

# BASIN SALINITY MANAGEMENT 2030

SOUTH AUSTRALIA'S BIENNIAL REPORT 2017



**Government of South Australia**  
Department of Environment,  
Water and Natural Resources



Water Policy Branch,  
Water Group

Department of Environment, Water and Natural Resources

GPO Box 1047, Adelaide SA 5001

*Telephone*        National (08) 8463 6946  
                         International +61 8 8463 6946

*Fax*                 National (08) 8463 6999  
                         International +61 8 8463 6999

*Website*           [www.environment.sa.gov.au](http://www.environment.sa.gov.au)

#### Disclaimer

The Department of Environment, Water and Natural Resources and its employees do not warrant or make any representation regarding the use, or results of the use, of the information contained herein as regards to its correctness, accuracy, reliability, currency or otherwise. The Department of Environment, Water and Natural Resources and its employees expressly disclaims all liability or responsibility to any person using the information or advice. Information contained in this document is correct at the time of writing.



Excepting Government of South Australia Branding all information is licensed under a Creative Commons Attribution 3.0 Australia License.

<http://creativecommons.org/licenses/by/3.0/au/>

© Crown in right of the State of South Australia

#### Preferred way to cite this publication

Department of Environment, Water and Natural Resources (2017). *Basin Salinity Management 2030, South Australia's Biennial Report 2017*, Government of South Australia, through Department of Environment, Water and Natural Resources, Adelaide.

Download this document at [www.environment.sa.gov.au](http://www.environment.sa.gov.au)

# Acknowledgements

This report has been compiled by the Department of Environment, Water and Natural Resources (DEWNR) with significant contributions from other agencies and organisations reflecting the cross-agency approach to managing salinity in the South Australian Murray-Darling Basin.

The Water Policy Branch of DEWNR would like to acknowledge and thank the following organisations and work groups from DEWNR for their contribution to this report:

- SA Water
- Primary Industries and Regions SA
- Water Science and Monitoring Branch
- Natural Resources SA Murray-Darling Basin
- Water and Fauna Permits Branch
- River Murray Operations Branch
- Major Projects Branch

# Contents

<b>1 Introduction</b>	<b>9</b>
<b>2 Accountability framework</b>	<b>10</b>
South Australia's Salinity Register balance	10
New and proposed accountable actions	10
<b>3 Salinity accountability for environmental water management</b>	<b>11</b>
South Australian Riverland Floodplain Integrated Infrastructure Program salinity assessment	11
Chowilla Icon Site Operation and Monitoring	12
<b>4 Responsive management of salt interception schemes</b>	<b>13</b>
Operations 2015–16	13
Operations 2016–17	14
<b>5 Flow management</b>	<b>15</b>
Targets for managing water flows	15
Maintaining an open Murray Mouth	17
<b>6 Salinity management in catchments</b>	<b>19</b>
6.1 End of Valley outcomes	19
6.2 Land-based management	20
Water quality management plans	20
Review of irrigation salinity management in South Australia	20
South Australian irrigation efficiency improvement programs	20
River Murray Forest	21
Mallee Dune Seepage	22
Disposal basin management	22
South East Flows Restoration Project	22
<b>7 Efficient governance</b>	<b>24</b>
7.1 Basin-wide core salinity monitoring network	24
7.2 Review of salinity register models	24
7.3 Run of river salinity survey	26
<b>8 Strategic knowledge improvement</b>	<b>28</b>
<b>9 Community engagement and communication</b>	<b>29</b>
Regular reporting	29
Media releases	29
Community consultation and engagement	29
<b>10 Priorities for future work</b>	<b>30</b>
Strategic Knowledge Priorities – Floodplain processes	30
Basin Salinity Management procedures	30
Groundwater model updates	30

South Australia’s irrigation salinity management policy	30
Water Quality Management Plans	30
Environmental watering for SARFIIP	31

## **11 Glossary** **32**

Units of measurement commonly used	32
Shortened forms	32

## **List of figures**

Figure 1. Flow to South Australia in 2016–17	17
Figure 2. Barrage Releases in 2016–17 (using Barrage Calculator)	18
Figure 3. The new Blackford Drain regulator under-construction	23
Figure 4. Coverage of Groundwater Models in South Australia	25
Figure 5. Cumulative salt loads flowing into the River Murray between Lock 3 to Morgan	27

## **List of tables**

Table 1. South Australia's salinity register position	10
Table 2. Updates for the 2016 Salinity Register - Post 1988 irrigation based on site use approvals	10
Table 3. SIS performance in 2015–16 and 2016–17	13
Table 4. Basin Plan Targets for Reporting Sites - Salinity in 2016–17	16
Table 5. Basin Plan Targets for Reporting Sites - Salinity in 2015–16	16
Table 6. End-of-Valley summary report card	19

# Executive summary

Salinity is a significant challenge and poses ongoing risks to the Murray–Darling Basin. If left unmanaged, salinity has serious implications for water quality, biodiversity, agricultural productivity, the supply of water for critical human needs and industry. However, salinity in the Basin is carefully managed. For the past thirty years South Australia has actively contributed to the management of salinity in collaboration with partner governments across the Murray–Darling Basin to meet the Basin Salinity Target<sup>1</sup>.

The Basin Salinity Management 2030 strategy (BSM2030) provides a framework for continued investment and collective action to continue to meet the Basin Salinity Target. The BSM2030 strategy encompasses regulatory settings and management arrangements that provide the foundation for Basin salinity management. As part of efficient governance it aligns with the Basin Plan, streamlining administration, and it explores ways to further optimise operation of salt interception schemes.

The BSM2030 strategy requires partner governments to implement eight key elements which are reported on in the biennial report. This is South Australia's first biennial report under BSM2030. South Australia remains committed to the ongoing delivery of salinity management obligations under Schedule B. The implementation of BSM2030 strategy will be critical to continue to protect the environment, irrigated agriculture, industry and critical human water supplies from adverse effects of high salinities.

South Australia's key achievements and outcomes over the past two years, separated into the eight elements of BSM2030 are outlined below.

## **Accountability framework**

- South Australia remains compliant with Schedule B to the Murray–Darling Basin Agreement with a Salinity Register net salinity credit of \$7.035 million.

