Australian Government

MURRAY–DARLING BASIN AUTHORITY

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Basin Salinity Management Strategy

2007–08 Annual Implementation Report

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June 2009

Published by Murray–Darling Basin Authority
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This report may be cited as: Murray–Darling Basin Ministerial Council, 2009. *Basin Salinity Management Strategy 2007–08 Annual Implementation Report*. Murray–Darling Basin Authority, Canberra.

MDBA Publication No. 07/09

ISBN (online) 978-1-921557-15-6
ISBN (print) 978-1-921557-16-3

Prepared by the Murray–Darling Basin Authority, Canberra as per the requirement of the *Water Act 2007 (Cwlth)* (Schedule B, Clause 32, as it appears in Schedule 1, Murray–Darling Basin Agreement in the *Water Act 2007*).

Cover Images: Mallee Cliffs Salt Disposal Basin, SA © P. Pfeiffer

FOREWORD

I have pleasure in releasing the 2007-08 Annual Implementation Report of the Basin Salinity Management Strategy.

In September 2001, the Murray–Darling Basin Ministerial Council released a 14-year strategy for salinity management. The Mid-Term Review of the Basin Salinity Management Strategy highlighted significant successes to 2007. In particular the review made recommendations related to policy, operational issues, as well as scientific and technical understanding.

With the establishment of the Murray Darling Basin Authority in December 2008, a new chapter in managing salinity across the Basin is opening up. The Water Quality and Salinity Management Plan to be developed as part of the Basin Plan, will build on the successes of the Basin Salinity Management Strategy to date, as well as the Mid-Term Review recommendations.

Over the 2007-08 reporting period, there have been low salinity levels in the Murray River as a result of improved irrigation practices, salt interception schemes and drought. The measured salinity level at the Basin Target site (Morgan, South Australia) remained below the 95 percentile target of 800 EC.

The Independent Audit Group for Salinity conducted the sixth audit of the Strategy in November 2008. The Auditors reviewed the implementation of the Strategy by the MDBC and the Contracting Governments in accordance with the Schedule B (previously Schedule C) to the Murray–Darling Basin Agreement and the associated Basin Salinity Management Strategy Operational Protocols. The executive summary of the Report of the Independent Audit Group for Salinity 2007-08 with their recommendations is included in this report.

Implementation of the Basin Salinity Management Strategy would not be possible without the cooperation of the Contracting Governments. In particular, their work in delivering basin-wide salinity management activities and cooperation in maintaining a rigorous salinity accountability framework are greatly appreciated.

Rob Freeman

Chief Executive
Murray–Darling Basin Authority

Morning Mist over Pyramid Creek, Northern Victoria. Photo: P. Pfeiffer

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ABBREVIATIONS

AEM	airborne electromagnetic
BSMS	Basin Salinity Management Strategy
BSMS IWG	BSMS Implementation Working Group
CAC	Community Advisory Committee
CAP	Catchment Action Plan
CMA	catchment management authority
CMB	Catchment Management Board
CRC	Cooperative Research Centre
CRCCH 2CSalt	CRC for Catchment Hydrology 2CSalt model
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cwlth	Commonwealth
DSE	Department of Sustainability and Environment
EC	Electrical Conductivity unit
EM1	Eastern Mallee 1 model
IAG–Salinity	Independent Audit Group for Salinity
ICM	integrated catchment management
IQQM	Integrated Quantity and Quality Model
LWMP	land and water management plan
LWMS	Land and Water Management Strategy
MDB	Murray–Darling Basin
MDBA	Murray–Darling Basin Authority
MDBC	Murray–Darling Basin Commission
MDBMC	Murray–Darling Basin Ministerial Council
MSM-BIGMOD	Daily flow and salinity model for the Murray River
NAP	National Action Plan for Salinity and Water Quality
NHT	Natural Heritage Trust
NHT2	the extension of the Natural Heritage Trust
NLP	National Landcare Program
NLWRA	National Land and Water Resources Audit
NRC	Natural Resources Commission
NRM	natural resources management
QMDB	Queensland Murray–Darling Basin
QMDC	Queensland Murray–Darling Committee
RCS	Regional Catchment Strategy
RZD	root zone drainage
SDE	salt disposal entitlement (Victoria)
SIMRAT	Salinity Impact Rapid Assessment Tool
SIS	salt interception scheme(s)
SRWA	Sunraysia Rural Water Authority
SWNRM	South West Natural Resource Management
TLM	The Living Murray
VSDWG	Victorian Salt Disposal Working Group
WQMS	Water Quality Management Strategy

EXECUTIVE SUMMARY

Basin status during 2007–08

During 2007–08, the Murray–Darling Basin continued into its seventh consecutive year of drought.

Although good rain fell in northern parts of the basin in December and January, overall it was a dry year especially in the southern basin. Inflows into the river remained very low and many regions of the basin remained in the grip of a prolonged drought. Water availability along the Murray continued to be impacted by the combination of low inflows and low storage levels.

In times of drought, there is a decline in rainfall and irrigation drainage entering the groundwater system. More salt remains in the landscape rather than discharging into tributary rivers and irrigation drains as happens in wetter years. Also, salt accumulates in the lower Murray floodplains rather than being regularly flushed into the river by flooding. Low water levels in the river can concentrate salt and raise river salinity. As in previous years, these effects continued to be displayed during 2007–08.

The Basin Salinity Management Strategy

For over 20 years, the priority of the Basin Salinity Management Strategy (BSMS) and its predecessor, the Salinity and Drainage Strategy, has been to work together to control salinity and protect important environmental values and assets in the Murray–Darling Basin.

Set up in 2001, the BSMS provides an overarching and coordinated approach to control salinity and protect water quality, environmental values, regional infrastructure and productive agricultural land. It promotes on-ground works and measures, improved irrigation practices and cooperative management to address salinity risks.

Key achievements of the BSMS

During 2007–08, the BSMS made significant progress in policy, operational arrangements and improvements in science and technical understanding. A summary of these achievements include:

- recorded salinity was approximately 550 EC at Morgan during 2007–08, even though levels peaked at 785 EC towards the end of September 2007;
- the removal of over half a million tonnes of salt from the Murray River system through the network of salt interception schemes;
- progress in assessing the salinity impacts of environmental watering;
- continued refinement of the Salinity Registers;
- progress in the development of an Irrigation Salinity Assessment Framework for the southern MDB irrigation region; and
- development of an approach to real-time in-stream salinity management to achieve river salinity outcomes.

The BSMS Mid-Term Review found that significant progress had been made in implementing the strategy's first phase (2001-07). The report noted that the strategy achieved significant outcomes in policy, operational arrangements and improvements in science and technical understanding.

These and other achievements are explored further in this report. In addition to this report there are six jurisdictional companion reports, as required by legislation. A summary of BSMS achievements has been provided in the document *BSMS 2007–08 Summary*.

Key projects in 2008–09

During 2008–09, the BSMS will continue to progress established projects and those identified through the mid-term review process. The key projects during 2008–09 include:

- identifying and managing salinity risks caused by short-term impact activities, such as those under the Living Murray Program;
- progressing a real-time, in-stream salinity management approach to improve river salinity outcomes;
- the establishment of a catchment salinity program that will address salinity from high-risk areas in the upper Murray–Darling Basin areas;
- revising the existing BSMS Operational Protocols which guide basin salinity management;
- continuing to progress joint works and measures activities aimed at achieving a reduction of in-river salinity levels, through the investigation of opportunities, an accelerated construction program and the continuation of improvement in the operational performance of existing salt interception schemes; and
- the establishment of the Salinity Registers database to refine Salinity Registers documentation.

The accountability features of the BSMS in Schedule C of the *Murray–Darling Basin Agreement*, have now become Schedule B to the Murray–Darling Basin Agreement which appears in Schedule 1 of the *Water Act 2007* (Cwlth). The Murray–Darling Basin Commission was subsumed into the Murray–Darling Basin Authority, on the 15th December 2008. A key responsibility of the new Murray–Darling Basin Authority will be to develop a Basin Plan that will include a Water Quality and Salinity Management Plan. These developments will impact on the BSMS and its reporting responsibilities in future years.

Salt Bush at Stockyard Plains, SA. Photo: C. Dennis

1. THE BASIN SALINITY MANAGEMENT STRATEGY

The BSMS provides the basis to coordinate and implement salinity activities across the basin and within catchments. Its objectives help communities and governments work together to control salinity and protect water quality, environmental values, regional infrastructure and productive agricultural land. During 2007 a review of the strategy was conducted with the results released in early 2008. More details are provided in Section 2.9.

1.1 Objectives and elements

The objectives of the strategy are to:

- maintain water quality of shared water resources of the Murray and Darling Rivers;
- control salt loads in all tributary rivers;
- control land degradation; and
- maximise net benefits from salinity control.

The BSMS brings together nine elements to address salinity. The elements are sufficiently broad to cover basin-scale coordination and accountability, and provide a joint approach to large scale works and measures to address in-stream salinity management such as the construction and operation of salt interception schemes. They also include regional scale priorities such as improvements in catchment planning, farming systems and vegetation management.

The nine BSMS elements are:

- developing capacity to implement the strategy;
- identifying values and assets at risk;
- setting and maintaining salinity targets;
- managing trade-offs with the available within- valley options;
- implementing salinity and catchment management plans;
- redesigning farming systems;
- targeting reforestation and vegetation management;
- constructing salt interception works; and
- ensuring basin-wide accountability – monitoring, evaluating and reporting.

1.2 BSMS partners and responsibilities

On behalf of the BSMS partners, the MDBA has responsibility for whole-of-basin issues and outcomes associated with implementing the strategy, delivering:

- increased understanding of basin-scale bio-physical processes and associated socio-economic impacts;
- design and management of basin-scale salinity infrastructure and operational activities; and
- design and operation of accountability arrangements supported by basin-level monitoring, evaluation and reporting.

The state and territory governments are responsible for catchment outcomes. They rely on partnerships with catchment management bodies to deliver:

- within-valley actions and tools to predict salinity and salt load trends;
- on-ground investment to address salinity risks and their impacts;

- assessments of the effects and trade-offs associated with salinity management options; and
- monitoring and assessment of salinity as part of a range of catchment health targets.

Implementation of the strategy has been strongly supported by the Australian Government salinity funding programs as well as the salinity initiatives of each state government. Investments specifically relate to salt interception schemes and vegetation management and other on-ground actions.

This report reflects the MDBC responsibilities during 2007–08. State, territory and Australian Government reporting are available in the 'companion' 2007–08 salinity reports:

- *South Australia:* South Australia's 2007–08 Report to the Basin Salinity Management Strategy.
- *Victoria:* Murray–Darling Basin Salinity Management Strategy: Victoria's 2007–08 Annual Report.
- *New South Wales:* Murray–Darling Basin Salinity Management Strategy: NSW Annual Implementation report 2007–08.
- *Queensland:* Basin Salinity Management Strategy Annual Report 2007–08 Queensland Murray–Darling Basin.
- *Australian Capital Territory:* Annual Report 2007–08 – ACT.
- *Australian Government:* Basin Salinity Management Strategy 2007–08: Australian Government Report.

During 2007–08, the Commission's role was to coordinate the strategy which included overseeing the activities under the provisions of Schedule C to the *Murray–Darling Basin Agreement 1992,* responding to the recommendations of the IAG-Salinity and collaboration with partner agencies. These activities were supported by the inter-jurisdictional BSMS Implementation Working Group (BSMS IWG) as part of the governance arrangements of the Commission (Appendix VI). Salt interception scheme development and coordination were overseen by the River Murray Water Committee.

1.3 BSMS into the future

From 15 December 2008, the Murray–Darling Basin Authority absorbed all the functions of the former Murray–Darling Basin Commission, which ceased to exist.

The creation of the new, independent Authority headed by Acting Chair and Chief Executive Mr Robert Freeman, means that for the first time a single agency is responsible for planning the integrated management of water resources of the Murray–Darling Basin. In addition to the Commission's former functions, the Authority has the responsibility of preparing a comprehensive Basin Plan to set sustainable limits on water that can be taken from surface and groundwater systems across the Basin.

The Authority will also advise the Minister for Climate Change and Water, Senator Penny Wong on the accreditation of state water resource plans, develop a water rights information service and monitor water resources in the Basin.

The BSMS, which was part of Schedule C of the Murray–Darling Basin Agreement, has been revised into Schedule B to the Murray–Darling Basin Agreement which appears in Schedule 1 of the *Water Act 2007* (Cwlth). Substantially, the BSMS will continue its present functions. However, as part of the new Authority responsibilities, a Basin Plan that includes a Water Quality and Salinity Management Plan, will commence in 2011.

2. THE NINE BSMS ELEMENTS

2.1 Element 1: Capacity to implement

The capacity to implement the BSMS requires basin and within-valley planning and implementation of initiatives that will assist in the management of salinity.

Much of the capacity building within the basin relates to regional roles and responsibilities and is therefore, a key component of the companion reports. The MDBC supports the basin scale planning and implementation through contributing to the development of modelling tools, and studies that have broad scale value across the basin. Key 'capacity' projects progressed in 2007–08 are discussed below, and relate largely to the development of basin-wide frameworks and guidelines, particularly for assessing the salinity impacts of irrigation and environmental watering activities on river salinity.

2.1.1 Irrigation Salinity Assessment Framework (ISAF)

The development of an Irrigation Salinity Assessment Framework (ISAF) has been a major focus for 2007–08. This framework will assist in developing improved guidelines and standards required for irrigation salinity impact assessment and reporting for the southern MDB irrigation region.

The scope and guidelines for improved irrigation salinity assessment include tools, data and administrative procedures. To support the development of the Irrigation Salinity Assessment Framework, reviews were conducted on the current approaches to Mallee salinity accountability in New South Wales, Victoria and South Australia along with an assessment of the implications for irrigation salinity accountability arising from the National Water Initiative.

Work was also completed on evaluating the factors and drivers affecting river salinity arising from irrigation activities within the Riverine Plains.

The next stage in the development of the framework will document appropriate elements within BSMS guidelines that are likely to incorporate a risk assessment methodology, requirements for regular and long term land and water use data collation, and the requirement for consistency in salinity assessment and reporting obligations. If appropriate, necessary elements of the framework will be incorporated into the BSMS Operational Protocols.

Root Zone Drainage assumptions within the Operational Protocols

The BSMS Operational Protocols provide guidance for irrigation salinity assessment within the Mallee region of the Murray–Darling Basin, as the Mallee is a significant contributor of salt to the Murray River. Deep drainage arising from irrigation and rainfall events (termed Root Zone Drainage or RZD) moves beyond the crop root zone causing increased groundwater recharge that displaces highly saline groundwater to the river. The BSMS Operational Protocols prescribe a RZD assumption of 10 per cent of water traded for estimating salinity impacts of irrigation development in the Mallee region, however, given the risks to river water quality, better understanding of the extent to which irrigation in the Mallee is contributing to river salinity requires an improved quantification of RZD estimates.

This issue was progressed in 2007–08 with a literature review and documentation of scientific knowledge and methodologies available for assessing RZD. The key conclusions are that the 10 per cent value adopted in the protocols for new development under prescribed management regimes is a reasonable median value for the mix of crops distributed across the Mallee. However, a more sophisticated approach is warranted. With the recent widespread adoption of in-situ moisture and salinity monitoring instruments to manage the application of irrigation water, an evaluation system was developed through a tri-State collaborative initiative. There is significant potential to provide improved estimates for a range of irrigation management scenarios in specific regions of the Mallee. Accordingly, a project is being scoped in 2008–09 to develop default RZD estimates for irrigation management regimes in specified areas and irrigation management arrangements of the Mallee region.

2.1.2 Assessing environmental watering impacts

In addition to the need to develop a consistent framework for assessing the impacts of irrigation on River salinity, there is increasing recognition that environmental watering of the lower floodplain poses a salinity risk to both the river, and possibly the floodplain.

Consistent with an integrated approach to natural resource management, linkages between MDBC programs such as the BSMS and the Living Murray (TLM) programs have been a priority in 2007–08 to ensure that such risks are addressed. The inter-jurisdictional BSMS/TLM Task Force have overseen this coordination with emphasis placed upon developing a common, transparent management and accountability process for assessing the salinity impacts of environmental works and measures projects and investment proposals.

This process has identified the need to address accountabilities at both temporal and spatial scale. The intention is to ensure that salinity impacts are considered both over the short and long term, with due consideration given to impacts both within the river, and in the wider floodplain. The existing accountability framework (the Salinity Registers are discussed in Section 2.9) addresses the long term in-river salinity impacts, with work progressing in 2008–09 to assess the likely short term in-river salinity impacts, such as TLM actions.

2.1.3 Information coordination and dissemination

A key role for the MDBC is to coordinate the availability of basin scale information on progress towards implementation of the BSMS. This role includes the publication of summary brochures and involvement in national and international salinity forums.

A number of brochures and reports were produced and distributed by the BSMS through the MDBC and its partner governments during 2007–08. These included:

- *Managing salinity in the Murray–Darling Basin* – a policy focused brochure that provides an overview of the BSMS during its first 7 years and priorities for the future;
- *Living with salt* – a general purpose brochure that raises awareness of salinity and introduces the BSMS;
- *Keeping salt out of the Murray* – an update of the popular brochure describing the role and achievements of Salt Interception Schemes in contributing to water quality improvements in the Murray River;
- *BSMS 2006–07 Annual Implementation Report* and associated summary;
- *Report of the Independent Audit Group for Salinity 2006–07*; and
- *BSMS Mid-Term Review* report.

The MDBC also played a major role in sponsoring and contributing to the 2nd International Salinity Forum held in Adelaide, South Australia, during March – April 2008. The forum attracted over 500 delegates, including about 80 international visitors. Presentations and debate centred on the increasing understanding of salinity processes and improvements in salinity management. Specific BSMS presentations by the MDBC and its partner governments including:

- policy status of the BSMS;
- the Salinity Registers – a contemporary environmental accountability framework;
- saline groundwater disposal in the Murray–Darling Basin, and
- 40 years of living with salt – salinity management in the lower Murray–Darling Basin.

Wendy Craik, the MDBC Chief Executive provided an outline of Basin Scale Salinity Management in the MDB for comparison with the Colorado Basin in the USA. The BSMS also provided a coordinated platform for the Australian Government, the South Australian Department of Land, Water and Biodiversity Conservation and the MDBC to deliver complementary displays on salinity over the duration of the forum.

Further salinity communication activities were facilitated across the basin agencies through the activities of the Basin Salinity Information Task Force, which provides an opportunity to encourage the transfer and sharing of salinity information across all the jurisdictions. During 2007–08 three meetings were held, including a field trip

to the Wellington region in New South Wales. These meetings provide an opportunity to share processes and experiences and support a coordinated approach to delivering the BSMS.

The BSMS also has representatives that sit on the National Co-ordinating Committee for Salinity Information, a committee that resulted from the National Land and Water Resources Audit. The committee provides a forum for the delivery of national salinity information. This committee met three times during 2007–08.

2.2 Element 2: Values and assets at risk

This element reflects the partner Governments work with catchment communities to identify important values and assets at risk from salinity. It emphasises the triple-bottom line approach, requiring a balance between economic, environmental and social values. It recognises the importance of preventing the degradation of natural systems that are currently in good condition. Alternatively, in some cases, living with salinity may be the only choice.

This element is largely a responsibility of the BSMS partner governments and further information can be found in 2007–08 salinity annual reports of each state.

2.3 Element 3: Salinity targets

As a measure of the success of the BSMS in progressing towards meeting its water quality objectives, the strategy has established targets at both valley and catchment scales. End-of-valley targets are intended to provide a measure of success against the protection of values and assets. They are also indicators of catchment and basin health. Catchment management organisations advise on end-of-valley targets and determine within-valley targets and monitoring arrangements, under salinity and catchment management plans. The targets are able to be revised as new information becomes available.

End-of-valley targets have been established for each major tributary within the basin. States have implemented monitoring programs for these sites to assist in the five-yearly reviews of progress against targets. Data from these monitoring programs is summarised in Section 3.

The MDBC reports on performance against the Basin Salinity Target. The Basin Salinity Target established under the BSMS is to maintain the average daily salinity at Morgan, South Australia, at a simulated level of less than 800 EC for at least 95 per cent of the time, modelled over the years 1975–2000 (the Benchmark Period) under the current land and water management regime.

In addition to the information provided in this section, details of the achievements of the partner governments during 2007–08 can be found in their individual salinity annual reports.

2.3.1 Real-time salinity outcomes

Although good rains fell in northern parts of the basin in December and January, 2007–08 was another dry year especially in the southern basin. Inflows into the river remain very low and many regions of the basin remain in the grip of a prolonged and unprecedented drought.

In times of drought, there is a decline in rainfall and irrigation drainage entering the groundwater system. More salt remains in the landscape rather than discharging to tributary rivers and irrigation drains as happens in wetter years. Consequently, salt accumulates in the lower Murray floodplains rather than being regularly flushed into the river.

Drought normally delivers low salinity outcomes for the Murray River as a consequence of reduced salt mobilisation from the landscape. However, lower river salinities depend on river flows being adequate to dilute the base level salt load entering the river from saline aquifers and wetlands.

For most of 2007–08, river flows were sufficient to dilute salt loads, particularly in the lower Murray. However, extremely low inflows and storage levels in 2007–08 reduced downstream flows, leading to rising salt concentrations in September-October of 2007.

While in-river salinities are monitored at various points along the river channel, the prime site for reporting purposes is at Morgan, in the lower Murray, where progress against the Basin Salinity Target is assessed.

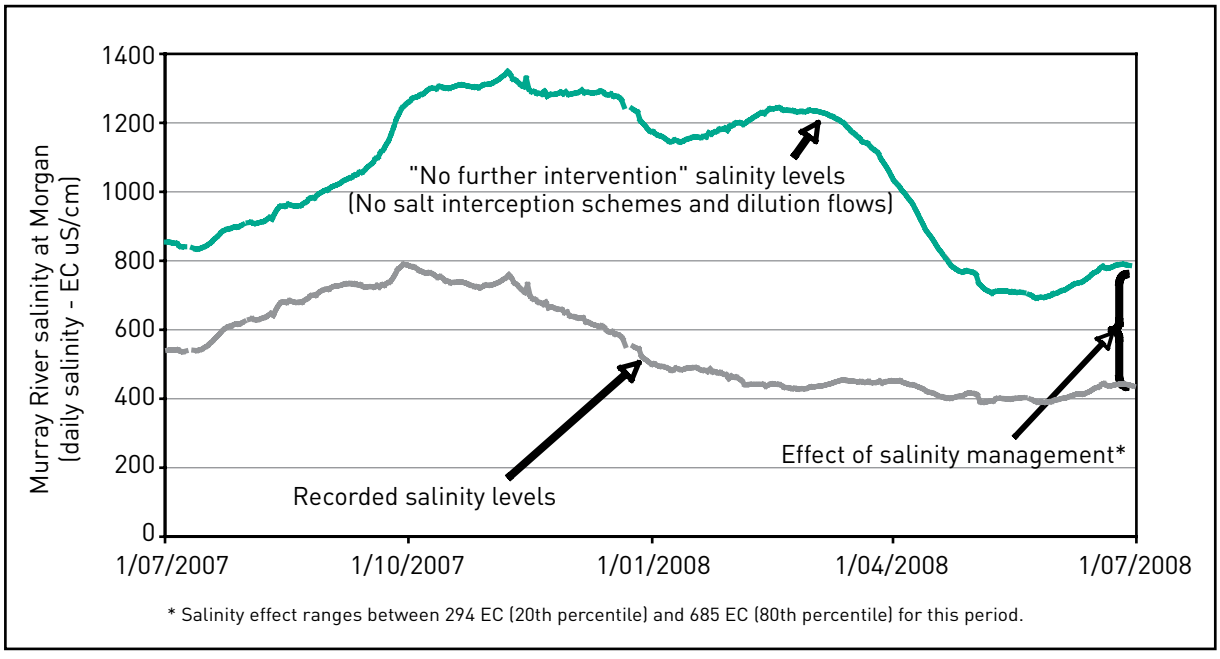
The average daily recorded salinity during 2007–08 was 549 EC at Morgan with levels peaking at 785 EC at the end of September 2007, as dilution from regulated flows declined to critically low levels. Table 1 summarises the salinity levels recorded at Morgan over four time intervals: one, five, ten and 25 years. The comparison shows that the average, median and peak salinities are lower over the last five years compared with longer timeframes. The decline in salinity in recent years reflects the combined effects of lower in-river salt loads (due to a substantial decline in salt mobilisation as a consequence of the drought) and the cumulative benefits arising from the progressive commissioning of salinity mitigation works such as salt interception schemes (Section 2.8).

Table 1: Summary of salinity levels (EC) recorded at Morgan, South Australia.

	Time Interval	Average	Median	Peak
1 year	July 2007 – June 2008	549	495	785
5 years	July 2003 – June 2008	420	396	785
10 years	July 1998 – June 2008	467	446	826
25 years	July 1983 – June 2008	535	511	1220

Figure 1 shows the recorded salinity levels at Morgan during 2007–08. The grey line shows the actual recorded salinity while the green line shows what salinity levels would have been without the salt interception schemes or targeted dilution flows. The green line, therefore, describes what is commonly referred to as a 'no further intervention' scenario.

Figure 1: The effect of salinity management in the Murray–Darling Basin. Daily salinity levels – July 2007 to June 2008.



* Salinity effect ranges between 294 EC (20th percentile) and 685 EC (80th percentile) for this period.

