Report on Managing Water Quality and Salinity – Basin Authority

The Basin Authority 2014- 15 annual report on the implementation of the water quality and salinity management plan (Schedule 12, Item 14)

Reporting context

The water quality and salinity management plan provides a Basin-wide framework of water quality objectives and targets for Basin water resources. The water quality and salinity management plan is set out in Chapter 9 of the Basin Plan and includes a list of the key causes of water quality degradation, water quality objectives for Basin water resources and water quality targets for long-term planning.

The purpose of this report is to monitor the extent to which the water quality and salinity management plan has been implemented. This report is a requirement of Chapter 13 of the Basin Plan and relates to Item 14 of Schedule 12.

Indicators for measuring success

Implementation of the water quality and salinity management plan is evaluated using the following five indicators:

- Governments regard to water quality and salinity targets when managing water flows (**14.1**)
- Governments having regard to water quality targets when making decisions about using environmental water (**14.2**)
- Recorded salinity at reporting sites is consistent with salinity targets (**14.3**)
- Adequacy of the flushing of salt from the River Murray System to the Southern Ocean (salt export) (**14.4**)
- Measures governments take to achieve end-of-valley salinity targets (**14.5**)

MDBA reports on all five indicators.

14.1: Managing water flows with regard to water quality targets (s9.14)

14.1.1. What procedures and tools were in place to enable water quality targets (dissolved oxygen, recreational water quality and salinity) to be met?

Response

The Authority used the following procedures and tools to have regard to the salinity targets:

- implementing procedures that maintain minimum flows at key locations along the River Murray System (with the exception of Menindee Lakes, which was under the control of NSW);
- improving processes to allow duty operator better access to daily salinity data on operations sheets;
- preparing weekly flow and salinity forecasts available on the Authority web site http://www.mdba.gov.au/river-data/current-information-forecasts;
- where possible, operating Lake Victoria to improve the salinity levels of the flow to South Australia as specified in the Specific Objectives and Outcomes
- assisting with the delivery of environmental water.

The Authority used the following procedures and tools to have regard to the dissolved oxygen (DO) targets:

- maintaining minimum flow rates at strategic points according to the O&O (with the exception of Menindee Lakes, which was under the control of NSW);
- minimising overbank flows in the warmer months of the year;
- contributing to the monitoring of DO levels along the Murray at key locations, and working collaboratively with the states to improve DO monitoring. For instance, the Authority has responded to a DO information use questionnaire provided by NSW Office of Water;
- identifying additional sites where telemetered DO data is being collected and adding these to operational spreadsheets. For instance, new gauging at TLM sites will be used where possible, to monitor dissolved oxygen and other variables for environmental watering events in 2015-16. DO data is now also being collected from some locks and weirs and provided to the Authority;
- commencing the task of converting the DO data (mg/L) into % saturation and coding the operational spreadsheets with ‘conditional formatting’ to alert river operators when data may be trending toward target levels;
- reviewing real time DO information, collated in DO Circulars and periodically provided by the NSW Office of Water. This served as a surveillance tool to provide ‘early warning’ of potential low DO levels.
- discussing the potential of low DO levels for and during environmental watering events and potential mitigation measures, for example in Operations Advisory Group teleconferences.

The Authority used the following procedures and tools to have regard to the blue-green algae (BGA) targets:

- contributing to the monitoring of BGA levels along the Murray at key locations;
- participating in Murray and Sunraysia Regional Algal Co-ordinating Committee meetings;
- reviewing an onscreen cyanobacteria (BGA) status mapping product weekly. The status map brings together the algal reporting from the states (algal data and alerts published by NSW Regional Algal Coordinating Committees, Goulburn-Murray Water and South Australia).
- considering the forecast storage volume for Lake Hume for autumn. Studies suggest that the risk of BGA blooms in Lake Hume increases as the water depth over the period December-April

decreases and is more likely when the storage falls below about 10 to 15% capacity. Operators had regard for this increased risk by continuing bulk transfers from Dartmouth over spring, summer and autumn to ensure Hume Dam did not fall below 20%. Wetter conditions in April also contributed to Hume level.

14.1.2. Statement that procedures and tools were used to meet water quality targets

Response

The Authority used the procedures and tools described in section 14.1.1 to have regard to the water quality targets.