## **Salinity accountability for environmental management.**

- The South Australian Government notified the Murray–Darling Basin Authority (MDBA) of actions proposed to be undertaken as a part of the South Australian Riverland Floodplains Integrated Infrastructure Program (SARFIIP) that are likely to have a Significant Effect<sup>2</sup>.
- Groundwater models and methodologies were developed to assess the potential salt loads that may be discharge to the River Murray from actions undertaken as part of SARFIIP.
- Modelled salinity impacts of the Chowilla regulator were validated using monitoring data gathered during the testing of the regulator and ancillary structures.

---

<sup>1</sup> The Basin salinity Target is to maintain the average daily salinity at Morgan at a simulated level of less than 800 EC for at least 95 percent of the time, during the Benchmark Period (1 May 1975 to 30 April 2000) (Schedule B, Murray–Darling Basin Agreement).

<sup>2</sup> A change in average daily salinity at Morgan which is estimated to be at least 0.1 EC within 100 years.

## Responsive management of salt interception schemes

- Salt Interception Schemes located in South Australia intercepted more than 431,000 tonnes of salt over the past two years.

## Flow Management

- Salinity levels at reporting sites identified in the Basin Plan and South Australian River Murray Operating Plan were maintained below the identified targets for 100 percent of the time during 2015–16 and 2016–17.
- The Department of Environment, Water and Natural Resources (DEWNR) developed and implemented the 2016–17 and 2017–18 South Australian River Murray Operating Plans that assisted DEWNR to meet Basin salinity and water quality targets while managing river flows.
- Fifty three River Murray Action Requests relating to flow and wetland management were assessed for potential impacts on salinity and water quality parameters.
- Coordinated lake water level fluctuations led to the average salinity in Lake Albert decreasing by approximately 220 EC during 2016–17.
- The Murray Mouth remained open 100 percent of the time due to dredging operations combined with delivery of unregulated flow and environmental water. This enabled the continued discharge of salt from the Basin.

## Salinity management in catchments

- In 2015–16 and 2016–17 monitored daily salinity remained below the target levels at all End-of-Valley Target sites (see Table 1)

**Table 1. End-of-Valley report card**

Valley	End of Valley Target	Valley Reporting Site	2015–16 monitoring (Daily Mean EC)		2016–17 monitoring (Daily Mean EC)	
Basin salinity target	800 EC (95 %ile)	Murray at Morgan (A4260554)	EC (Max)	378	EC (Max)	732
			EC (Avg)	268	EC (Avg)	363
			EC (95 %ile)	344	EC (95 %ile)	533
SA Border	412 EC (80 %ile)	Murray at SA Border (A4261022)	EC (Max)	269	EC (Max)	342
			EC (Avg)	173	EC (Avg)	219
			EC (80 %ile)	198	EC (80 %ile)	293
Berri	543 EC (80 %ile)	Murray at Berri (A4260537)	EC (Max)	303	EC (Max)	473
			EC (Avg)	221	EC (Avg)	289
			EC (80 %ile)	252	EC (80 %ile)	402
Below Morgan	770 EC (80 %ile)	Murray at Murray Bridge (A4261162)	EC (Max)	435	EC (Max)	640
			EC (Avg)	328	EC (Avg)	389
			EC (80 %ile)	356	EC (80 %ile)	537

- Draft Water Quality Management Plans have been developed for South Australia’s water resource plan areas that identify causes of water quality degradation, risks to water quality, water quality and salinity targets and measures that will contribute to the achievement of the water quality objectives.

- A review of irrigation salinity management policies commenced in late 2016 to ensure that the policy settings are appropriate for contemporary irrigation and salinity management requirements. Community consultation is a focus of the review with consultation on a policy options paper being undertaken in late 2017.
- On-farm efficiency measures were implemented for 186 South Australian River Murray-based irrigators that will deliver 35 GL of water entitlements for environmental use. Improved irrigation efficiency reduces recharge to groundwater, reducing salinity discharge to the river. In addition environmental water can be used to dilute existing salt inflows.
- Construction of the South-East Flows Restoration Project commenced to manage excessive salinity levels in the Coorong South Lagoon in conjunction with improved environmental flows from the River Murray.

### **Efficient governance**

- DEWNR identified a network of 435 regional and floodplain groundwater monitoring wells to be nominated as part of the Basin-wide core monitoring network to inform monitoring and salinity register models.
- DEWNR has worked with the MDBA and the Basin Salinity Management Advisory Panel (BSM AP) to progress the reviews of groundwater models which underpin the assessment of 16 accountable actions on the Salinity Registers.
- Run of river salinity surveys were conducted from Lock 7 to Morgan in June 2016 and 2017 to improve knowledge of the impact of salt management actions undertaken along the river.

### **Strategic knowledge improvement**

- South Australian officials have actively contributed to work to improve our knowledge of salinity impacts and management in the mallee regions of the Murray-Darling Basin.

### **Community engagement and communication**

- Extensive community consultation was undertaken as part of the Review of Irrigation Salinity Management project in South Australia including the release of a short [animated video on salinity](#) in the River Murray.

### **Priorities for future work (2017–18)**

- Apply new groundwater numerical models to improve our understanding of the influence of evapotranspiration, changing river levels, inundation recharge and solute transport processes within floodplains and their effect on salt fluxes to the river.
- Development of Basin Salinity Management (BSM) Procedures to update and replace the Basin Salinity Management Strategy (BSMS) Operational Protocols.
- Review and update of groundwater models and register entries in accordance with the BSM2030 review plan approved by the Basin Officials Committee in December 2015, including shifting existing models to new software platforms, undertake data-gap analysis of existing models and updating our estimates of irrigation extent.

- Finalise the Review of Irrigation Salinity Management project in South Australia project and outline potential changes to the River Murray Salinity Zoning Policy to more efficiently manage the salinity risk.
- Continue development of Water Quality Management Plans for South Australia's three water resource plan areas; South Australian Murray Region, Eastern Mount Lofty Ranges and the South Australian River Murray.