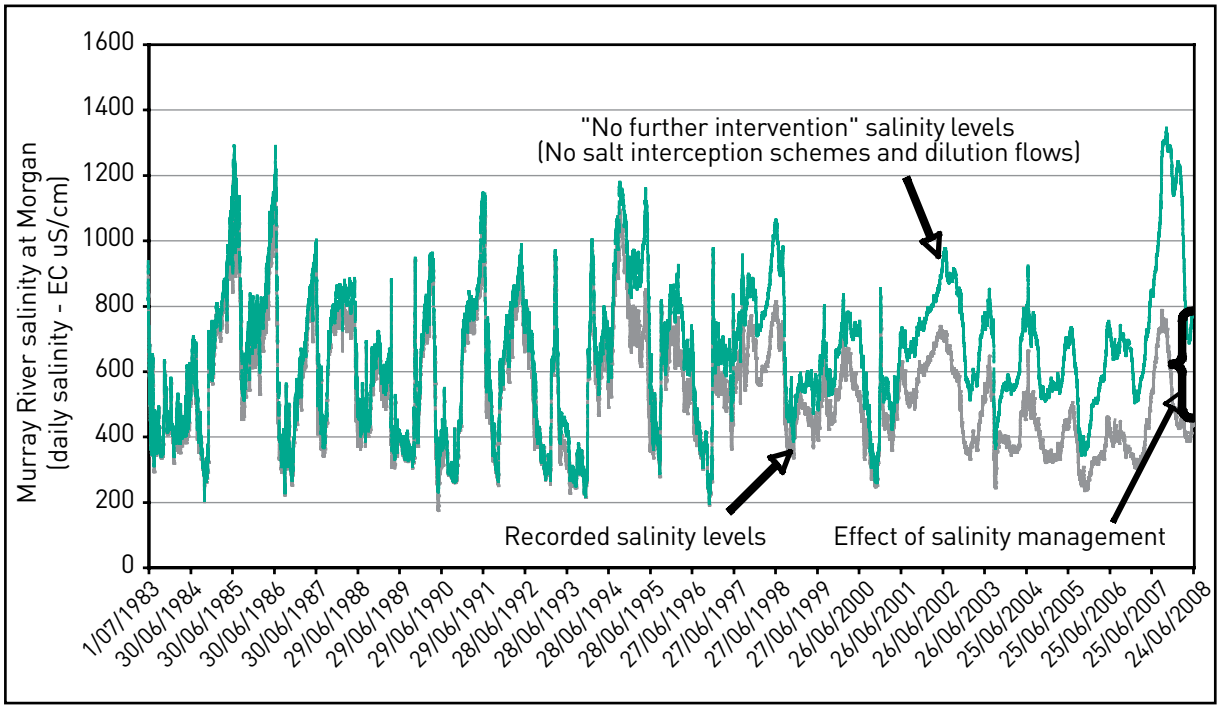
'No further intervention' results are obtained through computer modelling which simulates river salinities that would have occurred if salt interception works were not operating and dilution flows were not provided. 'Further' is used because the Baseline Conditions include those schemes which were operating before 1975, the year in which the data used to establish the Baseline Conditions commences.

During 2007–08, the effect of salinity management (i.e. the difference between the green and grey lines) ranged between approximately 300 to 800 EC. The 'no further intervention' modelling indicates that intervention has reduced the average daily salinity from 1052 EC to 549 EC and the peak salinity from nearly 1342 EC (modelled – green line) to 785 EC.

Figure 2 illustrates a similar concept for the period 1983 – 2008 (reliable monitoring data is readily available from 1983 onwards). Trends over this 26 year period demonstrate:

- a reduction in the occurrence of measured peak salinities (blue line); and
- the increasing benefits to river salinity arising from salt interception and dilution flows which was particularly apparent in late 2007 when salinities would have exceeded 1300 EC without the operation of the schemes (illustrated by the widening gap between green and grey lines).

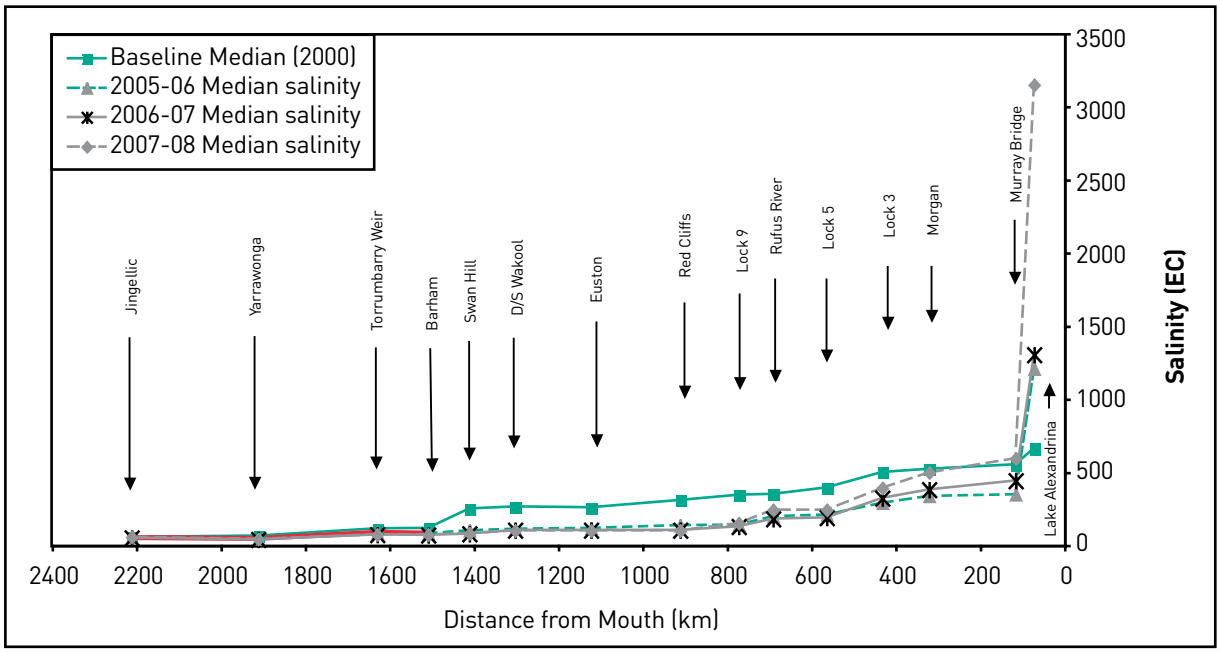
Figure 2: The effect of salinity management in the Murray–Darling Basin. Daily salinity levels – July 1983 to June 2008.



As in-river salinities also have economic, social and environmental impacts upstream of Morgan, Figure 3 illustrates changes in salinity along the River over the 2007–08 year and compares these outcomes with the two previous years and the median salinity in 2000, the year in which the BSMS commenced.

The figure shows recorded salinity from Jingellic (headwaters of the Murray River) on the left-hand end of the figure, through the monitoring sites along the Murray to Lake Alexandrina (Lower Lakes) at the right-hand end. All the locations along the river upstream of Morgan have a median 2007–08 salinity below that occurred in 2000. At Morgan the median salinity for 2007–08 was the same as the 2000 median and the lower reaches of the Murray River significantly rising in salinity at Murray Bridge and the Lower Lakes due to the low inflows and evaporation during the drought.

Figure 3: Murray River salinity profile – Baseline median for the Benchmark Period 1975–2000 and the 2007–08 median.



2.3.2 Performance against the Basin Salinity Target

The strategy assesses the performance against the Basin Salinity Target over a modelled Benchmark Period because long term salinity outcomes are highly dependent upon climatic variability. The use of modelling allows for some stability in comparisons. At the time that the strategy was developed, the 1975-2000 period was considered to have an adequate climatic range to represent this variability.

Modelling outcomes show that, when the 2008 use of land and water is assessed against the climatic period from 1975 to 2000, in-river salinity would be less than 800 EC for 88 per cent of the time. This is significant because the Basin Salinity Target is for salinity to be less than 800 EC for 95 per cent of the time modelled over this 25-year period. Whilst these results illustrate that the BSMS has yet to achieve the modelled river salinity target, Table 2 demonstrates that the exceedence of 800 EC has dropped substantially over the modelled period from 28 per cent under 1988 conditions, to 12 per cent under 2008 conditions. This outcome reflects the significant benefits that salinity mitigation activities have delivered over a period of variable climatic conditions.

Table 2: Summary of salinity levels (EC) modelled at Morgan, South Australia.

	Time Interval	Average	Median	95 percentile	% Time > 800 EC
25 years	Modelled 1988 conditions 1975-2000	665	666	1058	28%
25 years	Modelled 2008 conditions 1975-2000	563	541	886	12%

2.3.3 Priorities and challenges

As the Benchmark Period is the fundamental hydrological dataset underpinning the modelling framework, progress against the Basin Salinity Target is highly sensitive to the selected period (currently 1975-2000). The Mid-Term Review recommended that hydrological data sets that reflect the latest research on climate change and climate variability should be developed and applied to modelling scenarios to ensure the best possible tools for predicting long term salinity impacts. In addition, the need to assess the appropriateness of the current target and the selected period against which performance against targets are assessed, is a key direction arising from the BSMS Mid-Term Review.

Therefore, the first step in reviewing the Benchmark Period is to clarify its role as the basis for future investment decisions, i.e. whether future investment decisions will continue to be based upon average salinity benefits over the Benchmark Period, or should be more targeted towards delivering real time salinity outcomes.

During 2008–09 increased focus will also be applied to understand the historical context of targets, particularly end-of-valley targets and the role of Programs of Actions in contributing to basin scale water quality outcomes.

2.4 Element 4: Managing trade-offs

Under this element, states are expected to analyse and review the best mix of land management, engineering, river flow, and living with salt options to achieve salinity targets while meeting other catchment health objectives and social and economic needs. The states assist communities to understand and agree to options with affected groups, industries and people through best practice planning processes.

This element is largely a responsibility of the BSMS partner governments and further information can be found in the individual state 2007–08 BSMS annual reports.

2.5 Element 5: Implementing plans

This element recognises that communities have made significant contributions to land and water management through the development of plans for regions and catchments. Where these plans have, or will, result in a significant change in land or water management, they must be assessed and reported against the end-of-valley and Basin targets and recorded on the Salinity Registers. The partner governments continue to support land and water management plans (LWMPs) in irrigation regions and the development and implementation of salinity and catchment management plans in dryland regions.

This element is largely a responsibility of the BSMS partner governments and further information can be found in the individual state 2007–08 salinity annual reports.

2.6 Element 6: Redesigning farming systems

This element is essentially about two areas – improvements in farming systems and research and development. It reflects the need for practical changes to farming systems which reduce the salinity risk without jeopardising the viability of farming enterprises at the same time. It also includes the requirement that the partner governments coordinate and enhance research and development into:

- new farming and forestry systems that deliver improved control of groundwater recharge in the high rainfall grazing, winter rainfall cropping, and summer rainfall cropping zones.
- new industries based on salinised resources, such as broadacre saltland agronomy, saline aquaculture and salt harvesting.

The recently completed Mid-Term Review identified that options for packages of works, measures and payments need to be investigated to address viability and deliver required salinity outcomes. The emphasis for designing farming systems to achieve in-river salinity outcomes is expected to be prioritised towards irrigated regions as they are likely to have the greatest impacts on salinity targets. Opportunities for proactive intervention to influence salinity outcomes from new irrigation developments and retirement of irrigation should also be contemplated.

This element is largely a responsibility of the BSMS partner governments and further information can be found in their individual state 2007–08 salinity annual reports.

2.7 Element 7: Vegetation management

The necessity for landscape change specifically targeted at salinity control requires better management of native vegetation, its rehabilitation and improved land stewardship.

This element is largely a responsibility of the BSMS partner governments and further information can be found in the individual state 2007–08 salinity annual reports.

2.8 Element 8: Salt interception works

A significant achievement for the first half of the strategy has been the substantial investment in salt interception schemes (SIS). These schemes intercept saline groundwater and drainage flows before they reach the Murray River and its tributaries. The schemes are located within three of the MDBC partner states- New South Wales, Victoria and South Australia. The MDBC coordinates the investigation, construction and management of these joint schemes.

At the strategy's half way point, salt interception schemes divert half a million tonnes of salt away from the Murray River each year and offset predicted increases in average salinity by 40 EC per year at Morgan. Construction of these schemes in optimum positions is a critical factor in their success. Upon completion of the current program, water quality benefits will have increased to offset an average 61 EC per year. The salinity benefits accrued from the operation of the salt interception schemes are recorded on the Salinity Registers as credits.

Since 1988 New South Wales, Victoria and South Australia, together with the Australian Government, have funded the construction of nine salt interception schemes. In addition, the following work is underway:

- five schemes are under construction; and
- three schemes are being investigated.

The total budget expenditure under the investigations and construction program for the 2007–08 year was just over $8,300,000.

The complexity associated with planning, investigations and construction has inhibited the achievement of the 61 EC program by 2007. However, the 2005–06 funding initiative from the Australian Government has meant that this outcome is expected to be achieved by 2010–11.

Management of extracted groundwater and salt is a critical component of the joint works and measures program. The following plans and reports were endorsed during 2007–08:

- South Australian Riverland Salt Disposal Management Plan. Following on from this there has been a request to investigate actions identified in this management plan regarding the long term sustainability of disposal in this region.
- the Sunraysia Regional Salt Disposal Management Options Report. It was agreed that a community engagement process be initiated through the local catchment management authorities.

Table 3 summarises schemes that are completed or expected to be completed under the strategy. The table provides details of their operational capacities, EC credits and notes current issues.

Table 3: Joint salt interception scheme performance reporting 2007–08.

Salt Interception Scheme	Volume Pumped (ML)	Salt Load Diverted (Tonnes)	Average Salinity (EC)	Target Achieved (% of Time)	Power Consumption kWh	BSMS Average Salinity Change at Morgan (EC)	Comment
Pyramid Creek 1 Stages 2 / 3	753	20,398	39,401	100%	109,495	-3.0 -2.6	Stage 1 in operation. The first harvest of salt was May 2006. Stages 2/3 edc[1] December 2008.
Barr Creek	528	30,084	14,339	100%	87,804	BC/S&DS[2]	Effective Drainage Diversion Scheme.
Mildura-Merbein	1,378	39,844	47,292	70%	84,214	BC/S&DS[2]	Business case for refurbishment/extension 2008.
Mallee Cliffs	2,620	62,550	53,000	70%	661,290	BC/S&DS[2]	Effective SIS.
Buronga	2,830	84,148	46,460	95%	495,266	-0.44	Rehabilitated and extended in 2005.
Bookpurnong	1,287	38,226	45,000	95%	389,422	-10.9 Current -4.0 AlHo area	Effective SIS. Business case for the aluminium hydroxide area will be presented during 2008–09.
Loxton	789	19,215	38,500	100%	324,225	-18.7Joint -4.0 SA	Floodplain Borefield was progressively brought into service during the year including the cliff toe interceptor drain.
Woolpunda	5,405	109,300	30,000	98%	3,480,000	BC/S&DS[2]	Effective SIS.
Waikerie	3,568	62,400	25,800	95%	1,440,000	BC/S&DS[2]	Effective SIS.
Rufus River Total		22,577		~100%	143,698	BC/S&DS[2]	Older scheme which remains effective. It is managed as three separate elements. * Note that while the targets for Lines 2–4 are achieved 100% of the time, Line 1 achieves its target 96% of the time.
Lines 1-4	619	15,185	36,985	100%*	109,709		
Minor P/S	0	0	200,000	100%	218		
Major P/S	433	8,184	30,764	94%	22,822		
Waikerie 2L						-8.84 Joint -0.56 SA	Extension to the Waikerie scheme under construction with edc 2010–11.
Murtho						-19.8 Joint -0.4 SA	Approval granted to proceed to construction ready stage; edc – 2011–12.
Pike						-22.7 (est)	Business Case to Commission by the end of 2008.
Upper Darling						-2.2	REF under preparation. Approved for construction August 2008.
Redcliffs						-3.0	Business Case to MDBC in 2008.
Augmentation of Mildura/Merbein						-2.0	As part of the Rehabilitation of the MMIS, additional benefits will accrue. Business case to Commission by the end of 2008.
Dareton						-1.0	Potential for a scheme being investigated.

1. EDC- expected date of commissioning.
2. BC/S&DS – the EC benefit is not part of the BSMS; it forms part of the BSMS Baseline Conditions (BC) as it was built prior to, or during the life of, the Salinity & Drainage Strategy (S&DS).

The salt interception scheme Program of Works will continue to progress activities aimed at achieving the river salinity off-sets as set out in the strategy. They will include investigations of opportunities, an accelerated construction program and the continuation of improvement in the operational performance of existing schemes. Significant work will include:

- development of an integrated Sunraysia salinity management submission that will incorporate a range of Engineering and Catchment actions;
- development of implementation plans for saline water disposal for Sunraysia and the Riverland; and
- continued work on the engineering and hydrological concept design for possible schemes at Redcliffs (Victoria), Mildura-Merbein Augmentation (Victoria), Pike River (South Australia), Overland Corner (South Australia) and Bookpurnong – Nitsche Road (South Australia).

The BSMS Mid-Term Review identified that this element should be widened to include other salinity mitigation initiatives such as dilution flows, and to recognise synergies with other programs such as the Living Murray. This direction is being pursued in 2008–09 through a project investigating a future joint works and measures program that is intended to take the program forward beyond the 61EC program targeted under the original approved salt interception works.

2.9 Element 9: Basin-wide accountability

The partner governments are accountable to the Commission and Council; accountability mechanisms include the BSMS Salinity Registers, monitoring, and in 2007–08, the completion of the Mid-Term Review. The Salinity Registers are a critical part of the process as they record the salinity effects of actions, including salt interception schemes and salinity and catchment management plans.

In addition to the information provided in this section, details of the work achieved by the partner governments during 2007–08 can be found in their salinity annual reports.

2.9.1 Independent Audit of the BSMS

The Murray–Darling Basin Agreement requires that an annual audit of performance in implementing the provisions of Schedule C must be carried out. The Independent Audit Group – Salinity (IAG-Salinity) undertook the sixth audit of BSMS activities and the Executive Summary of their Report, including recommendations, is included in Appendix I. The Audit report is provided to Ministerial Council and activities responding to their recommendations are incorporated in the three-year rolling plan. Specific recommendations from previous years are addressed in Section 4.

2.9.2 The BSMS Salinity Registers

The BSMS Salinity Registers are an important feature of the BSMS as they provide a salinity-based accounting system. They are the primary record of jurisdictional accountability for actions that affect river salinity and are a working example of an effective environmental accountability framework.

The Salinity Registers are an accounting tool. They provide a debit-and-credit balance of reduction or increase in salinity impacts. This is defined as items that will increase or decrease the salinity in the Murray River at Morgan by 0.1 EC within 100 years. Using this framework, basin-wide salinity trade-offs are managed transparently. Credit and debit entries account for states' actions which cause river salinity to increase or decrease. Actions such as new irrigation developments can generate a debit on the Salinity Registers because in some areas they may produce increased salt loads to the Murray River. Actions such as infrastructure (for example salt interception schemes) or improved irrigation practices can generate a credit on the Salinity Registers.

Annually, each jurisdiction provides information to the MDBC on activities having significant salinity effects during that year. The MDBC then calculates the salinity cost of these activities and updates the BSMS Salinity Registers which are then reviewed by independent auditors. In this way, the Salinity Registers track the modelled effects of Accountable Actions on river salinity levels, including costs and benefits along the river.

The strategy provides for continuous improvement through a program of reviews: rolling five-year reviews of Register entries and seven-year reviews of models.

The BSMS Salinity Registers 2007–08, dated 7 November 2008, are at Appendix II. Table 4 provides a summary of key aspects and shows only the sub-total lines from the Registers. An explanation of the lines and headings used in the Registers has been supplied with the full BSMS 2008 Registers in Appendix II.

Table 4: Summary of the Salinity Registers

Actions	NSW	VIC	SA	QLD	ACT	Transfers to Register B	Commonwealth contribution (EC)
Joint works & measures	2.386	2.386	0.462	0.0	0.0	1.434	28.7
State shared works & measures	0.218	0.218	0.0	0.0	0.0	0.0	0.0
State actions	0.856	1.762	6.573	tbd	tbd	0.0	4.1
Total Register A	3.459	4.366	7.035	tbd	tbd	1.434	32.8
Total Register B	0.298	-0.517	-1.339	0.0	0.0	0.0	0.0
Balance – Registers A & B	3.758	3.849	5.696	0.0	0.0	1.434	32.8

Register A includes each Accountable Action that occurred after the Baseline date (1988 for NSW, Victoria and South Australia, 2000 for Queensland) and jointly funded works and measures, while Register B accounts for 'legacy of history' or actions taken pre-1988 arising within each major tributary valley.

New Register A entries for the 2008 Register include:

- The highland borefield for the *Loxton Salt Interception Scheme* has been constructed and is operational and is therefore now included into the Salinity Registers;
- An incision into saline groundwater called *Church's cut*, historically exported salt to the river, but was in-filled during the construction of the Pyramid Creek SIS, and was incorporated into Victoria's benefit of the scheme. In the 2007–08 registers, a separate register entry has been created for Church's cut.
- The decommissioning of several Mallee drainage bores that formerly discharged drainage to the saline regional watertable, and so reducing long term salt discharge to the Murray River.

There are no new Register B entries in the 2008 Register.

Rolling reviews

Schedule C requires that each Accountable Action incorporated into the Salinity Registers, have a five year rolling review to provide for progressive improvement in the estimate of the cost impact of actions over the short and long term.

A robust peer review of each rolling Five-Year Review provides rigour to any changes recommended to the Salinity Registers.

Tables 5 and 6 summarise the status of rolling five-year reviews.

Table 5: Status of rolling five-year reviews for all Salinity Register A entries as at June 2008.

COMMISSION REGISTER A (Accountable Actions)	Rolling five year review		
	Last review completed	Review deadline	Status
JOINT WORKS & MEASURES			
Former Salinity & Drainage Works			
Woolpunda SIS	2007	2012	Modelling to be reassessed.
Improved Buronga and Mildura/Merbein IS	-	-	Update for next rolling five-year review awaits scheme rebuild.
New Operating Rules for Barr Creek Pumps	2005	2010	
Waikerie Interception Scheme	2007	2012	Modelling to be reassessed.
Changed MDBC River Operations 1988 to 2000	2005	2010	
Mallee Cliffs Salt Interception Scheme	2005	2010	
Changed Operation of Menindee and Lower Darling	2005	2010	
Waikerie SIS Phase 2A	2007	2012	Modelling to be reassessed.
Changed MDBC River Operations 2000 to 2002	2006	2011	
Basin Salinity Management Strategy			
Changed MDBC River Operations after 2002	2005	2010	
Pyramid Ck Stage 1 including Churches Cut (14.7% Victorian)	2005	2010	Churches Cut separated for the 2008 Register.
Bookpurnong Joint Salt Interception Scheme	2006	2011	
Improved Buronga Scheme	2006	2011	
STATE WORKS & MEASURES			
Shared NSW & Victorian Measures			
Permanent Trade Accounting Adjust- NSW to Victoria	2006	2011	
Barmah-Millewa Forest Operating Rules	2006	2011	
New South Wales			
Boggabilla Weir	1991	2005	Formal submission to be completed.
Pindari Dam Enlargement	1994	2005	As above.
Tandou pumps from Lower Darling	2005	2010	
NSW MIL LWMP's	2000	2005	Peer review of impacts report underway.
NSW Changes to Edward-Wakool and Escapes	2005	2010	
Permanent Trade Accounting Adjustment – NSW to SA	2005	2010	
NSW Sunraysia Irrigation Development 1997-2006	2007	2012	Formal submission of final documentation to be completed.

COMMISSION REGISTER A (Accountable Actions)	Rolling five year review		
	Last review completed	Review deadline	Status
Victoria			
Barr Creek Catchment Strategy	2006	2011	
Tragowel Plains Drains at 2002 level	2006	2011	
Shepparton Salinity Management Plan	2006	2011	
Nangiloc-Coligan S.M.P.	2002	2007	Formal submission of documentation to be completed.
Nyah to SA Border SMP – Irrigation Development	2002	2007	Formal submission of documentation to be completed.
Kerang Lakes/Swan Hill Salinity Management Plan	2003	2008	Planning for rolling five year review commenced.
Campaspe West Salinity Management Plan	2002	2007	Rolling five year review expected to be finalised in 2008–09.
Psyche Bend	2000	2005	
Permanent Trade Accounting Adjustment – Victoria to SA	2005	2010	
Woorinen Irrigation District Excision	2006	2011	
Sunraysia Drains Drying up	2003	2008	
Lamberts Swamp	2004	2009	
South Australia			
SA Irrigation Development 1988 to 2007	2003	2008	MODFLOW models under development to support review.
SA Component of Bookpurnong Scheme	2006	2011	Updated modelling outputs to be provided during 2008–09.
SA Improved Irrigation Efficiency	2004	2009	MODFLOW models under development to support review.
SA Irrigation Scheme Rehabilitation	2005	2010	Peer review of rolling five year review to be completed by July 2008.
Qualco Sunlands GWCS	2005	2010	Documentation to support register update in preparation.
Queensland			
Land Clearing Post 2000	-	2007	
Irrigation Development Post 2000	-	2007	

Table 6: Status of rolling five-year reviews for all Salinity Register B entries as at June 2008.

COMMISSION REGISTER B (Delayed Salinity Impacts)	Rolling Five Year Review		
	Last Review Completed	Review Deadline	Status
Shared New South Wales and Victoria			
Mallee Legacy of History – Dryland	1999	2004	EM1 model under further development.
Mallee Legacy of History – Irrigation	1999	2004	As above.
New South Wales			
Darling Catchment Legacy of History – Macquarie	1999	2004	Final report to be submitted.
Darling Catchment Legacy of History – Macintyre	1999	2004	As above.
Darling Catchment Legacy of History – Gil Gil Ck	1999	2004	As above.
Darling Catchment Legacy of History – Gwydir	1999	2004	As above.
Darling Catchment Legacy of History – Namoi	1999	2004	As above.
Darling Catchment Legacy of History – Castlereagh	1999	2004	As above.
Darling Catchment Legacy of History – Bogan	1999	2004	As above.
Lachlan Legacy of History	1999	2004	As above.
Murrumbidgee Catchment Legacy of History	1999	2004	As above.
Victoria			
Campaspe Catchment Legacy of History	2003	2008	
Goulburn Catchment Legacy of History	2003	2008	
Loddon Catchment Legacy of History	2003	2008	
Kiewa Catchment Legacy of History	2003	2008	
Ovens Catchment Legacy of History	2003	2008	
South Australia			
SA Mallee Legacy of History – Dryland	2005	2010	
SA Mallee Legacy of History – Irrigation	1998	2003	Peer review of rolling five year review report to be completed by July 2008.
Queensland			
Condamine Balonne Legacy of History	2000	2005	Draft report close to completion.
Border Rivers and Moonie Legacy of History	2007	2012	Audit reports have been submitted.
Warrego-Paroo Legacy of History	2007	2012	Audit reports have been submitted.
Queensland Irrigation Development pre 1 Jan 2000	-	-	

Register A

Victoria has prioritised the review of Land and Water Management Plan areas where most of their Accountable Actions arise. Particular items of note for the 2008 register are that:

- *NSW Murray Irrigation Limited LWMP Review* was peer reviewed. Recommendations are being considered by NSW, leading to some amendments to the technical documentation and finalisation prior to entry onto the registers; and
- *Victoria's Nangiloc-Colignan Salinity Management Plan and Nyah to the SA Border Salinity Management Plan five year* Rolling five year reviews were substantially completed.

