



The Minister for Water

**Independent Review of
Options to Reduce Salinity in
the Upper Collie River Basin**
Summary Report

May 2010
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Reference to “review” throughout this report has not been used in the context of a review in accordance with Australian Auditing Standards and Australian Standards on Review Engagement.

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KPMG have indicated within this report the sources of the information provided. We have not sought to independently verify those sources unless otherwise noted within the report.

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The findings in this report have been formed on the above basis.

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This report is solely for the purpose set out in section 2 and for the Minister for Water’s information.

This report has been prepared at the request of the Western Australian Government in accordance with the terms of KPMG’s contract dated 8 April 2010. Other than our responsibility to the Minister for Water, neither KPMG nor any member or employee of KPMG undertakes responsibility arising in any way from reliance placed by a third party on this report. Any reliance placed is that party’s sole responsibility.

1 Executive Summary

In July 2009, the Western Australian Government engaged KPMG (with the assistance of WorelyParsons acting as a sub-contractor) to undertake an independent review of options to reduce salinity in the Upper Collie River Basin and to make recommendations to the Minister for Water.

The Salinity Issue

Since the 1960's Wellington Reservoir and the Upper Collie River Basin have become increasingly saline as a consequence of land clearing in the catchment. This land clearing was exacerbated by the Conditional Purchase Scheme, which required land clearing.¹ As a result, Wellington Reservoir has become largely unusable for the purposes for which it was built, being for public water supply and irrigation.

The increase in salinity has imposed costs in the form of land degradation and reduced agricultural output, environmental damage, reduced amenity and the need to construct Harris Dam to provide an alternative source of potable water.

The Department of Water, and its predecessors, have been working on developing salinity recovery solutions for the Upper Collie River Basin for some years. These solutions commenced with controls on land clearing, followed by a land purchase and reforestation program.

This initial salinity recovery work appears to have prevented salinity reaching predicted levels of over 1,700 mg/L total dissolved solids (TDS), moving salinity levels towards an average of about 900 mg/L TDS. Further work would be required to bring the quality of Wellington Reservoir water back to levels suitable for broad irrigation and public water supply purposes.

Figure 1-1 below shows the history of salinity levels in Wellington Reservoir including the actual and predicted affects of past and prospective schemes to reduce salinity. It has been drawn from the Department of Water's submission only to show the historical record, although it also shows that currently planned activities (i.e. expansion of the Department of Water's pilot scheme known as Stage 1A of its Salinity Recovery Scheme), is expected to reduce salinity to 750 mg/L TDS.

¹ The Conditional Purchase Scheme was re-introduced in 1961 and continued until 1982. Under it, areas of land were released at extremely low costs (around 25 cents per ha) and purchases were conditional on clearing a proportion of the land. See Australian Greenhouse Office, *Land Clearing: A Social History*, Technical Report no.4.

Figure 1-1: Forecast average salinity levels at Wellington Reservoir inflow²

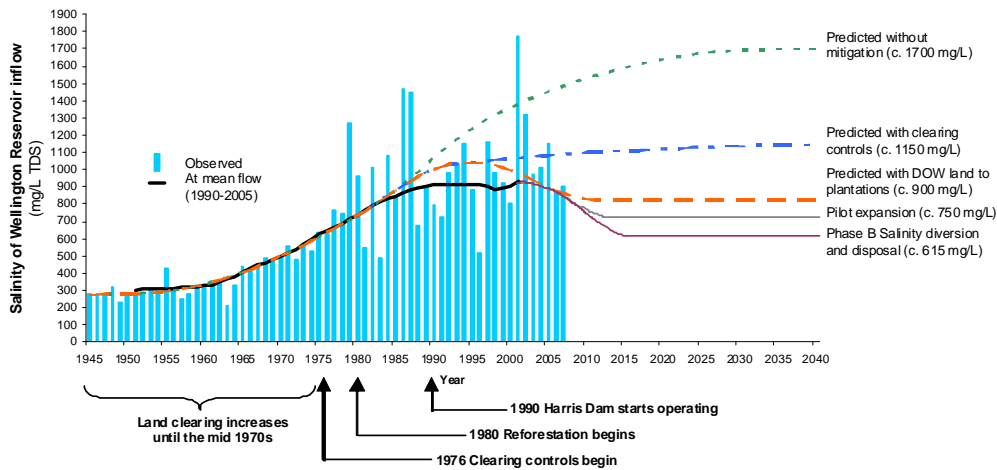


Figure 1-1 shows that the existing measures appear to have had success in preventing salinity levels deteriorating. It also shows that additional steps would need to be taken to reduce salinity further. There is, however, a wide range of views on what those steps might be.

The rationale for addressing salinity in Wellington Reservoir is that high-value groundwater which is often “fresh” (< 500mg/l TDS) and potentially potable is currently being used for industrial purposes (e.g. process cooling at power stations) in the Collie area. This coincides with the under-utilisation of the significant water resources in Wellington Reservoir, the quality of which could be improved with more effective resource management.

While there would not appear to be a ‘shortage’ of water resources in the Collie industrial area today, the Upper Collie Water Allocation Plan states that:

“Water allocation planning is a high priority in the Upper Collie catchment given the increasing water demand for power generation, industry and public water supply, as well as the need to protect the natural environment.”³

The plan seeks to limit the maximum total allocation of groundwater licences to 9.2 GL/a, and to issue no further commercial licences. The most imminent risk to the security of supply is likely to be to the power generation and other new industries. There is, therefore, widespread industry support to address salinity in Wellington Reservoir as over the longer term, water availability and quality may threaten the viability of industry in the region.

² The Department of Water, 2009. The graph represents forecast and measured salinity levels on a weighted average across the inflows into Wellington Reservoir.

³ Department of Water, Upper Collie Water Allocation Plan, August 2009, page iii.

Objectives of the Independent Review

The Government's objectives, as outlined in its Terms of Reference for the review, were to examine options that:

- recover salinity in Wellington Reservoir and the Upper Collie River Basin;
- facilitate the sustainability and viability of the Collie Irrigation District;
- deliver or otherwise allow for the release of potable water for beneficial use; and/or
- deliver or otherwise allow for the release of fit-for-purpose industrial water.