# 1 Introduction

This biennial report provides an update on South Australia's progress on achieving the eight elements of Basin Salinity Management 2030 (BSM2030). The BSM2030 strategy is delivering a strategic, cost-efficient and streamlined program of coordinated salinity management measures until 2030. The strategy reflects the contemporary understanding of salinity risk in the Basin and it includes efficient governance arrangements, including annual and biennial reporting. This report has been structured to report on each of the eight elements which are:

- **Accountability framework** – the maintenance of the salinity registers and management of accountable actions.
- **Salinity accountability for environmental management** – creating transparency through accounting for environmental watering salinity impacts and dilution flows.
- **Responsive management of salt interception schemes** – a new salt interception scheme management regime developed during a 3-year trial conducted by the Murray-Darling Basin Authority (MDBA).
- **Flow Management** – supporting the implementation of Basin Plan salinity targets for managing water flows through a coordinated management approach.
- **Salinity management in catchments** – reporting on End-of-Valley Targets and implementing cost-effective measures to improve salinity outcomes.
- **Efficient governance** – risk-based register management, maintaining monitoring networks, streamlining annual reporting and independent auditing.
- **Strategic knowledge improvement** – involvement in improving our understanding of the priority areas of mallee legacy of history impacts, environmental water impacts, predictive salinity forecasting, responsive salt interception schemes.
- **Community engagement and communication** – maintaining communication engagement, relevant media releases and continuing consultation at community meetings.

## 2 Accountability framework

'BSM2030 retains the accountability framework of BSMS, which is established by Schedule B. This framework commits the partner governments to maintain agreed salinity levels and ensure that their actions that increase river salinity are offset by investing in actions to reduce salinity.' (BSM2030)

### South Australia's Salinity Register balance

Under Schedule B of the Murray-Darling Basin Agreement (Schedule 1 to the *Water Act 2007*), South Australia is accountable for actions that will change salinity in the River Murray. The actions are recorded as debits or credits on the Salinity Registers. Actions such as irrigation development increase the salinity impacts and result in a debit on the Salinity Register, whereas actions such as salt interception, improved irrigation efficiency and rehabilitation of drainage schemes decrease the salinity impacts and result in credits on the Salinity Register.

Based on the 2016 Salinity Registers endorsed by the Murray-Darling Basin Ministerial Council, South Australia maintains a positive credit balance of \$7.035 million (Table 1) and remains compliant with Schedule B. In 2050 South Australia's register balance is projected to go into debit. It is expected that the certainty of future Salinity Register balances will be improved as Salinity Register entries are regularly reviewed.

**Table 1. South Australia's salinity register position**

As at 12/09/16	Salinity cost (\$/yr)			
	Current year	Projected		
Register	2016	2030	2050	2100
A	4,782,000	1,818,000	-2,415,000	-22,903,000
B	2,253,000	2,237,000	2,214,000	371,000
<b>Total</b>	7,035,000	4,055,000	- 201,000	-22,532,000

### New and proposed accountable actions

In accordance with Basin salinity accountability arrangements, South Australia reports annually on the potential salinity impacts from new irrigation developments using the SIMRAT model. Changes to Site Use Approvals are used to represent new irrigation development as they provide the permission to use water at a particular location for a specified purpose.

In 2016–17 there were no increases to Site Use Approval volumes that were assessed using the SIMRAT model. In 2015–16 there were two increases to Site Use Approval volumes that were assessed using the SIMRAT model. The estimated salinity impacts associated with those approvals are documented in Table 2.

**Table 2. Updates for the 2016 Salinity Register - Post 1988 irrigation based on site use approvals**

Lock Reach	Site Use Approval	Volume (ML)	Salt Load (tonnes/day)		
			2015	2050	2100
Lock 4 to Lock 3	1	33,874	0.00	3.14	26.25
Lock 1 to Murray Bridge	1	2,006	0.00	0.00	0.24
<b>Total</b>	2	35,880	0	3.14	26.50

# 3 Salinity accountability for environmental water management

*'The recovery and use of significant volumes of water for the environment is a relatively new issue in salinity management. Environmental watering will provide long-term substantial dilution benefits, but it can also mobilise salt from floodplains into the river system. The salinity impacts of environmental watering must be understood and demonstrated transparently to communities through explicit inclusion in the accountability framework.'* (BSM2030)

## **South Australian Riverland Floodplain Integrated Infrastructure Program salinity assessment**

The South Australian Riverland Floodplains Integrated Infrastructure Program (SARFIIP) which commenced in 2014 is funded by the Australian Government and implemented by the DEWNR to improve the watering and management of River Murray floodplains in the Riverland.

The program has a focus on the Pike and Katarapko floodplains and optimizing integrated management of environmental water delivery in the South Australian River Murray. The program will be constructing environmental regulators and levee banks to achieve environmental watering of large areas of the floodplains. In addition, the program will construct saline groundwater management projects to improve ecological condition and offset salt loads that may be discharged to the river due to the altered watering regime of the Pike floodplain. To assist effective program delivery it is also delivering monitoring and management tools to support environmental watering in the future.

In accordance with Schedule B, clause 17(1) of the Murray-Darling Basin Agreement the South Australian Government has notified the MDBA that actions proposed to be undertaken as a part of SARFIIP are likely to have a Significant Effect (as defined in Schedule B sub clause 18(3)).

To enable DEWNR to accurately assess and account for the salinity impact of actions that are proposed to be undertaken as part of SARFIIP, it will assess the potential salt loads contributed to the River Murray using a series of groundwater models. A numerical, fine-resolution floodplain groundwater model has been built for the Pike floodplain which includes transient and solute transport capabilities. This model is currently being used to assist in the evaluation of saline groundwater management scheme alignments and designs to best complement surface water management in achieving ecological restoration of the floodplain. The model will also be used to refine the quantification of the salinity impacts of floodplain management actions.

A floodplain investigations phase was completed in 2016 with investment proposals being approved for the Pike and Katarapko saline groundwater management projects. The detailed design for surface water management and the first tranche of highland saline groundwater management wells at Pike floodplain have been completed and construction proposals are expected to be approved by August 2017.

Construction will commence from October for groundwater management infrastructure, and February 2018 for surface water management structures. Further saline groundwater management investment continues to be investigated for the Pike floodplain and a second construction proposal may be submitted in April 2018.