Register B

Tributary valley reviews assess the impact of the legacy of history for that valley, established by the Baseline Date (1 January 1988 for South Australia, Victoria and New South Wales; 1 January 2000 for QLD). NSW and Queensland reviews are mostly within the timelines. These five year rolling reviews assess the impacts on river salinity and progress towards achieving targets, with the provision to require further action as necessary.

- *South Australian Mallee Register B entry*: peer review of the suite of models has been completed and has provided direction for improvements in future modelling approaches;
- *NSW/Victorian Mallee Region Register B entries* (dryland clearing and irrigation development): the current register entries remain provisional while the Eastern Mallee Groundwater Model (EM1) is further developed;
- *New South Wales' upland catchments* – a report has been completed and is expected to be submitted in 2008–09;
- *Qld Warrego–Paroo valley* – this report has been submitted to the MDBC. There are no implications for the Salinity Register; and
- *Queensland Condamine-Balonne valley* – review report is under development and expected to be completed in 2008–09.

Salinity Models

The Commission's Salinity Registers are underpinned by a suite of numerical models to estimate the salinity outcome of Accountable Actions at end-of-valley target sites and on the Basin Salinity Target site at Morgan. As the results of this work are assessed and endorsed, the Salinity Registers are then amended. In addition, the Murray River model (MSM-BIGMOD) has been built to include an estimate of the cost to downstream users of any Accountable Action. The costs appear in the Salinity Registers as a $m/y figure for each entry and these costs are used by the jurisdictions to support decision-making for trade-offs and investment.

The Commission uses hydrologic models and groundwater models to assess the salinity impact on the Murray River, both tributary and main stem. The tributary surface water models produce the data used by MSM-BIGMOD to estimate the salinity, salt load, and flow, at the end-of-valley target sites (see Monitoring). These models were used to establish the Baseline Conditions for the Basin's catchments, against which the annual data is measured. The Baseline Conditions are provided in Appendix III.

The BSMS Operational Protocols ensure strong accountability in salinity management. In modelling terms, the Protocols provide maximum flexibility allowing the selection of the most appropriate methodology while requiring the model in question to be reviewed and deemed "fit for purpose" before its results can be used for the Registers.

Tributary surface water models provide key data inputs to the Commission's MSM-BIGMOD model. These models use the salinity, salt load and flow regimes at the end-of-valley sites (discussed in the monitoring Section 2.9) and have established Baseline Conditions (Appendix III) for the basin catchments, including the Murray River.

Achievements in salinity modelling during the 2007–08 year included:

- the EM model for the eastern Mallee is being further developed. The model is intended to provide the basis for evaluating Victorian and NSW Register B debits for legacy of history clearing and irrigation. This modelling platform is also being used to assess the impacts of SIS proposals in the New South Wales/ Victorian Mallee.
- the model to assess ACT baseline conditions was completed and has been peer reviewed.
- the Chowilla groundwater model underpinning the detailed salinity assessment for the proposed TLM environmental flows regulator was submitted to the Commission office. It is the first of a number of environmental watering proposals under TLM Environmental Watering Program, to be submitted for independent peer review to assess compliance of the model with MDBC assessment obligations.
- the Wilcania to Menindee river transport model has been updated and peer reviewed.
- Progress by South Australia in establishing a groundwater modelling platform from the SA/Victoria/NSW border to Lock 3 (between Loxton and Waikerie). Improvements to these models are intended to provide a groundwater modelling for the salinity assessment of a range of land and water management activities across the Riverland of South Australia.

Salinity Registers Governance

The continued focus on improved accountability includes the governance arrangements for the Salinity Registers. A process is in place whereby each potential entry is assessed by groundwater and hydrological models using the most recent data available. The process, supported by appropriate documentation, includes notification of actions, modelling the expected impacts using appropriate data, and the formal decision-making which oversights model accreditation and the endorsement of changes to the Registers.

This process will be greatly enhanced by the use of a purpose-built database which has been an on-going task. The 2007–08 year saw design of the database now completed and arrangements made for construction to commence early in the 2008–09 year. The database will enable the relationship between decisions, letters, correspondence and technical documentation associated with the salinity registers and documents to be transparent and auditable.

2.9.3 Monitoring

Monitoring is a key element of BSMS implementation. The data collected at the end-of-valley target sites provide salinity, salt load and flow information for the basin's catchments, or in some cases a series of interpretation sites along the river. Over time, the data will inform the review of end-of-valley targets and the B register "legacy of history" of impacts from tributary valleys.

The collection of data has gradually improved (Table 7). However, it is not always possible to provide full datasets. In recent years, the most common reason for lack of data at a site is greatly reduced or ceased flow in the river. Table 8 shows those sites with less than 95 per cent availability of monitoring data. The Summary Report card that provides an indication of river conditions over the 2007–08 year is supplied in Section 3. Appendix IV shows monitoring results at each individual end-of-valley target sites in Queensland, New South Wales, Victoria and South Australia and the ACT. In Appendix V, Tables 11 and 12 compare the salinity and salt load data for the individual sites against the long-term records, providing an indication of the current situation against the long-term.

Table 7: Availability of Monitoring Data 2000–2008.

Year	Aggregate % of days with EC records	Aggregate % of days with flow and EC records
2000	43%	34%
2001	48%	37%
2002	65%	51%
2003	75%	50%
2004	85%	54%
2005	72%	53%
2006	83%	55%
2007	82%	58%
2008	83%	66%

Table 8: Sites with less than 95 per cent data availability for 2007–08.

Site	Measurand	No. of days with records	Per cent of year
Avoca at Quambatook	Electroconductivity	0	0%
Avoca at Quambatook	Flow	140	38%
Ballandool at Hebel Bollon Rd	Electroconductivity	214	58%
Bogan at Gongolgon	Flow	279	76%
Bokhara at Hebel	Electroconductivity	281	77%
Briarie at Woolerbilla-Hebel Rd	Electroconductivity	40	11%
Broken at Casey's Weir	Electroconductivity	0	0%
Broken at Casey's Weir	Flow	288	79%
Campaspe at Campaspe Weir	Electroconductivity	339	93%
Campaspe at Campaspe Weir	Flow	0	0%
Castlereagh at Gungalman Bridge	Flow	0	0%
Goulburn at Goulburn Weir	Flow	0	0%
Loddon at Laanecoorie	Electroconductivity	0	0%
Loddon at Laanecoorie	Flow	331	90%
Macquarie at Carinda	Flow	340	93%
Moonie at Fenton	Electroconductivity	193	53%
Paroo at Caiwarro	Electroconductivity	320	87%
River Murray at Murray Bridge	Flow	0	0%
River Murray at Redcliffs	Flow	0	0%
River Murray at Redcliffs	Electroconductivity	25	7%
Warrego at Barringun No 2	Electroconductivity	349	95%
Wimmera at Horsham Weir	Electroconductivity	171	47%
Wimmera at Horsham Weir	Flow	310	85%

Table 8 shows that in 2007–08, there was a slight increase since 2006-07, in the number of sites and days with less than 95 per cent availability. Full datasets may not always be available due to the various circumstances, such as dry conditions, equipment malfunction or poor quality data.

2.9.4 Mid-Term Review

Schedule C includes a requirement for a review of the BSMS to be undertaken by December 2007 and at intervals of no more than seven years thereafter. In 2007 a Mid-Term Review was conducted with the report finalised during 2007–08, as required.

The Mid-Term Review was based on an examination of the changes in the policy, operational arrangements, science and technical understanding over the first phase of implementation of the BSMS and how these will influence implementation directions. The report was developed over an 18 month period, through interviews, workshops and working group processes.

Recommendations and directions were largely reported in the 2006-07 Annual Implementation Report, however some highlights include:

1. Significant progress has been made in implementing the BSMS to date;
2. Schedule C and the Strategy are sufficiently robust to deal with the challenges identified in the Mid-Term Review process and therefore no significant changes to the BSMS or Schedule C are required;
3. Methods to account for environmental outcomes should continue to be developed;
4. There is a need for greater emphasis on:
    a. Preventative salinity actions in catchments such as irrigation efficiency improvements;
    b. Managing salinity through real time operations including real time targets;
5. A program for further investment should be made in flexible and sustainable joint works and measures, to continue the achievements from the Salt Interception Scheme program;

Progress on these directions is anticipated during 2008–09 and beyond.

3. VALLEY REPORTS

Valley annual reports detail progress in implementation of Programs of Actions to deliver end of valley targets, with a progressive estimate of salinity effect (at end-of-valley and/ or Morgan as appropriate) to those actions actually implemented to date.

Each state end-of-valley report is included in their 2007–08 salinity annual report.

The end-of-valley Summary Report card is presented in Table 9. It contains the flow and salinity data for all the end-of-valley target sites. A map (Figure 4) following the card provides a geographical location for all the end-of-valley target sites.

The in-stream salinity and salt loads for 2007–08 for end-of-valley target sites in QLD, NSW, VIC, SA and the ACT are provided in Appendix IV. The comparison of 2007–08 in-stream salinity and salt loads against long-term data is at Appendix V.

Full datasets may not be available over the year, as dry conditions can prevent accurate measurements at sites if water levels fall below the gauges or the stream ceases to flow completely, or equipment may malfunction or provide poor quality data, which is rejected.

Salinity Monitoring Pontoon upstream of Mildura Weir. Photo: A. Katupitiya

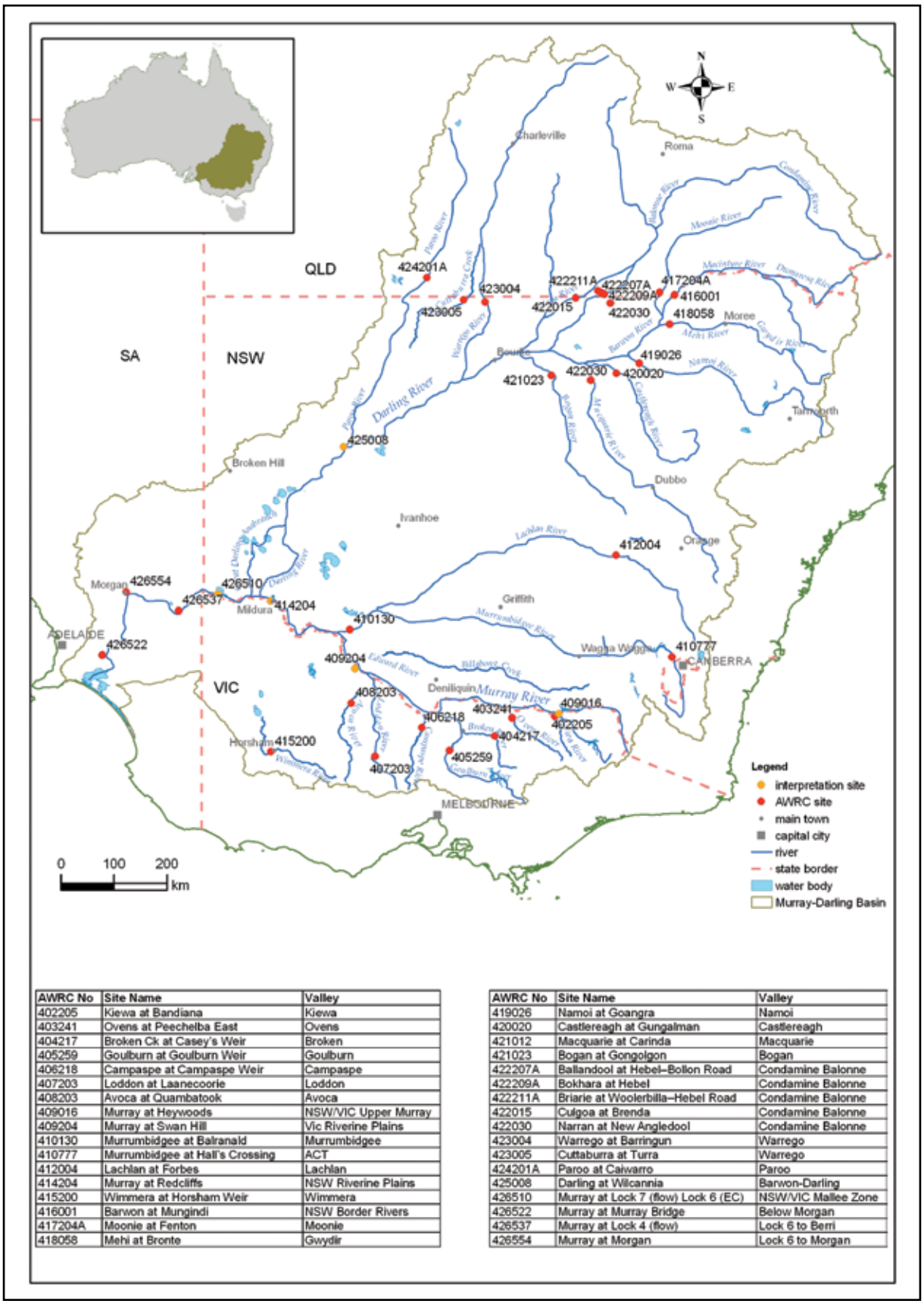
Table 9: End-of-valley summary report card.

Site	AWRC no.	No. of days with salinity records	No. of days with flow records	Days with flow above zero	Salinity				Flow			
					Mean	Median	80%ile	Peak	Mean	Median	80%ile	Peak
SA												
River Murray at Lock 6	426510	366	366	366	236	220	295	369	2652	2558	3650	9423
River Murray at Lock 4	426514	366	366	366	331	297	297	515	1741	1880	2290	3720
River Murray at Morgan	426554	366	366	366	542	489	705*	770	1212	1250	1520	2700
River Murray at Murray Bridge	426522	366	NA	NA	670	623	832	988	NA	NA	NA	NA
NSW												
Murrumbidgee at Balranald	410130	366	366	366	236	206	282	2564	389	220	282	1408
Lachlan at Forbes	412004	366	353	366	531	505	582	1035	58	35	71	838
Bogan at Gongolgon	421023	366	279	219	242	220	351	529	306	1	95	5740
Macquarie at Carinda	421012	358	340	161	314	384	622	810	3	0	4	26
Castlereagh at Gungalman Bridge	420020	366	354	213	347	383	563	1415	95	0	75	1891
Namoi at Goangra	419026	366	366	254	259	316	398	639	200	17	105	5709
Mehi at Bronte	418058	366	366	366	367	347	458	759	49	28	61	948
Barwon at Mungindi	416001	366	366	335	249	263	298	374	383	111	728	3456
River Murray at Heywoods	409016	360	366	366	52	52	63	145	3536	3085	6900	10800
Darling at Wilcannia	425008	354	353	339	528	244	1185	2585	2420	59	4826	19600
River Murray at Redcliffs	414204	39	NA	NA	156	136	207	292	NA	NA	NA	NA
River Murray at Lock 6	426510	366	366	366	236	220	295	369	2652	2558	3650	9423
VIC												
Wimmera at Horsham Weir	415200	171	310	114	625	705	731	1184	1	0	1	12
Avoca at Quambatook	408203	NA	140	73	NA	NA	NA	NA	7	0	10	72
Loddon at Laanecoorie	407203	NA	331	331	NA	NA	NA	NA	20	21	27	52
Campaspe at Campaspe Weir	406218	339	NA	NA	977	1168	1311	1398	NA	NA	NA	NA

Site	AWRC no.	No. of days with salinity records	No. of days with flow records	Days with flow above zero	Salinity				Flow			
					Mean	Median	80%ile	Peak	Mean	Median	80%ile	Peak
Goulburn at Goulburn Weir	405259	366	NA	NA	76	59	101	183	NA	NA	NA	NA
Broken at Casey's Weir	404217	NA	288	288	NA	NA	NA	NA	20	14	29	66
Ovens at Peechelba East	403241	366	366	366	58	52	70	164	1437	795	2147	11484
Kiewa at Bandiana	402205	366	366	366	33	33	39	58	800	642	1190	3943
River Murray at Heywoods	409016	360	366	366	52	52	63	145	3536	3085	6900	10800
River Murray at Swan Hill	409204	366	366	366	81	75	92	316	4019	3588	5804	8673
River Murray at Lock 6	426510	366	366	366	236	220	295	369	2652	2558	3650	9423
QLD												
Moonie at Fenton	417204A	193	366	142	143	138	155	290	364	0	70	16536
Ballandool at Hebel Bollon Rd	422207A	214	366	148	149	148	170	204	41	0	73	372
Bokhara at Hebel	422209A	281	366	120	218	219	268	341	54	0	122	419
Briarie at Woolerbilla-Hebel Rd	422211A	40	366	77	184	159	253	379	24	0	0	1315
Culgoa at Brenda	422015	366	366	151	133	161	177	208	277	0	194	3266
Narran at New Angledool 2	422030	366	366	139	82	114	147	253	146	0	165	2974
Paroo at Caiwarro	424201A	320	366	168	109	81	172	275	4238	0	551	71938
Warrego at Barringun No 2	423004	349	366	171	67	29	139	241	788	0	1076	11673
Cuttaburra at Turra	423005	366	366	149	106	106	162	795	2186	0	1543	61486
ACT												
Murrumbidgee at Hall's Crossing	410777	353	365	142	226	224	271	518	635	307	612	25470

* 95%ile for BSMS Target at Morgan
NA – data not available

Figure 4: Map of end-of-valley target site locations.



AWRC No	Site Name	Valley
402205	Kiewa at Bandiana	Kiewa
403241	Ovens at Peechelba East	Ovens
404217	Broken Ck at Casey's Weir	Broken
405259	Goulburn at Goulburn Weir	Goulburn
406218	Campaspe at Campaspe Weir	Campaspe
407203	Loddon at Laanecoorie	Loddon
408203	Avoca at Quambatook	Avoca
409016	Murray at Heywoods	NSW/VIC Upper Murray
409204	Murray at Swan Hill	Vic Riverine Plains
410130	Murrumbidgee at Balranald	Murrumbidgee
410777	Murrumbidgee at Hall's Crossing	ACT
412004	Lachlan at Forbes	Lachlan
414204	Murray at Redcliffs	NSW Riverine Plains
415200	Wimmera at Horsham Weir	Wimmera
416001	Barwon at Mungindi	NSW Border Rivers
417204A	Moonie at Fenton	Moonie
418058	Mehi at Bronte	Gwydir

AWRC No	Site Name	Valley
419026	Namoi at Goangra	Namoi
420020	Castlereagh at Gungalman	Castlereagh
421012	Macquarie at Carinda	Macquarie
421023	Bogan at Gongolgon	Bogan
422207A	Ballandool at Hebel–Bollon Road	Condamine Balonne
422209A	Bokhara at Hebel	Condamine Balonne
422211A	Briarie at Woolerbilla–Hebel Road	Condamine Balonne
422015	Culgoa at Brenda	Condamine Balonne
422030	Narran at New Angledool	Condamine Balonne
423004	Warrego at Barringun	Warrego
423005	Cuttaburra at Turra	Warrego
424201A	Paroo at Calwarro	Paroo
425008	Darling at Wilcannia	Barwon-Darling
426510	Murray at Lock 7 (flow) Lock 6 (EC)	NSW/VIC Mallee Zone
426522	Murray at Murray Bridge	Below Morgan
426537	Murray at Lock 4 (flow)	Lock 6 to Berri
426554	Murray at Morgan	Lock 6 to Morgan

4. RESPONSE TO THE IAG – SALINITY

Schedule C, and the replacement Schedule B to the Murray–Darling Basin Agreement which is Schedule 1 in the *Water Act 2007* (Cwlth), provide for the appointment of independent auditors for the purpose of carrying out an annual audit, whose task is to review progress on implementation of the BSMS. This annual audit is an integral part of the BSMS as it ensures a fair and accurate annual assessment of the partner governments' and Commission's (or Authority's) performances against the Schedule. During 2007–08, four members of the Independent Audit Group for Salinity (IAG-Salinity) were appointed.

In the 2006-07 audit, the IAG-Salinity identified that progress on the BSMS was substantial over all of its elements. IAG-Salinity made a recommendation that relates to the MDBC. Previous recommendations specific to MDBC and responses have also been included.

Recommendation from 2006-07

1. *That New South Wales, Victoria and South Australia complete the review work required to provide high confidence data for the Registers, especially the entries associated with Mallee Legacy of History, and resolve other Register problems.*

Response: In collaboration with the States, a number of significant projects are underway to improve confidence in the Salinity Registers including:

- completion of the Victoria/NSW Mallee 'legacy of history' predictions;
- support for South Australian Mallee modelling;
- resolving a number of Register anomalies with Victoria and NSW; and
- continued improvement in documentation underlying Register entries.

More detailed information has been provided in Section 2.9 of this report.

Previous IAG-Salinity Recommendations

1. End-of-valley targets

   The IAG-Salinity recommended that studies be done to determine the effect on salinity at Morgan if end-of-valley salt loads and concentrations were in line with the adopted end-of-valley targets, and what changes in end-of-valley targets would be required to meet the BSMS objective of contributing a credit of 10 EC towards the Basin Salinity Target through in-valley actions. Corollaries of these questions include: what is the future role of the Basin Salinity Target, and is there a case for modification or extension of the present target? These issues were considered during the Mid-Term Review, and agreed to be important. The IAG-Salinity understands that they will be followed up in 2008.

   Response: The Mid-Term Review (MTR) reinforced the need for a review and revision of the end-of-valley targets. The scoping of issues to be addressed from this review is underway including:

   - the lower salinity risks now anticipated from dryland areas;
   - the need for 10 EC credit from Valley actions as originally envisaged in the BSMS; and
   - an increased emphasis towards real time river targets.

More information about these projects has been included in Section 2.3 of this report.

2. Irrigation Impact Zoning

In the 2004–05 report, the IAG-Salinity recommended that New South Wales should actively consider establishing an irrigation impact zoning policy for the New South Wales Sunraysia, and that Victoria, and in due course New South Wales, consider extending the zoned area upstream, to cover all high risk areas. The two states are studying their options for implementing these recommendations. It is accordingly recommended:

- *that NSW establish a salinity impact zoning policy for the NSW Sunraysia;*
- *that VIC consider extending its zoned area upstream; and*
- *that VIC, SA and NSW cooperate in setting zoning policies that are consistent across state boundaries.*

Response: An Irrigation Accountability Framework is under development under the guidance of the Irrigation Salinity Impact Evaluation Task Force. This Framework will identify any gaps and solutions required to improve the BSMS operational protocols.

3. Salt accessions during flood recessions

In all its reports so far, the IAG-Salinity has recommended that research and investigations be undertaken into the mechanisms leading to salt accessions during flood recessions, with a view to identifying works and measures to reduce post-flood salinities and to understanding related causes of flood plain environmental degradation. As drought conditions continue, salt continues to build up in and upon floodplain sediments. Much of this salt would be available for mobilisation into the River Murray and some of its tributaries during flood recessions. Little is known, however, about the distribution of stored salt or the mechanisms of mobilization. This problem has been seen as rather intractable, though it is important to both the BSMS and TLM. For example an understanding of salt occurrence in the Chowilla floodplain and its mobilisation during inundation is vital to programs under consideration there. Very little progress has been made on this issue. It is therefore yet again recommended:

- *that investigations be undertaken into the mechanisms of salt accretion and mobilisation in the floodplain, and management options for post-flood salt accessions.*

Response: As proposed in the BSMS Mid-Term review, the MDBC will investigate options for real time river operations so as to manage large salt loads mobilised to the river. This work, which would include salt mobilised from the floodplain, has been incorporated into the BSMS three year rolling plan.

Significant progress is underway with respect to TLM BSMS co-ordination including a process and actions for accounting for salinity impacts arising from TLM activities (Section 2.1).

5. KEY PROJECTS FOR 2008–09

During 2008–09, the BSMS will continue to progress established projects and those identified through the mid-term review process. The key projects during 2008–09 include:

- pursuing work towards identifying and managing salinity risks caused by the short-term impact activities, such as those under the Living Murray Program;
- further progression of the real-time, in-stream salinity management approach that will allow basin partners to manage in real time for river salinity outcomes;
- the establishment of a catchment salinity program that will address salinity from high-risk areas in the upper Murray–Darling Basin areas;
- revising the existing BSMS Operational Protocols to become guidelines for basin salinity management. Of importance are items such as the Irrigation Salinity Assessment Framework and findings from the MTR.
- the Joint Works and Measures program will continue to progress activities aimed at achieving the reduction of in-river salinity levels as set out in the strategy. They will include new investigations of opportunities, an accelerated construction program and the continuation of improvement in the operational performance of existing schemes.
- the establishment of the Salinity Registers database to refine Salinity Registers documentation.

A key responsibility of the new Murray–Darling Basin Authority, established under the *Water Act 2007* (Cwlth), will be to develop a Basin Plan, which will include a Salinity and Water Quality Plan. It is expected that these developments will impact on the BSMS and its reporting responsibilities in the next few years.

Buronga SIS Outfall, NSW. Photo: P. Pfeiffer

6. REFERENCES

Murray–Darling Basin Ministerial Council. 2005. *Basin Salinity Management Strategy Operational Protocols*. MDBC, Canberra. (35/05).

Murray–Darling Basin Ministerial Council. 2001. *Basin Salinity Management Strategy 2001–2015*. MDBC, Canberra.

Murray–Darling Basin Commission, 2008. *BSMS Mid-Term Review – Final Report*, MDBC Canberra (11/08).

APPENDIX I: EXTRACT FROM THE REPORT OF THE IAG-SALINITY 2007–08

Introduction

In August 2001, the Murray–Darling Basin Ministerial Council (MDBMC) launched the Basin Salinity Management Strategy (BSMS)[1]. In December 2008 the Murray Darling Basin Commission (MDBC) was succeeded by the Murray–Darling Basin Authority (MDBA). Schedule C to the Murray Darling Basin Agreement, which set down the legislative framework for the implementation of the BSMS, became Schedule B to the Murray–Darling Basin Agreement, which is Schedule 1 to the *Water Act 2007* (Commonwealth) (hereafter referred to as Schedule B).