Review process

The independent review was established and monitored by the Government's Steering Committee to ensure it was conducted independently and transparently, and met the Government's timeframes.

The review process included:

- issuing invitations to register interest in making submissions during the two-week submission period of 13 to 28 August 2009;
- issuing registrants with a Request for Submissions document outlining the review process, the basis on which options would be assessed and the information required from participants to assess any options contained in their submissions;
- receiving submissions and undertaking a process of evaluation to short-list the options that were most likely to meet the Government's objectives; and
- conducting, to the extent practical, cost benefit analysis on those short-listed options to form conclusions on those that were most likely to meet the Government's objectives, and making recommendations on that basis.

KPMG issued a confidential final report to the Minister of Water in October 2010 outlining the findings of the review. In April 2010, the WA Government instructed KPMG to produce a report summarising the findings of the review, which would be suitable for public release.

Review outcomes

The public submissions provided a valuable collation of stakeholder requirements and conceptual engineering options. As reinforced by the number and nature of the submissions received, there remains a range of strong stakeholder views on the optimal outcome and approach for the region.

Eighteen submissions were received, six of which provided options that addressed the Government's Terms of Reference. Two of the six submissions were not considered to be technically feasible resulting in four short-listed submissions undergoing a cost benefit evaluation.

The key components of the four short-listed options are:

- *Agritech*: to deliver potable water proximate to Wellington Reservoir by first investing in a gravity fed desalination plant and associated infrastructure ex-Wellington Reservoir and then by developing a saline channel diversion network to capture saline water flows from the entire Upper Collie River Basin (and perhaps beyond), with some diversion to the desalination plant in the long term.
- *Department of Water*: to install a desalination plant and associated pipework which would divert and remove salt loads currently transferring to Wellington Reservoir.⁴
- *Marsden Jacobs*: to deliver fresh water in Wellington Reservoir by relying on the Department of Water option (Stage 1B and Stage 2). It also includes additional water sources (i.e. de-watering, unallocated water in Wellington Dam and water trades) for its proposed water utility within the Collie industrial area and provides an institutional framework to deliver the outcomes sought.
- *WA Forest Products Commission*: to improve salinity in Wellington Reservoir by expanding commercial plantations in the Upper Collie River Basin, and which would also deliver fresh water if Stage 1 (A and B) of the Department of Water option was also undertaken.

As the short-listed submissions are at the conceptual phase and in many cases are not mutually exclusive, it was not possible to conduct a comprehensive cost benefit analysis on each of the options. Instead, more of a cost effectiveness approach was used based on the key outcome all the options had in common: producing "fresh" water in Wellington Reservoir.⁵

The Request for Submission document outlined to respondents that their submissions would be compared to the base case (or status quo), which included Stage 1A of the Department of Water's Salinity Reduction Scheme. This was done on the assumption that Stage 1A was already committed and would proceed.

The other benefits that each option offered were also considered where they were likely to be material, but given the significant differences in the cost effectiveness of producing the key outcome, the analysis suggested it was unlikely that these other benefits would have altered the overall merits of the options.

⁴ The Department of Water's proposal contains several stages. Stage 1A involves a 2.5 GL/a diversion into the WSH mine void and is expected to reduce salinity to 750 mg/L TDS. Stage 1B involves an additional 2.0 GL/a diversion and the addition of a desalination plant. This would produce 3.7 GL of product water and is expected to reduce salinity to 615 mg/L TDS. Stage 2 involves increasing the diversion to 8.0 GL/a, and expansion of the desalination plant. This would produce 6.7 GL/a of product water is expected to reduce salinity to 500 mg/L TDS. Stage 3 is less developed and involves the addition of a network of collection and distribution pipework, further expansion of the desalination plant and the establishment of a water service provider.

⁵ In practice, the Agritech option would in the first instance produce fresh water to ex-Wellington Reservoir.

Comparing the options on the basis of cost effectiveness suggests that the business case largely rests on whether larger scale engineering solutions (i.e. desalination and canals), as reflected in the Agritech proposal, are likely to be a more cost effective way of producing fresh water, than a smaller scale engineering solution (desalination), or some combination of a smaller scale engineering solution and reforestation. The latter solutions are reflected in the Department of Water, Marsden Jacobs and Forest Products Commission options respectively.

The results of the evaluation indicated the Forest Products Commission option in conjunction with the Department of Water Stage 1B option is more likely than the other options of providing a cost effective way of delivering fresh water in Wellington Reservoir. Furthermore, the costs of the Forest Products Commission option appear to be lower than the respective element of the Department of Water option, but they are also less certain. This is because they depend on the incentive payments that would need to be made to encourage the change in land use (which might be significantly higher than estimated) and uncertainty around the modelling to date. The benefits are also likely to be more long term.

More generally the review highlighted that:

- three of the options relied on the Department of Water's option at least to Stage 1B;
- all options would appear to require additional utilisation of the Verve ocean outfall pipeline but mostly failed to recognise the issues associated with its use (e.g. the limited capacity of the pipeline, the environmental conditions on discharge water quality and the costs of access to the pipeline); and
- addressing the salinity issue in the Upper Collie River Basin is unlikely to occur without some form of government facilitation or involvement.

Review recommendations

The key recommendations from the review were:

- *Confirming intent:* The Government provide public support to focus on and continue with its current strategy to address the salinity issue in the Upper Collie River Basin, subject to confirmation that it will provide net benefits.
- *Department of Water Stage 1B:* Undertake a full feasibility study to assess the costs and benefits of the Department of Water Stage 1B option in more detail.
- *Assess benefits of 500mg/l TDS target:* As Wellington Reservoir is unlikely to be used as a potable water source in the short to medium term, the appropriateness of the target should be reviewed at a high-level.
- *Progress water management:* Revise legislation to enable appropriate management (allocation) of mine dewatering resources and form an industrial water agencies forum to enable collation of data, issues and actions to progress beneficial water (and environmental) outcomes in the Upper Collie River Basin.

