Paper for International Salinity Forum
For inclusion in the "Policy and Government" forum theme

A review of the Murray Darling Basin Salinity Management Strategy –the role and effectiveness of Catchment Actions

Dr John Cooke
Department of Sustainability and Environment, Victoria, Australia.
john.cooke@dse.vic.gov.au

Abstract

The Murray Darling Basin Commission Basin developed a Salinity Management Strategy (BSMS) for the period 2001-2015. The BSMS contains a commitment to a number of Catchment Actions designed to meet the agreed objectives. The BSMS required that 10 EC was anticipated to come from within valley actions, which equates to approximately 15 % of the overall target.

The BSMS also contains a commitment to undertake a Mid-Term Review; to be completed by the end of 2007. This paper will report on the key findings of the Review relevant to the effectiveness of Catchment Actions on reducing River salinity, and on meeting broader objectives regarding general catchment health.

Whilst it appears that the Catchment Actions, when viewed collectively will have met the salinity target appropriate at the time of the Mid-Term Review, there is potential for improvement in a number of key actions.

To date Catchment Actions have been focussed on achieving River salinity targets and to a lesser extent on within valley actions. The broader objectives of theBSMS, including actions directed to land productivity and biodiversity protection do not appear to have been as effective as those actions directed at River salinity. There could be a better focus on achieving the wider objectives.

People interpret this BSMS differently, and this leads to problems in communicating what is being attempted through Catchment Actions. Tightening of language, improving processes and better linkages between the targets, objects and the key elements in the BSMS would help.

There has been a shift from focussing on the costs of salinity to the benefits of its management. Catchment Actions are being increasingly targeted to protecting high value assets.

The BSMS will need to be robust enough in the future to provide a means for addressing salinity impacts that may arise from climate change, the trade-off between water yields and salt loads, and to allow for the evaluation of impacts of vegetation based catchment actions.

During the course of the first seven (7) years of the BSMS there has been a realisation that Catchment Actions need to be delivered via three (3) levels of government, that substantial change in land and water use arise from circumstances beyond the influence of the program's capacity to intervene, and farming systems are evolving due to many different forces e.g. climatic, technological, markets; and that these changes are not designed or readily influenced by any particular program.

Catchment Actions is the term used to cover the planning and implementation of on-ground (including in-stream) activities within a catchment or valley with the potential to impact on end-of-valley (EoV) targets (including the Morgan Target of <800EC, 95% of the time over the benchmark period of 1975-2000 which is intended to reflect typical climatic variability).

1. Introduction

Salinity is one of the most challenging environmental and economic issues facing the Murray-Darling Basin and is addressed through the Basin Salinity Management Strategy (BSMS) (Murray-Darling Basin Commission, 2001). The target contained in the BSMS is to maintain the modelled salinity at Morgan at less than 800 EC units for 95% of the time over the 1975-2000 benchmark period which was considered to reflect typical climatic variability. Morgan is a town on the lower reaches of the Murray River. The modelling of outcomes against targets is a way of assessing progress towards achieving in-stream salinity objectives. However the broader objectives of the BSMS are:

- maintaining the water quality of the shared water resources of the Murray and Darling Rivers;
- controlling the rise in salt loads in all tributary rivers of the Murray-Darling Basin;
- controlling land degradation and protecting important terrestrial ecosystems, productive farm land, cultural heritage and built infrastructure; and
- maximising net benefits from salinity control across the Murray-Darling Basin.

Jurisdictional obligations under the BSMS are applied via Schedule C to the Murray-Darling Basin Agreement (Murray-Darling Basin Ministerial Council 2005) which sets out responsibilities and accountabilities for governments that are party to that Agreement. Key requirements of Schedule C are to:

- establish and then report against tributary river salinity targets,
- develop and implement a program of actions to meet tributary salinity targets;
- assign salinity impact credits or debits to all land or water management actions that will have a significant salinity effect on the River Murray;
- record these impacts in the Murray-Darling Basin Commission's Salinity Registers;
- undertake five-yearly technical reviews of each tributary river valley and each Salinity Register entry to ensure that the credits or debits on the register are continually improved over time;
- prepare and publish annual reports by each partner government and the Commission;
- prepare an annual audit to provide an independent assessment of the partner government's compliance with its obligations and commitments to the BSMS and Schedule C; and
- undertake a seven yearly review of the BSMS and Schedule C to examine changes in the policy, operational arrangements, science and technical understanding so as to guide the future of the BSMS. This Review is complete but was not released at the time of writing this paper.