Schedule B provides for the appointment of "independent auditors for the purpose of carrying out an annual audit", whose task is to review progress on implementing the BSMS. The four members of the present Independent Audit Group for Salinity (IAG-Salinity) were appointed in October 2008.

The Terms of Reference for the IAG-Salinity and Schedule B require the IAG-Salinity to review progress on the BSMS both broadly and in terms of the steps laid down in the Schedule. They also require it to focus on the specific measurement and recording of progress with the BSMS, and the outcomes at 30th June each year.

This report presents the consensus view that we have reached in undertaking the Audit covering the year 2007–08. The following summarises the most important of our findings. The main text provides context and the findings and recommendations in detail.

All partner governments and the MDBC submitted reports on their activities, valley reports, the status of 5 year rolling reviews and Salinity Register entries or adjustments.

All Contracting Government annual reports contained the necessary information to make an assessment. The new agreed format with specific reporting on the nine elements of the BSMS was most helpful.

The audit process adopted by the IAG-Salinity included review of these reports, together with the report of the Mid-Term Review (MTR) and the Salinity Registers and their supporting documentation. This was followed by meetings with representatives of the jurisdictions and with members of the MDBC Office. The recommendations and their relative priorities were developed with the involvement of representatives of the State Contracting Governments.

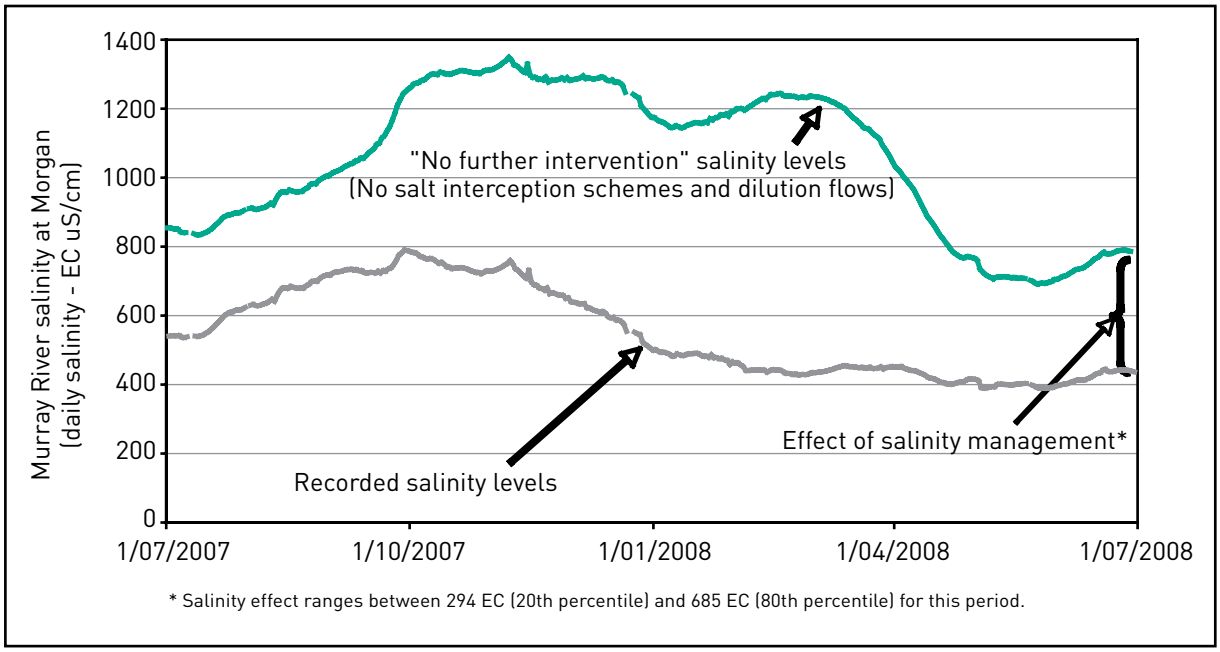
Progress in implementing Schedule B – Items for special mention

Current salinity management in the basin

The IAG-Salinity was impressed with the progress made in reducing saline inflows into the River Murray. During the previous drought, River Murray salinities were much higher than those recorded in the current drought. This can be attributed to both the low salinity water coming from the main storages in the upper catchments and the salt interception schemes protecting this water from regional salinity inflows. These schemes now are operating along a significant length of the River Murray. Figure 1 shows the effect on salinity management in the MDB on salinity at Morgan, based on actual measurements and predicted salinity if management had not occurred. The benefit varied from about 800 EC in February 2008 to about 300 EC in June 2008.

1 Murray–Darling Basin Ministerial Council, 2001. *Basin Salinity Management Strategy 2001–2015,* MDBC, Canberra.

Figure 5: The effect of salinity management in the Murray–Darling Basin. Daily salinity levels – July 2007 to June 2008.



Flood recession salt risk

The IAG-Salinity is very concerned about the potential for a significant rise in salinity levels which are expected to follow the next high river or flood. During the attenuation phase of the flood, saline groundwater will be mobilised and will discharge into the river. There has not been a high river event for 12 years and salt has been accumulating in the flood plain for that time. The sediments underlying irrigation areas have also been accumulating salt. In addition, the Shepparton Irrigation Area has not needed to put any saline drainage water into the river since 1996. It is during and following flood events that these huge salt accumulations are likely to be mobilised.

In every previous Audit, and in the mid-term review of the BSMS, this issue was raised, but there has been little action in assessing the risk and developing a management plan to deal with the expected salinity peaks which may exceed those of the past. While it is acknowledged that resources have been directed into managing the current water shortages, resources are required to prepare management plans for the high salinity risk that is expected to occur following future high flows.

Financial and human resources for BSMS implementation

River salinity, and the area of land affected by salinity, have been held down over the last few years, due both to successful actions taken under the BSMS, and to the drought. The successes of the BSMS are welcome, but they appear to be leading to a sense of complacency. As indicated by the MTR, and by this and previous salinity audit reports, salt is accumulating in the landscape and will re-appear when rainfall increases.

It is for these reasons that management of salt in the catchments will continue to be a key emphasis of the BSMS from 2008 to 2015. Contracting state governments, the Catchment Management Authorities (CMAs), and the salinity research community, are important participants in achieving the goals of the BSMS.

However the reduced funding for the CMAs and for salinity research and development, following the expiry of the National Heritage Trust and the National Action Plan on Salinity and Water Quality means that the salinity related programs are likely to be cut.

The IAG-Salinity urges all Contracting Governments, in setting priorities for resource allocation, to recognise the need for continuing management of salt in the MDB.

Strategies for land based salinity management

During the first phase of the BSMS, the strategies and actions adopted to reduce the mobilisation of salt in the landscape often proved to be ineffective. Recent work suggests that strategies and techniques are available to greatly improve salt management outcomes, and to enable the salinity related actions of the CMAs to be much more cost effective. Important actions in 2008-09 should therefore include a review of landscape salt management strategies and actions for their effectiveness, and the preparation of guidelines for the selection of sites and of remediation measures.

The IAG-Salinity's opinion regarding the balance of salinity credits and debits for each state

Schedule B, Clause 16 (1) provides as follows:

16. (1) A State Contracting Government must take whatever action may be necessary:

(a) to keep the total of any salinity credits in excess of, or equal to, the total of any salinity debits, attributed to it in Register A; and

(b) to keep the cumulative total of all salinity credits in excess of, or equal to, the cumulative total of all salinity debits, attributed to it in both Register A and Register B.

Register A currently shows New South Wales, Victoria and South Australia to be in net credit, while Register B shows New South Wales to be in net credit, with Victoria and South Australia slightly in debit.

In the years 2004–06, most of the entries with low confidence ratings were replaced with data of medium or high confidence rating. The same rate of improvement was not achieved in 2007–08. In the Registers, as provided to us for the 2007–08 audit, only one of the remaining low-confidence entries was upgraded (to high). The others remain unchanged, pending the completion of reviews. Some 20 five year rolling reviews were overdue by mid 2008, but most of these are close to completion and are likely to be submitted to the MDBA Office during 2009. This should result in most of the smaller low-confidence entries being upgraded.

The IAG-Salinity continues to be concerned that the reviews needed to finalise the entries for the Mallee 'legacy of history' items in Register B remain unfinished. Current data from extensive airborne electromagnetic surveys are improving the understanding of flood plain processes in this region.

Opinion on Register balances:

The IAG-Salinity has examined the Registers as provided for this audit, and has come to the opinion that NSW, Victoria and SA are in a net credit position.

When Register items that are currently provisional are included in the Register totals, and if a decision is made to harmonise the method of calculation of Register B salinity with the method used for all other entries, as the IAG-Salinity recommends, some states may no longer be in credit.

The accuracy of the Commission in maintaining the Salinity Registers

In 2007–08, the MDBC made excellent progress in upgrading its systems to ensure secure record keeping, to compile a full record of the processes and decisions leading to the making of the entries, and to maintain and improve the Registers themselves.

Opinion on the Commission's accuracy in maintaining the Registers:

The IAG-Salinity found no inaccuracies in the Commission's maintenance of the Registers, as provided for incorporation into this report.

Updating the Commission's Salinity Registers

The Audit did not identify any requirement to update individual entries in the Registers incorporated in this report, aside from the matters referred to above and in the main body of this report.

Recommendations

The following are the recommendations of the IAG Salinity, given in three groups – very high, high and normal priority. Within the very high priority group (coloured purple below), the recommendations are in descending order. Recommendations 8 to 13 are high priority.

The IAG-Salinity recommends:

Very high priority:

1. ***Flood recession salt risks:*** That the MDBA Office urgently facilitate development of a conceptual model of flood recession salt mobilisation in the floodplains and operational response management plans in preparation for the next high flow event.
2. ***Financial and human resources for BSMS implementation:*** That all Contracting Governments recognise the importance of continuing to manage salinity in the MDB, the gains that have been made, and the threats that still exist; and that they continue their investment following the conclusion of the NHT and NAP for Salinity and Water Quality.
3. ***Strategies for land based salinity management:*** That the MDBA facilitate a review of strategies and actions to reduce the mobilisation of salt in the landscape, and the strategies be assessed for their effectiveness using an evidence based approach, and that guidelines be prepared to assist catchment management organisations and state and ACT jurisdictions in the selection of sites and remediation methods with the best prospects of success.
4. ***Salinity targets below Morgan:*** That salinity targets below Morgan be provided to protect the significant assets and populations that may be affected by high salinity below Morgan. These targets should include targets set to aid real time operations, as peaks in salinity which can be accommodated in the current Morgan target may be unacceptably high for critical human needs or for agricultural and ecological requirements.
5. ***Water management futures for climate change and salt:*** That a single set of scenarios be developed by the MDBA, and used to model the effects of climate change consistently across a number of issues including salinity.
6. ***End-of-valley salinity-flow interpretations/Salinity hot spots:*** That further use be made of the end-of-valley target monitoring data to identify in-valley processes operating with changed flow conditions that, in combination with within-valley targets, can identify salinity 'hot spots' for management intervention. The BSMS MDBA Office should work with the BSMS IWG to develop appropriate techniques for data interpretation.
7. ***Finalising Register entries currently with low confidence ratings:*** That the work be completed to finalise the remaining large entries in the Salinity Registers that currently have low confidence ratings. This includes for Register B the "SA Mallee Legacy of History – Irrigation", and the shared "NSW and Victoria Mallee Legacy of History" entries. Model development is under way and this should be completed, accredited and applied. The South Australian entries in Register A "Improved Irrigation Efficiency" and "Irrigation Scheme Rehabilitation" should be split between Registers A and B.

High priority

8. ***Living with salinity:*** That research and development associated with the concept of "Living with salt" be encouraged so that enterprises that can use the large quantities of moderately saline ground and surface water in the Basin can be promoted.
9. ***Within-valley salinity targets:*** That all state and ACT contracting governments develop within-valley complementary targets for catchments with end-of-valley targets where salinity assessed as EC is greater than a decided level, commencing with those where EC increases with increasing flow to identify the processes contributing to the mobilisation of salt.
10. ***Synergies in activities and funding:*** That criteria for assessing projects submitted to the Australian Government from areas within the Murray–Darling Basin should include an assessment of the alignment with strategies and desired outcomes of the MDBA, in order to achieve synergies and efficiencies and adopt the most recent scientific advances.
11. ***Alignment of BSMS with catchment plans:*** That NSW seek closer alignment between BSMS obligations and regional Catchment Action Plans with a transparent role for Catchment Management Authorities in meeting targets particularly for catchments with end-of-valley targets through the development of within-valley targets, and that the CMAs be supported in upgrading data management and reporting.
12. ***Market-based instruments (MBI):*** That to fulfil the promise of MBI to provide an incentive-based environment that may aid in irrigator and district accountability, and further improve salinity management, the investigation of market based approaches be continued, following up on work started in 2007–08 in South Australia.
13. ***Flood and high flow SIS operational rules:*** That MDBA Office undertake a review of salt interception scheme operational rules during high flow events and flood events to determine the feasibility of operating groundwater pumps continuously during such events.

Normal priority:

14. ***Assessment of uncertainty in Register entries:*** That BSMS modellers routinely assess the uncertainty in Salinity Effect Register entries by repeating the MSM-BIGMOD runs for new items for upper and lower estimates of error bounds. The resulting EC range for the Morgan 30-year average should be recorded as an additional entry in the Confidence column in the Registers.
15. ***Harmonisations of methods of calculating entries in the Salinity Registers:*** That the MDBA Office conduct a trial to harmonise Register A and B calculation methods and assess whether any jurisdictions might be disadvantaged or treated inequitably should a common currency be adopted for the Salinity Registers.
16. ***Salinity Registers and targets for Queensland:*** That Queensland provide a timetable for completion of the blank entries in the Salinity Registers. If required, salinity flow relationships may need to be reassessed and the impacts remodelled given the recent flood flow events. The setting of within-valley targets should be considered particularly for catchments with saline groundwater or significant dryland salinity potential or future coal-seam gas water disposal.
17. ***Salinity implications of coal-seam gas production in Queensland:*** That further development of the Queensland Coal-Seam Gas Water Management Policy deal effectively with the impacts of disposal options for saline water produced in coal-seam gas operations, to minimise any impacts on MDB resources, salinity targets and obligations under the Water Act (2007).

Determination of priorities

The recommendations in this report were arrived at through a review of the reports of the jurisdictions, the BSMS Mid-Term Review (MTR) report, annual BSMS implementation reports, and past IAG-Salinity reports, followed by discussion with representatives of the jurisdictions and the CMAs (where present). In each meeting, representatives were asked to indicate their priorities among the four or five recommendations that were proposed for their jurisdiction, and a consensus was reached. The priorities as seen by each of the states regarding the recommendations that most affect them, are summarised in Table 1.

Table 10: Priorities of recommendations as seen by the individual states

	NSW	Victoria	Queensland	SA
Priority 1	Strategies for land based salinity management	Flood recession salt risks	Financial and human resources	Salinity target(s) below Morgan
Priority 2	Financial and human resources	Financial and human resources	Strategies for land based salinity management	Flood recession salt risks
Priority 3	Water management futures for climate change & salt	Water management futures for climate change & salt	Salinity registers and targets for Queensland	Financial and human resources
Priority 4	Alignment of BSMS with catchment plans	Strategies for land based salinity management	Salinity implications of coal-seam gas production	Finalising Register entries
Priority 5				Market based instruments

The priorities given in the listing of the 17 recommendations are the views of the IAG-Salinity based on the views of the states, the IAG-Salinity's own views of the current challenges of the BSMS, and the IAG-Salinity's assessment of level of risk and scale of consequences if action is not taken or is delayed. All of the first five priority recommendations of the IAG-Salinity (above) also appeared as the first or second recommendations by one or more states. Rationales for the allocation of high priorities to these are:

Flood recession salt risks: This represents the most serious risk in the basin, in terms of threats to agriculture, human population, ecosystems and industry in the mid and lower river. It will remain so unless this recommendation is acted on. This risk was identified, and the same recommendation was made, in the MTR report, and in every one of the IAG-Salinity's five previous annual reports.

Financial and human resources: Failure to follow the now expired NAP and NHT programs with new funding mechanisms that recognise salinity as a major national and basin wide challenge, could spell a significant reduction of CMA-implemented programs aimed at diminishing and preventing dryland salinity, and in-river salinity programs such as salt interception works.

Strategies for land based salinity management: Traditional approaches to control of land salinisation have not worked. The MTR pointed out that this is a major area of the BSMS but little real progress has been made. A reformed approach, through new and/or upgraded strategies, holds promise to achieve greater effectiveness.

Salinity target(s) below Morgan: This recommendation is an important step towards real time management of the two risks of high salinity in the lower river: flood recession risks, and the risk of salt accumulation below Lock 1 under continuing drought conditions.

Water management futures for climate change and salt: Modelling to evaluate risk and development scenarios at basin scale, including changes in water use, climate change, drought, and salt storage and transport, will provide essential tools for the development of a truly useful Basin Plan.

Recommendations of Previous IAG-Salinity Reports

Important past recommendations not included above, or not already implemented, are:

Long term increase in salinity due to growth of new irrigation in SA

Recommendation: *That SA consider supplementing its Salinity Zoning Policy with measures to contain the high growth in saline inflows that will arrive later this century (IAG-Salinity 2006–07 report, page ix).*

South Australia has assessed new groundwater modelling results on this issue. This work is at a preliminary stage. Early indications are that previous assessments of year 2050 and 2100 salt inflows using SIMRAT may be over estimated. Before considering further action, South Australia will complete its development of groundwater models, and submit them for the required review processes. It will use them, in conjunction with the MDBA and in consultation with the BSMS IWG, to obtain the most reliable estimates of the long term salinity increases that would result from existing and possible future irrigation development. The IAG-Salinity agrees with this approach.

Salinity Impact Zoning

Recommendation: *That NSW establish a salinity impact zoning policy for Sunraysia, that Victoria consider extending its zoned areas upstream. SA, Vic and NSW cooperate so zoning policies are consistent. (IAG-Salinity 2006–07 report, page xii).*

NSW has commenced preparing groundwater models, which when completed would provide a sound analytical framework for establishing a salinity impact zoning system. The merits of such a system would then be evaluated. Victoria has under consideration the possible extension of its zoned areas. Representatives of the three states have met to compare notes on approaches to the control of the siting of new irrigation.

APPENDIX II: BSMS SALINITY REGISTERS 2007–08 – 7 NOVEMBER 2008

The BSMS Salinity Registers 2007–08 show individual Accountable Actions as credits and debits and are expressed both in EC impacts and cost effects (in dollars).

Register A records actions that increase or decrease salinity at Morgan. Increases are recorded as debits (in red). Examples of action that may result in a debit include irrigation developments, construction of irrigation drains, and wetland flushing. Decreases are recorded as credits (in black) and are obtained by such activities as investment in salt interception schemes.

Register B shows the debit for delayed salinity impacts, where actions taken before the Baseline date (1 January 1988 for SA, VIC and NSW; 1 January 2000 for QLD) were not apparent until after 1 January 2000. Credits can be obtained by in-valley activities which will help to achieve the BSMS end-of-valley salinity targets for individual catchments.

Explanation of Salinity Registers Lines and Headings

Joint works and measures

The first line of the table summarises the economic benefits in the river arising from joint works and measures. Joint Works and Measures refer to salt interception schemes constructed as part of the 1988 Salinity and Drainage Strategy and those under the current BSMS. The Registers demonstrate the benefits of the shared schemes between the investing states. The Australian Government provides significant financial input to the schemes which is reflected in the right hand side column showing a salinity benefit equivalent to this contribution. A proportion of credits generated by the Joint Works and Measures Program are assigned to individual States to off-set the debits recorded in Register B. In the Registers Summary (Table 4) these Transfers are shown in the "Transfers to Register B" column.

State Shared Works and Measures

Some states have carried out actions such as adopting targeted river operating rules that provide downstream salinity benefits. These benefits are shown as 'shared measures' in the Salinity Registers.

State Actions

The individual state actions reflect the land and water use salinity cost and benefits to the river. Typical examples of activities that increase salinity costs include new irrigation developments and the construction of new drainage schemes that mobilise salt to the river and wetland flushing. Off-setting activities include improved irrigation efficiencies and improved river operations.

Total Registers A and B

The overall cumulative accountability for salinity impacts on the river in 2006-07 is summarised in the lines termed Total Register A and Register B. Register A maintains accountability for actions arising after 1 Jan 1988 for NSW, Vic and SA, and 1 Jan 2000 for Qld. The total for Register A reflects the sum of the salinity cost of the state actions offset by joint works and measures or shared works and measures shown in the preceding lines. Register B accounts for actions that occurred before the above dates but where the impacts were not experienced until after the year 2000 because of the slow movement of groundwater to the river.

Balance Register A & B

The Register balance provides an overall assessment of whether each Basin partner is in net credit or debit. Assessment of this balance needs to be considered in light of different levels of confidence in individual Register entries, and different methodologies used to calculate the A and B Registers.

	COMMISSION REGISTER A (Accountable Actions)	Type	Date Effective	Provisional Salinity Credit ($m/yr)	Current Impact on Morgan 95%ile Salinity (EC)	Impact on Flow at Mouth (GL/y)	Salinity Effect (EC at Morgan)				
							Modelled Current Conditions	2000	2015	2050	2100
	JOINT WORKS & MEASURES										
	Former Salinity & Drainage Works										
1	Woolpunda SIS	SDS	Jan 1991		-87	0	-47.4	-47.4	-47.4	-47.4	-47.4
2	Improved Buronga and Mildura/Merbein IS	SDS	Jan 1991		-6	0	-3.0	-3.0	-3.0	-3.0	-3.0
3	New Operating Rules for Barr Creek Pumps	SDS	Jul 1991		-8	0	-4.9	-4.9	-4.9	-4.9	-4.9
4	Waikerie Interception Scheme	SDS	Dec 1992		-19	0	-12.8	-12.8	-12.8	-12.8	-12.8
5	Changed MDBC River Operations 1988 to 2000	SDS	Apr 1993		-1	4	-1.6	-1.6	-1.6	-1.6	-1.6
6	Mallee Cliffs Salt Interception Scheme	SDS	Jul 1994		-21	0	-13.3	-13.3	-13.3	-13.3	-13.3
7	Changed Operation of Menindee and Lower Darling	SDS	Nov 1997		3	8	0.9	0.9	0.9	0.9	0.9
8	Waikerie SIS Phase 2A	SDS	Feb 2002		-14	0	-8.2	-8.1	-8.3	-10.8	-9.0
9	Changed MDBC River Operations 2000 to 2002	SDS	Feb 2002		0	-1	-1.4	-1.2	-1.6	-1.9	-2.4
	Sub Total - Former Salinity & Drainage Works				**-152**	**11**	**-91.8**	**-91.5**	**-92.1**	**-94.9**	**-93.6**
	Basin Salinity Management Strategy										
10	Changed MDBC River Operations after 2002	BSMS	Dec 2003		2	7	-0.2	-0.2	-0.2	-0.2	-0.3
11	Pyramid Ck Stage 1	BSMS	Mar 2006		-2	0	-1.1	-1.1	-1.2	-1.1	-1.1
12	Bookpurnong Joint Salt Interception Scheme	BSMS	Mar 2006		-20	0	-11.9	-11.9	-11.9	-11.4	-11.5
13	Improved Buronga Scheme	BSMS	Mar 2006		-1	0	-0.6	-0.5	-0.6	-0.6	-0.5
14	Loxton SIS	BSMS	Jun 2008		-12	0	-7.6	-6.8	-8.3	-8.7	-9.5
	Sub Total Joint Works under BSMS				**-34**	**7**	**-21.4**	**-20.6**	**-22.1**	**-22.0**	**-22.9**
	Joint Works Sub Total				**-186**	**18**	**-113.2**	**-112.1**	**-114.2**	**-116.9**	**-116.5**
	STATE WORKS & MEASURES										
	Shared New South Wales and Victorian Measures										
15	Permanent Trade Accounting Adjustment - NSW to Victoria	50N50V	Jun 2006		0	0	-0.0	-0.0	-0.1	-0.1	-0.1
16	Barmah-Millewa Forest Operating Rules	50N50V	Mar 2002		-2	33	-2.2	-1.8	-2.5	-3.1	-3.8
	Shared Measures Sub Total				**-2**	**33**	**-2.2**	**-1.8**	**-2.6**	**-3.2**	**-3.9**
	New South Wales										
17	Boggabilla Weir	NSW	Dec 1991		1	0	-0.1	-0.1	-0.1	-0.1	-0.1
18	Pindari Dam Enlargement	NSW	Jul 1994		0	-17	0.7	0.7	0.7	0.7	0.7
19	Tandou pumps from Lower Darling	NSW	Sep 1994		2	-3	-0.1	-0.1	-0.1	-0.1	-0.1
20	NSW MIL LWMP's	NSW	Feb 1996	0.684	-4	57	-4.0	-4.0	-4.0	-4.0	-4.0
21	NSW Changes to Edward-Wakool and Escapes	NSW	Jan 1990		-1	4	-2.0	-2.0	-2.1	-2.1	-2.1
22	Permanent Trade Accounting Adjustment - NSW to SA	NSW	Jun 2006		-2	1	-0.5	-0.5	-0.5	-0.5	-0.5
23	NSW Sunraysia Irrigation Development 1997-2006	NSW	Jul 2003		1	0	0.5	0.0	0.9	4.5	6.1
24	NSW S&DS Commitment Adjustment	NSW	Nov 2002		0	0	0.0	0.0	0.0	0.0	0.0
	New South Wales Works and Measures				**-4**	**43**	**-5.6**	**-6.0**	**-5.2**	**-1.6**	**-0.1**
	Victoria										
25	Barr Creek Catchment Strategy	Vic	Mar 1991		-12	0	-7.7	-7.7	-7.7	-7.7	-7.7
26	Tragowel Plains Drains at 2002 level	Vic	Mar 1991		1	1	0.2	0.2	0.2	0.2	0.2
27	Shepparton Salinity Management Plan	Vic	Mar 1991		1	27	2.3	2.3	2.3	2.3	2.3
28	Nangiloc-Coligan S.M.P.	Vic	Nov 1991		3	2	1.1	1.1	1.1	1.1	1.1
29	Nyah to SA Border SMP - Irrigation Development	Vic	Jul 2003		12	0	6.8	6.8	6.8	6.7	6.8
30	Kerang Lakes/Swan Hill Salinity Management Plan	Vic	Jan 2000		1	4	1.4	1.1	1.6	0.9	1.2
31	Campaspe West Salinity Management Plan	Vic	Aug 1993		0	0	0.5	0.5	0.5	0.5	0.5
32	Psyche Bend	50V50C	Feb 1996		-4	0	-2.1	-2.1	-2.1	-2.1	-2.1
33	Permanent Trade Accounting Adjustment - Victoria to SA	Vic	Jun 2006		1	2	-0.7	-0.7	-0.7	-0.9	-1.1
34	Woorinen Irrigation District Excision	Vic	Sep 2003		-2	0	1.4	1.6	1.2	1.4	1.6
35	Sunraysia Drains Drying up	Vic	Jun 2004		-4	-4	-2.1	-2.2	-2.1	-1.9	-1.8
36	Lamberts Swamp	Vic	Jun 2004		-7	0	-3.0	-3.0	-2.9	-2.9	-3.0
37	Church's Cut decommissioning	Vic	Mar 2006		0	0	-0.2	-0.2	-0.1	-0.1	-0.2
38	Mallee Drainage bore decommissioning	Vic	Jun 2008		-1	0	-0.2	-0.1	-0.3	-0.3	-0.3
39	Victorian S&DS Commitment Adjustment	Vic	Nov 2002		0	0	0.0	0.0	0.0	0.0	0.0
	Victoria Works and Measures				**-10**	**31**	**-2.3**	**-2.3**	**-2.3**	**-2.9**	**-2.5**
	South Australia										
40	SA Irrigation Development 1988 to 2008	SA	Jul 2003		4	0	1.8	0.0	3.4	36.4	76.5
41	SA Component of Bookpurnong Scheme	SANAP	Jul 2003		-3	0	-1.3	2.5	-4.5	-11.8	-12.5
42	SA Component of Loxton Scheme	SA		TBA							
43	SA Improved Irrigation Efficiency	SA	Jan 2000		-79	0	-43.2	-25.3	-58.9	-102.1	-117.4
44	SA Irrigation Scheme Rehabilitation	SA	Jan 2000		-2	0	-1.2	0.3	-2.6	-5.7	-6.7
45	Qualco Sunlands GWCS	SA	Sep 2004		-4	0	-3.0	-1.8	-4.0	-6.5	-7.5
46	Irrigation Development behind Bookpurnong SIS	SA	Jul 2003		3	0	1.3	-2.5	4.5	11.8	12.5
47	Irrigation Development behind Loxton SIS	SA		TBA							
	South Australia Subtotal				**-81**	**0**	**-45.6**	**-26.7**	**-62.0**	**-77.9**	**-55.0**
	Queensland										
48	Land Clearing Post 2000	Qld	Jul 2005	TBA							
49	Irrigation Development Post 2001	Qld	Jul 2005	TBA							
	Queensland Subtotal				**0**	**0**					
	Balance - Register A				**-284**	**125**	**-168.9**	**-148.9**	**-186.3**	**-202.4**	**-178.0**
							Factors for allocating transferred credits to Register B				