In addition, while the governance arrangements are likely to be critical for any solution, it would be difficult for the Government to ‘second-guess’ the most workable solution and having it act as a ‘middleman’ in the negotiations and developing the commercial agreements is unlikely to be successful. Rather, it may be more appropriate that the Government creates the conditions and incentives for other stakeholders to progress the project.

Review qualifications

It should also be noted that:

- three of the options relied on the Department of Water undertaking at least Stage 1B of its Salinity Reduction Scheme. As the base case (or status quo) included Stage 1A of the Department of Water’s Salinity Reduction Scheme, only the costs of Stage 1B were assessed as part of this review. The costs of Stage 1A were not assessed as part of this review;
- no options other than those proposed in the submissions were considered as part of this review. It is possible therefore that there may be other more cost effective ways of producing fresh water in Wellington Reservoir. KPMG is aware that subsequent to this review a new proposal has been made in this regard; and
- Marsden Jacobs no longer wish to put themselves forward as proponents as per their submission. Marsden Jacobs still considers that its proposal has merit, however, it is no longer in a position to be a party responsible for implementing the proposal.

2 Introduction

2.1 Purpose of this report

In July 2009, the Western Australian Government engaged KPMG (with the assistance of WorelyParsons acting as a sub-contractor⁶) to undertake an independent review of options to reduce salinity in the Upper Collie River Basin and to make recommendations to the Minister for Water.

The Government's objectives, as outlined in its Terms of Reference for the review, were to examine options that:

- recover salinity in Wellington Reservoir and the Upper Collie River Basin;
- facilitate the sustainability and viability of the Collie Irrigation District;
- deliver or otherwise allow for the release of potable water for beneficial use; and/or
- deliver or otherwise allow for the release of fit-for-purpose industrial water.⁷

This report provides a summary of the findings from the review.

2.2 Structure of report

The remainder of this report contains the following sections:

- Section 3 outlines the independent review process and discusses the submissions received and the common themes that emerged from stakeholder submissions.
- Section 4 describes the methodology for short-listing the options and the approach to assessing the short-listed options.
- Section 5 presents the results of the evaluation of the short-listed options.

Appendix A lists the registered parties and those who submitted a response to the review.

⁶ WorelyParsons provided advice to KPMG on the technical feasibility of the options, the physical outcomes they were likely to produce and on the indicative costs of the options.

⁷ Minister for Water, Media Statement 27 July 2009,
<http://www.mediastatements.wa.gov.au/Pages/WACabinetMinistersSearch.aspx?ItemId=132263&search=Independent+review&admin=Barnett&minister=Jacobs&portfolio=®ion=>

3 Review process and submissions received

3.1 Process to undertake the review

The independent review was established and monitored by the Government's Steering Committee to ensure it was conducted independently and transparently, and met the Government's timeframes.

The review process included:

- issuing invitations to register interest in making submissions during the two-week submission period of 13 to 28 August 2009;
- issuing registrants with a Request for Submissions document outlining the review process, the basis on which options would be assessed and the information required from participants to assess any options contained in their submissions;
- receiving submissions and undertaking a process of evaluation to short-list the options that were most likely to meet the Government's objectives; and
- conducting, to the extent practical, cost benefit analysis on those short-listed options to form conclusions on those that were most likely to meet the Government's objectives, and making recommendations on that basis.

3.2 Outline of submissions received

During the Expression of Interest period twenty eight parties registered to receive the Request for Submission document. Appendix A lists the registered parties and those that provided a submission. Eighteen submissions were received, reviewed and classified as follows:

- Six were classified as "**proponents**" providing options which addressed the Terms of Reference.
- Eleven were classified as "**stakeholders**" providing experience, industry or community preferences on outcomes and identified potential risks.
- One was classified as a "**supplier**" providing experience on projects relevant to the Terms of Reference, but did not provide a water salinity recovery option as a whole.
- Two submissions were received several days after the closure of the submission period and were deemed by the Steering Committee to not be accepted.

3.3 Common stakeholder themes

In addition to receiving six submissions proposing options that addressed the government's Terms of Reference, eleven submissions were received from parties potentially impacted by the planned programs or proposed activities and, in many cases, likely to bear the costs of catchment improvements. All stakeholders appeared well informed on regional issues from technical, social, environmental and policy perspectives and provided additional context to technical aspects and infrastructure or tenure access feasibility for the options.

Common responses to emerge from the submissions included:

- support for the independent review process, however, there was concern over inadequate time to provide a detailed response and one respondent commented on the limited scope of the Terms of Reference considering it was not extensive enough for the Collie industrial area seen as critical to State development;
- general support was expressed for some form of water utility in the region, in addition to support for a water utility to manage all wastewater disposal requirements for the Collie region (excluding municipal sewerage);
- the majority of stakeholder submissions sought 'treatment of the cause and not the symptom', that is, programs which mitigate dryland salinity rather than desalinate affected waters;
- stakeholders with tenure or existing infrastructure provided commentary on option feasibility and risks generally. Commentary included some offer of capital or licensing contribution to supporting proposed options where applicable;
- there were stakeholder requests not to under-value agricultural operations in the Upper Collie and [Lower] Collie Irrigation District;
- one stakeholder highlighted a potential brine concentrate synergy in the Kemerton Industrial Estate (salt reuse in industrial applications) rather than ocean disposal;
- there was general support of maintaining multiple programs to improve water salinity;
- there was commentary of low confidence in the water balance of a proposed water utility particularly with respect to variability in dewatering sources; and
- one stakeholder did not support transfer of regional [Collie] water sources to the metropolitan IWSS.