Annual audits of accountability for significant Catchment Actions are required under Schedule C. Reports of the implementation of the BSMS (MDBC 2007a) and Audits (MDBC 2007b) are published annually and are readily accessible.

2. Discussion

The BSMS is the vehicle by which the jurisdictions across three levels of Government maintain commitment and cooperation to progress salinity management in the Murray-Darling Basin. It provides guidance to communities and governments in working together to control salinity in the Murray-Darling Basin and to protect key natural resource values within their catchments.

Through the Basin target at Morgan in South Australia, end-of-valley salinity targets for each major tributary within the Murray-Darling Basin, an administration and reporting framework, and a register of credits and debits, the BSMS provides a means by which otherwise significant, but disparate Catchment Actions can be managed and effectively targeted.

Schedule C to the Agreement, and its associated protocols provide the basis for salinity accounting procedures. It sets out the framework to balance in-stream outcomes between the costs and benefits of an action, jurisdictional responsibility for past and future actions, and jurisdictional discretion to implement principles whereby the costs are shared either by society at large, or charged directly to the polluter.

The assignment of credits and debits to land or water management (Catchment) actions must have regard to the confidence of prediction, the relative significance of the action, the fairness of the cost sharing arrangements, practicality of actions and administrative arrangements, and a recognition that data and analytical tools to support the delivery of improved predictions improve over time.

Salinity debits and credits are recorded as salinity effects (the water quality implications of changes in timing or magnitude of water flow and salt within the river) and salinity cost effects (the dollar implications from changes in water quality). The latter brings into the decision framework a dollar value termed the 'salinity cost function'. It is through the cost function that the benefit cost assessments can be conducted.

Making Comparisons Across a Range of Catchment Actions

In making a decision on which of a range of possible Catchment Actions to adopt, the following items are both important and catered for under the BSMS. These are that;

- the relationships between salinity impact actions and outputs are considered important by society;
- a range of catchment actions can affect salinity at a single point of accountability, or one catchment action may affect the salinity impacts at several points;
- Catchment Actions can have both a positive and negative economic impact concurrently, and hence the situation is important;
- the effectiveness of particular Catchment Actions may be the result of many factors such as location, surrounding environment, understanding of existing conditions, and weather;
- salinity impacts are often a consequence of another action such as farm improvement which is being undertaken for some other reason, such as price or efficiency;

- salinity impacts on biodiversity are not as readily costed in dollar terms as impacts on crops and infrastructure;
- biophysical and economic models are sufficiently robust and locally relevant to explain and quantify relationships; and
- Catchment Actions are only accountable if they are considered significant. Schedule C defines a significant effect as one in which an individual action (or cumulative actions) change the average daily salinity at Morgan by at least 0.1 EC.

For the purpose of this paper, Catchment Actions will be summarised into three (3) general areas;

1. Salt interception schemes that consist mainly of engineering works that prevent saline groundwater reaching the River Murray, mainly through the reversal of groundwater gradients in close proximity to the river;
2. Improvements to irrigation development and management where the direct drainage of irrigation runoff, subsurface drainage and groundwater discharge to the River is minimised; and
3. Modification of rain-fed agricultural practices and reafforestation of agricultural land aimed at reducing recharge to groundwater and its consequence discharge to rivers and streams.

Whilst the detail of accountability for Catchment Actions is explicit (Wright *et al.* 2008) the task of assessing the in-stream impact of Catchment Actions is complex, particularly for Actions 2 and 3 where there are a myriad of possible interventions with highly spatial and temporal variation in outcomes. Sources of variation are annual climatic factors, changes in prices paid and prices received for farm inputs and outputs, and social and technical developments. Some costs are readily estimated such as energy, whilst others are less obvious, such as damage to biodiversity.