	Salinity Credits (30 Year Average Benefits $m/year)							Common-wealth Contribu-tion (EC)	5 Year Rolling Review			Confidence	
30 Year Average	NSW	Vic	SA	Qld	ACT	Total			Latest Review		Status	Rating	Comment
-47.4	0.729	0.729				3.890	1	11.8	2007	2012		High	Based on Salt loads in river
-3.0	0.140	0.140				0.748	2	0.8	2005	2010		Medium	Based on Salt loads in river
-4.9	0.225	0.225				1.198	3	1.2	2005	2010		High	Rules need to be revisited 2007
-12.8	0.198	0.198				1.057	4	3.2	2007	2012		High	Based on Salt loads in river
-1.6	0.150	0.150				0.797	5	0.4	2005	2010		High	
-13.3	0.603	0.603				3.216	6	3.3	2005	2010		Medium	Little pre-scheme data
0.9	-0.146	-0.146				-0.776	7	-0.2	2005	2010		Medium	
-8.9	0.122	0.122				0.649	8	2.2	2007	2012		High	
-1.6	-0.098	-0.098				-0.521	9	0.4	2006	2011		High	
-92.8	**1.923**	**1.923**	**0.000**	**0.000**	**0.000**	**10.257**		**23.2**					
-0.2	0.021	0.021	0.021			0.125	10	0.1	2005	2010		High	
-1.1	0.063	0.063	0.063			0.384	11	0.3	2005	2010		High	Remodelled 2006
-11.8	0.208	0.208	0.208			1.268	12	2.9	2006	2011		Low	Salt load continue to rise with scheme in
-0.6	0.023	0.023	0.023			0.138	13	0.1	2006	2011		High	Remodelled 2006
-8.3	0.148	0.148	0.148			0.905	14	2.1				High	Constant salt loads to floodplain
-22.0	**0.462**	**0.462**	**0.462**	**0.000**	**0.000**	**2.820**		5.5					
-114.8	**2.386**	**2.386**	**0.462**	**0.000**	**0.000**	**13.078**		28.7					
-0.1	0.011	0.011				0.023	15	0.0	2006	2011		High	Trade figures updated annually (2006)
-2.7	0.207	0.207				0.414	16	0.0	2006	2011		High	
-2.7	**0.218**	**0.218**	**0.000**	**0.000**	**0.000**	**0.436**		0.0					
-0.1	0.024					0.024	17	0.0	2007	2012		Medium	
0.7	-0.121					-0.121	18	0.0	2007	2012		Medium	
-0.1	0.034					0.034	19	0.0	2005	2010		Medium	
-4.0							20	0.0	2000	2005	In Progress	Low	Model review initiated
-2.1	0.371					0.371	21	0.0	2005	2010		High	
-0.5	0.119					0.119	22	0.0	2005	2010		High	Trade figures updated annualy (2006)
1.8	-0.482					-0.482	23	0.0	2007	2012		High	2006 analysis
0.0	0.910					0.910	24	0.0					
-4.3	**0.856**					**0.856**		0.0					
-7.7		1.963				1.963	25	0.0	2006	2011		High	Reviewed 2006
0.2		-0.022				-0.022	26	0.0	2006	2011		High	Reviewed 2006
2.3		-0.581				-0.581	27	0.0	2006	2011		Low	Only Updated to 2004 - No Drying up of drains
1.1		-0.293				-0.293	28	0.0	2002	2007	In Progress	Medium	Updated estimates provided 2006
6.8		-1.794				-1.794	29	0.0	2002	2007	In Progress	High	Data updated 2007
1.4		-0.388				-0.388	30	0.0	2003	2008	In Progress	High	Remodelled 2006
0.5		-0.128				-0.128	31	0.0	2002	2007	In Progress	Low	No work. Salt added to cause 0.5 EC
-2.1		0.237				0.474	32	1.0	2000	2005		Medium	
-0.8		0.162				0.162	33	0.0	2005	2010	-	High	Trade figures updated annualy (2006)
1.3		-0.408				-0.408	34	0.0	2006	2011	-	High	Remodelled 2006
-2.1		0.691				0.691	35	0.0	2003	2008	-	Medium	
-2.9		0.579				0.579	36	0.0	2004	2009	-	High	
-0.1		0.063				0.063	37	0.0				High	14.3% of Pyramid Ck Stage 1 with Church's Cut
-0.3		0.081				0.081	38	0.0				High	Constant salt loads to floodplain
0.0		1.600				1.600	39	0.0					
-2.5		**1.762**				**1.999**		1.0					
11.9			-1.936			-1.936	40	0.0	2003	2008		High	Used SIMRAT figures
-6.1			0.649			0.649	41	**3.1**	2006	2011		High	Remodelled 2006
-68.7			7.856			7.856	43	0.0	2004	2009		Very low	Split between Registers A & B to be reviewed
-3.3			0.346			0.346	44	0.0	2005	2010		Very low	Split between Registers A & B to be reviewed
-4.5			0.307			0.307	45	0.0	2005	2010	In Progress	Medium	Constant salt loads to floodplain
6.1			-0.649			-0.649	46	0.0	2006	2011		Low	Salt loads continue to rise with scheme in
-64.6			**6.573**			**6.573**		3.1					
							48			2007			Low Impact - Long lag times
							49			2007			Modelling required
-188.8	**3.459**	**4.366**	**7.035**	**0.000**	**0.000**	**22.942**		**32.8**					
	0.243	**0.194**	**0.563**	**0.000**	**0.000**								

	COMMISSION REGISTER B (Delayed Salinity Impacts)	Type	Year of Predic-tions	Provi-sional Salinity Credit ($m/yr)	Current Impact on Morgan 95%ile Salinity (EC)	Impact on Flow at Mouth (GL/y)	Salinity Effect (EC at Morgan)				
							Modelled Current Condi-tions	2000	2015	2050	2100
	Transfers from Register A										
	Shared New South Wales and Victoria										
50	Mallee Legacy of History - Dryland	50N50V	Jan 2000	-1.447	9	0	4.8	0.0	8.9	33.2	68.1
51	Mallee Legacy of History - Irrigation	50N50V	Jan 2000	-5.492	38	0	26.4	0.0	49.5	119.6	133.6
	New South Wales										
52	Darling Catchment Legacy of History - Macquarie	NSW	Jan 2000		0	0	0.1	0.0	0.1	0.3	0.4
53	Darling Catchment Legacy of History - Macintyre	NSW	Jan 2000		0	0	0.0	0.0	0.0	0.0	0.0
54	Darling Catchment Legacy of History - Gil Gil Ck	NSW	Jan 2000		0	0	0.0	0.0	0.0	0.0	0.0
55	Darling Catchment Legacy of History - Gwydir	NSW	Jan 2000		0	0	0.0	0.0	0.0	0.0	0.0
56	Darling Catchment Legacy of History - Namoi	NSW	Jan 2000		0	0	0.1	0.0	0.2	0.4	0.5
57	Darling Catchment Legacy of History - Castlereagh	NSW	Jan 2000		0	0	0.0	0.0	0.0	0.0	0.1
58	Darling Catchment Legacy of History - Bogan	NSW	Jan 2000		0	0	0.0	0.0	0.1	0.2	0.3
59	Lachlan Legacy of History	NSW	Jan 2000		0	0	0.0	0.0	0.0	0.0	0.0
60	Murrumbidgee Catchment Legacy of History	NSW	Jan 2000		0	0	0.0	0.0	0.1	0.2	0.2
	Victoria										
61	Campaspe Catchment Legacy of History	Vic	Jan 2000		0	0	0.1	0.0	0.1	0.2	0.3
62	Goulburn Catchment Legacy of History	Vic	Jan 2000		3	0	0.3	0.0	0.6	12.3	12.3
63	Loddon Catchment Legacy of History	Vic	Jan 2000		1	0	0.2	0.0	0.3	4.9	10.0
64	Kiewa Catchment Legacy of History	Vic	Jan 2000		0	0	0.1	0.0	0.1	0.0	0.0
65	Ovens Catchment Legacy of History	Vic	Jan 2000		0	0	0.0	0.0	0.0	0.6	1.3
	South Australia										
66	SA Mallee Legacy of History - Dryland	SA	Jan 2000		6	0	2.0	0.0	3.8	18.5	51.2
67	SA Mallee Legacy of History - Irrigation	SA	Jan 2000		30	0	24.8	-0.4	46.8	87.1	113.0
	Queensland										
68	Queensland Legacy of History	Qld	Jan 2000	TBA							
69	Queensland Irrigation Development pre 1 Jan 2000	Qld	Jan 2000	TBA							
	Balance - Register B			**-6.938**	**87**	**0**	**58.8**	**-0.4**	**110.6**	**277.4**	**391.4**
	Balance - Registers A & B				**-197**	**125**	**-110.1**	**-149.3**	**-75.7**	**75.0**	**213.4**
	Basin Salinity Target (Morgan) - Modelled Current Status				**872**	**4,970**	**555**	**515**	**589**	**740**	**878**

Registers Explanatory Notes

TBA - To be assessed

Salinity Effect - Increase in average salinity at Morgan in EC

Salinity Credits - Unit of account of Salinity and Drainage Strategy = Reduction in Salinity Costs ($m/year March 2005 values)

Register B - Contributions to Morgan salinity in 2005 interpolated from the increase up to 2050

	Salinity Cost Effect ($m)							5 Year Rolling Review			Confidence	
Pro-Rata Effect	NSW	Vic	SA	Qld	ACT	Total		Latest Review		Status	Rating	Comment
	0.349	0.278	0.807	0.000	0.000	1.434						
5.6							50	1999	2004	In progress	Low	To be revised pending current review
20.3							51	1999	2004	In progress	Low	To be revised pending current review
0.0	-0.013					-0.013	52	1999	2004	In Progress	Medium	
0.0	0.000					0.000	53	1999	2004	In Progress	Medium	
0.0	0.000					0.000	54	1999	2004	In Progress	Medium	
0.0	-0.001					-0.001	55	1999	2004	In Progress	Medium	
0.1	-0.018					-0.018	56	1999	2004	In Progress	Medium	
0.0	-0.002					-0.002	57	1999	2004	In Progress	Medium	
0.0	-0.009					-0.009	58	1999	2004	In Progress	Medium	
0.0	0.000					0.000	59	1999	2004	In Progress	Medium	Little connection to Murrumbidgee
0.0	-0.007					-0.007	60	1999	2004	In Progress	Medium	
0.0		-0.007				-0.007	61	2003	2008		Medium	
2.1		-0.522				-0.522	62	2003	2008		Medium	
0.8		-0.241				-0.241	63	2003	2008		Medium	Remodelled 2006
0.0		0.001				0.001	64	2003	2008		Medium	
0.1		-0.026				-0.026	65	2003	2008		Medium	
3.1			-0.413			-0.413	66	2005	2010		Medium	
14.5			-1.733			-1.733	67	1998	2003	In Progress	Very Low	Only part of SA pre 88 irrigation modelled
							68			In Progress		Low Impact - Long lag times
							69					Modelling required
46.8	**0.298**	**-0.517**	**-1.339**	**0.000**	**0.000**	**-1.558**						
-141.9	**3.758**	**3.849**	**5.696**	**0.000**	**0.000**	**21.384**						
523												

APPENDIX III: BASELINE CONDITIONS

The BSMS Baseline Conditions are the agreed suite of conditions in place within the catchments and rivers of the Basin on 1 January 2000 and they incorporate: land use (level of development), water use (level of diversions), land and water management policies and practices, river operating regimes, salt interception schemes, run-off generation and salt mobilisation processes, and groundwater status and conditions.

The Baseline Conditions given below have been set for all four Basin States and a Baseline Conditions is in the process of being established for the ACT.

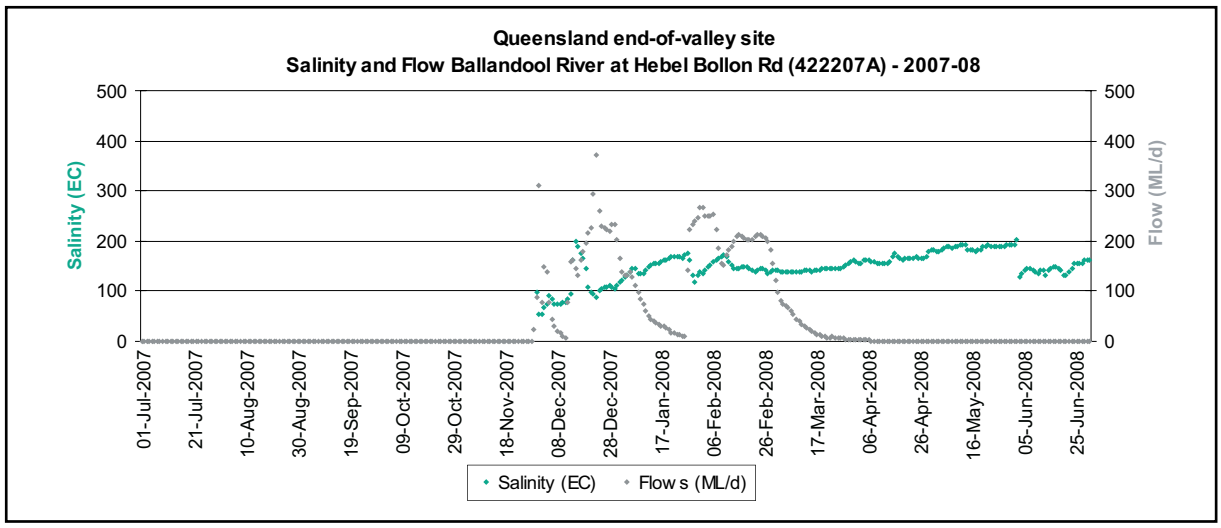
Table 11: BSMS End-of-valley Baseline Conditions

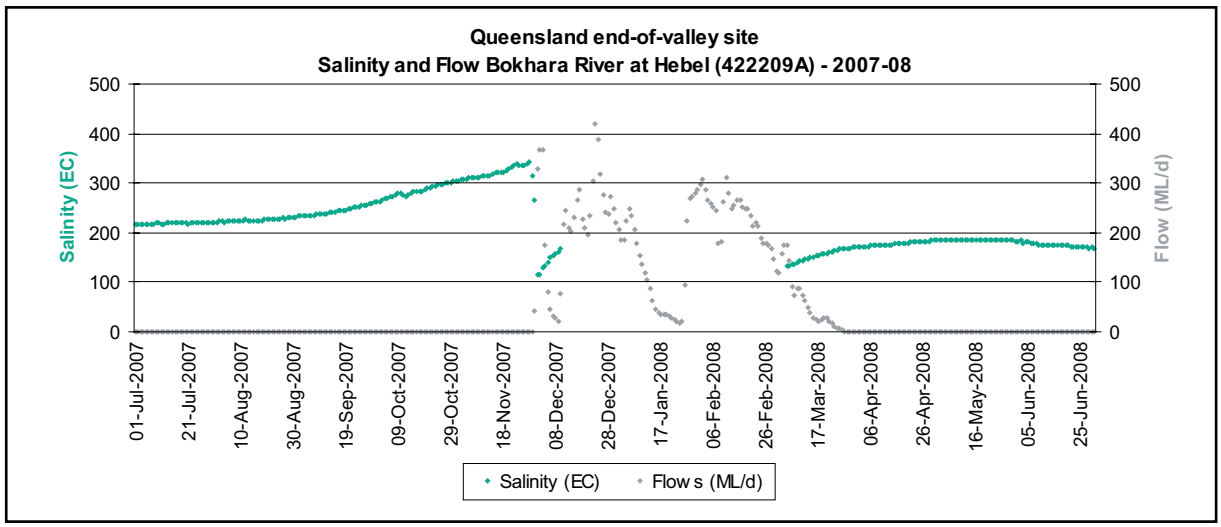
Valley	Salinity (EC µS/cm)		Salt Load (t/yr) Mean	Valley Reporting Site	AWRC Site Number
	Median (50%ile)	Peak (80%ile)			
Victoria					
Vic Upper Murray	*54*	*59*	*150,000*	*Murray R at Heywoods*	*409016*
Kiewa	47	55	19,000	Kiewa R at Bandiana	402205
Ovens	72	100	54,000	Ovens R at Peechelba-East	403241
Broken	100	130	15,000	Broken Ck at Casey's Weir	404217
Goulburn	100	150	166,000	Goulburn R at Goulburn Weir	405259
Campaspe	530	670	54,000	Campaspe R at Campaspe Weir	406218
Loddon	750	1,090	88,000	Loddon R at Laanecoorie	407203
Avoca	2,060	5,290	37,000	Avoca R at Quambatook	408203
Wimmera	1,380	1,720	31,000	Wimmera R at Horsham Weir	415200
Vic Riverine Plains	*270*	*380*	*630,000*	*Murray R at Swan Hill*	*409204*
Vic Mallee Zone	*380*	*470*	*1,300,000*	*Flow to SA*	*426200*
Australian Capital Territory					
ACT	tba	tba	tba	Murrumbidgee R at Hall's Crossing	410777
New South Wales					
NSW Upper Murray	*54*	*59*	*150,000*	*Murray R at Heywoods*	*409016*
Lachlan	430	660	250,000	Lachlan R at Forbes (Cottons Weir)	412004
Murrumbidgee	150	230	160,000	Murrumbidgee R d/s Balranald Weir	410130
NSW Riverine Plains	*310*	*390*	*1,100,000*	*Murray R att Redcliffs*	*414204*
NSW Border Rivers	250	330	50,000	Macintyre R at Mungindi	416001
Gwydir	400	540	7,000	Mehi R at Bronte	418058
Namoi	440	650	110,000	Namoi R at Goangra	419026
Castlereagh	350	390	9,000	Castlereagh R at Gungalman Bridge	420020
Macquarie	480	610	23,000	Macquarie R at Carinda (Bells Bridge)	421012
Bogan	440	490	27,000	Bogan R at Gongolgon	421023
Barwon-Darling	*330*	*440*	*440,000*	*Darling R att Wilcannia Main Channel*	*425008*
NSW Mallee Zone	*380*	*470*	*1,300,000*	*Flow to SA*	*426200*

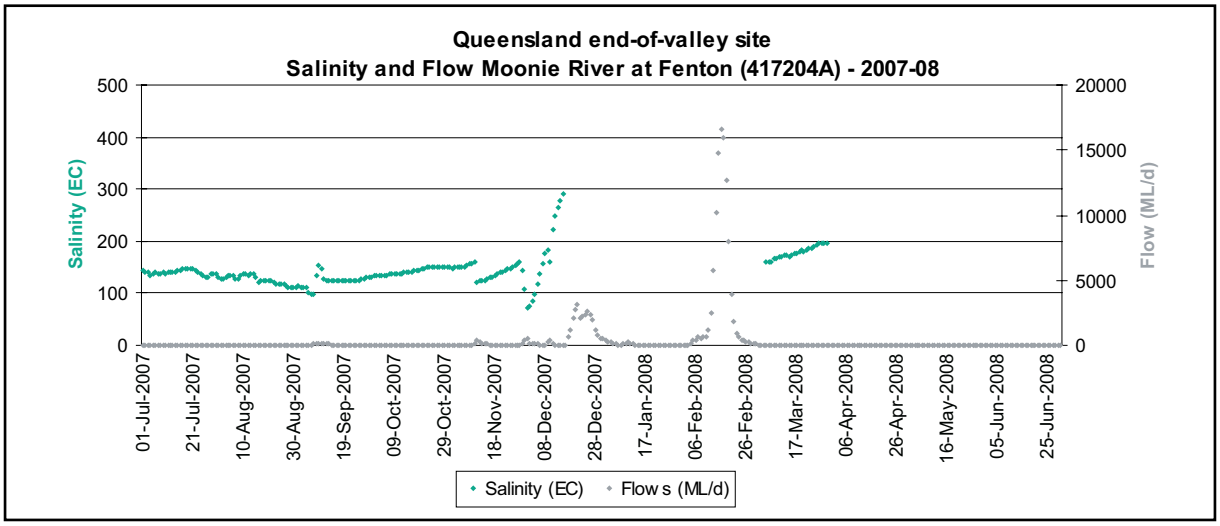
Valley	Salinity (EC µS/cm) Median (50%ile)	Salinity (EC µS/cm) Peak (80%ile)	Salt Load (t/yr) Mean	Valley Reporting Site	AWRC Site Number
Queensland					
Qld Border Rivers	250	330	50,000	Barwon R at Mungindi	416001#
Moonie	140	150	8,700	Moonie R at Fenton	417204A
Condamine-Balonne	160	210	10,000	Narran R at New Angeldool	422030 #
	170	210	5,000	Bohkara R at Hebel	422209A
	170	210	4,200	Ballandool R at Hebel-Bollon Rd	422207A
	150	280	6,500	Briaire Ck at Woolerbilla-Hebel Rd	422211A
	170	210	29,000	Culgoa R at Brenda	422015 #
Warrego	101	110	4,800	Warrego R at Barringun No.2	423004 #
	100	130	5,500	Cuttaburra Ck at Turra	423005 #
Paroo	90	100	24,000	Paroo R at Caiwarro	424201A
South Australia					
SA Border	*380*	*470*	*1,300,000*	*Flow to SA*	*426200*
Lock 6 to Berri	450	600	1,500,000	Murray R at Lock 4 (Flow)	426514
				Berri Pumping Station (Salinity)	426537
Below Morgan	600	820	1,600,000	Murray R at Murray Bridge	426522
All Partner Governments					
Murray–Darling Basin	**570**	**920**	**1,600,000**	**Murray R at Morgan (Salinity)**	**426554**
		(95%ile)		**Murray R at Lock 1 (Flow)**	**426902**