The detailed design for Katarapko surface water management is underway with a construction proposal expected by April 2018. Saline groundwater management continues to be investigated for Katarapko floodplain.

A floodplain groundwater model is also being developed for the Katarapko floodplain. Due to data limitations, this model will be a transient only model. Once completed the model is intended to improve our understanding of groundwater changes due to surface water management actions to support ecological risk and benefit assessments. The model will also be used to quantify the salinity impacts of floodplain management actions.

### **Chowilla Icon Site Operation and Monitoring**

The Chowilla floodplain is one of the six icon sites under The Living Murray program. It is recognised that managed inundation of the floodplain via operation of the Chowilla environmental regulator will improve soil conditions including salinity and soil moisture availability, thereby improving vegetation health and providing an environmental benefit to the Chowilla region.

Floodplain inundation results in discharge of salt into the Chowilla anabranch creeks and to the River Murray. Accordingly, work has been undertaken to assess both long-term and short-term salinity impacts associated with operation of the Chowilla regulator structures. This work has informed the development of an operating strategy for the regulator and estimation of the long-term salinity impact for inclusion in the 'The Living Murray Works and Measures and Water for Rivers' Salinity Register entry.

Testing of the regulator and ancillary structures has now been undertaken on three occasions which have provided an opportunity to undertake validation of the modelled salinity impacts and confirm risk mitigation measures. During spring 2014 the initial testing involved mid-level operation of the Chowilla regulator to 19.1 metres Australian Height Datum (mAHD) resulting in a floodplain inundation of approximately 2,300 hectares of wetlands and floodplains. In 2015 a low level in channel operation was undertaken with limited inundation of riparian areas. In 2016 a high level regulator operation was undertaken to 19.75 mAHD resulting in inundation of approximately 7,650 hectares which was followed by a natural high flow event where flows to South Australia peaked at over 95,000 ML/d.

The surface water monitoring network indicated only a slight increase in salinity (20 EC) in the River Murray during, and on recession of the 2014 testing event. This increase in salinity is similar to the typical background increase in salinity downstream of Chowilla Creek in the Murray River, and the salinity levels recorded during and following the testing were relatively low in comparison to averages recorded over the previous 12 months.

The salinity response from the 2016 managed floodplain inundation from the regulator operation is difficult to separate from the response from the ensuing natural high flow event. Daily salt load peaked at almost 1,700 tonnes/day (t/d) in the River Murray and 650 t/d in Chowilla soon after the peak of the high flows with elevated salt loads recorded for a number of months following the recession. Elevated salt load discharge following inundation is expected for Chowilla floodplain and it is diluted in the river. Salt interception schemes assist in offsetting the salt load impact. Work to assess the salinity responses from Chowilla regulator operations against the modelled salinity impacts is ongoing.

## 4 Responsive management of salt interception schemes

*'BSM2030 will explore the potential to operate SIS in response to forecast river flow and salinity conditions, taking opportunities to reduce operations and therefore operating costs during periods of low in-river salinity. It will also provide an opportunity to better understand the operational capabilities of SIS and system responses to changed operations. Given that there is uncertainty regarding the risks associated with changing SIS operations, responsive SIS management will initially be trialled for a 3-year period commencing in 2016, with the outcomes being reported annually.'* (BSM2030)

There are seven Salt Interception Schemes (SIS) in South Australia. The Bookpurnong, Loxton, Murtho and Waikerie Lock 2 SIS were constructed in South Australia as part of the 61 EC joint works program for BSMS. These SIS complement the Woolpunda and remainder of Waikerie SIS constructed under the Salinity and Drainage Strategy and the Qualco-Sunlands and Pike SIS which are South Australian state actions.

These SIS have diverted an estimated 431,000 tonnes of salt that would have flowed into the River Murray during the past two years. They significantly contribute to the achievement of the Basin Salinity Target and the maintenance of acceptable salinity levels above Lock 1 during low-flows. The annual performance of each scheme is presented in Table 3 below.

**Table 3. SIS performance in 2015–16 and 2016–17**

Salt Interception Scheme	2016–17			2015–16		
	Volume Pumped (ML)	Salt Load Diverted (Tonnes)	Average Salinity (EC)	Volume Pumped (ML)	Salt Load Diverted (Tonnes)	Average Salinity (EC)
Pike	104	4,373	54,750	291	12,707	54,438
Murtho	898	21,349	39,245	968	24,285	39,612
Bookpurnong	334	8,535	42,155	1,002	22,374	36,935
Loxton	356	5,719	23,444	1,164	20,820	23,397
Woolpunda	5,281	104,383	30,973	4,894	91,828	29,535
Waikerie	3,336	56,430	30,038	3,100	56,726	31,201
total	10,308	200,790	n/a	11,489	230,158	n/a

Schemes are operated by the MDBA in accordance with the Responsive SIS trial. A description of scheme operations provided by SA Water is summarised below.

### Operations 2015–16

In 2015–16 the Murtho SIS operated 18 bores using off-peak power and the remaining five were kept in standby mode (operating for 1 hour per day). At the Loxton SIS all low-yielding bores were kept in standby mode and the Rilli's Cliff Airwells were decommissioned. The Waikerie Lock 2 bores and the Bookpurnong highland bores were also kept in standby mode and Bookpurnong well 51FP was decommissioned due to low production rates.

## **Operations 2016–17**

The high-flow event in 2016 required many floodplain bores to be removed prior to inundation and then be reinstated as flows receded.

In 2016–17, Murtho SIS initially operated the 4 floodplain bores during off-peak hours only, before two were removed in September prior to high-flows. In December 2016 the floodplain bores were reinstated and all were run 100 percent of the time. In March 2017 the scheme reverted to full operations, including highland bores.

The Loxton SIS floodplain bores were progressively decommissioned from July 2016 in preparation for high-flows, and following the high-flows they were reinstated as soon as possible at 100 percent operations. In March 2017 all highland bores also recommenced full operations.

The Waikerie SIS bores initially operated in off-peak mode and then from October 2016 floodplain bores were decommissioned in preparation for high-flows. As the flows receded the floodplain bores were reinstated to 100 percent operations as soon as possible.

