	5.95	6.94	7.92	8.91	9.89	10.88	11.87	12.85	13.84
Average	5.54	6.54	7.87	9.16	10.47	11.77	13.07	14.37	15.68	16.98	18.28