BDA Group

Economics and Environment

Preliminary economic assessment of options for the Sustainable Rivers Audit

Draft Report

to

Murray Darling Basin Commission

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Executive Summary

The Sustainable Rivers Audit (SRA) is an initiative of the Murray Darling Basin Commission (MDBC) and involves partner agencies in each state and territory within the Basin. The SRA will use scientific indicators as a standard for comparisons to reveal the health status and trends of rivers in different parts of the Basin. The Audit will identify areas needing attention and environmental assets needing protection, and help to set targets and monitor progress towards them.

The MDBC has commissioned BDA Group (BDA) to provide advice to the SRA project team in relation to an assessment of options for the SRA. This report draws together the information assembled by the SRA project team into an economic assessment of SRA options. The report will be used by the SRA project team as an input to a business case to be submitted to the MDBC Board in September.

While the costs of implementing the Sustainable Rivers Audit can be quantified, it is very difficult to quantify the benefits of the program, as they are contingent on numerous and largely unknown actions and policy decisions. As a result a standard benefit-cost analysis is not a suitable evaluation tool. The approach used for this assessment is a threshold approach to examine whether the costs of the proposed SRA seem reasonable in the context of the investments being made to improve the Murray Darling Basin and the level of benefits possible from programs to improve environmental values.

The report provides an assessment of the relative efficiency of eight individual components that could be included in the SRA as well as the relative efficiency of options (combinations of components) proposed by the SRA team. The Independent Sustainable Rivers Audit Group (ISRAG) has provided expert judgement on the relative performance of the components. Many assumptions and simplifications have been made about the form, scope, cost and performance of potential components of the SRA in order to assess the relative efficiency of options. The assessment is not definitive and is presented to provide some insights into what drives the relative benefits of different options.

Two of the components have significantly higher costs than other components and lower performance in terms of contributing to the assessment of river health (the water quality and metabolic processes components). All other components have much lower costs and higher performance. The floodplain and riparian components are the most efficient in providing information on river health. There are also important synergies between components that need to be considered in assessing bundles of these components. Some components combine well together enhancing the performance of both components in indicating river health. Other components combine well because common activities can lower implementation costs.

The costs of the options proposed by the SRA team range from around $6 million to $40 million (net present value over the six year period). The annualised costs range from $1.3 million to $8.8 million per year. The costs of the options seem reasonable in the context of expenditure on R&D by OECD countries (apart from the highest cost option). The costs are less than 1.5% of the current investment proposed for the Living Murray Initiative. They also seem reasonable in the context of the magnitude of possible future environmental benefits.

The options proposed by the SRA team are a series of building blocks involving an increasing number of components. Of the options proposed by the SRA team, Option 1 is the most efficient (it includes only fish, bugs and hydrology for regulated areas). The key drivers for the lower efficiencies of subsequent options are the inclusion of the metabolic processes and water quality components. The assessment has confirmed that the dedicated water quality component has a much higher cost and relatively lower performance than other possible components. It also suggests that the MDBC should consider the merits of including the metabolic processes component in the SRA ahead of other components. However, there may be other factors influencing the inclusion of this component.

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1 Introduction

Development of water, land and other environmental resources has made the economy and society of the Murray-Darling Basin as it exists today. However, the use of these resources has also caused significant degradation. The Murray Darling Basin is under stress with major environmental issues such as salinity, nutrient and sediment export, and changes to river flows that have adversely affected many of the plants and animals that live in the rivers, floodplains and wetlands. A balance needs to be struck between consumptive uses of water (eg for irrigation) and environmental uses of water to keep the Basin's rivers healthy.

In 1997, a permanent cap on water diversions from the rivers was introduced to limit off-stream use of water and to protect the riverine environment. In 2000 the cap was reviewed and it was concluded that there had been a positive overall benefit from the cap. One of the recommendations of the review of the cap was the introduction of a regular environmental audit of the Basin's rivers to assess and report on their health.

The Sustainable Rivers Audit (SRA) is an initiative of the Murray Darling Basin Commission (MDBC) and involves partner agencies in each state and territory within the Basin. The Audit will use scientific indicators as a standard for comparisons to reveal the health status and trends of rivers in different parts of the Basin. The Audit will identify areas needing attention and environmental assets needing protection, and help to set targets and monitor progress towards them. A pilot Audit across four valleys was undertaken in 2002 to trial techniques, develop protocols and reporting methods and identify the likely costs of introducing the Sustainable Rivers Audit across the basin.