4 Evaluation process

The first step in assessing the submissions was to isolate those that were classified as “**proponents**” (i.e. those providing options which addressed the Terms of Reference). Six of the submissions were classified as proponents each of which was then further classified as either a regional or local scale option defined as follows:

4.1 Short listing assessment framework

In accordance with the Request for Submissions assessment framework, the proponent submissions were evaluated against the five main criteria as follows:

- Technical feasibility – whether the option would achieve the nominated outcomes with the proposed option.
- Terms of Reference – whether the option addressed the Terms of Reference.
- Governance & ownership – the feasibility of the governance and ownership arrangements (including capital funding).
- Implementation Risks – the risks associated with the option including tenure risk, required approvals and construction and operational risks.
- Costs and benefits – a preliminary comparison of option costs and benefits as presented by the proponent.

All six proponent submissions were reviewed in parallel and found to contain some overlapping concepts in option design. Of the six proponent submissions, two were not considered to be technically feasible:

- WISALTS: who proposed a shallow drainage canal system at a local (farm) scale to “manage surface and subsurface water in order to alleviate waterlogging and renovate farmland affected by erosion, salinity and acid soils”. This was considered not technically feasible primarily due to insufficient detail on the design of the canals and the required geological profile to support the system. There is also a body of evidence showing the WISALTS system may not result in terrestrial or water salinity improvements.
- Southern Cross Water and Infrastructure: who proposed building a desalination plant at Wellington Reservoir and transporting product water to the IWSS via Brunswick Reservoir. It was considered not technically feasible to address the Terms of Reference primarily because, for example, it contained some key technical issues in terms of the Stirling Reservoir pipeline capacity to transfer water to the IWSS, the lack of bulk water balance between dams for Wellington seasonal scouring and the lack of a specific concept to address Upper Collie River Basin salinity recovery.⁸

⁸ It also was very similar to the Agritech Stage 1 option

4.2 The short-listed options

The remaining four options were considered technically feasible despite most of them not being progressed beyond a concept or conceptual design. Furthermore, the engineering/scientific and commercial data provided for actual options was limited, qualitative rather than quantitative, and in most cases unsubstantiated (as supporting information could not be submitted in a report form). Thus the technical feasibility assessment included identifying any technical gaps in the proponent's submissions based on the information provided.

The following four options were short-listed for detailed evaluation. A brief description of the four short-listed options is provided below, particularly focussing on what they all have in common (which informs our evaluation). In particular, all four short-listed options would produce "fresh" water at Wellington Reservoir. Fresh water was defined for the purposes of this review as <500 mg/L TDS.⁹

The four short-listed options are:

- *Agritech*: to deliver potable water proximate to Wellington Reservoir by first investing in a gravity fed desalination plant and associated infrastructure ex-Wellington Reservoir and then by developing a saline channel diversion network to capture saline water flows from the entire Upper Collie River Basin (and perhaps beyond), with some diversion to the desalination plant in the long term.
- *Department of Water*: to install a desalination plant and associated pipework which would divert and remove salt loads currently transferring to Wellington Reservoir. The Department of Water estimate that the next stage (Stage 1B) of this option would reduce salinity to 615 mg/L TDS by diverting the most saline streamflows, treating them in a fit-for-purpose desalination plant and disposing of the concentrated (saline) water through Verve's ocean outfall pipeline. Stage 2 involves increasing the diversion and capacity of the desalination plant to reduce the Wellington Reservoir salinity to not more than 500 mg/L TDS.
- *Marsden Jacobs*: to deliver fresh water in Wellington Reservoir by relying on the Department of Water option (Stage 1B and Stage 2). It also includes additional water sources (i.e. de-watering, unallocated water in Wellington Dam and water trades) for its proposed water utility within the Collie industrial area and provides an institutional framework to deliver the outcomes sought.
- *WA Forest Products Commission*: to improve salinity in Wellington Reservoir by expanding commercial plantations in the Upper Collie River Basin, and which would also deliver fresh water if Stage 1 of the Department of Water option was also undertaken.

It is worth noting that three of the four short-listed options depend on at least Stage 1B of the Department of Water's option which would involve increasing the river diversion by 2.5 GL/a

⁹ Mayer, X.M., Ruprecht, J.K. & Bari, M.A. 2005. Stream salinity status and trends in South-West Western Australia. Department of Environment, Salinity and Land Use Impacts Series Report No. SLUI 38. Perth, Western Australia. Cited in Beckwith Environmental Planning Pty Ltd, prepared for the Department of Water Government of Western Australia, June 2007, *Upper Collie Water Management Plan Issue Scoping Report*.

(to a total of 4.5GL/a), treating it in a desalination plant, and reducing average salinity in Wellington Reservoir to 615 mg/L TDS.

4.3 Approach to assessing the short listed options

Following identification of the short-listed options, we conducted a more detailed analysis of their costs and benefits.

The Government's Terms of Reference suggest its key objective is to reduce the salinity in Wellington Reservoir and put more of the water to greater beneficial use. This could involve using that water more for irrigation purposes, industrial purposes and/or potable purposes. Alternatively, it could be used more for one or more of these purposes if it, in effect, released other (perhaps higher value) water sources for other purposes.

As the value of the water is, amongst other things, highly dependent on its salinity, maximising the beneficial use of water is dependent on the relative costs and benefits of reducing that salinity, and putting the water to more beneficial use. The critical question, in the context of the analysis, was whether the socio-economic benefits of an option or the options (where they might be complimentary) were likely to outweigh the socio-economic costs.

We disaggregated this question into two component questions:

- Which option is likely to be most effective in meeting the Government's objectives?
- Is an option likely to be beneficial in its own right?

The analysis focused on answering the first question (i.e. the relative rather than the absolute merits of the options). The key reasons for this were:

- The options were not conducive to the options analysis typically undertaken in cost benefit analysis essentially because:
 - They covered a wide range of projects, approaches, stages and geographic areas and therefore have costs and benefits that relate to different things and entail significantly different risks.
 - The options were not mutually exclusive, indeed, in some cases they were complimentary.
 - In many cases the costs, benefits and risks were not well defined (this was a function of their stage of design development).
- The short-listed options also implicitly raised issues that go well beyond the Upper Collie River Basin. This review was focussed on the Government's four objectives as outlined in the Terms of Reference, which included the merits of undertaking actions that may "*deliver or otherwise allow for the release of potable water for beneficial use*". The short-listed

options implicitly however, addressed a broader question, which is: *what is the best option for augmenting the IWSS or potable water supplies more generally?* The key, but not only reason for this, is that all the options would require significant investment.¹⁰ That investment is only likely to be economically justified if the options deliver or otherwise allow for the release of water that could be used for higher value uses (e.g. potable uses).