14.1.3. Case study

Response

In addition to the routine procedures for having regard to the water quality targets, as per the Authority's Response to 14.1.1 above, a water quality study (in conjunction with sampling for larval/juvenile Murray cod) was undertaken in the Lower Darling River during 2014-15. This study was managed by the MDBA and was jointly funded by the Authority, the Office of Environment and Heritage and Local Land Services Western Region, and it was conducted with assistance from those agencies as well as Water NSW and DPI Fisheries. Key findings from that study are summarised below.

The project included a two-stage assessment of water quality and fish in the lower Darling River, during the 2014-15 spring/summer period, with a focus on Murray cod larval presence and subsequent juvenile survival. Stage 1 investigated larval Murray cod presence and abundance, Stage 2 investigated survival of larval Murray cod to juvenile life stages, with water quality monitoring conducted throughout both stages. We also identified the potential risks and benefits from fish and water quality perspectives, of recently constructed block banks near Burtundy.

Thermal stratification and related dissolved oxygen gradients (i.e. oxygen depletion at depth) were identified throughout the summer 2014-15 period of this assessment, particularly at locations upstream of weirs or block banks, where lower flow velocities contribute to reduced water column mixing. Under these circumstances we would expect adult Murray cod to avoid the deeper anoxic habitats in preference for shallower, more oxygenated areas.

Murray cod in the lower Darling River spawned in late October and early November 2014, with no drifting larvae detected after mid-November. This is not to say spawning did not commence earlier than this study or resume later in the summer of 2014–15. The abundance estimates determined may serve as a useful reference, or baseline for future larval assessments in the lower Darling River. The highest abundances of Murray cod larvae were detected at Tolarno, downstream of Weir 32 (21 individuals), with five larvae detected downstream of Pooncarie. No Murray cod larvae were detected in the pooled habitats sampled upstream of Weir 32 and within the Wentworth (Murray River Lock 10) weir pool. We suggest that higher flow velocities downstream or Weir 32 and Pooncarie Weir were likely to result in greater within-channel hydraulic complexity, and thus a greater diversity of micro-habitats which may in turn support spawning and larval life stages of Murray cod. Although we demonstrate that Murray cod in the lower Darling River will spawn in spring in periods of protracted low flow, success of subsequent recruitment remains a knowledge gap.

14.2: Making decisions about using environmental water with regard to water quality targets (s9.14)

14.2.1. What procedures and tools were in place to enable water quality targets to be met?

Operating plans for environmental works

In collaboration with TLM partner governments and icon site management authorities, operating plans have been developed to guide the use of the environmental works at Gunbower–Koondrook–Perricoota Forest, Hattah Lakes and the Chowilla Floodplains–Lindsay–Wallpolla Islands icon sites. These operating plans assist TLM to effectively and efficiently deliver environmental water as well as manage risks (including water quality risks) related to their operation.

Modelling

Operational and hydrodynamic models are used to inform watering activities at the icon sites with environmental works. These models simulate the operation of the works to produce information about areas of inundation, water usage, impacts on downstream flows and water quality.

A blackwater model of the River Murray and Edward–Wakool rivers is used to predict downstream Dissolved Oxygen (DO) levels during watering activities, assisting water managers and river operators manage low DO (blackwater) during environmental water delivery. The model provides an assessment of the predicted DO levels from the inundation of major floodplains of Barmah, Millewa, Gunbower and Koondrook–Perricoota forests.

A similar blackwater model is being developed for the Chowilla Floodplain in South Australia. This model is still considered developmental. However, it is anticipated that once complete, it will be used as a predictive tool to inform water quality risk assessments associated with environmental water planning and delivery activities.

Operational salinity risk management framework

A salinity risk management framework is in place to use when planning and delivering TLM environmental water to high salinity risk sites (currently, only site is Chowilla Floodplain). The framework allows salinity risks and mitigation and/or monitoring measures to be identified. Selected measures will depend on a range of factors at the time of delivery. Some important measures include hydrograph manipulation, improved coordination of water deliveries and dilution flows.

Watering proposals

The TLM Annual Watering Plan outlines the framework for planning and delivering TLM water. It notes that TLM must have regard to Basin Plan water quality targets and embeds this into the planning and delivery processes. Using the tools outlined above, icon site managers are asked to assess the risk of proposed watering actions and provide appropriate mitigation strategies when they develop watering proposals for their icon sites. These watering proposals are reviewed by state agencies and then prioritised by an inter-jurisdictional environmental watering committee using criteria that includes the risks associated with the watering action.