The Bookpurnong SIS began the year with all highland bores in standby mode. From July 2016 floodplain bores were decommissioned in preparation for high-flows and as the flows receded the floodplain bores were reinstated to 100 percent operations as soon as possible. In March 2017 all highland bores also reverted to 100 percent operation.

# 5 Flow management

*'River operations and flow management can have a significant effect on river salinity. With greater volumes of environmental water available there is greater potential to improve river salinity through increased dilution. Environmental watering can also, in some circumstances, increase salinity. Those circumstances need active management to minimise salinity impacts. The salinity risks associated with flow management therefore need to be identified and managed within the context of broader flow management objectives.'* (BSM2030)

## **Targets for managing water flows**

The Basin Plan establishes the Water Quality and Salinity Management Plan (WQSMP), which sets out key causes of water quality degradation, water quality objectives for Basin water resources and water quality targets. Under the WQSMP, water managers, river managers and holders of environmental water must have regard to “targets for managing water flows” when making flow management decisions.

The salinity targets for managing water flows (Basin Plan 9.14) that are relevant to South Australia are:

- River Murray at Lock 6 – 580 EC
- River Murray at Morgan – 800 EC
- River Murray at Murray Bridge – 830 EC
- Lower Lakes at Milang – 1,000 EC

Flow management decisions are made on a daily basis by DEWNR River Murray Operations Group consistent with the objectives of the South Australian River Murray Annual Operating Plan and the Annual Environmental Watering Plan. Decisions are made using a range of hydrological data, modelling and other information gathered regularly.

Oversight of decisions is provided by a defined governance structure. A multi-agency River Murray Operations Working Group meets monthly to review status and provide guidance to the River Murray Operations Group on issues that arise throughout the year. Any proposed actions that may have an impact on salinity and water quality are considered by the multi-agency group and any actions that are likely to have negative impacts are elevated to the Director, River Murray Operations for consideration. If a decision cannot be resolved the action is elevated to DEWNR senior officials through the internal Murray-Darling Basin Coordinating Committee (MDBCC).

Regular monthly reporting on River Murray operations and flow and water quality outcomes is provided to the MDBCC. All plans (including the South Australian River Murray Annual Operating Plan and the Annual Environmental Watering Plan) and significant policy and operational decisions relating to the River Murray that may have an impact on water quality are assessed and approved by the MDBCC before implementation.

To ensure that regard is had to the targets for managing water flow and salinity when planning and delivering environmental water, DEWNR uses an adapted 'The Living Murray' template that considers the risks associated with not watering and watering wetlands. The template assists working groups in their decision making processes relating to development, planning and use of environmental water and to make an assessment against the targets listed under Basin Plan s 9.14.

The annual environmental watering priorities must identify salinity risks associated with delivery of environmental water and ensure that due regard is given to the requirement to not exceed salinity targets specified in the Water Quality and Salinity Management Plan (Chapter 9 of the Basin Plan).

Decisions to use environmental water are dependent on the real-time river conditions, the likely risks and available contingency measures. During watering events, specific monitoring of water quality occurs in real-time at the major wetland sites. Smaller sites are monitored through the in-stream monitoring network. DEWNR also participates in the MDBA operations-led advisory group for environmental watering and the information provided about water quality from that group is also used in real-time operational decisions.

River Murray operations outside those defined in the South Australian River Murray Annual Operating Plan and the Annual Environmental Watering Plan are managed through River Murray Action Request Forms. River Murray Action Request Forms require the proponent to identify the potential impacts of flow management decisions as they relate to water quality for actions that arise throughout the year.

In 2015–16 and 2016–17, 53 River Murray Action Request Forms relating to flow management and wetland management were received for consideration and assessed for impacts on River Murray water quality or other users. Where potential implications for water quality are identified, proponents are required to identify potential mitigation strategies and monitor outcomes. DEWNR management and planning for salinity management assured salinity levels at reporting sites identified in the Basin Plan and South Australian River Murray Operating Plan were maintained below the identified targets for 100 percent of the time during 2015–16 and 2016–17 (refer to Table 4 and Table 5).

**Table 4. Basin Plan Targets for Reporting Sites – Salinity in 2016–17**

Location	Target (EC) ( $\mu\text{S/cm}$ )	Max (EC) ( $\mu\text{S/cm}$ )	Min (EC) ( $\mu\text{S/cm}$ )	Ave (EC) ( $\mu\text{S/cm}$ )
Lock 6	<580	339	111	221
Morgan	<800	746	154	365
Murray Bridge	<830	642	173	390
Milang	<1,000	905	317	538

**Table 5. Basin Plan Targets for Reporting Sites – Salinity in 2015–16**

Location	Target (EC) ( $\mu\text{S/cm}$ )	Max (EC) ( $\mu\text{S/cm}$ )	Min (EC) ( $\mu\text{S/cm}$ )	Ave (EC) ( $\mu\text{S/cm}$ )
Lock 6	<580	234	117	168
Morgan	<800	377	199	272
Murray	<830	436	268	329
Milang	<1,000	903	695	796

DEWNR has also been actively managing salinity levels in the Lake Albert and the Coorong. To achieve this, where possible DEWNR coordinates lake level fluctuations and water releases through the barrages. As a result,

- the average daily salinity in the Coorong North Lagoon and Coorong South Lagoon was maintained below 100 parts per thousand (ppt) for 2016–17. The maximum average daily salinity level was 87 ppt in the Coorong South Lagoon on 2 March 2017.
- the average salinity in Lake Albert decreased by approximately 220 EC during 2016–17 (average salinity at the end of June 2016 was approximately 1,910 EC and at the end of June 2017 was approximately 1,690 EC).

The BSM2030 strategy requires states to facilitate continuous improvement in flow management by reviewing practices, particularly in response to elevated salinity events. In late 2016 there was a significant high-flow event with a peak of 95 gigalitres per day (GL/day) at the South Australian border and as the high-flow event receded rapidly in December 2016, an elevated salinity event developed. Salinity levels at Basin Plan target reporting locations of Morgan and Murray Bridge both peaked at 730 EC and 640 EC respectively, but remained below the target maximum values of 800 EC and 830 EC respectively.