Addressing what is the best way to augment the Integrated Water Supply Scheme (IWSS) or potable supplies more generally was beyond the scope of the review because, if this important question is to be addressed, then it would be inappropriate to focus just on the Upper Collie River Basin. Moreover, it is not obvious that this is a question that needs answering in the short term.¹¹

- A detailed bottom-up cost benefit analysis was not deemed appropriate in the circumstances or necessary to address the Terms of Reference.

To assess the relative merits of the options we determined the key business case underpinning the option (i.e. what it involves doing to produce an outcome) and assessed the relative cost effectiveness in delivering that outcome. The key outcome all four options share is that they would produce ‘fresh’ water at Wellington Reservoir, albeit via different means. This is the most appropriate basis on which to compare them, in light of the above, and after taking into account any additional material benefits they would provide.

4.3.1 Socio-economic evaluation

The socio-economic evaluation assumed the technical objectives of the options can and would be met in the timeframes indicated in the submissions.

To compare the cost effectiveness of the four short-listed options an approach consistent with those used in standard cost benefit analysis by most governments and agencies in Australia, albeit in a slightly modified form, reflecting the greater focus on cost effectiveness.¹²

¹⁰ The others are that: Agritech’s proposal is about producing potable water; Marsden Jacob’s proposal includes releasing fresh groundwater but for potable use; and reducing the salinity in Wellington Reservoir enables Harvey Water to release potable water.

¹¹ In relation to Wellington Reservoir, the key decision for government is whether it may want to use Wellington Reservoir as a potable resource and the timeframe over which it may want to do so. This is, however, not a decision that necessarily needs to be made now. The only decision that needs to be made in the short term is whether the Government wants to continue to retain the option of using Wellington Reservoir as a potable resource.

¹² See http://www.infrastructureaustralia.gov.au/files/IA_priority_List-Minimum_information_requirements.pdf and http://www.infrastructureaustralia.gov.au/files/assessment_framework.pdf. The Nation Building program has replaced AusLink II national transport funding package. http://www.auslink.gov.au/whatis/nation_building.aspx. In the case of the Western Australian Government see http://www.dtf.wa.gov.au/cms/uploadedFiles/07_samf_peg_082005.pdf and http://www.dtf.wa.gov.au/cms/uploadedFiles/06_samf_bcg_082005.pdf. In the case of the Commonwealth Government see http://www.finance.gov.au/publications/finance-circulars/2006/docs/Handbook_of_CB_analysis.pdf and <http://www.finance.gov.au/publications/gateway-publications/docs/FMR7.pdf>.

5 Results of evaluation process

This section summarises the evaluation of the short-listed options. As discussed in section 4.3, the submitted options were not mutually exclusive and provided limited quantitative information on benefits. Thus in order to compare the options, a cost effectiveness analysis was used to determine which option would deliver “fresh” water in Wellington Reservoir at the lowest cost. Therefore the options are ranked according to the costs involved with producing a fresh water supply from Wellington Reservoir. This section outlines:

- the business case underpinning the short-listed option;
- the governance arrangements for each of the short-listed options; and
- the ranking of the options according to their cost effectiveness rather than providing actual costs given the commercial nature of the cost data. It also compares, as far as is practical, the socio-economic costs and benefits of the options by examining the broader benefits that the more effective management of water resources in the Upper Collie River Basin might provide by identifying those benefits where possible.¹³

5.1.1 Agritech

5.1.2 The business case underpinning the option

Stage 1 of the Agritech option involves building and operating a gravity fed desalination plant ex-Wellington Reservoir and infrastructure to deliver potable water into the IWSS including a:

- 21 km feedwater pipe;
- pre-treatment plant;
- buffer storage reservoir;
- 20 km product water delivery pipe to Harvey Reservoir; and
- new 15 km brine disposal pipe to Verve’s ocean outfall easement.

Stage 2 of the Agritech option involves:

¹³ National, State and Territory guidelines for cost benefit analysis generally apply a discount rate of 4%, 7% and 10%. For the purposes of assessing each of the short-listed options we have adopted a 7% discount rate. This has been done over a 20 year period for each of the options given this was the asset life stipulated by the Department of Water (therefore applying to the Marsden Jacob option and part of the Forest Products Commission to obtain fresh water), and Agritech used an economic life of 20 years when calculating the cost of Stage 1 of its option and following advice from WorleyParsons the infrastructure associated with Stage 2 is likely to be more suitable to a 20 year life than 50 years as specified in their submission. The tree plantation incentives were based on a 30 year budget.

- building a deep drainage diversion network capable of reducing dryland salinity in the Upper Collie River Basin and thus Wellington Reservoir. It is proposed that the main transfer canal would pass through the east Collie catchment and, together with feeder canals, reduce salinity levels throughout that catchment, including the Collie River and its tributaries; and
- building a hydropower station fed by the salinity channel diversion network.

Thus, the key costs of the option are the direct costs of building and operating the:

- desalination plant and associated infrastructure;
- deep drainage canal system and water disposal system; and
- the hydropower plant.

The key benefits are the additional value that:

- the use of the lower salinity water could create;
- could be created by the more productive use of land in the Upper Collie River Basin; and
- the margins of the power plant to the extent that it can produce competitively priced power.

The business case for this option largely rests on whether its two large scale engineering solutions are likely to be a more cost effective way of producing fresh water, compared to forestry or a small scale engineering solution, after accounting for the additional benefits these solutions might provide (i.e. the improved productive value of agricultural land).

There are at least two approaches to assessing the Agritech option because the option involves at least three conceptually separate investment decisions. In other words, these projects can either be viewed collectively or in isolation.