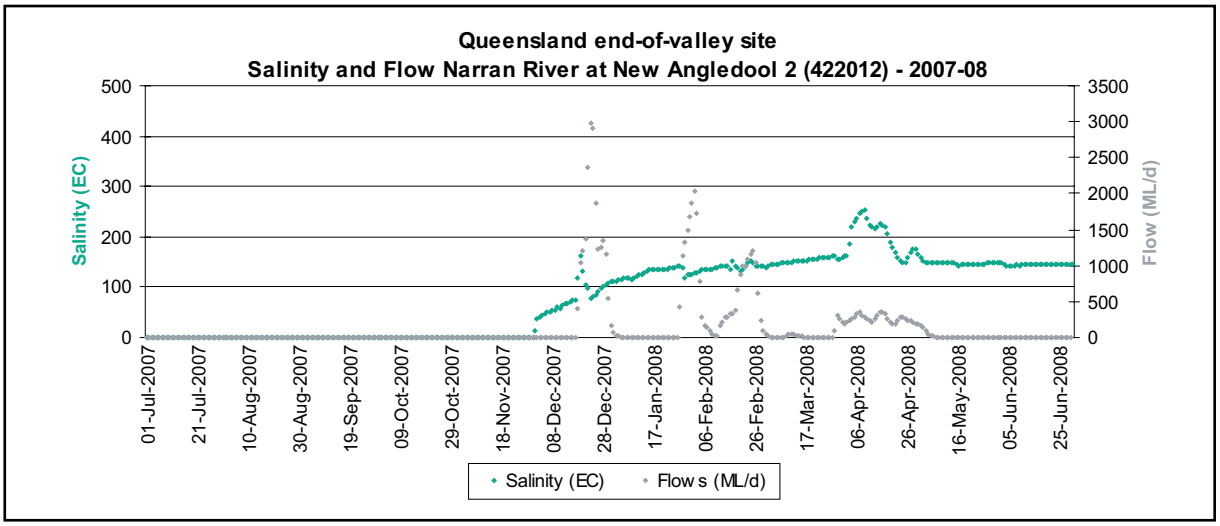
APPENDIX IV: FLOW AND SALINITY DATA FOR END-OF-VALLEY TARGET SITES

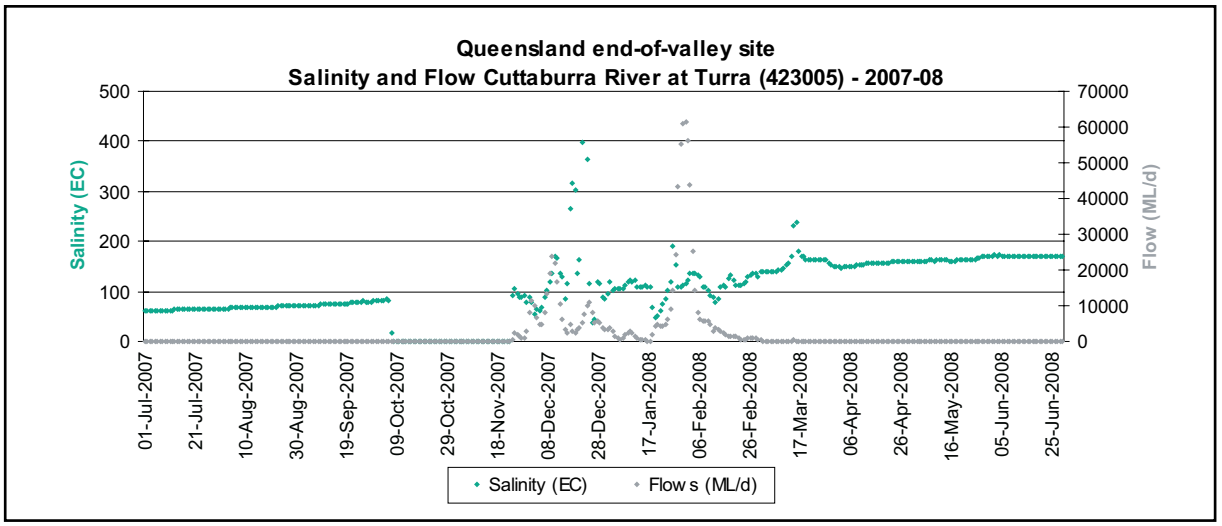
Queensland

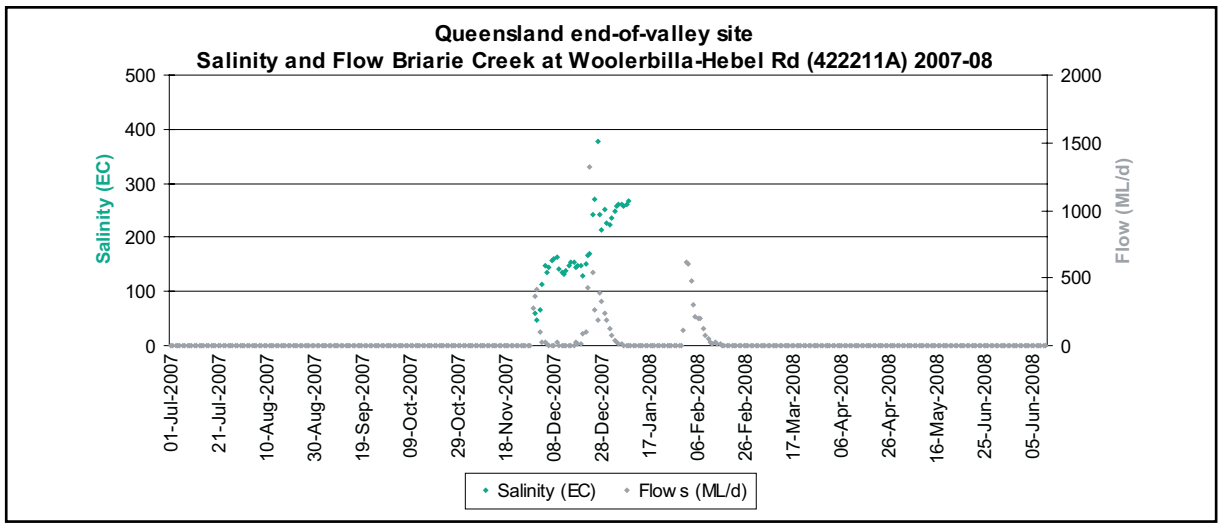


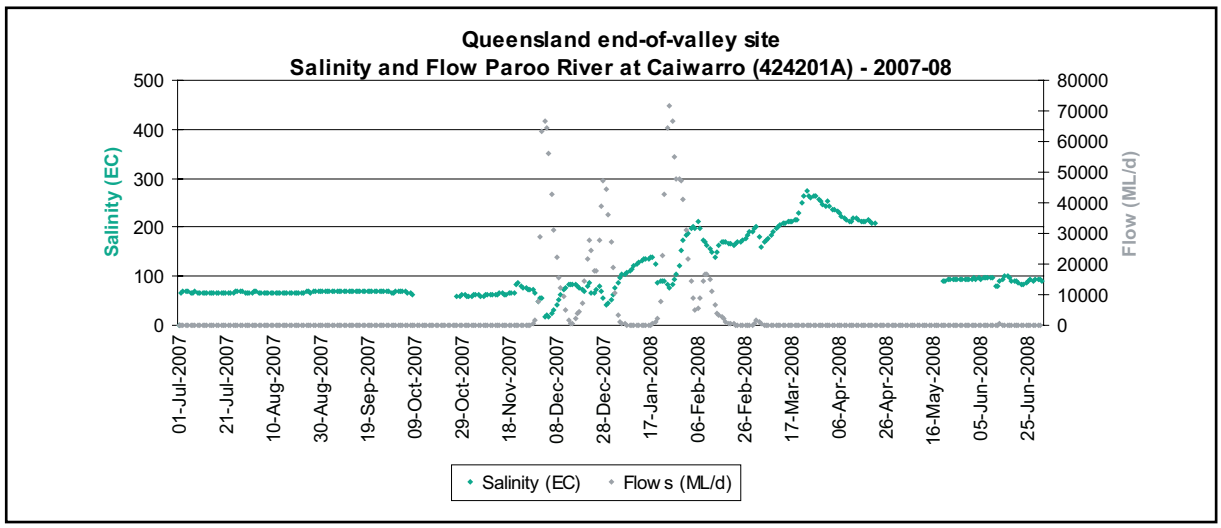


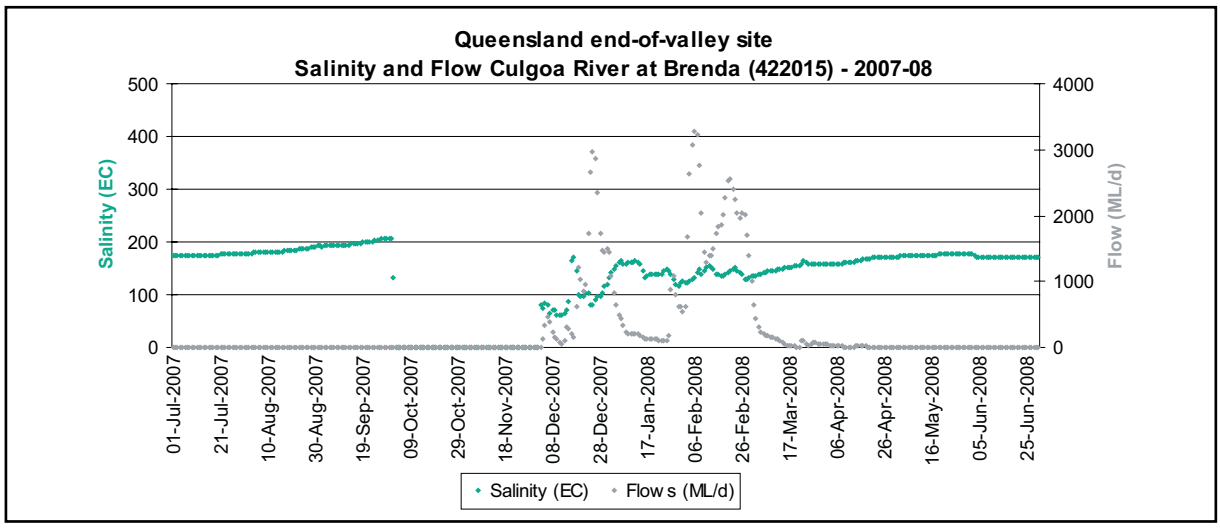

Queensland end-of-valley site
Salinity and Flow Moonie River at Fenton (417204A) - 2007-08
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
20000
15000
10000
5000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

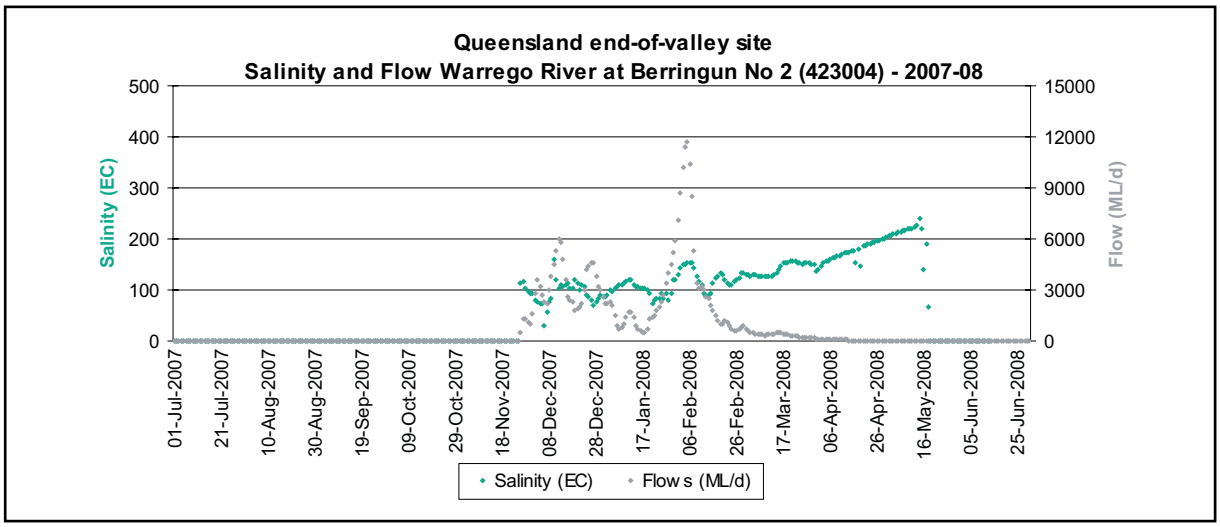

Queensland end-of-valley site
Salinity and Flow Narran River at New Angledool 2 (422012) - 2007-08
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
3500
3000
2500
2000
1500
1000
500
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)


Queensland end-of-valley site
Salinity and Flow Cuttaburra River at Turra (423005) - 2007-08
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
70000
60000
50000
40000
30000
20000
10000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

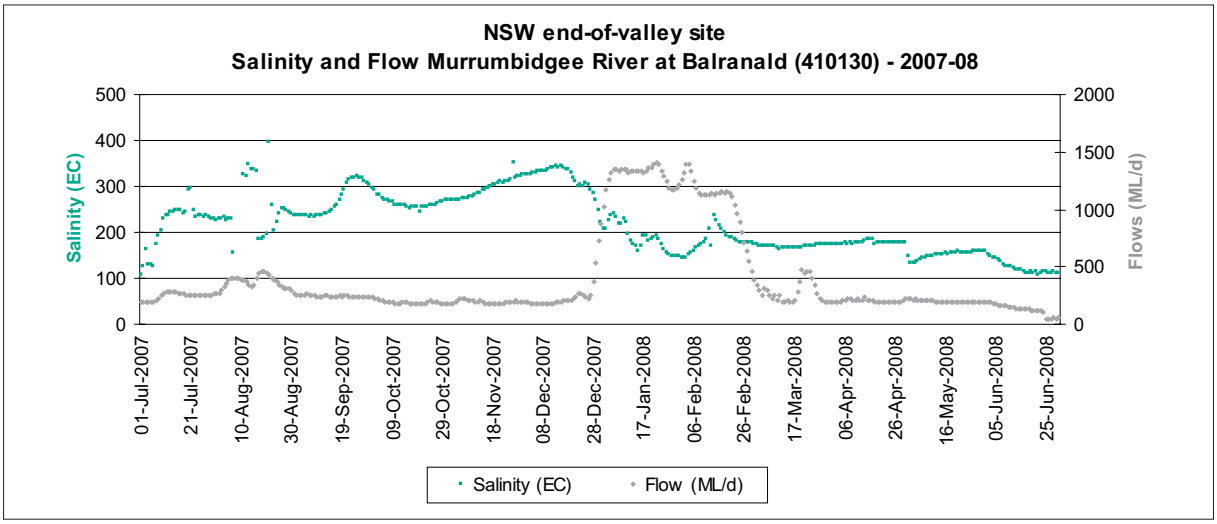

Queensland end-of-valley site
Salinity and Flow Briarie Creek at Woolerbilla-Hebel Rd (422211A) 2007-08
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
2000
1500
1000
500
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
25-Jun-2008
05-Jun-2008
Salinity (EC)
Flow s (ML/d)

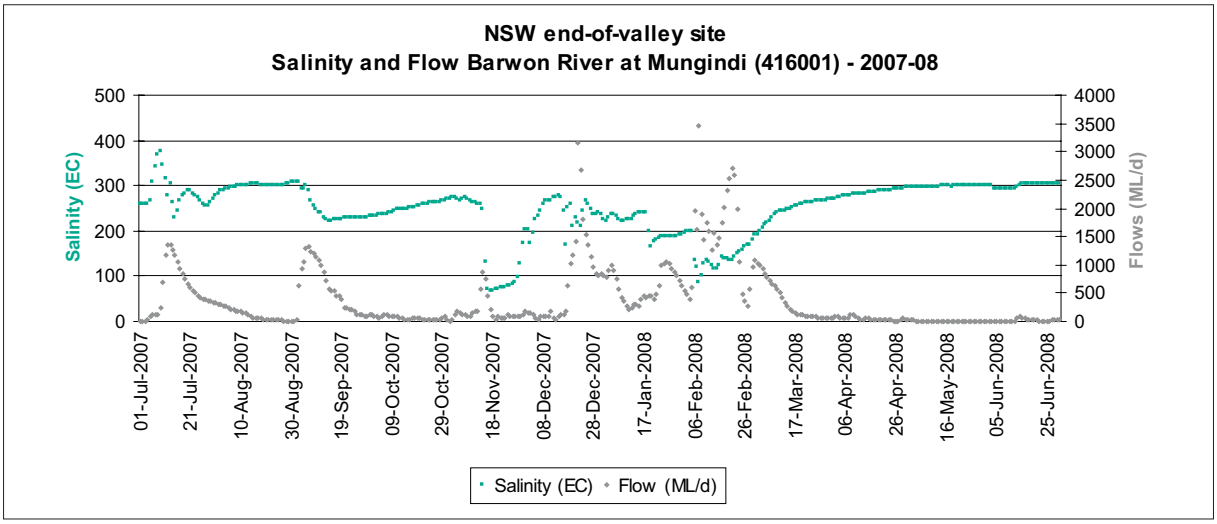

Queensland end-of-valley site
Salinity and Flow Paroo River at Caiwarro (424201A) - 2007-08
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
80000
70000
60000
50000
40000
30000
20000
10000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow s (ML/d)

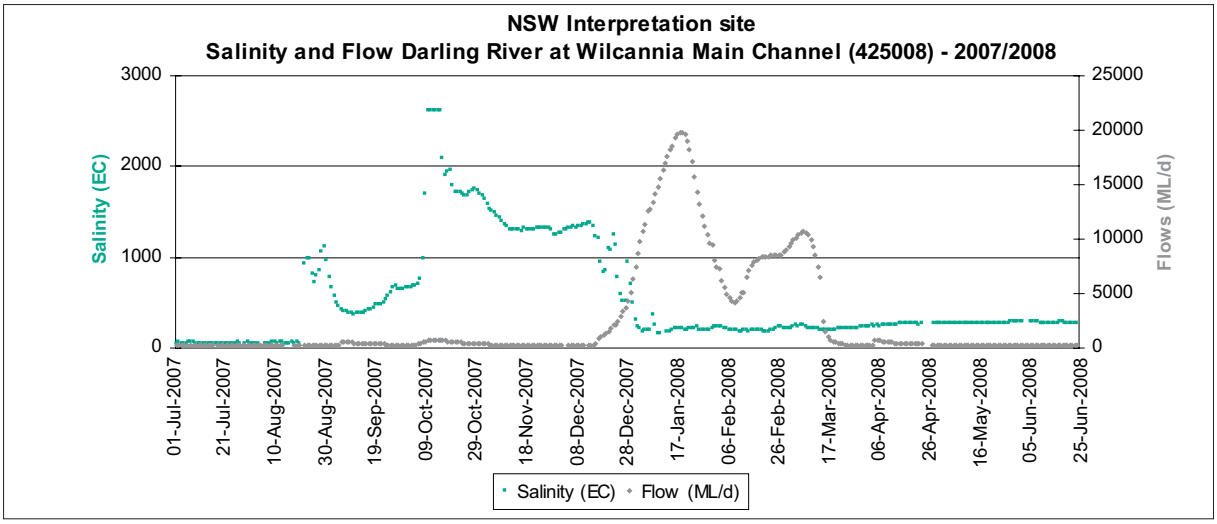

Queensland end-of-valley site
Salinity and Flow Culgoa River at Brenda (422015) - 2007-08
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
4000
3000
2000
1000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow s (ML/d)

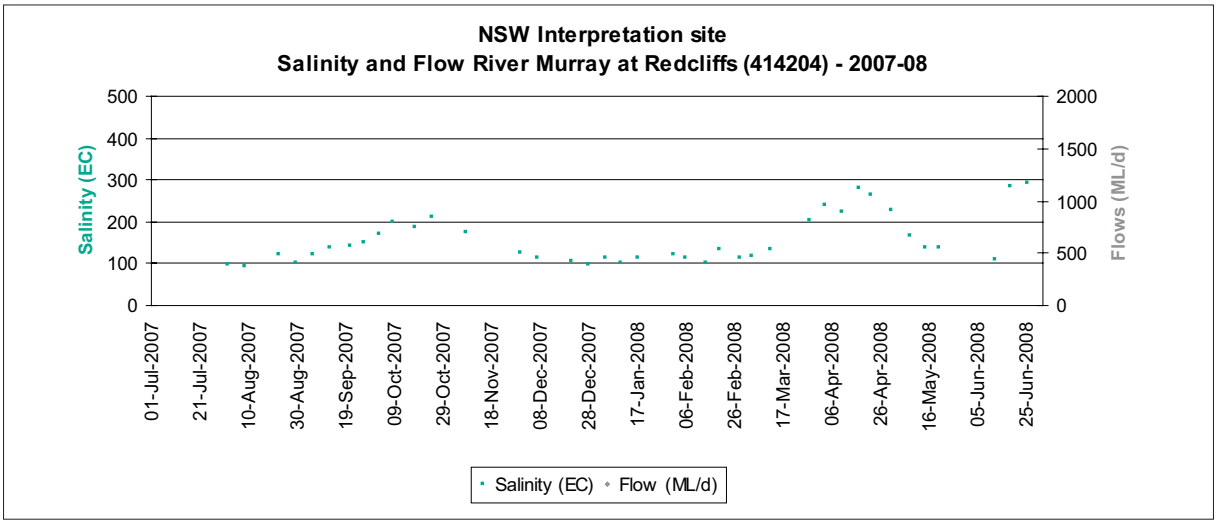

Queensland end-of-valley site
Salinity and Flow Warrego River at Berringun No 2 (423004) - 2007-08
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
15000
12000
9000
6000
3000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow s (ML/d)