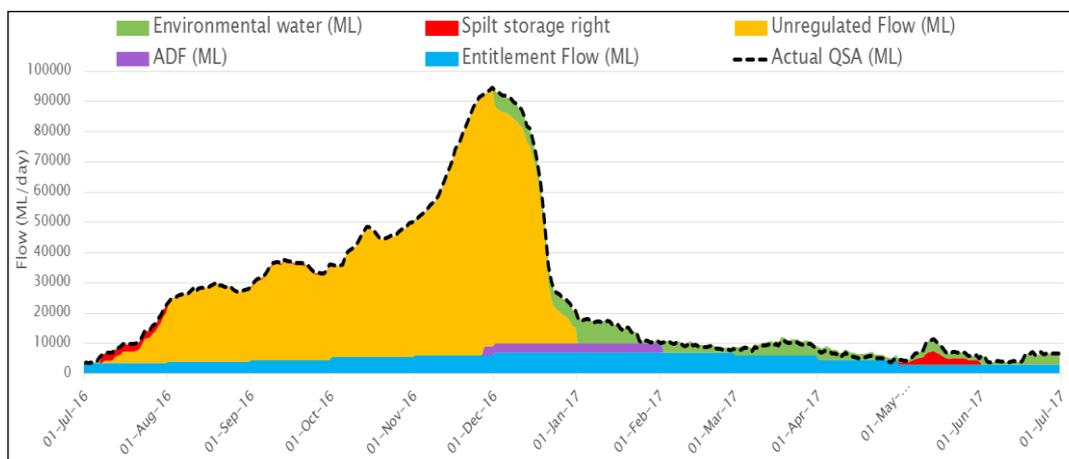
The spike in salinity was attributed to water levels in the Lock 3 weir pool dropping below normal pool level as the flows rapidly diminished. The source of the salt was predominately from large connected waterbodies such as Lake Bonney which have higher salinity levels than the main channel.

In light of the observations in 2016–17, opportunities to mobilise and discharge salt from connected water bodies of higher salinities while ‘having regard’ to Basin Plan Targets are being investigated. The aim will be to ensure that discharge of saline water from connected water bodies and backwaters are managed to minimise the salinity spike during the recession of a high-flow event.

### Maintaining an open Murray Mouth

The Murray Mouth, near Goolwa in South Australia, is a dynamic system influenced by the flow of River Murray water at the barrages and tidal movement from the Southern Ocean. Maintaining an open mouth is a key objective under the Murray-Darling Basin Plan. An open mouth is required to ensure adequate flushing of salt from the River Murray systems into the Southern Ocean.

When the flow to South Australia and barrage releases are low, sand deposits may occur inside the Mouth causing restrictions and increasing the risk of closure. Substantial barrage releases are only possible if South Australia receives unregulated flow and/or large volumes of environmental water. In 2016–17, South Australia received approximately 9,236 GL of flow, which included 6,318 GL of unregulated flow and 996.4 GL of environmental water (Figure 1).

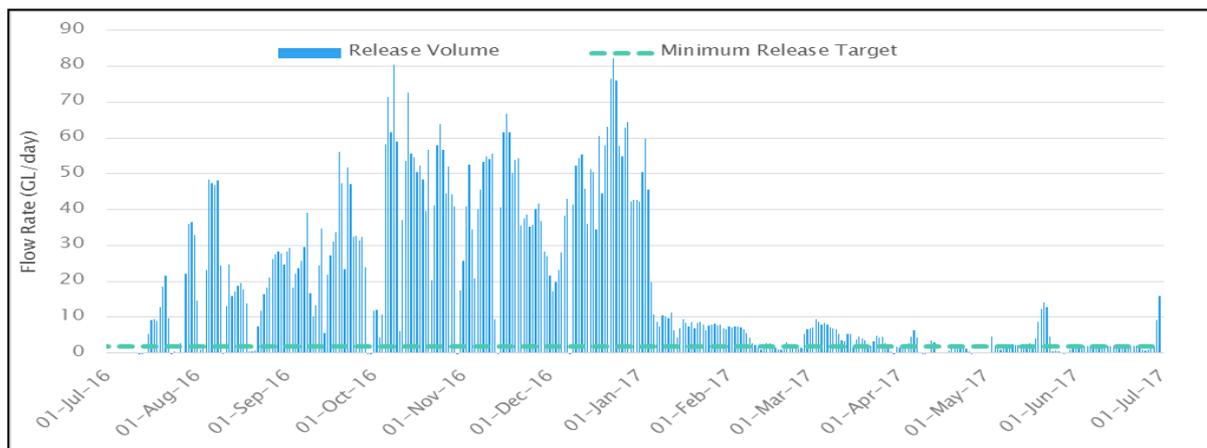


**Figure 1. Flow to South Australia in 2016–17**

The high flows in 2016–17 provided for approximately 6,491 GL to be released through the barrages with releases equalling or exceeding 2 GL/day for 276 days (76 percent of the time).

Between 18 and 23 May 2017, a pulse of unregulated flow and environmental water was delivered to flush the Mouth to scour sand. This operation was a success. As a result, environmental water was delivered to provide a

further scouring flush, which commenced on 29 June 2017, as weather conditions were conducive for the event to proceed (Figure 2).



**Figure 2. Barrage Releases in 2016-17 (using Barrage Calculator)**

To maintain connectivity (exchange of water) between the Coorong and the Southern Ocean it has been necessary for dredging operations to be undertaken at the Murray Mouth since 9 January 2015. At 30 June 2017, approximately 2 million cubic metres of sand had been removed by dredging operations.

At the start of 2016-17, two dredges were operating in the Goolwa and Tauwitche Channels to maintain an open Mouth. As a result of the scouring effect from the high flow event in late 2016, dredging operations were reviewed by the Murray Mouth Sand Pumping Steering Committee and one of the two dredges was decommissioned on 23 October 2016. The committee reviewed the condition of the Mouth and the need for dredging in May 2017 which has resulted in the reinstatement of the second dredge in August 2017.

As a result of these conditions, in 2015-16 and 2016-17 the Murray Mouth (Mouth) remained open 100 percent of the time due to dredging operations combined with delivery of unregulated flow and environmental water.