If a collective perspective is taken, the business case rests on the assumption that a desalination plant and a saline water collection network provide a more cost effective mechanism for delivering fresh water than the other options, or the next best alternative.

If a disaggregated perspective is taken, the key business case rests on the proposition that:

- desalinating Wellington Reservoir water and delivering it into the potable system represents a more cost effective approach to meeting potable water demands than the alternative options;
- investing in the Blackwood and Upper Collie River Basin deep drainage network is a cost effective way of reducing salinity in the Upper Collie River Basin and improving the productive use of the land in the area; and

- investing in a hydropower plant is cost effective, given you have already invested in the salinity channel diversion network.

When viewed in these terms, it is apparent that the Agritech option has a number of notable features:

- In theory, although the two key investments create somewhat different benefits (i.e. the additional upstream benefits associated with the saline channel diversion network and the ability to generate power), it is not obvious that one would invest in two different assets to produce the same primary outcome (fresh water in or ex-Wellington Reservoir).
- If the desalination of Wellington Reservoir provides a more cost effective means of delivering potable water into the IWSS, then it is not obvious why it would not make more sense to build a bigger desalination plant that utilises more of the capacity of the Reservoir. If this approach were taken, however, Agritech would, if possible, need to buy water from the Collie irrigators thus increasing the per unit costs of the potable water produced from the desalination plant.

It may result in water from Wellington Reservoir no longer being as available for other uses (such as irrigation), because the water may be too valuable. This may however, threaten the Government's ability to meet its second objective. There may be other ways of furthering this objective and it would seem prudent to make that trade-off transparent rather than deliberately undersize a major investment (and potentially generate diseconomies as a result).

- If the desalination of Wellington Reservoir provides a more cost effective means of delivering potable water into the IWSS, then it is not obvious why the saline channel diversion network is relevant to this decision. In other words, one of these options should provide a more cost effective solution, notwithstanding that they have a somewhat different scope (i.e. the saline channel diversion network also creates upstream benefits). As there might be other ways of improving salinity in the Upper Collie River Basin that are more cost effective (e.g. reforestation), the building of salinity channels should therefore be assessed on its own merits.

5.1.3 Governance and ownership arrangements

Agritech proposed the project be owned and operated by the Agritech Hydropower Consortium, comprising of 11 stakeholder groups (including Shires, farmer bodies, Australian Wheat Board, Cooperative Bulk Handling and others). This consortium would provide financing of the cost of hydropower stations and associated pipeline infrastructure.

Agritech stated that financing of infrastructure costs for installation of canal systems, including road and river crossings, and a holding reservoir would require infrastructure funding from the Federal and State governments.

Over the life of the project, Agritech also required that farmers and landowners contribute to ongoing maintenance and cleaning of the canal systems.

The option is unclear in relation to a number of governance, ownership and financial management matters. It is unclear what and when Federal and State contributions are involved, and whether these contributions are in the form of capital funding or a rate-based scheme.

A key issue concerning the governance of Stage 2 is the complexity of arranging land acquisition for canal routes. Negotiating tenure for 955 kilometres of interconnected canals, involving 15 shires and an unknown number of landowners, is likely to require a major and intensive task.

5.2 The Department of Water

5.2.1 The business case underpinning the option

The Department of Water option consists of three stages.

- Stage 1 B involves the diversion of 2.0 GL/a (being additional to the 2.5GL/a to be diverted under the current Stage 1A, which forms the base case for assessing each of the submissions in this review), and the addition of a desalination plant to produce 3.7 GL/a of product water and 0.8 GL/a of saline water to be disposed of via Verve's ocean outfall pipeline. Stage 1B is expected to reduce salinity at the inflow to Wellington Reservoir to an average of 615 mg/L TDS by 2015 from 750 mg/L TDS.
- Stage 2 of the option involves increasing the diversion to 8.0 GL/a, expansion of the desalination plant and the production of 6.7 GL/a of product water. Stage 2 is expected to reduce average Wellington Reservoir salinity to less than 500 mg/L TDS. The submission does not specify the timeframe for realising this level of salinity.
- Stage 3 is less developed and involves the addition of a network of collection and distribution pipework, further expansion of the desalination plant and the establishment of a water service provider to optimise the water balance.¹⁴

The key costs of the option are:

- the direct cost of building and operating the desalination plant;
- the direct cost of building and operating the collection and distribution pipe network; and
- the cost of disposing the saline water from the desalination plant.

The key benefit is the additional value that the use of the lower salinity water could create.

¹⁴ In addition, the treatment of water in the Department of Water's stage 1A project (Salinity Recovery Scheme) creates the opportunity for use of fresh water in the vicinity of industry. However, this does not mandate the requirement for a water utility to facilitate the water use to support the project's technical feasibility as the treated (or reclaimed water) can be allowed to return to the Collie River.

The Department of Water option has a number of potential phases, which could ultimately return the Wellington Reservoir to fresh water. The features differentiating the Department of Water (and the Marsden Jacob outlined below) option is that it:

- involves an incremental engineering solution, which involves building the smallest amount of infrastructure (and incurring the smallest amount of cost) to achieve the objective; and
- contains a degree of optionality as is reflected in the stages it proposes.

The business case for this option largely rests on whether a scaled engineering solution is likely to be a more cost effective way of producing fresh water, compared to forestry or a large-scale engineering solution (ex-Wellington Reservoir).

5.2.2 Governance and ownership arrangements

The submission noted that:

- “Stage 1 will be a Department of Water asset and the Options and policy framework identifies a number of governance arrangements”; and
- “Governance has not been finalised at this time as options for a service provider are still to be evaluated”.

The Department of Water proposed to take primary responsibility for governance of the project in Stage 1, and as owner of the assets, proposed to be responsible for ongoing operations and maintenance with the Water Corporation providing infrastructure system and project management and Harvey Water laying pipe work.

Given the Department of Water’s statutory responsibilities, public service governance arrangements would apply to the administration and ongoing operation of the project overall.

The ‘Options and policy framework’ was not completed and the draft was not provided and thus could not be assessed, particularly for Stages 2 and 3.