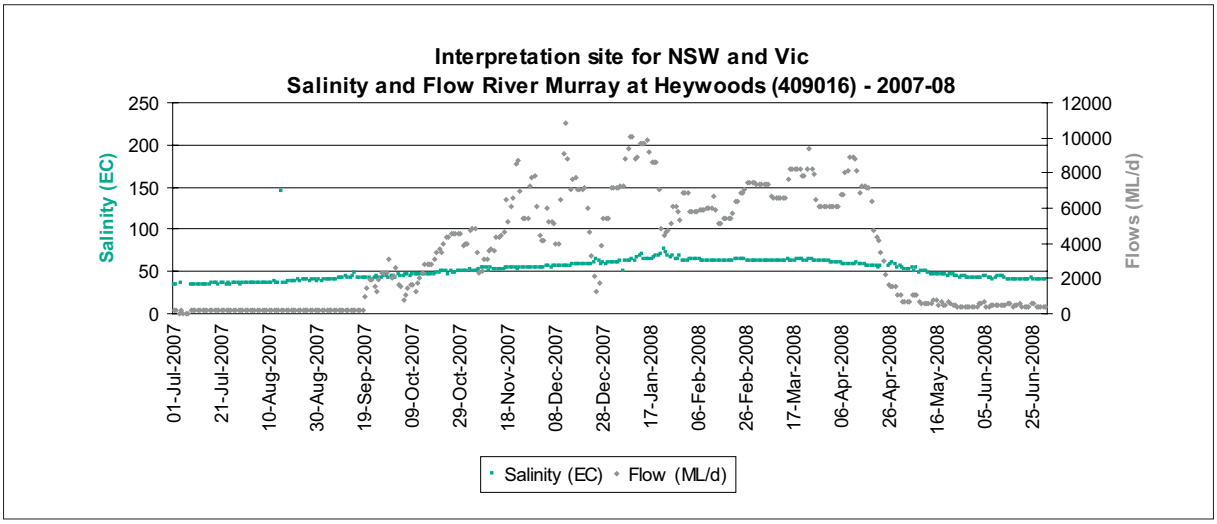
New South Wales

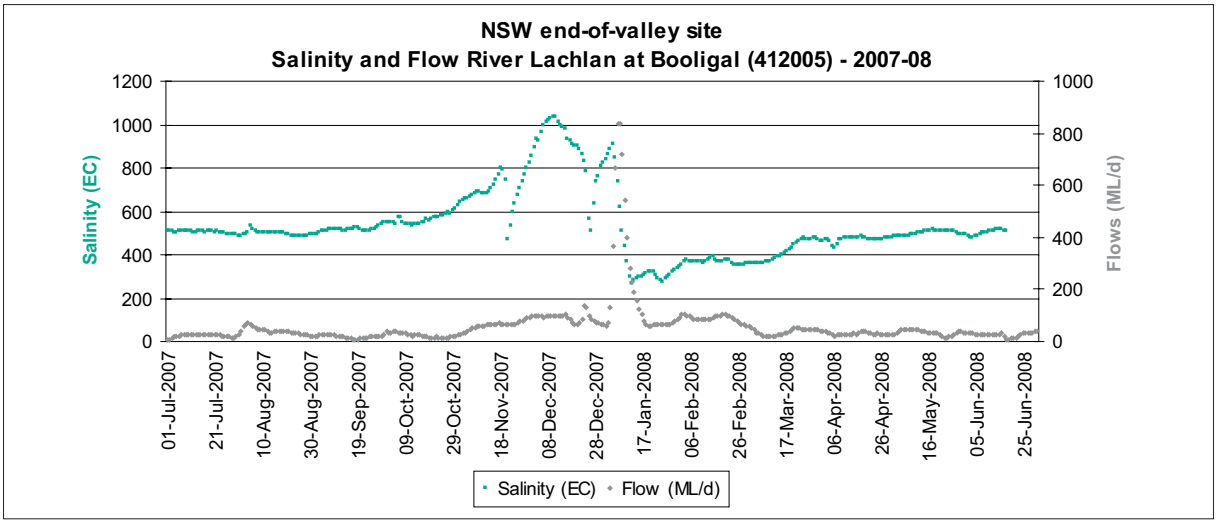


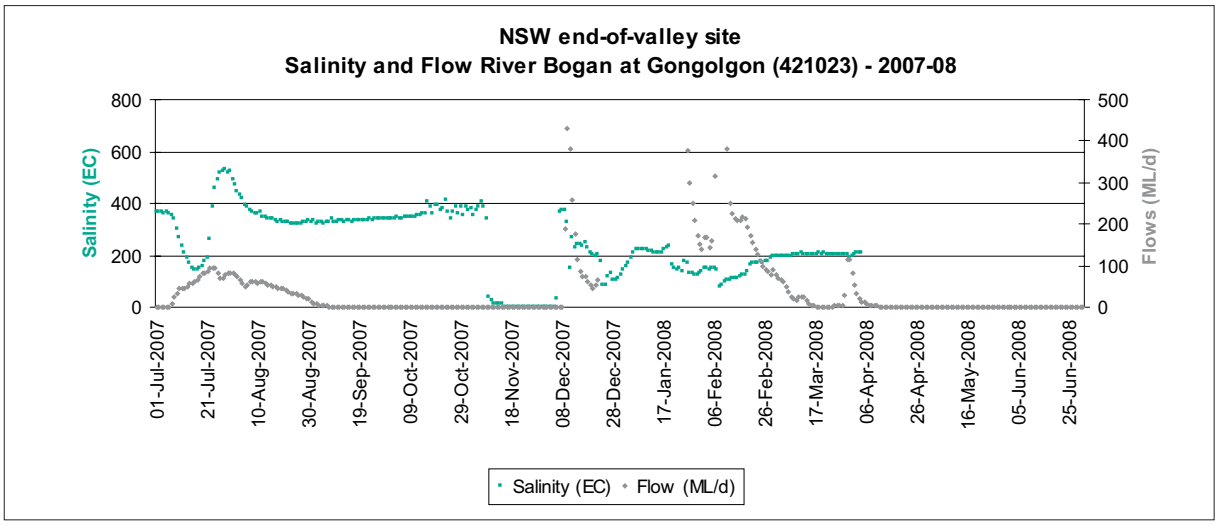


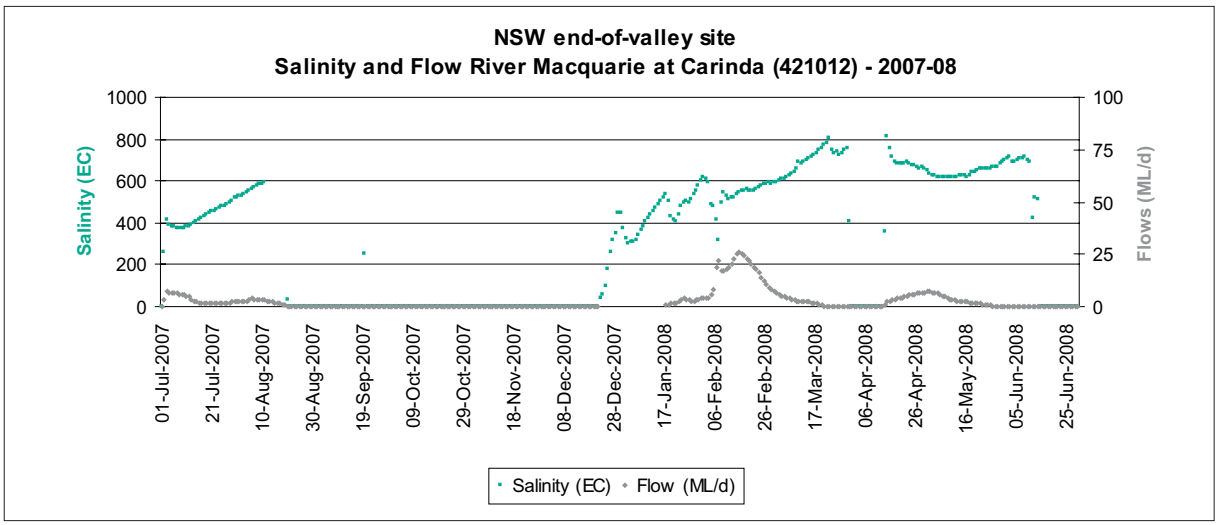


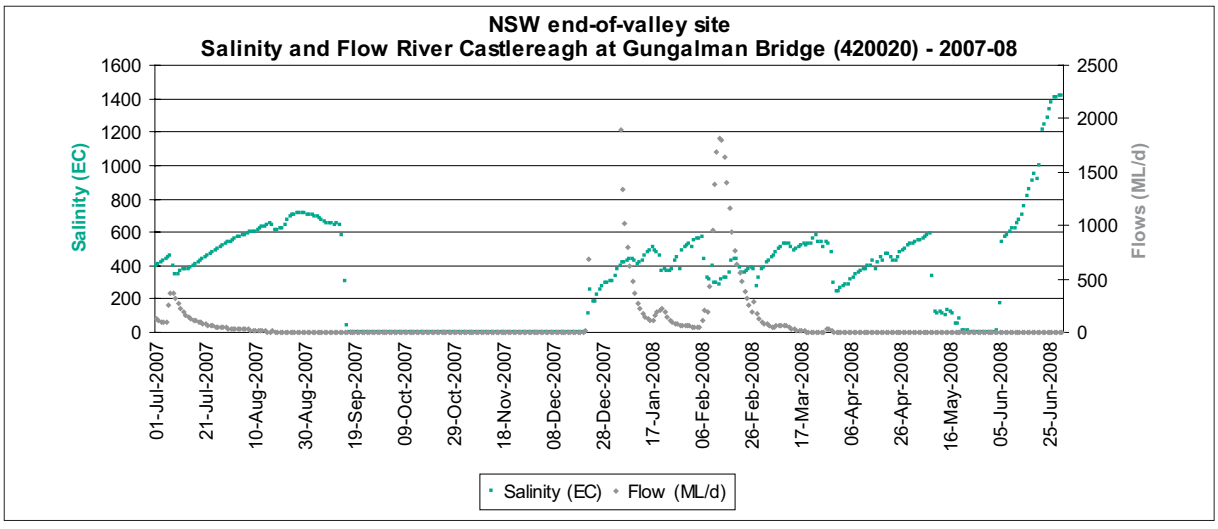

NSW Interpretation site
Salinity and Flow River Murray at Redcliffs (414204) - 2007-08
Salinity (EC)
Flows (ML/d)
500
400
300
200
100
0
2000
1500
1000
500
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)

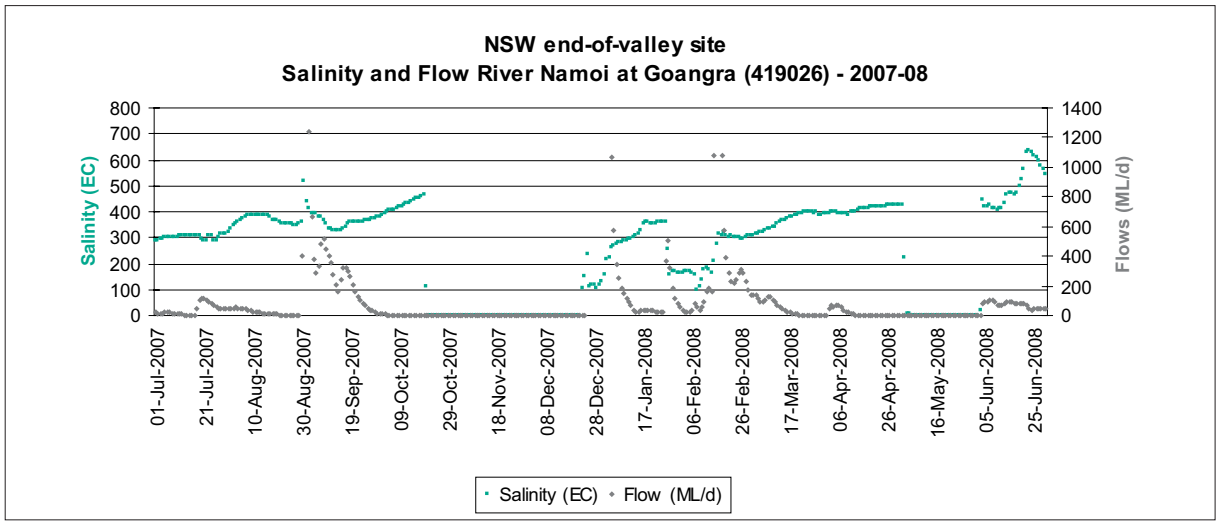

Interpretation site for NSW and Vic
Salinity and Flow River Murray at Heywoods (409016) - 2007-08
Salinity (EC)
Flows (ML/d)
250
200
150
100
50
0
12000
10000
8000
6000
4000
2000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)

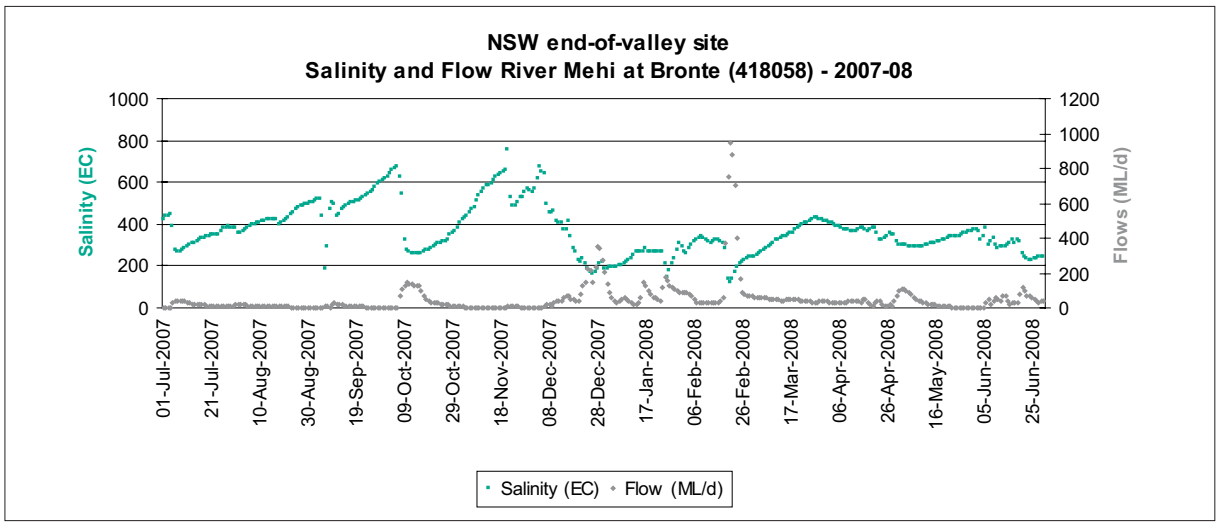

NSW end-of-valley site
Salinity and Flow River Lachlan at Booligal (412005) - 2007-08
Salinity (EC)
Flows (ML/d)
1200
1000
800
600
400
200
0
1000
800
600
400
200
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)


NSW end-of-valley site
Salinity and Flow River Bogan at Gongolgon (421023) - 2007-08
Salinity (EC)
Flows (ML/d)
800
600
400
200
0
500
400
300
200
100
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)

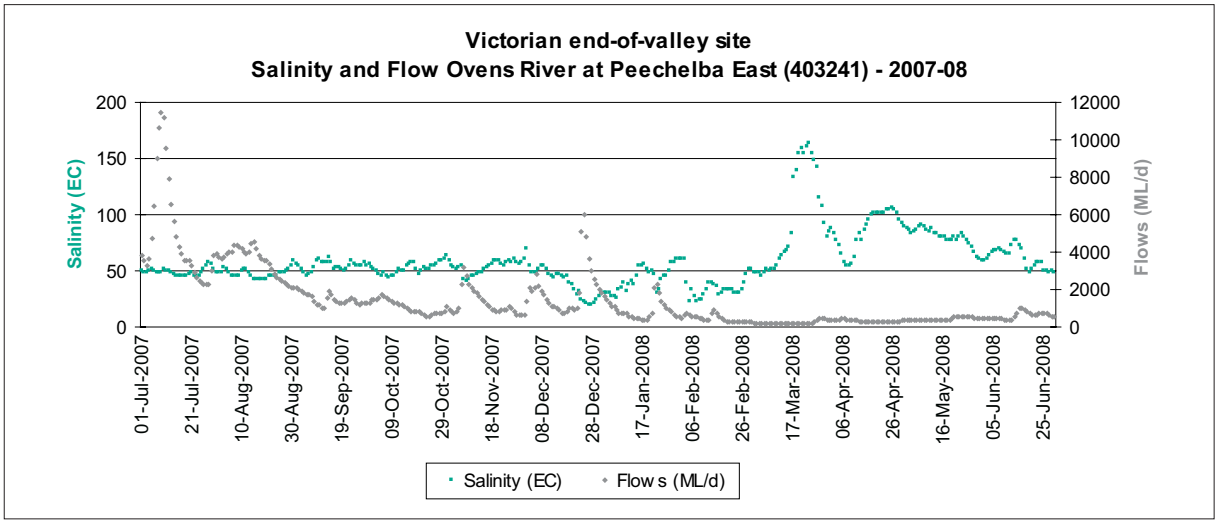

NSW end-of-valley site
Salinity and Flow River Macquarie at Carinda (421012) - 2007-08
Salinity (EC)
Flows (ML/d)
1000
800
600
400
200
0
100
75
50
25
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)

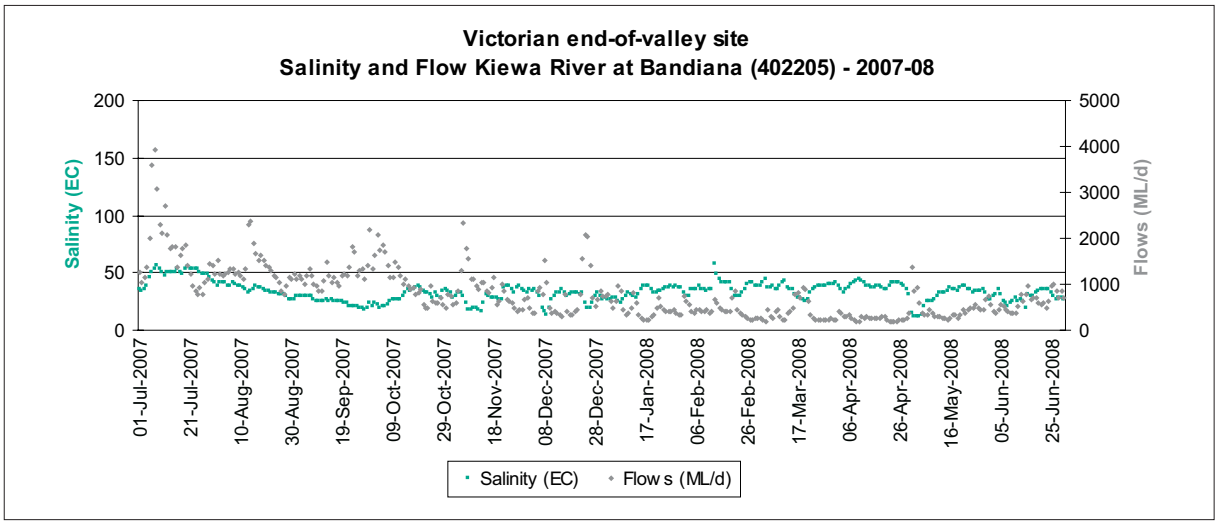

NSW end-of-valley site
Salinity and Flow River Castlereagh at Gungalman Bridge (420020) - 2007-08
Salinity (EC)
Flows (ML/d)
1600
1400
1200
1000
800
600
400
200
0
2500
2000
1500
1000
500
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)

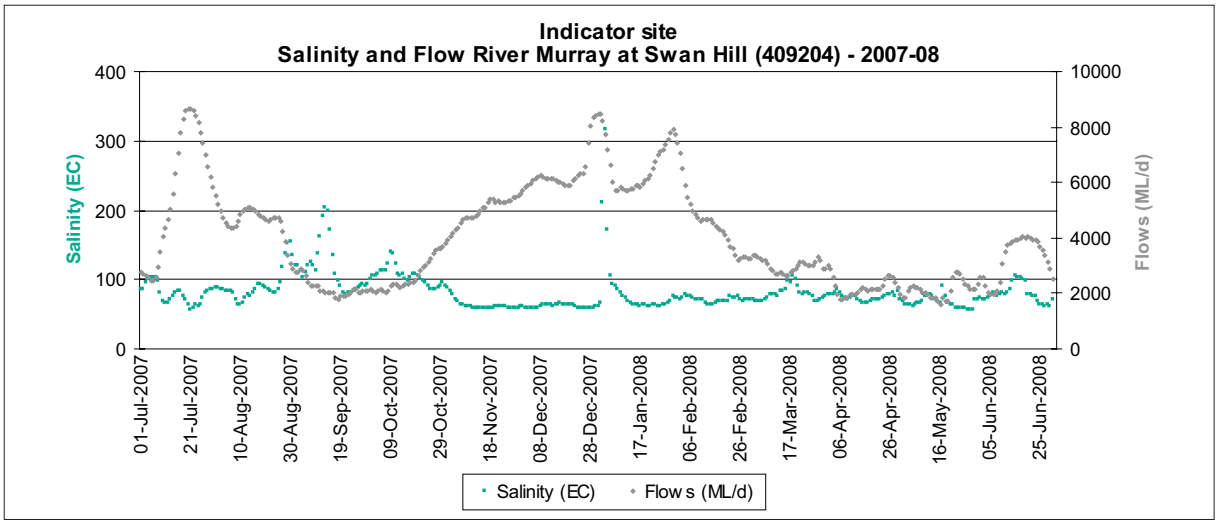

NSW end-of-valley site
Salinity and Flow River Namoi at Goangra (419026) - 2007-08
Salinity (EC)
Flows (ML/d)
800
700
600
500
400
300
200
100
0
1400
1200
1000
800
600
400
200
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)

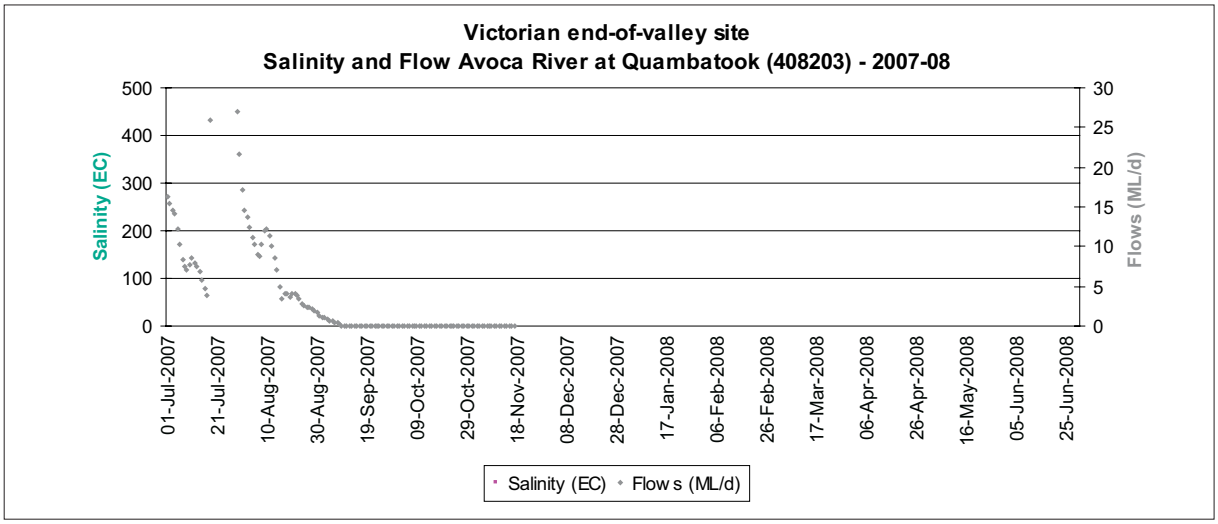

NSW end-of-valley site
Salinity and Flow River Mehi at Bronte (418058) - 2007-08
Salinity (EC)
Flows (ML/d)
1000
800
600
400
200
0
1200
1000
800
600
400
200
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flow (ML/d)

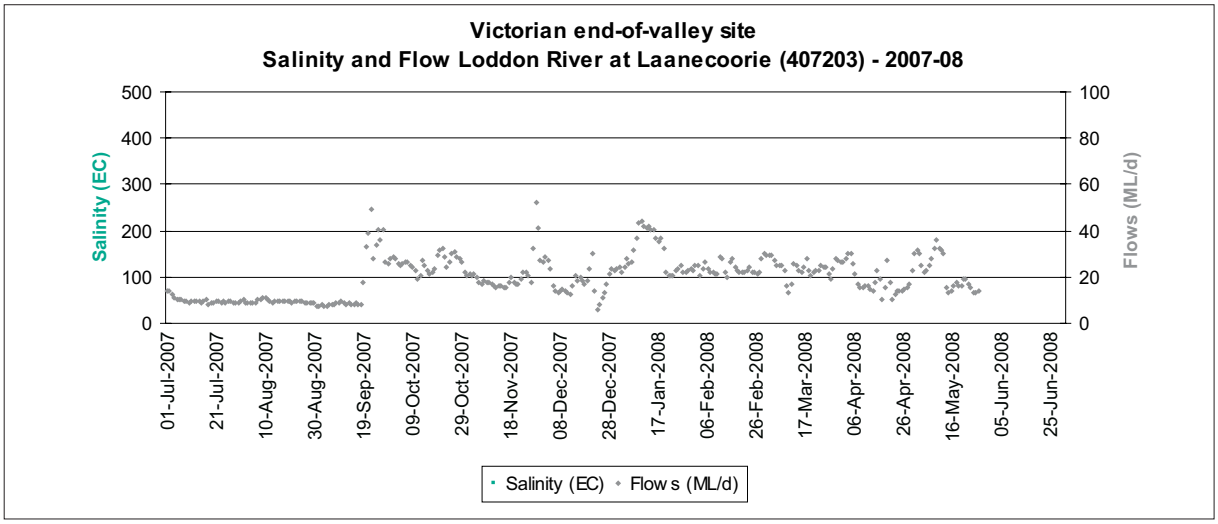
Victoria

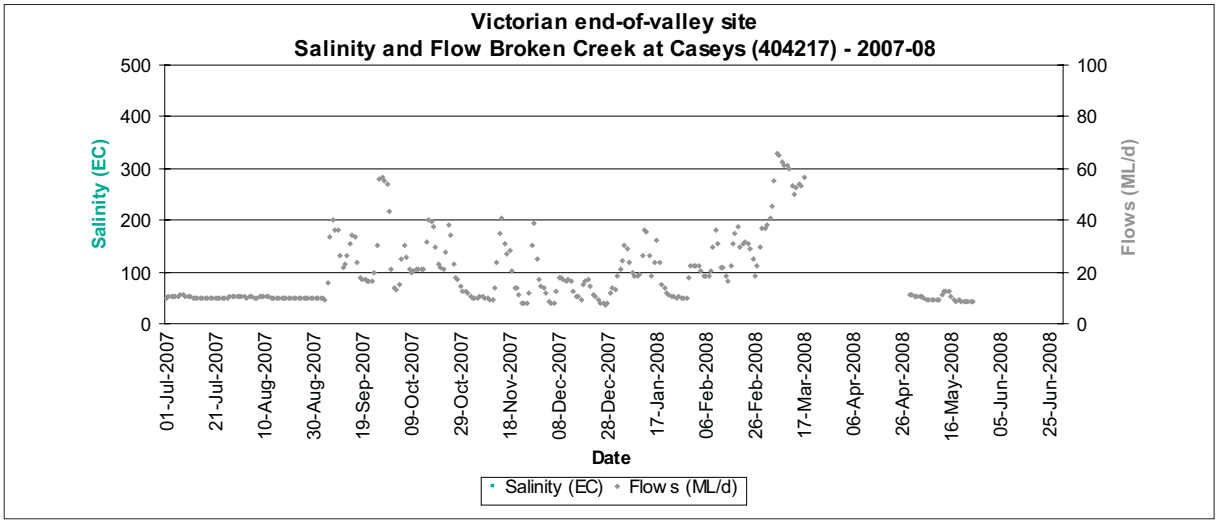

Victorian end-of-valley site
Salinity and Flow Ovens River at Peechelba East (403241) - 2007-08
Salinity (EC)
Flows (ML/d)
200
150
100
50
0
12000
10000
8000
6000
4000
2000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

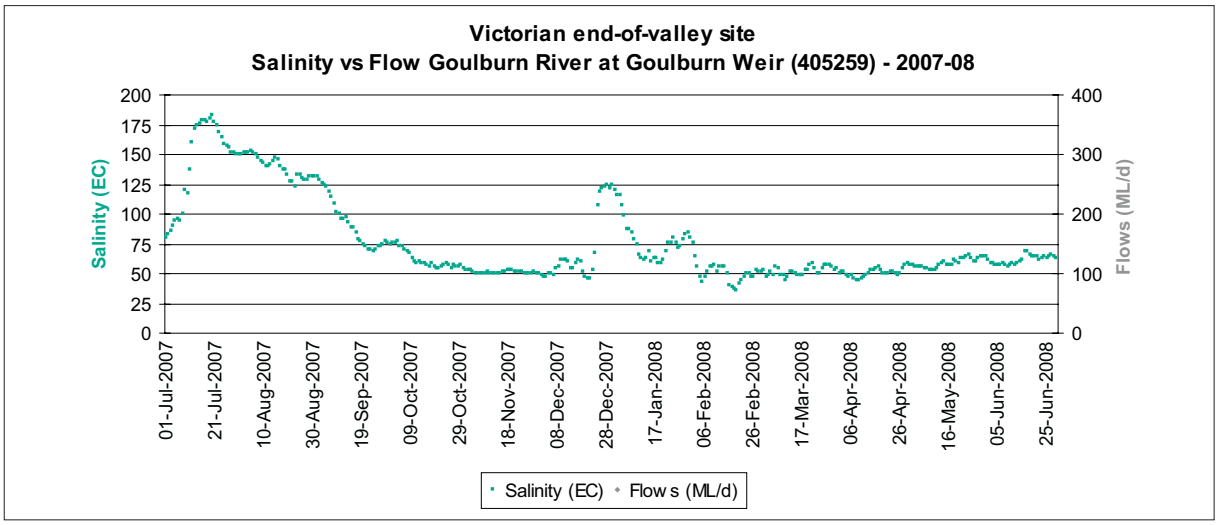

Victorian end-of-valley site
Salinity and Flow Kiewa River at Bandiana (402205) - 2007-08
Salinity (EC)
Flows (ML/d)
200
150
100
50
0
5000
4000
3000
2000
1000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

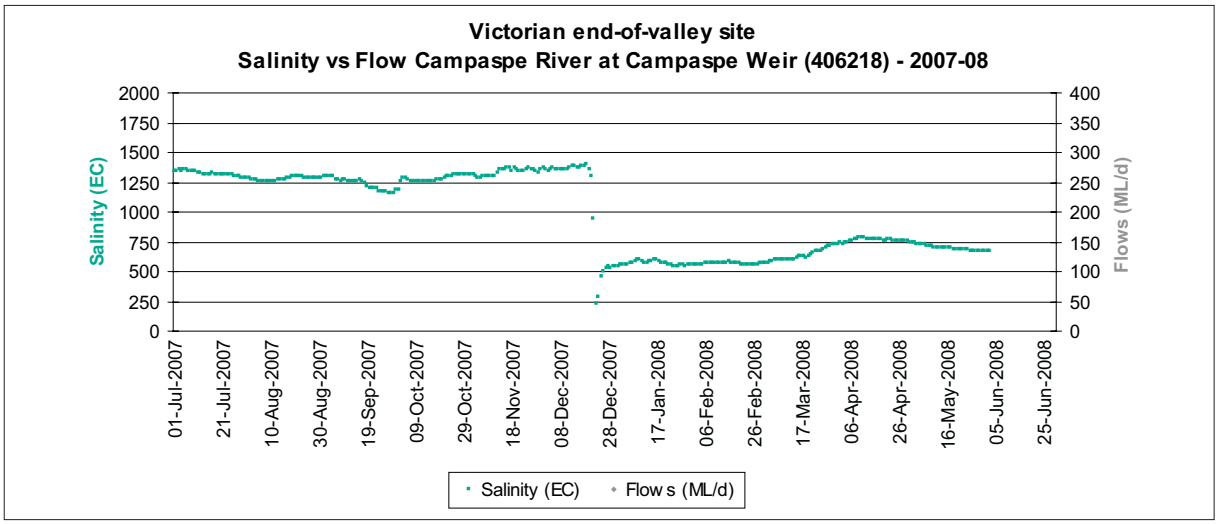

Indicator site
Salinity and Flow River Murray at Swan Hill (409204) - 2007-08
Salinity (EC)
Flows (ML/d)
400
300
200
100
0
10000
8000
6000
4000
2000
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