# 6 Salinity management in catchments

*'Basin States have responsibility for land and water management activities that address salinity risks. Depending on the magnitude of the salinity risks within their particular catchments, communities and governments throughout the Basin have worked together to improve landscape management and irrigation practices. Since the 1980s these activities have typically been implemented through state-based instruments such as land and water management plans or catchment plans or individual investments.'* (BSM2030)

## 6.1 End of Valley outcomes

BSM2030 retains the End-of-Valley Targets to preserve Basin-wide monitoring and to inform the assessment of salinity risk to the shared water resources and within-valley assets.

As part of the BSM2030, flow and salinity must be monitored at each End-of-Valley Target site and reported annually. The flow monitoring results for the Basin Salinity Target and the three South Australian End-of-Valley Target sites are presented in Table 6.

In 2015–16 and 2016–17 monitored daily salinity remained below the target levels at all sites. The program of salinity controls implemented to date, including salt interception schemes, improved irrigation system and on-farm practices, have contributed to the maintenance of in-river salinity levels below target levels.

**Table 6. End-of-Valley summary report card**

Valley	End-of-Valley Target	Valley Reporting Site	2015–16 monitoring (Daily Mean EC)		2016–17 monitoring (Daily Mean EC)	
Basin salinity target	800 EC (95%ile)	Murray at Morgan (A4260554)	EC (Max)	378	EC (Max)	732
			EC (Avg)	268	EC (Avg)	363
			EC (95 %ile)	344	EC (95 %ile)	533
SA Border	412 EC (80%ile)	Murray at SA Border (A4261022)	EC (Max)	269	EC (Max)	342
			EC (Avg)	173	EC (Avg)	219
			EC (80 %ile)	198	EC (80 %ile)	293
Berri	543 EC (80%ile)	Murray at Berri (A4260537)	EC (Max)	303	EC (Max)	473
			EC (Avg)	221	EC (Avg)	289
			EC (80 %ile)	252	EC (80 %ile)	402
Below Morgan	770 EC (80%ile)	Murray at Murray Bridge (A4261162)	EC (Max)	435	EC (Max)	640
			EC (Avg)	328	EC (Avg)	389
			EC (80 %ile)	356	EC (80 %ile)	537

## **6.2 Land-based management**

### **Water quality management plans**

A key element of Basin Plan implementation in South Australia is the development and implementation of Basin Plan compliant Water Resource Plans for each of the State's three Water Resource Plan areas. Water Resource Plan requirements are set out in Chapter 10 of the Basin Plan, with specific water quality provisions included in Part 7.

The water quality provisions, require that Water Resource Plans establish a Water Quality Management Plan that has been developed with consideration of the impacts of wider natural resource management and land management on water quality within the Water Resource Plan area.

The Water Quality Management Plans will identify causes of water quality degradation, risks to water quality, water quality and salinity targets and measures that will contribute to the achievement of the water quality objectives.

Water Quality Management Plans for South Australia's three water resource plan areas are currently under development as part of the state's Water Resource Plan development program. As part of the program, a final draft Water Quality Management Plan has been developed for the South Australian Murray Region, an initial draft Water Quality Management Plan for the Eastern Mount Lofty Ranges has been submitted to the Murray-Darling Basin Authority for comment and development of the South Australian River Murray Water Quality Management Plan has commenced.

### **Review of irrigation salinity management in South Australia**

The salinity zoning policy is a key element of South Australia's broader salinity management program. The policy was introduced in 2003 to minimise the salinity impacts from new irrigation development, by limiting irrigation water use in defined salinity management zones.

The policy also assists South Australia to meet its obligations under the Murray-Darling Basin Agreement by ensuring that there is a balance between actions that have an adverse salinity impact and actions which have a positive salinity impact.

Over the last 14 years there have been considerable changes to irrigation and land and water management activities due to the millennium drought, unbundling of water rights and implementation of the Basin Plan. To ensure that the policy settings are appropriate, a review of irrigation salinity management policies was initiated in late 2016.

Consultation on a Review of Irrigation Salinity Management Policy issues paper was undertaken in April 2017 to gain a clearer understanding of stakeholder issues. The issues paper is available for further information at (<https://yoursay.sa.gov.au/decisions/river-murray-irrigation-salinity-management/about>).

Community and stakeholder feedback is being taken into account to develop a policy options paper for consultation in October 2017. It is anticipated that recommendations on updating the policy will be provided to the Minister for Water and the River Murray before the end of 2017.

### **South Australian irrigation efficiency improvement programs**

Irrigation efficiency improvement programs apply the latest irrigation technology on farms to manage water consumption. Typically, projects aim to reduce the volume of water required to meet the crop requirements which results in reduced root zone drainage. Reduced root zone drainage contributes to a reduction in discharge of saline groundwater to the River Murray. South Australia currently has three irrigation efficiency improvement programs in different stages of implementation which are outlined below. The current programs are primarily motivated by the need to achieve water recovery targets under the Murray-Darling Basin Plan.

### *Sustainable Rural Water Use Infrastructure Program*

Since the commencement of the Sustainable Rural Water Use and Infrastructure program (SRWUIP) the South Australian Murray-Darling Basin Natural Resources Management (SA MDB NRM) Board has been involved in the delivery of four rounds of the Australian Government funded *On-Farm Irrigation Efficiency Program (OFIEP)* and Round Two of the *Private Irrigation Infrastructure Program for South Australia (PIIP-SA)*.

Across both the OFIEP and PIIP-SA over 27.5 GL of water savings have been generated through 378 on and off farm irrigation efficiency projects with more than 18.5 GL of water entitlements having been returned to the Commonwealth Environmental Water Holder. The \$67m injection of investment has also provided significant flow on benefits to regional communities.

The SA MDB NRM Board continues to implement key initiatives of the SRWUIP across the South Australian Murray-Darling Basin Region. Detailed benefit cost analysis showed an average benefit cost ratio of 3.2:1 highlighting the value that the investment is having for regional irrigation communities.

### *South Australian River Murray Sustainability program*

The flagship element of South Australian River Murray Sustainability Program (SARMS) is the \$240 million Irrigation Industry Improvement Program (3IP). SARMS is a National Partnership Agreement between the South Australian Government and Australian Government. 3IP projects are reshaping the region, including the reconfiguration of irrigation and production systems, change in crop types, and increased value-adding to products and processes through things like automated fruit and vegetable packing machines.