5.3 Marsden Jacobs

5.3.1 The business case underpinning the option

The Marsden Jacobs option is essentially identical to the Department of Water option, except that it focuses on the infrastructure and servicing stages, takes a more market based approach to when expansion will occur and proposes a means for delivering the investment. The submission proposed establishing an independent private sector water utility that would co-ordinate water supplies between sources and large water users in the Upper Collie area. The utility would take on the obligation of operating the Department of Water’s diversion scheme, including the upgrade of the scheme to desalinate 8-9 GL/a. The option consists of several stages, the first

involving the utility assuming operation of the Department of Water's diversion scheme. This would be followed by upgrades to the diversions and use of excess mine dewatering to service customers. The utility would also source the unallocated 17 GL/a of water from Wellington Reservoir.

The key costs of the project are the:

- costs associated with the desalination plant and collection and distribution pipe network as per the Department of Water submission; and
- infrastructure costs of establishing and operating the water utilities network of operations.

The key benefit is the additional value that the use of the lower salinity water could create.

The key additional premise of the Marsden Jacob option is establishing a water utility in the Collie River Basin. It therefore addressed the question of how to manage water resources in the region.

The business case for this option largely rests on whether a larger, but still staged, engineering solution is likely to be a more cost effective way of producing fresh water, compared to forestry or a large scale engineering solution (ex-Wellington Reservoir). It also rests to some degree on the effectiveness of a water utility in delivering and operating the investment (but that is not a question addressed by other proponents).

5.3.2 Governance and ownership arrangements

The option indicated the utility would be an independent, private sector utility.

The key operational arrangements to be established are:

- arrangements for usage with identified customers. Contractual arrangements are proposed to be initially negotiated with individual customers and if the number of increases in the future a more generalised tariff arrangement would be implemented.
- access arrangements for usage of other providers facilities; and
- rights to purchase water allocations from Harvey Water irrigators.

5.4 WA Forest Products Commission

5.4.1 The business case underpinning the option

The Forest Products Commission option involves retaining the existing tree farms in the area and planting approximately 3,000 ha of additional trees in order to reduce salinity in the Upper

Collier River Basin (and thus Wellington Reservoir). In order to achieve fresh water standards Stage 1B of the Department of Water's option is also required.¹⁵

The Forest Products Commission believes that its approach would require 6 to 10 years to deliver the full water quality benefits.

The key costs of the option are:

- the direct cost of tree planting and maintaining the plantation; and
- the indirect cost of any net lost economic production associated with changing the land use in the Upper Collie Basin from its current use (which is assumed to represent a higher value land use in most cases).

The key benefits are the additional value that:

- the use of the lower salinity water could create;
- any better use of land in the Upper Collie River Basin could create (i.e. recovering more land for productive use, using that land more effectively either in its existing use or by changing its use); and
- additional benefits such as carbon credits and possible biomass power generation.

The business case for this option largely rests on whether forestry is likely to be a more cost effective way of producing fresh water, compared to various engineering solutions. From the Forestry Products Commission's submission, it would appear that forestry offers generally lower capital and operating costs than the engineering solutions considered here, but is likely to reduce other agricultural production in the shift in land use from agriculture to forestry.

5.4.2 Governance and ownership arrangements

The Forest Products Commission's options raised different governance and ownership issues. The option noted:

- Provision of incentive payments to encourage commercial tree planting would be exchanged for caveats and/or covenants that ensure existing and additional vegetation areas remain long term.
- State funded revegetation programs, where land is purchased by the State, would not require long term covenants to be established.

¹⁵ The Forest Products Commission submission did not put forward the option of planting more trees instead of adopting the Department of Water's Stage 1 Phase B diversion scheme.

The Forest Products Commission offered to take responsibility for coordinating and managing each of the above. It was therefore assumed that public service governance arrangements would apply to the administration and ongoing operation of the project overall.

Key governance and ownership issues to consider further include:

- the role, if any, for the Forest Products Commission in such a proposal;
- how the caveats and covenants may be monitored and how compliance by landowners with their contracted obligations may be ensured;
- how the payments comply with public service financial management; and
- land investments by the State would presumably be governed by public sector policies concerning financial investments, however, long-term arrangements for the management of the land area, supervision and oversight of the achievement of the objectives and the use of the funds were not detailed. Further, involvement of the Department of Water would most likely be needed to measure the achievement of salinity related outcomes.

5.5 Summary of assessment

As discussed above, comparing the costs of obtaining a fresh water supply from Wellington Reservoir for each of the short-listed options allows a comparison of the cost-effectiveness of achieving this outcome as most of the benefits associated with this salinity outcome would be the same.

Table 5-1 ranks the options from one (lowest cost) to five (highest cost). Marsden and Jacobs and the Department of Water have the same ranking as they are both require implementing Stage 1 and 2 of the Department of Water's proposal to achieve "fresh" water.

The analysis of the costs of reducing salinity for each of the options provided two key insights:

- there is significant variability in the unit cost across each of the options in achieving fresh water in Wellington Reservoir; and
- the cost of reducing salinity increases materially as the salinity reduction increases.

The variability in costs provides further evidence of the difficulty in drawing conclusions on a preferred option, particularly since most options were still at the concept development phase.

The increasing cost for reducing salinity suggests it may be beneficial to undertake an evaluation of what the optimal salinity target should be before determining the best approach to meeting the Government's four objectives for the review.

Other Benefits

Table 5-1 also provides a summary of the key types of costs and benefits of each of the options. In particular, it highlights that the key benefit that would be equivalent under each of the options include the increased gross value of water in Wellington Reservoir.

In addition to these benefits, however, two of the short listed options are likely to provide benefits that are additional to the benefits applicable to all options. Namely, the Forest Products Commission and Stage 2 of the Agritech option are likely to yield additional benefits associated with the upstream agricultural benefits from improved use of other land in the Upper Collie River Basin, however these are not expected to significantly influence relative attractiveness of the options. In addition, there are likely to be other benefits not equivalent under each of the options that are difficult to quantify such as the additional environmental benefits associated with the Forest Products Commission.