Monitoring

Monitoring of water quality issues is primarily undertaken using data obtained by River Management Division water monitoring stations. The data is extracted to inform environmental water planning or delivery activities.

Other sources of data are available from state-based staff who record water quality data from spot readings during watering actions at icon sites.

During the real-time management of TLM watering events this information is reviewed by Operational Advisory Groups (OAGs); further information on OAGs is presented below.

Operational Advisory Groups (OAGs) and Hydrometrics reports

OAGs support operational decisions on the real time management of environmental water delivery at the TLM Icon Sites. OAGs include representatives from state agencies, state water authorities, river operators, icon site managers, environmental water managers and scientists.

Before and during watering events, OAGs meet on a weekly basis to discuss a range of operational matters including flow management, inundation extents, risk management, ecological responses, engineering issues, fishway operations and water accounting.

To inform OAG discussions, the MDBA produces Hydrometrics reports which present recent data and information about flows, water quality, inundation extents and water accounting associated with the event. These reports also form a detailed hydrometric record of the watering events.

14.2.2. Statement that procedures and tools were used to meet water quality targets

Operating plans for environmental works

Operating plans were used to underpin 2014-15 watering events at TLM icon sites which have environmental watering works. These include Gunbower-Koondrook-Perricoota Forest, Hattah Lakes and the Chowilla Floodplains-Lindsay-Wallpolla Islands icon sites. Specifically, the plans provided knowledge and guidance to help achieve the desired objectives as well as manage water quality risks.

Many of the watering events in 2014-15 involved the initial testing of new works. Accordingly those events were planned and conducted in a conservative manner whereby strict planning approval conditions were followed to ensure adverse outcomes such as poor water quality were avoided.

Modelling

TLM models were used in 2014-15 to help make the best use of the water and minimise any risks such as poor water quality. In particular, they were used to:

- Test proposed watering options at the icon site scale, such as different inflow volumes, holding times and release patterns.
- Provide information on potential risks, including poor water quality (low DO or high salinity levels), which could then be used to assess appropriate mitigation strategies.
- Simulate flow events through icon sites, which provided information on the water use, inundation extent, flow mosaic characteristics and water quality responses.

Monitoring data was collected from watering events and used to validate and recalibrate the models to improve their accuracy for future environmental watering.

Operational salinity risk management framework

The operational salinity risk management framework was used in 2014-15 to underpin planning and delivery activities at the Chowilla Floodplain. Here, the environmental watering proposal included a robust assessment of the salinity risks, with clear management strategies identified from the Chowilla Floodplain Event Plan and Hazard Mitigation Strategy.

During the watering event, two key management strategies were implemented. These included provision of suitable dilution flows and maintaining target water exchange on the floodplain. As a result, the impact on River Murray salinity levels was barely detected.

Watering proposals

The watering proposals across the icon sites considered risks, including salinity and blackwater, and provided mitigation strategies where it was deemed necessary. Assessment of TLM watering proposals gave a higher weighting to events which had lower risks compared to higher risk events.

Prioritisation of 2014-15 watering actions was made by the Environmental Watering Group. Note that the Southern Connected Basin Environmental Watering Committee has now taken on this role for the 2015-16 watering season. Further information on this new committee is reported against Matter 10.

Monitoring

Data taken from telemetered monitoring stations or spot readings were used to inform the watering events. DO and salinity data was used to manage inflows and outflows from the sites to avoid any problems in the River Murray.

Operational Advisory Groups (OAGs) and Hydrometrics reports

OAGs for the different icon sites met frequently (weekly and sub-weekly when needed) in the lead-up and during the watering events. With their diverse perspectives, they guided event implementation to help achieve the desired outcomes whilst managing risks such as poor water quality outcomes.

Hydrometrics reports provided the necessary information concerning flow and water quality parameters to inform OAG discussions.

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14.3: Salinity at reporting sites consistent with salinity targets in s9.14(5)

14.3.1. Proportion of days where measured salinity met the target EC at reporting sites

Response

The salinity at the five reporting sites is monitored continuously, and has been assessed over a five-year reporting period (2010-2015). The targets are deemed to have been met if the percentage of days above the target value is less than 5%, or the 95th percentile[1] is less than the target value.

The table below shows that the salinity targets at the reporting sites were met except in the Darling River downstream of Menindee Lakes at Burtundy, and in the Lower Lakes at Milang.

[1] The 95th percentile is the value that is not exceeded for 95% of the time.