Estimating the Benefits and Costs of Catchment Actions

There has not been a comprehensive or formal review of all Catchment Actions supported under the BSMS, and as a consequence it is not possible to be clear if the Key Objective, to *maximise net benefits from salinity control across the Basin,* has been met or establish the extent to which trade-offs between other natural resource management outcomes have been achieved. However, there has been an ongoing recognition of the need to make decisions based on sound practical and economic logic. Three such projects where some evaluation has been conducted are outlined below.

The estimated benefits over the estimated costs for a number of potential salt interception schemes for Victoria and South Australia have been investigated and reported in SKM (2006a) and SKM (2006b) respectively. These reports show that: there are a large range of potential actions to address salinity; potential benefits over potential costs can be readily estimated; and the benefits over costs relative to the magnitude of investment can also be provided. For salt interception schemes there is sufficient information to make sound judgement on location, size and configuration of schemes.

Analysis of benefits over costs has provided a great deal of insight and direction in identifying potential areas for investment in wider Catchment Actions. Some comparisons of salt interception schemes with other Catchment Actions are provided in SKM (2006a), and hence there has been some attempt to develop a process to maximise net benefits.

The contribution to salinity reduction in the River Murray from a range of interventions and Catchment Actions in the Victorian Mallee were evaluated in RMCG, Cummins & Associates (2005). The analysis compared outputs from a range of actions pertaining to price, quantity of product and market friction. The analysis showed that there was a large variation in the effectiveness of a range of investments in achieving in-stream salinity reduction, and hence it would be fairly straightforward to identify a package of actions that would maximise net benefits.

The RMCG, Cummins & Associates (2005) study showed that irrigation impact zoning and levy arrangements that direct new irrigation developments to low salinity impact zones and impose salt pollution costs upon developers, are an order of magnitude more effective on river salinity, than some other investments. Notwithstanding the cost effectiveness of this approach, it was also recognised that equity and administrative arrangements may influence the choice of intervention methods.

The impact of one action, irrigation development, on the risk to either the salinity of the river, or to increased cost of salt mitigation, was evaluated by Connor (2003). The investigation showed that continued and unbridled irrigation development in a high salinity impact zone will lead to a situation where either the river salinity will rise or salinity mitigation will become expensive or impractical. At some stage, society will need to decide whether the economic and social benefits arising from further increases to areas of irrigation justify the salinity mitigation costs, who bears the mitigation costs and shares in the benefits, and what level of in-stream salinity will be tolerated.

These three studies provide evidence that attempts are being made to maximise net benefits of salinity control. The studies also show that the BSMS provides a mechanism to evaluate and rank the in-stream salinity cost effects of a range of disparate actions. The studies relate to the ranking of relatively similar investments, and to balancing priorities for expenditure on investigations and further work.

To date however, there has been no analysis of the relative in-stream benefits of investments between the full range of Catchment Actions, nor has there been any measure or attempt to maximise the benefits of all Catchment Actions now being implemented.

Delivering Catchment Actions

For any investment, a choice must be made as to the best investment and administrative model. Government can choose to invest in administration or legislative actions, either through voluntary or contractual arrangements, or to use some suasion such as incentives or advice. The need for a clear transaction point is clear.

For much of the rain-fed agricultural areas of Australia, farmers have an *as of right* condition to change farming systems and practices. Farmers modify their actions, practices and crops in response to market prices, technological change or social circumstances. *As of right* conditions provide considerable benefits to farmers, as they are not generally required to seek approvals to change land management or use. The *as a right* condition also provides considerable benefits to society in that Government is not required to fund and manage agricultural land use licences or conditions and farmers are able to respond relatively quickly to society's demand (both nationally and internationally) for food and fibre.

By contrast, agriculture based on irrigation particularly in the southern Murray Darling Basin is more highly regulated, with all States now legislating for *use licences* to both develop new irrigation areas, and to continue to irrigate existing areas. Continual improvement can be imposed via licence conditions should the need arise albeit that regulation may be administratively expensive to implement. Environmental protection can be piggy-backed on water use licences in irrigation areas.