The MDBC has commissioned BDA Group (BDA) to provide advice to the SRA project team in relation to an assessment of options for the SRA. This report draws together the information assembled by the SRA project team into an economic assessment of SRA options. The report will be used by the SRA project team as an input to a business case to be submitted to the MDBC Board in September 2003.

2 The Murray Darling Basin

The Murray Darling Basin covers 1.06 million square kilometers (14% of Australia), has a population of 2 million and annual economic output of $23 billion a year. The Basin generates 40% of the national income derived from agriculture and grazing. It contains more than twenty major rivers as well as important groundwater systems. It is an important source of fresh water for domestic consumption, agricultural production and industry.

Within the basin there are large variations in climate from summer rainfall areas, temperate coastal ranges and large arid inland areas. The Basin is characterized by rivers with short upland sections and long lowland areas with extensive floodplains. Many of the Basin's natural resources are of high environmental value. Its wetlands are extensive and perform essential hydrological, biological and chemical functions, which support and maintain the productivity and health of the river systems. A number of these wetlands are recognized for their international importance. A recent assessment of the ecosystem services provided by the rivers, wetlands and floodplains of the Murray Darling Basin estimates their value at $187,302 million per annum (Thoms and Sheldon 2000).

Development to improve the economic productivity of the basin has caused many biophysical changes. Some of these changes have reduced biodiversity and threaten economic production in the future. The operation of water storages and extraction of large volumes of water have reduced the annual and seasonable variability of river flows which shaped the ecology of the region. Extensive clearing of native vegetation is causing widespread and serious salinity problems. Broad scale clearing has also reduced the habitat for many native plant and animal species. The Basin's economy is heavily dependant on the availability of water – potentially affecting the well being of its 2 million inhabitants and a further 1 million people outside the basin.

The Basin spans a number of State and Territory jurisdictions. The Murray Darling Basin Ministerial Council facilitates interstate cooperation on the management of the Basin's natural resources and consists of the ministers responsible for land, water and environmental resources in each of the Commonwealth and relevant State and Territory governments.

There are a number of significant programs underway to improve the health of the Murray Darling Basin including the Living Murray initiative, the Native Fish Strategy and the National Action Plan on Salinity.

3 The Sustainable Rivers Audit

The Sustainable Rivers Audit will assess river health and ecological condition at the valley scale. It will provide consistent, basin-wide information on the health of rivers to enable sustainable land and water management. Information from the Audit will be used by the Basin community, Catchment Management organisations, Water Management Committees, partner Governments, the Ministerial Council and MDBC itself.

Riverine monitoring can be broadly categorized into three types:

- Surveillance monitoring – aimed at assessing overall condition and long term trends;
- Investigative monitoring – aimed at monitoring specific management interventions or issues; and
- Operational or compliance monitoring – to check compliance with a standard.

Some monitoring of river health or water quality is currently being undertaken in all Basin jurisdictions. This is primarily investigative or operational monitoring that provides insights into river condition at various locations, times or in relation to particular impacts. While useful it does not provide a comprehensive picture of health.

The proposed SRA is a *surveillance monitoring program* to assess the relative condition of each valley and the overall condition of the basin. Surveillance monitoring can indicate whether broad scale conditions are improving or deteriorating and provide quantitative information to establish priorities for action at a Basin scale and assess whether actions are effective over time. The SRA aims to provide a comparable, consistent, statistically rigorous and defensible assessment of the rivers across the basin. The approach adopted in the SRA is a referential approach – assessing condition relative to what the rivers should have been if they hadn't been changed.

The MDBC has stated that the aims of the SRA are to:

- provide baseline information to enable the development of targets for river health;
- monitor progress towards targets;
- help identify assets for protection or priority areas; and
- facilitate more informed public debate on river health.

A pilot Audit was undertaken to test ideas, indicators and procedures that could be used for a basin wide audit. The pilot sampled four valleys: the Ovens valley in Victoria, the Condamine-Culgoa catchment straddling the Queensland/NSW border, the Lachlan in NSW and part of the Murray River in South Australia. The pilot was completed in early 2003.