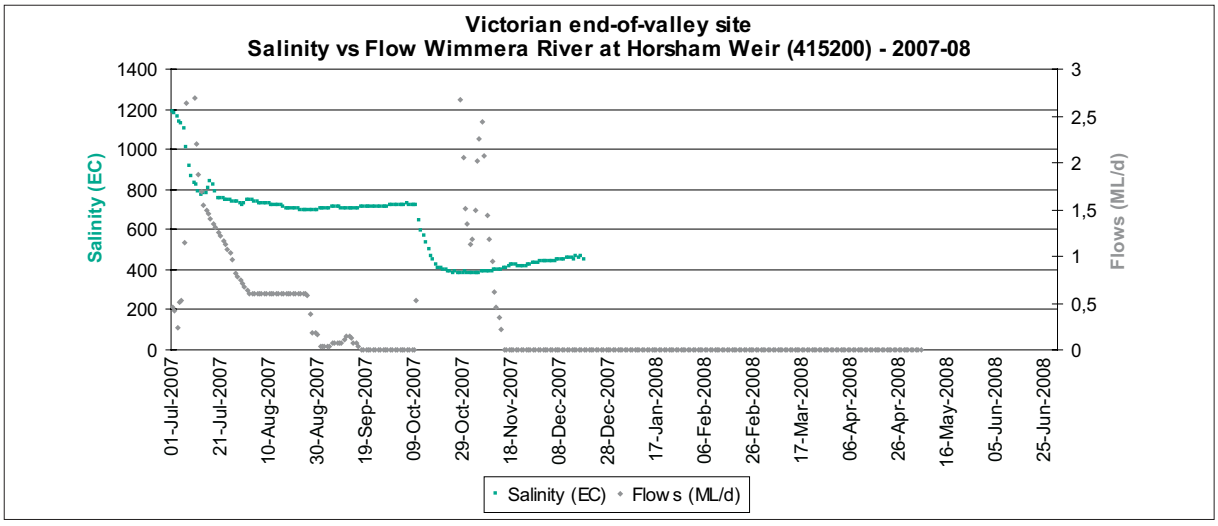

Victorian end-of-valley site
Salinity and Flow Avoca River at Quambatook (408203) - 2007-08
Salinity (EC)
Flows (ML/d)
500
400
300
200
100
0
30
25
20
15
10
5
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)


Victorian end-of-valley site
Salinity and Flow Loddon River at Laanecoorie (407203) - 2007-08
Salinity (EC)
Flows (ML/d)
500
400
300
200
100
0
100
80
60
40
20
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

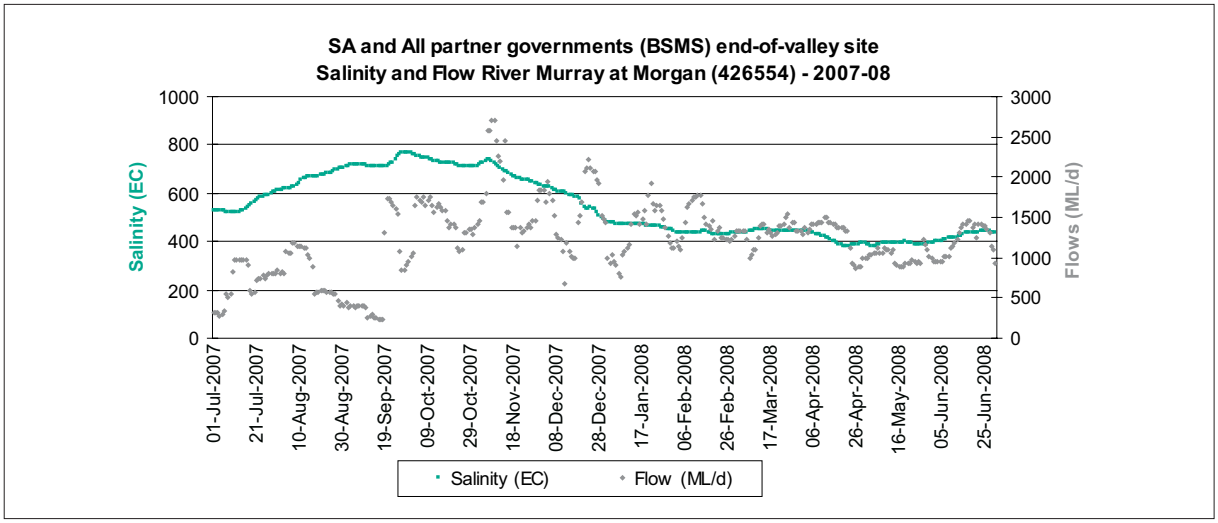

Victorian end-of-valley site
Salinity and Flow Broken Creek at Caseys (404217) - 2007-08
Salinity (EC)
Flows (ML/d)
500
400
300
200
100
0
100
80
60
40
20
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Date
Salinity (EC)
Flows (ML/d)

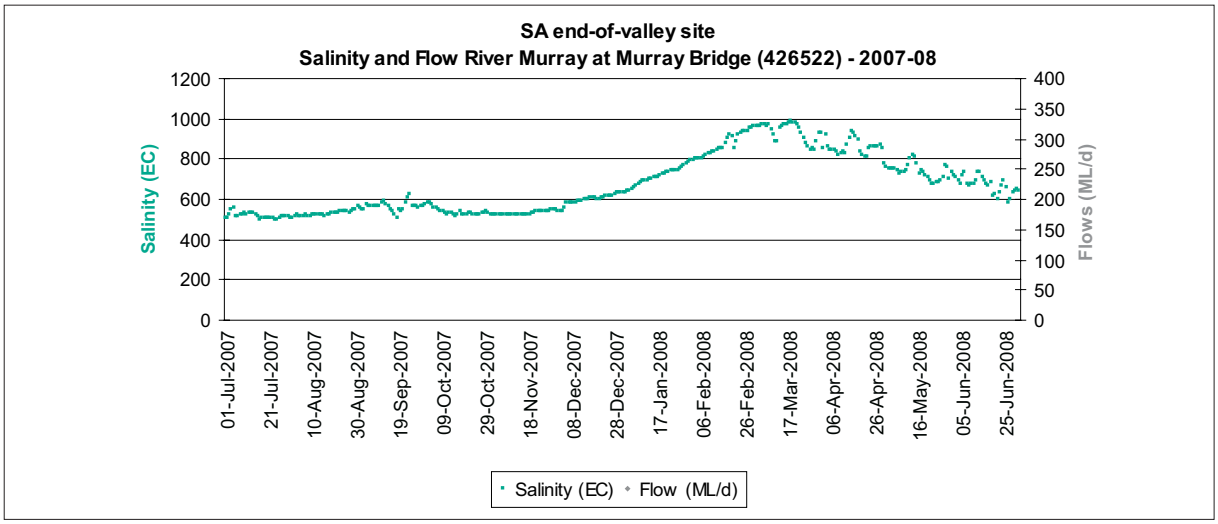

Victorian end-of-valley site
Salinity vs Flow Goulburn River at Goulburn Weir (405259) - 2007-08
Salinity (EC)
Flows (ML/d)
200
175
150
125
100
75
50
25
0
400
300
200
100
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

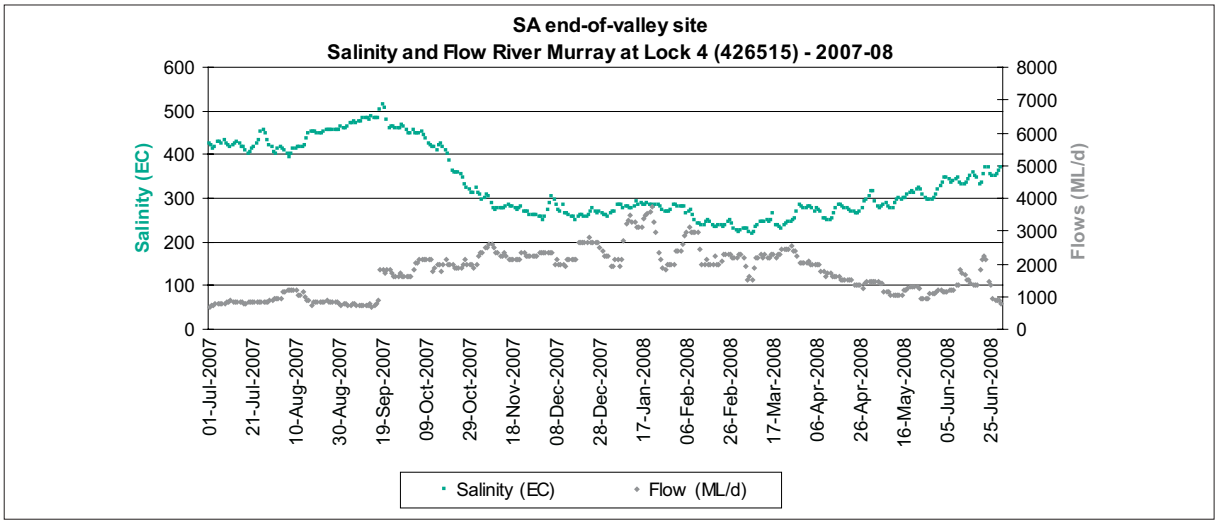

Victorian end-of-valley site
Salinity vs Flow Campaspe River at Campaspe Weir (406218) - 2007-08
Salinity (EC)
Flows (ML/d)
2000
1750
1500
1250
1000
750
500
250
0
400
350
300
250
200
150
100
50
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

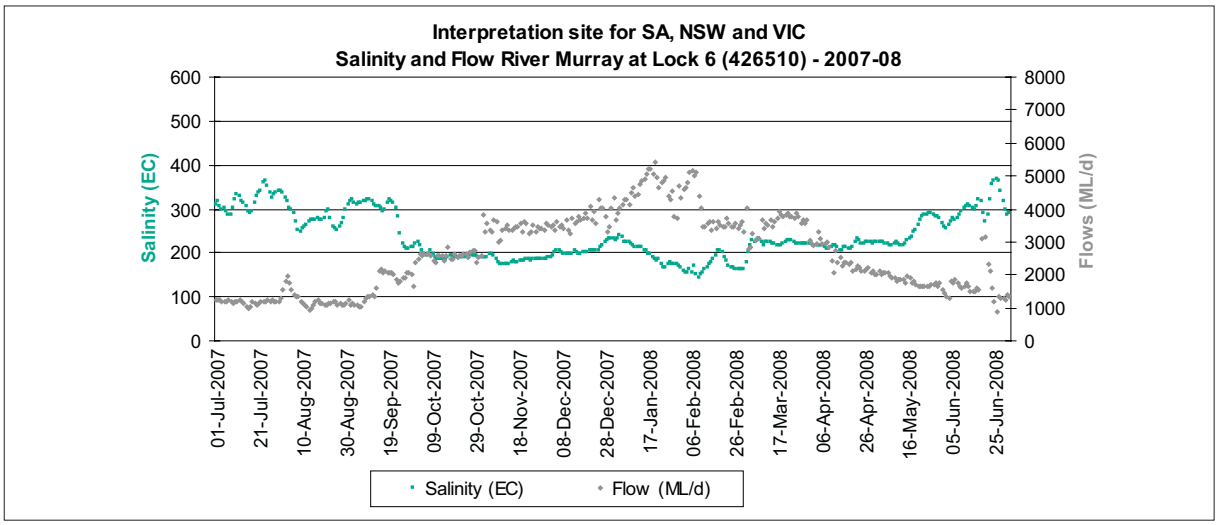

Victorian end-of-valley site
Salinity vs Flow Wimmera River at Horsham Weir (415200) - 2007-08
Salinity (EC)
Flows (ML/d)
1400
1200
1000
800
600
400
200
0
3
2,5
2
1,5
1
0,5
0
01-Jul-2007
21-Jul-2007
10-Aug-2007
30-Aug-2007
19-Sep-2007
09-Oct-2007
29-Oct-2007
18-Nov-2007
08-Dec-2007
28-Dec-2007
17-Jan-2008
06-Feb-2008
26-Feb-2008
17-Mar-2008
06-Apr-2008
26-Apr-2008
16-May-2008
05-Jun-2008
25-Jun-2008
Salinity (EC)
Flows (ML/d)

South Australia

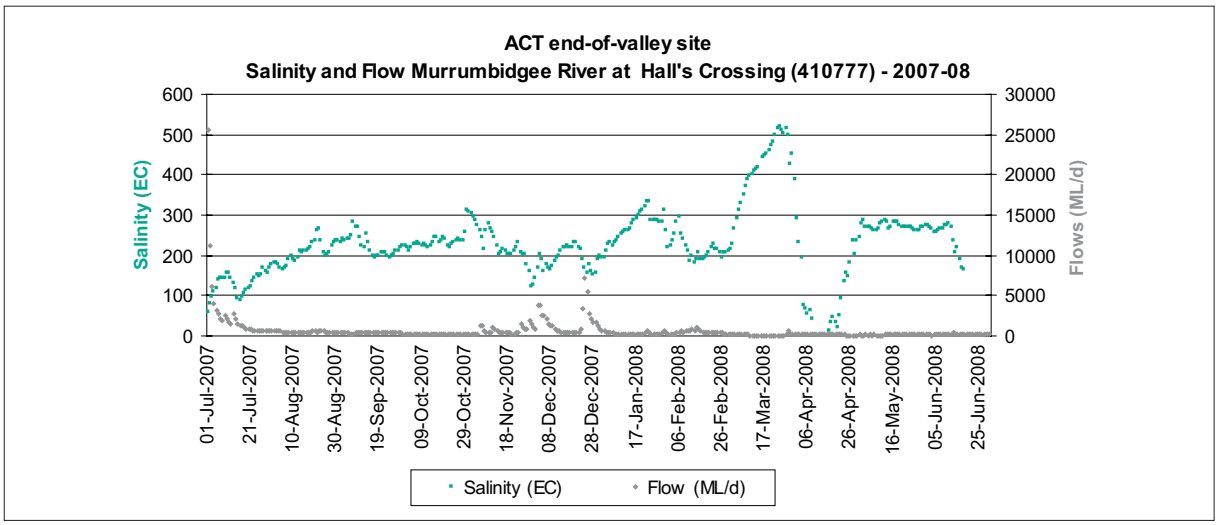








Australian Capital Territory



APPENDIX V: COMPARISON OF 2007–08 WITH LONG-TERM IN-STREAM AND SALT LOAD DATA FOR END-OF-VALLEY TARGET SITES

Under the BSMS, the jurisdictions monitor flow and salinity data for the nominated end-of-valley target sites and also, where applicable, for the interpretation sites (monitoring of salinity for shared rivers or valleys that cross State boundaries).

In-stream salinity and salt load for 2007–08 against the long-term records for each site are shown in Tables 11 – salinity and 12 – salt load (below). As noted for recent years, the data continues to reflect the extended dry conditions.

Table 12: Comparison of 2007–08 in-stream salinity data with longer-term records.

Site	Length of record (years)	Salinity data (EC)			
		50th percentile		80th percentile	
		2007–08	All data	2007–08	All data
NSW/Victoria shared					
Murray at Heywoods	35	52	52	63	59
Victoria					
Kiewa at Bandiana	35	33	46	39	57
Ovens at Peechelba East	29	52	69	70	59
Broken Ck at Casey's Weir	0	na	na	na	na
Goulburn at Goulburn Weir	19	59	73	101	126
Campaspe at Campaspe Weir	18	1168	614	1311	824
Loddon at Laanecoorie	0	na	na	na	na
Murray at Swan Hill	40	75	5344	92	14695
Avoca at Quambatook	22	na	4200	na	8200
Wimmera at Horsham Weir	16	705	1248	731	1712
Australian Capital Territory					
Murrumbidgee at Hall's Crossing	18	224	275	271	415
New South Wales					
Lachlan at Forbes	9	505	471	582	609
Murrumbidgee at Balranald	42	263	163	298	232
Murray at Redcliffs	41	136	285	207	376
Mehi at Bronte	7	347	464	458	635
Namoi at Goangra	16	284	403	397	556
Castlereagh at Gungalman	7	383	413	563	764
Macquarie at Carinda	16	384	564	622	666
Bogan at Gongolgon	8	220	365	351	562
Darling at Wilcannia	44	244	435	1185	863

Site	Length of record (years)	Salinity data (EC)			
		50th percentile		80th percentile	
		2007–08	All data	2007–08	All data
New South Wales/Queensland shared					
Barwon at Mungindi	16	263	257	298	323
Queensland					
Moonie at Fenton	5	138	125	155	155
Narran at New Angledool	6	114	114	147	180
Bokhara at Hebel	6	238	180	299	220
Ballandool at Hebel-Bollon Road	6	148	160	170	246
Braire at Woolerbilla-Hebel Road	5	159	130	253	281
Culgoa at Brenda	6	161	153	177	179
Warrego at Barringun	7	29	0	139	123
Cuttaburra at Turra	7	106	92	162	137
Paroo at Caiwarro	4	81	74	172	119
New South Wales/Victoria shared					
Murray at Lock 7 (flow) Lock 6 (EC)	46	217	349	283	460
South Australia					
Berri Pumping Station (EC)	66	297	425	422	590
Murray at Murray Bridge	74	623	555	832	811
Basin Target Site					
Murray at Morgan	70	489	550	705	797

Table 13: Comparison of 2007–08 salt load data with longer term records.

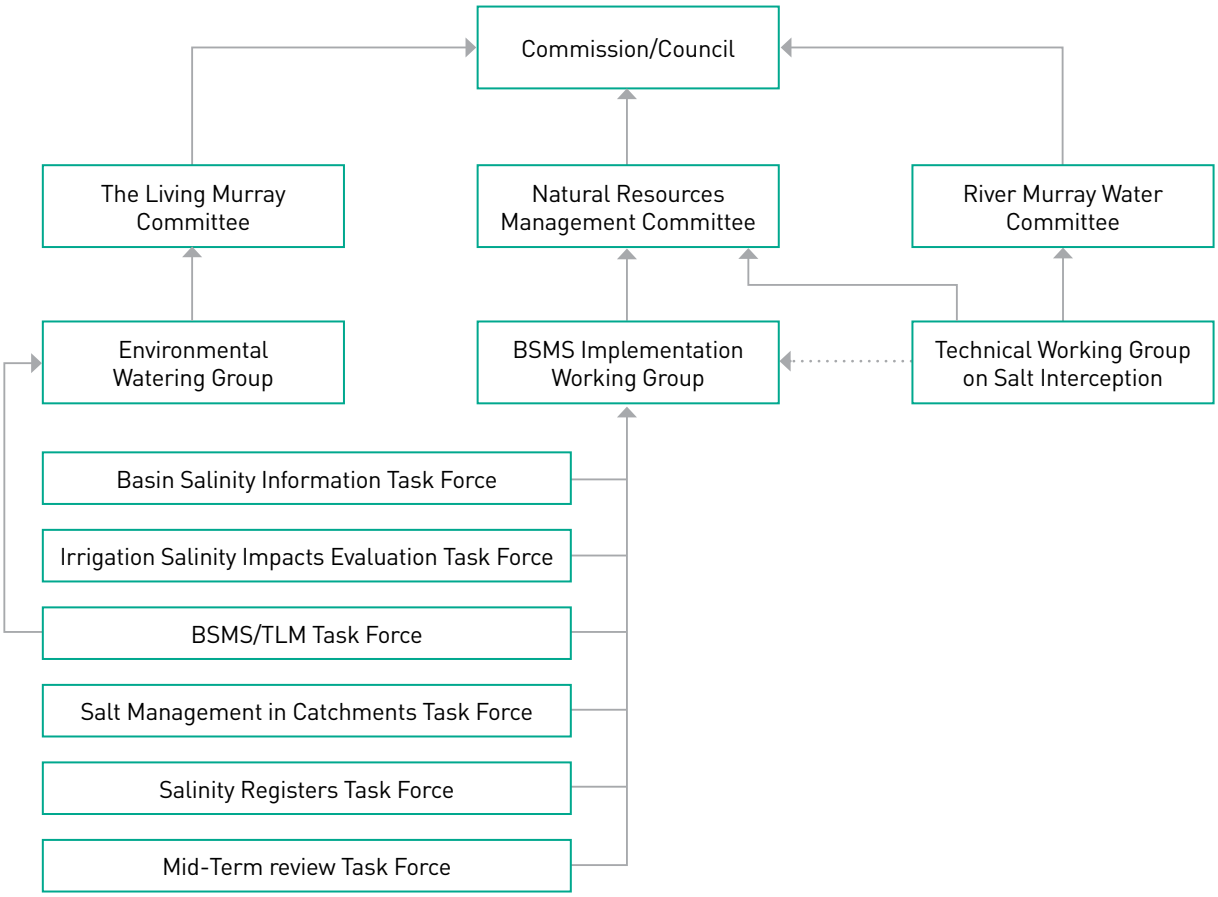
Site	Length of record (years)	Mean annual salt load (tonnes)	
		2007–08	All data
NSW/Victoria shared			
Murray at Heywoods	35	46100	130000
Victoria			
Kiewa at Bandiana	35	5800	15300
Ovens at Peechelba East	29	15500	42600
Broken Ck at Casey's Weir	0	na	na
Goulburn at Goulburn Weir	0	na	na
Campaspe at Campaspe Weir	0	na	na
Loddon at Laanecoorie	0	na	na
Murray at Swan Hill	40	28600	96200
Avoca at Quambatook	22	na	40900
Wimmera at Horsham Weir	16	100	10800
Australian Capital Territory			
Murrumbidgee at Hall's Crossing	18	23500	32500

Site	Length of record (years)	Mean annual salt load (tonnes)	
		2007–08	All data
New South Wales			
Lachlan at Forbes	9	7300	97200
Murrumbidgee at Balranald	42	9700	86100
Murray at Redcliffs	25	na	1235500
Mehi at Bronte	7	2800	6000
Namoi at Goangra	16	10200	79000
Castlereagh at Gungalman	7	7900	4400
Macquarie at Carinda	16	300	1400
Bogan at Gongolgon	8	16000	7500
Darling at Wilcannia	44	118300	210900
New South Wales/Queensland shared			
Barwon at Mungindi	16	17500	46500
Queensland			
Moonie at Fenton	5	700	4400
Narran at New Angledool	6	4200	1400
Bokhara at Hebel	6	300	800
Ballandool at Hebel-Bollon Road	6	2000	700
Braire at Woolerbilla-Hebel Road	5	Limited data	1600
Culgoa at Brenda	6	7800	3100
Warrego at Barringun	7	20500	7500
Cuttaburra at Turra	7	38800	15300
Paroo at Caiwarro	4	90900	25200
New South Wales/Victoria shared			
Murray at Lock 7 (flow) Lock 6 (EC)	14	20200	215000
South Australia			
Berri Pumping Station	14	118500	556800
Murray at Murray Bridge	0	na	na
Basin Target Site			
Murray at Morgan	41	143700	1532100

APPENDIX VI: BSMS OPERATIONAL PROCESSES DURING 2007–08

The BSMS oversees the monitoring, evaluation and reporting components, essential to ensure accountability under the strategy. The working group provides the necessary quality assurance and auditing, and liaises closely with the Technical Working Group on Salt Interception.

Figure 6: BSMS decision making and information links during 2007–08.



The BSMS IWG met a total of four times during the year, including one teleconference. Meeting 32 at Buronga allowed the BSMS IWG to understand many of the river salinity and water quality issues that were gaining in profile in the mallee region.

Table 14: Meeting schedule for the BSMS IWG during 2007–08.

Meeting No.	Meeting date	Location
29	21 September 2007	Adelaide
30	23 October 2007	Teleconference
31	7 February 2008	Canberra
32	26 June 2008	Buronga (and field trip)

APPENDIX VII: ASSOCIATED REPORTS AND FURTHER INFORMATION

Associated Reports

- *South Australia:* South Australia's 2007–08 Report to the Basin Salinity Management Strategy.
- *Victoria:* Murray–Darling Basin Salinity Management Strategy: Victoria's 2007–08 Annual Report.
- *New South Wales:* Murray–Darling Basin Salinity Management Strategy: NSW Annual Implementation report 2007–08.
- *Queensland:* Basin Salinity Management Strategy Annual Report 2007–08 Queensland Murray–Darling Basin.
- *Australian Capital Territory:* Annual Report 2007–08-ACT.
- *Australian Government:* Basin Salinity Management Strategy 2007–08: Australian Government Report.
- Report of the Independent Audit Group – Salinity 2007–08

Further information on BSMS implementation during 2007–08 can be obtained from the *BSMS 2007–08 Summary*, available on the MDBA website.

Other MDBC/A salinity reports of interest

Murray–Darling Basin Commission, 2008. *Managing salinity in the Murray–Darling Basin*. MDBC, Canberra.

Murray–Darling Basin Commission, 2008. *Living with salt*. MDBC, Canberra.

Murray–Darling Basin Commission, 2008. *Keeping Salt out of the Murray*. MDBC, Canberra.

Murray–Darling Basin Ministerial Council. 2005. *Basin Salinity Management Strategy Operational Protocols*. MDBC, Canberra. (35/05).

Murray–Darling Basin Ministerial Council. 2001. *Basin Salinity Management Strategy 2001–2015*. MDBC, Canberra.

Murray–Darling Basin Commission, 2008. *BSMS Mid-Term Review- Final Report*, MDBC Canberra (11/08).

Information on the Strategy and other Murray–Darling Basin Authority programs can be obtained from the website: www.mdba.gov.au or by contacting the Information Officer (02) 6279 0100.

Report of the Independent Audit Group – Salinity 2007–08

Australian Government