There is no licence in rain-fed farming equivalent to the water use licence that exists in the irrigation areas. This lack of a transaction point in rain-fed agricultural areas of Australia means that there is not a readily available regulatory instrument that could be utilised to deliver Catchment Actions under current legal and administrative frameworks. Rather, jurisdictions have relied upon incentives as an instrument to implement change which are often not responsive to external drivers such as climate and market influences on decision making on an annual basis. To achieve effective adoption, incentive packages have had to be appealing in a financial sense to the farm business, as well as offer other valued outcomes including community benefits or improvement of visual amenity.

As there is no overall register of land use and management, some beneficial changes may also have occurred but these benefits have not been recorded or recognised. An example may be reduced recharge following introduction of improved wheat varieties.

The lack of regulatory tools and reliance on incentives has worked in favour of Government and farmers in respect to reducing costs and encouraging a participatory approach to land management, but may be hampering natural resource management outcomes in the sense of foregoing the opportunity to partake in more outcome-based Government investment decisions.

In pursuit of whole of catchment outcomes, regional bodies are also increasingly aware of the potential for intervention to lead to conflicting outcomes. For example, improved irrigation water use efficiency within the Riverine Plains has the potential to increase in-stream salinity due to the reduced downstream dilution effect of tail-water. A further example is that in the current period of prolonged decline in catchment water resources and the consequential decline in water allocations, targeted revegetation for salinity mitigation is increasingly considered a threat to catchment yield with any salinity benefits considered a secondary issue.

3. Summary and Conclusions.

This paper has explored some of the more complex and underlying technical and economic challenges in managing complex Catchment Actions in an environment of high temporal and special variability such as the Murray-Darling Basin.

Audits and reports have provided a comprehensive review of the progress in implementing Catchment Actions, and are readily available. There are opportunities to undertake more extensive benefit/cost analyses, and to better focus investment on those Catchment Actions that have the most cost-effective impact on targets.

Further investigation as to the most cost-effective delivery model is warranted as the potential to deliver the most cost-effective Catchment Actions may be limited by gaps in administrative arrangements.

Acknowledgement

Greg Holland and Kelly Fyfe assisted in the preparation of this paper. Some of the concepts in this paper were developed following discussions with Tim Cummins, Jencie McRobert and Murray Chapman.

References

Connor, J.D. (2003) Reducing the cost to South Australia of achieving agreed salinity targets in the River Murray, Final Report for the Department of Water, Land and Biodiversity Conservation, CSIRO Land and Water, Policy and Economics Research Unit, December 2003.

Murray-Darling Basin Ministerial Commission. 2001. *Basin Salinity Management Strategy 2001-2015.* MDBC, Canberra.

Murray-Darling Basin Ministerial Commission. 2005. *Basin Salinity Management Strategy Operational Protocols Version 2.0.* MDBC, Canberra (MDBC Number 35/05).

Murray-Darling Basin Ministerial Commission. 2007a. *Basin Salinity Management Strategy 2005-2006 Annual Implementation Report.* MDBC, Canberra (MDBC number 13/07).

Murray-Darling Basin Commission. 2007b. *Basin Salinity Management Strategy Report of the Independent Audit Group for Salinity 2005–2006* MDBC, Canberra (MDBC number 14/07).

RM Consulting Group, Tim Cummins and Associates (2005). *The Role of Policy in Reducing the Impact of Irrigation on River Salinity within the Victorian Mallee. Final Report.* Mallee Catchment Authority.

SKM (2006a) Opportunities in Victoria for Reduction in River Murray Salinity, Review Methodology and Results MDBC, Canberra.

SKM (2006b) Opportunities in South Australia for Reduction in River Murray Salinity, Review Methodology and Results MDBC, Canberra

Wright. C., Holland. G and Power. E. (2008) The Murray Darling Basin Commission Salinity Registers – A Contemporary Environmental Accountability Framework. Second International Salinity Forum Adelaide 31 March – 3 April.