Environmental indicators for the pilot were selected taking into account their conceptual relevance, feasibility of implementation, response variability and ease of interpretation and utility. Information on five main components of river health was collected under the pilot. These included:

- Patterns of river flow
- Water quality and processes
- Habitat condition, both in and adjacent to the river
- Freshwater invertebrates
- Fish

The pilot Audit was co-ordinated and funded by the MDBC with the assistance of partner agencies. The total cost of the pilot Audit for the four valleys was $2.3 million. A significant portion of these costs were for the development of protocols and procedures.

4 Assessment approach

While the costs of implementing the SRA can be quantified, it is very difficult to quantify the benefits of a program that assesses river health to support planning and management of environmental issues. Improved information on river health will undoubtedly influence future resource management decisions which are likely to lead to greater and earlier improvements in river health. The timing and extent of environmental improvements that may flow from the SRA can at best be only hypothesized, as they are contingent on numerous and largely unknown actions and policy decisions. As a result a standard benefit-cost analysis is not a suitable evaluation tool.

Other organisations that carry out research and development face similar difficulties in using standard economic assessment frameworks to evaluate investment proposals. For example, Land and Water Australia invest in a range of research and development activities also aimed at improving the sustainability of our natural resource base. Most LWA innovations deliver knowledge products that require contingent action to achieve change in the long term.

The approach used for this assessment is a threshold approach to examine whether the costs of the proposed SRA seem reasonable in the context of the investments being made to improve the Murray Darling Basin and the level of benefits possible from programs to improve environmental values. The options developed represent a trade off between the cost of the SRA and how comprehensive an information set on river health is delivered.

The report provides an assessment of the relative efficiency of the eight individual components that could be included in the SRA as well as the relative efficiency of options (combinations of components) proposed by the SRA team. The Independent Sustainable Rivers Audit Group (ISRAG) has provided expert judgement on the relative performance of the components.

5 Environmental components

The SRA could comprise a number of different components and the timing of the introduction of those components could also vary. For each component there are different options for the number of sites and valleys sampled, different types and frequencies of sampling. The pilot audit provided an opportunity to trial techniques and revise protocols to inform the development of options including minimising the costs of collecting and analysing information under a basin wide audit.

Table 1 below shows the key variables to be measured for a range of possible SRA components.

Table 1 Possible SRA components

Component	Provides information on:	Key variables to be measured
Fish	Status of native fish species and relative health/decline of fish species	Observed, expected, nativeness, diagnostics
Bugs	Composition of macroinvertebrate communities water quality and habitat condition	Ausrivas OE50, raw signal, species richness, %EPT, filters
Water quality	Physical and chemical water quality indicators of river health	Physico chemical, nutrients
Metabolic processes	Instream processes	GPP, R24, Chloropyll-a
	Links between land use and groundwater interaction flows	Isotopes C13:C12, N15:N14
Hydrology	Flow related ecology	Annual flow, flow duration, seasonal differences, flow spells
Physical form	Habitat condition and degradation	To be determined
Riparian vegetation	Status and relative health/decline of vegetation	To be determined
Floodplain	Condition of floodplains	To be determined

There are also other possible environmental components for which further developmental work is needed to determine variables to be measured and methods. These include waterbirds, algae, lakes and estuaries.

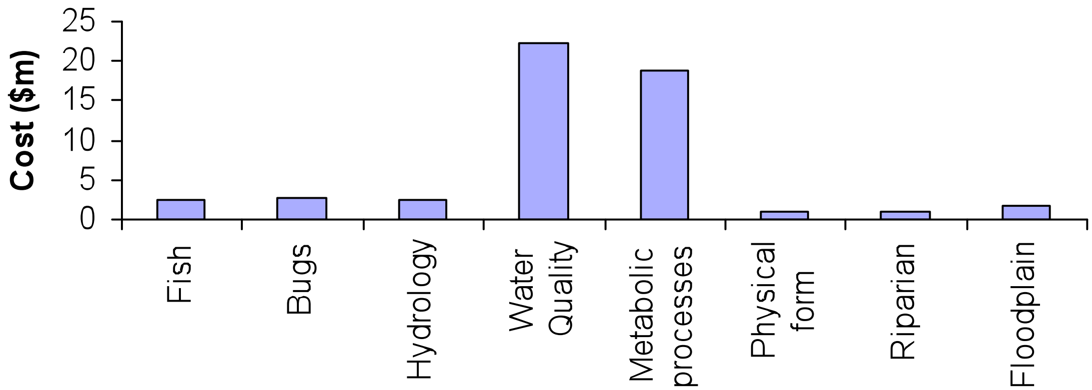
5.1 Costs of components

The costs of different components have been estimated using information provided by States and Territories. The States and Territories were provided with draft protocols for implementing various components and asked to provide comprehensive information on costs. This included information on the cost of training/capacity building, site selection, determining site reference condition, purchase of equipment, consumables, staff time and travel costs for sample collection, costs of data storage, analysis, and reporting and the costs of project management.