Table 5-1 Socio-economic summary¹⁶

Option	Ranking	Key types of costs	Key types of benefits relative to other options
1. Forest Products Australia	1	<ul style="list-style-type: none"> • Includes cost of DoW stage 1B Salinity Diversion Scheme • Cost of tree planning and maintaining the plantation • Any net loss in value of the land used for tree planting • Transaction costs of managing a scheme to incentivise existing owners to shift land use or of buying the land 	<ul style="list-style-type: none"> • Increased value of water in Wellington Reservoir • Potentially avoided IWSS system costs • Improved use of other land in the Upper Collie River Basin • Environmental benefits
2. Department of Water	2	<ul style="list-style-type: none"> • Capital and operating costs associated with the diversion scheme, desalination plant and saline water removal 	<ul style="list-style-type: none"> • Increased value of water in Wellington Reservoir • Potentially avoided IWSS system costs
3. Marsden Jacobs	2	<ul style="list-style-type: none"> • Capital and operating costs associated with the diversion scheme, desalination plant and saline water removal • Utility – Establishment, capital and opex costs 	<ul style="list-style-type: none"> • Increased value of water in Wellington Reservoir • Potentially avoided IWSS system costs (if all costs of producing and delivering potable water are included)
4. Agritech		<ul style="list-style-type: none"> • Ex-Wellington Desalination - capital and opex • Blackwood & Upper Collie deep drainage canal network - capex and opex • Hydropower plant – capex and opex • Associated infrastructure (pipes and water storages) • Cost of getting water into IWSS and to customers (if benefits are also included) 	<ul style="list-style-type: none"> • Increased value of water in Wellington Reservoir • Potentially deferred IWSS source development costs (if all costs of producing and delivering potable water are included) • Improved use of land in Upper Collie River Basin • Environmental benefits • Power station output
4.1 Desalination	4	<ul style="list-style-type: none"> • Ex-Wellington Desalination - capital and opex • Associated infrastructure (pipes and water storages) – capex and opex 	<ul style="list-style-type: none"> • Point 1 and 2
4.2 Canal system	5	<ul style="list-style-type: none"> • Blackwood & Upper Collie deep drainage canal network - capex and opex • Power plant – capex and opex • Associated infrastructure (pipes and water storages) – capex and opex 	<ul style="list-style-type: none"> • Points 1-5 (potentially)

¹⁶ Table 5-1 outlines the broader benefits of each of the options rather than just those associated with achieving a fresh water supply.

A Registered parties

Table A-1 below lists the parties who registered an interest in the review of those who submitted and option and how it was categorised.

Table A-2- Registered parties and submissions

	Proponent Name (status)	Short-listing evaluation, phase 1.
1.	Agritech Smartwater <i>(proponent)</i>	Two part engineering option submitted. Progress to short-listing process.
2.	Bunbury Wellington Economic Alliance <i>(stakeholder)</i>	Stakeholder commentary provided. No engineering and/or passive remediation option submitted.
3.	Department of Agriculture and Food	Did not submit
4.	Department of State Development <i>(stakeholder)</i>	Stakeholder commentary provided. No engineering and/or passive remediation option submitted.
5.	Department of Water <i>(proponent)</i>	Three stage engineering option submitted. Progress to short-listing process.
6.	GE Water & Process Technologies <i>(supplier)</i>	Capability and design experience summary for region; supports centralised desalination plant. Experienced but not relevant to catchment/regional planning.
7.	Geo-Processors USA, Inc	Did not submit
8.	Glyn Yates (Shire of Collie; South West Fire) <i>(stakeholder)</i>	Stakeholder commentary provided. No engineering and/or passive remediation option submitted.
9.	Griffin Coal Mining Company Pty Ltd <i>(stakeholder)</i>	Stakeholder commentary provided. Effectively no engineering option submitted though supportive of DoW planning.
10.	Harvey Water <i>(stakeholder)</i>	Stakeholder commentary provided. Effectively no engineering option submitted though willing contributor to recommended solution.
11.	Kemerton Industrial Park Coordinating Committee (South West Development Commission) <i>(stakeholder)</i>	Stakeholder commentary provided. No engineering and/or passive remediation option submitted.
12.	Landcorp <i>(stakeholder)</i>	Stakeholder commentary provided. No engineering and/or passive remediation option submitted.
13.	Leighton Contractors Pty Ltd	Did not submit.
14.	Marsden Jacob Associates <i>(proponent)</i>	Engineering and governance option submitted. Progress to short-listing process.
15.	Nautilus Marine and General Systems Pty Ltd	Did not submit.
16.	Perdaman Chemicals and Fertilisers	Did not submit.

	Proponent Name (status)	Short-listing evaluation, phase 1.
	Pty Ltd	
17.	Pex Industries Pty Ltd	Did not submit; contributed to Southern Cross submission.
18.	Shire of Collie <i>(stakeholder)</i>	Stakeholder commentary provided. No engineering and/or passive remediation option submitted.
19.	Southern Cross Water and Infrastructure Corporation Pty Ltd <i>(proponent)</i>	Engineering option submitted. Progress to short-listing process.
20.	The Chamber of Minerals and Energy of Western Australia	Received after the deadline.
21.	United Group Infrastructure	Did not submit.
22.	Verve Energy <i>(stakeholder)</i>	Stakeholder commentary provided. Effectively no engineering option submitted though supportive of DoW planning.
23.	WA Forests Products Commission <i>(proponent)</i>	Engineered passive option submitted. Progress to short-listing process.
24.	Water Corporation	Received after the deadline.
25.	Wesfarmers Premier Coal Ltd <i>(stakeholder)</i>	Stakeholder commentary provided. Effectively no engineering option submitted.
26.	West Arthur Landcare Office <i>(stakeholder)</i>	Stakeholder commentary provided.
27.	Western Australian Local Government Association	Did not submit.
28.	WISALTS Inc (Gavin Drew) <i>(proponent)</i>	Engineered option submitted. Progress to short-listing process.