Over the reporting period (2010-2015), the salinity at Burtundy was above the target value for 12% of days. Burtundy experienced around average flow conditions from 2010-2013 then dropped to below average flow in 2013-14. Salinity at Burtundy remained below target from 2010-11 to 2013-14. In 2014-15, salinity at Burtundy was above the target value for 40% of the year as a result of low flows with high salinity and no water being available from Menindee Lakes to manage salinity in the lower Darling River.

At the start of the five-year reporting period, salinity at Milang was extremely high due to low inflows and high rates of evaporation caused by the preceding drought that spanned over several years . In October 2010, water levels returned to normal in Lake Alexandrina resulting in a rapid reduction of Milang salinity. In 2014-15, salinity at Milang was below 731 EC for 95% of the time, and did not exceed the target value.

Item	Reporting Site	Target EC value (µS/cm)	95 percentile salinity during the reporting period (µS/cm)	% of days above the target (2010-2015)
1	River Murray at Murray Bridge	830	520	0
2	River Murray at Morgan	800	494	0
3	River Murray at Lock 6	580	362	0
4	Darling River downstream of Menindee Lakes at Burtundy	830	911	12
5	Lower Lakes at Milang	1,000	3,482	10

14.4: Adequacy of flushing and salt export (s9.09)

14.4.1. Estimated Salt Export (Tonnes) from the River Murray System to the Southern Ocean

Response

Provisional estimates indicate that salt export for 2014-15 was 0.9 million tonnes a year annualised over the reporting period (2012-15).

14.4.2. Adequacy of salt flushing

Response

The purpose of the salt export objective is to ensure that the health of the River Murray System is maintained by flushing enough salt from it to the Southern Ocean. The Basin Plan estimates that 2 million tonnes of salt per year, averaged over three years, should be discharged to the Southern Ocean in order to meet the objective. However, inflows to the River Murray system, affected by climatic factors can influence how much salt is exported each year. For example, during extended periods of below average inflows, flow in the River Murray System may not be adequate enough to flush 2 million tonnes of salt from the system whilst maintaining the salt concentration (salinity of river water) at acceptable levels.

Despite salt export being assessed at less than 2 million tonnes (the annualised rate of salt export over the preceding 3 years), the maintenance of flows over the barrages into the Coorong indicate that adequate flushing of salt through the system had occurred.

14.5: Implementation of measures to achieve end-of-valley salinity targets

MDBA reports on this indicator on behalf of Basin governments, drawing on the end-of-valley targets contained in the States' Basin Salinity Management Strategy annual implementation reports.

14.5.1. Types of measures implemented

Response

The Authority reports on this indicator on behalf of Basin governments about the types of measures Basin governments used in progressing towards the end-of-valley targets set for each Basin valley (catchment) for long-term salinity planning and management.

The following activities were undertaken in 2014-15:

· Salinity modelling tools were reviewed and updated to account for actions with significant salinity impacts in the salinity registers.

· Salt interception schemes were operated to divert salt away from the river system and keep river salinity levels at acceptable levels.

· Presentation of outcomes of the General Review of Salinity Management in the Basin to Ministerial Council who agreed to develop an updated salinity management program for the next 15 years (up to 2030).

14.5.2. Summary of objectives, activities and achievements with regard to each measure implemented

Response

Achievements during 2014–15 included:

· the Basin salinity target of an average daily salinity of less than 800 EC for at least 95% of the time at Morgan in South Australia was achieved
· MDBA and independent auditors confirmed a net credit balance in the NSW, Victoria and SA salinity registers
· salt interception schemes diverted approximately 432,000 tonnes of salt from the River Murray
· outcomes of the general review of salinity management in the Basin were presented to Ministerial Council
· Ministerial Council agreed to develop an updated salinity management program for the next 15 years (up to 2030)
· reporting obligations were met, including the *Report of the Independent Audit Group for Salinity 2013–14* (MDBA 2015a) and the *Basin Salinity Management Strategy 2013–14 Annual Implementation Report* (MDBA 2015b)

· all Basin states and the ACT complied with the Basin Salinity Management Strategy (BSMS) including reporting activities at catchment scale which contribute to long-term salinity outcomes at end-of-valley target sites. The state reports include the annual assessment of recorded salinity at end-of-valley target sites against the target values. A summary of the measures implemented by states and the Authority and salinity outcomes at the end-of-valley target sites will be presented in the 2014-15 BSMS Annual Implementation Report to be published in mid-2016.