The costs of different components vary depending on the number of sites and frequency of sampling required to provide robust information as well as the level of costs given the nature of the sampling and analysis required for each component.

Figure 1 below shows the relative cost of different components that could be included in the SRA.

Figure 1 Relative cost of SRA components



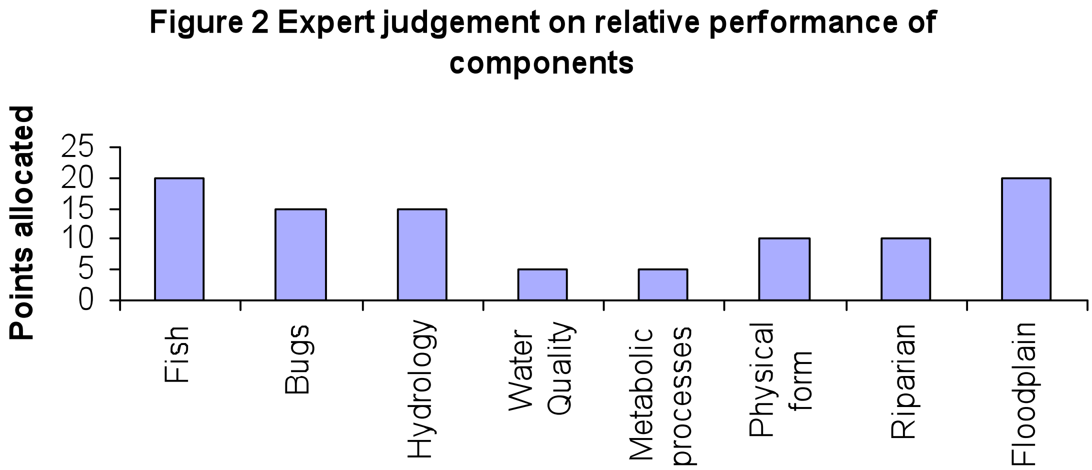
Notes: The relative costs for components have been estimated assuming full implementation over a six year period. See Appendix 1 for detailed assumptions made to derive relative costs.

The costs of the dedicated water quality program and metabolic processes are much higher than all other components. By comparison the physical form and riparian components are relatively low cost.

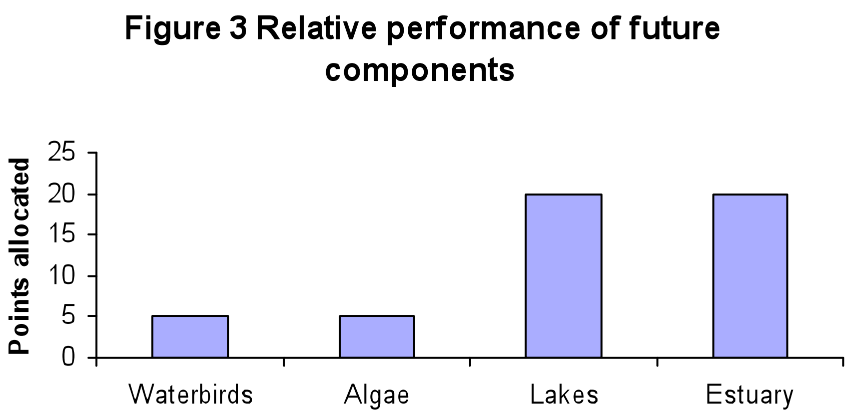
5.2 Performance of components

The greater the number of components included the more comprehensive the picture of river health. Different indicators are useful for different timeframes and respond to different types of impacts. Therefore, the wider the set of components and indicators, the more chance there is of reflecting the real condition of the rivers in the Basin.

In addition to considering costs, it is also necessary to understand the relative benefits provided by different SRA components. The Independent Sustainable Rivers Audit Group (ISRAG) has provided expert judgement on the performance of potential SRA environmental components. ISRAG were asked to allocate 100 points between the components that could be implemented in the first six year period of the SRA. Figure 2 below shows the relative performance of different components as judged by ISRAG. The fish and floodplain components were given the highest allocation of points (20) and the water quality and metabolic processes components were given the lowest allocation of points (5).



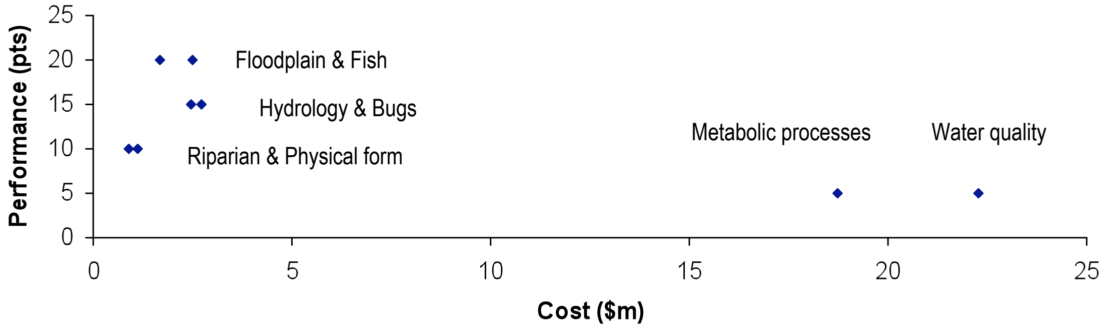
ISRAG also provided judgement on possible future components of the SRA to assist in setting priorities for further development work (figure 3).



5.3 Efficiency of components

The information on performance and cost of components can be combined to examine the attractiveness of different components for inclusion in the SRA. Figure 4 below plots the cost and performance of the components that are ready for implementation.

Figure 4 Cost & performance of SRA components



The comparison in Figure 4 shows that the water quality and metabolic processes components are estimated to have significantly higher costs than other components and lower performance in terms of contributing to the assessment of river health. The information in figure 4 can also be represented as a single index in order to provide a ranking of potential SRA components in terms of their efficiency in representing river health. Table 2 shows a ranking of components in terms of cost-effectiveness.

Table 2 Ranking of SRA components based on efficiency

Component	Efficiency index
Floodplain	12
Riparian	11
Physical form	9
Fish	8
Hydrology	6
Bugs	5.5
Metabolic processes	0.3
Water Quality	0.2

Note: The efficiency index has been derived by dividing the number of points allocated by ISRAG by the full implementation cost of the component (in $m).

Table 2 provides a raking of individual components. However, there are also important synergies between components that need to be considered in assessing bundles of these components (or options for the SRA). Some components combine well together enhancing the performance of both components in indicating river health. Other components combine well because common activities can lower implementation costs (for example, where a single site visit can be undertaken to gather information on more than one component). Table 3 below provides information from ISRAG on the synergies between components.

Table 3 Synergies between components

Synergy	Fish	Bugs	Hydrology	Water quality	Metabolic processes	Physical form	Riparian	Floodplain
Performance	Water quality Physical form Riparian	Water quality	Physical form	Fish Bugs Metabolic processes	Water quality	Fish Hydrology Riparian	Fish Hydrology Floodplain	Riparian
Cost	Bugs Physical form	Fish Physical form				Fish Bugs	Floodplain	Riparian

6 Cost & efficiency of SRA options

The audit options examined in this assessment are packages of components proposed by the SRA team for implementation over a six year period from 2004/05 to 2009/10. They have been developed taking into account:

- the importance of each environmental component in indicating river health
- the importance of getting a comprehensive picture (suggesting smaller programs covering many components rather than larger programs covering fewer components)
- confidence in the analytical framework for each component (some components need more developmental work before they can contribute)
- the cost of implementing each component.

6.1 Costs of SRA options

Tables 4 and 5 below show seven options that have been proposed and their estimated costs over the six year period. The cost information provided by States and Territories has been used to estimate the annualised costs of implementing the audit options over the period 2004/05 to 2009/10.

The costs of the options range from around $6 million to $40 million (net present value over the six year period). The annualised costs range from $1.3 million to $8.8 million per year.