Implementation of Round One, Two and Three projects is underway, including projects ranging from small family farm turnaround propositions, to large international-scale corporate ventures, as well as a number of innovative new proposals. Successful implementation of these projects will take the total of 3IP funding offers to \$177 million across 186 South Australian River Murray-based irrigators and provide 35 GL of water entitlements for environmental use, only 5 GL away from the Program's 40 GL target. A fourth round of funding opened on 20 March 2017.

### *Commonwealth On-Farm Further Irrigation Efficiency program*

In September 2016 the SA MDB NRM Board signed a deed of standing offer with the Australian Government to commence the delivery of the first pilot of the new Commonwealth On-Farm Further Irrigation Efficiency (COFFIE) program. Water savings achieved through the COFFIE program contribute towards the recovery of the additional 450 GL of bridging-the-gap water through the Murray-Darling Basin Plan, which is vital for the long-term health and sustainability of the River Murray.

The \$15 million pilot has attracted good early interest from the SA Murray irrigation community with the new and improved program design contributing to this. The new COFFIE design facilitates a much faster approval process than previous bridging-the-gap programs such as OFIEP and also allows the short term leasing back of transferred entitlements.

The Board is currently working with the Department of Agriculture and Water Resources to develop a number of case studies of COFFIE participants to inform industry stakeholders and the community. The case studies will focus not only on the on-farm outcomes that have been achieved but also the irrigators experience with the new COFFIE design. The first of the cast studies should be available later in 2017.

### **River Murray Forest**

This project has now been completed. Revegetation of cleared areas with deep-rooted vegetation reduces recharge to saline groundwater and resulting salt discharge to the River Murray. The River Murray Forest project was established with a South Australian Government commitment of \$5.7 million and involved the establishment of

native vegetation for biodiversity and carbon sequestration outcomes. The River Murray Forest project extended over the full length of the River Murray in South Australia. Over the ten years of the project, 372 hectares (ha) of forest has been planted on private land and a further 292 ha on public land.

### **Mallee Dune Seepage**

Investigations into root zone drainage under dryland-cropping contributes to our understanding of the impact of historical land-clearing and modern cropping methods on groundwater recharge rates and the long-term impact it may have on saline groundwater discharge to the river.

Mallee dune seeps have emerged as an issue affecting grain growers across Murray Mallee Districts in in South Australia, Victoria and New South Wales. Seeps are generally caused by lower crop water use on sand dunes which results in increased discharge to adjacent swales which are often underlain by Blanchetown clay. This process can contribute to elevated groundwater recharge rates. During the wet winter of 2016, the perched watertable increased by between 0.5 m and 1.2 m under some dunes and the issue was observed in areas where it had not been previously.

The SA MDB NRM Board is supporting a project to investigate methods for identifying areas at risk from dune seepage and to help choose appropriate management options that can be strategically implemented.

The project will trial a number of management options including the use of high water use plants such as Lucerne, perennial salt tolerant shrubs and strategic planting of native vegetation to reduce groundwater recharge rates. For solutions to be effective it is essential that environmental and agronomic solutions are practical and cost effective. A range of additional management options are being considered to intercept recharge including pasture cropping, cover cropping, growing summer crops, and water harvesting. Whilst these methods are considered feasible for the reduction of recharge, significant research and extension would be required to quantify the environmental and agronomic benefits before widespread adoption and integration into farming systems could be realised.

### **Disposal basin management**

Drainage water from the former South Australian Government irrigation areas in the Riverland is disposed to 17 basins, principally on the river floodplain close to the river edge. Some floodplain disposal basins remain critical to divert saline groundwater from salt interception scheme operations to the inland disposal basin at Noora. However, as a consequence of the rehabilitation of irrigation water supply systems, improved water management, improved irrigation practices and changes in crop types, the volume of drainage water has declined over the last two decades to the point where most if not all of the drainage water is lost to evaporation. This trend is expected to continue for the foreseeable future thus reducing the need for floodplain basins to dispose of drainage water to the river.

The reduced need for the floodplain disposal basins provides opportunities for the modified future management and rehabilitation of the disposal basins (e.g. by management of their water regime). Berri Barmera Council has taken over full responsibility and management of the Berri Stormwater basin while Loveday Disposal Basin and Mussel Lagoons Wetland Complex are being managed as part of an Integrated Management Plan for ecological benefits.

DEWNR will continue to look for opportunities for similar arrangements to be put in place for other floodplain drainage basins that are no longer required.

### **South East Flows Restoration Project**

The South East Flows Restoration Project (SEFRP) is an infrastructure and environmental project which aims to help prevent excessive salinity levels in the Coorong South Lagoon by complementing River Murray barrage flows with

inflows from the South East of South Australia. The objective is to maintain salinity of the Coorong South Lagoon within the target range of 60 g/L to 100 g/L (93,600 – 156,000 EC). The project is jointly funded under the Australian Government’s Sustainable Rural Water Use and Infrastructure Program and South Australia’s Murray Futures program, and is part of the Coorong, Lower Lakes and Murray Mouth Recovery Project. Construction work commenced in March 2017 and are scheduled for completion in mid-2018 (Figure 3).



**Figure 3. The new Blackford Drain regulator under-construction**

# 7 Efficient governance

*'BSM2030 will streamline the management program developed under BSMS by making it risk-based and more efficient. The monitoring, reporting, review and auditing arrangements will ensure transparency and assure compliance with the agreed actions and accountabilities of BSM2030. They will also help to continually improve the knowledge of salinity risks.'* (BSM2030)

## 7.1 Basin-wide core salinity monitoring network

The BSM2030 strategy requires partner governments, and the MDBA, to nominate their core salinity monitoring network and make a commitment to the operation, maintenance and reporting on the delivery of monitoring at these sites for the life of the BSM2030 strategy.

The Basin-wide Core Salinity Monitoring Network includes monitoring sites considered critical to underpin the models that quantify register entries, evaluate trends at End of Valley Target sites, assess compliance with the Basin Plan, improving knowledge in priority areas, and support river operations, SIS management and environmental flow management.

There are three components to the salinity monitoring network in South Australia. These are:

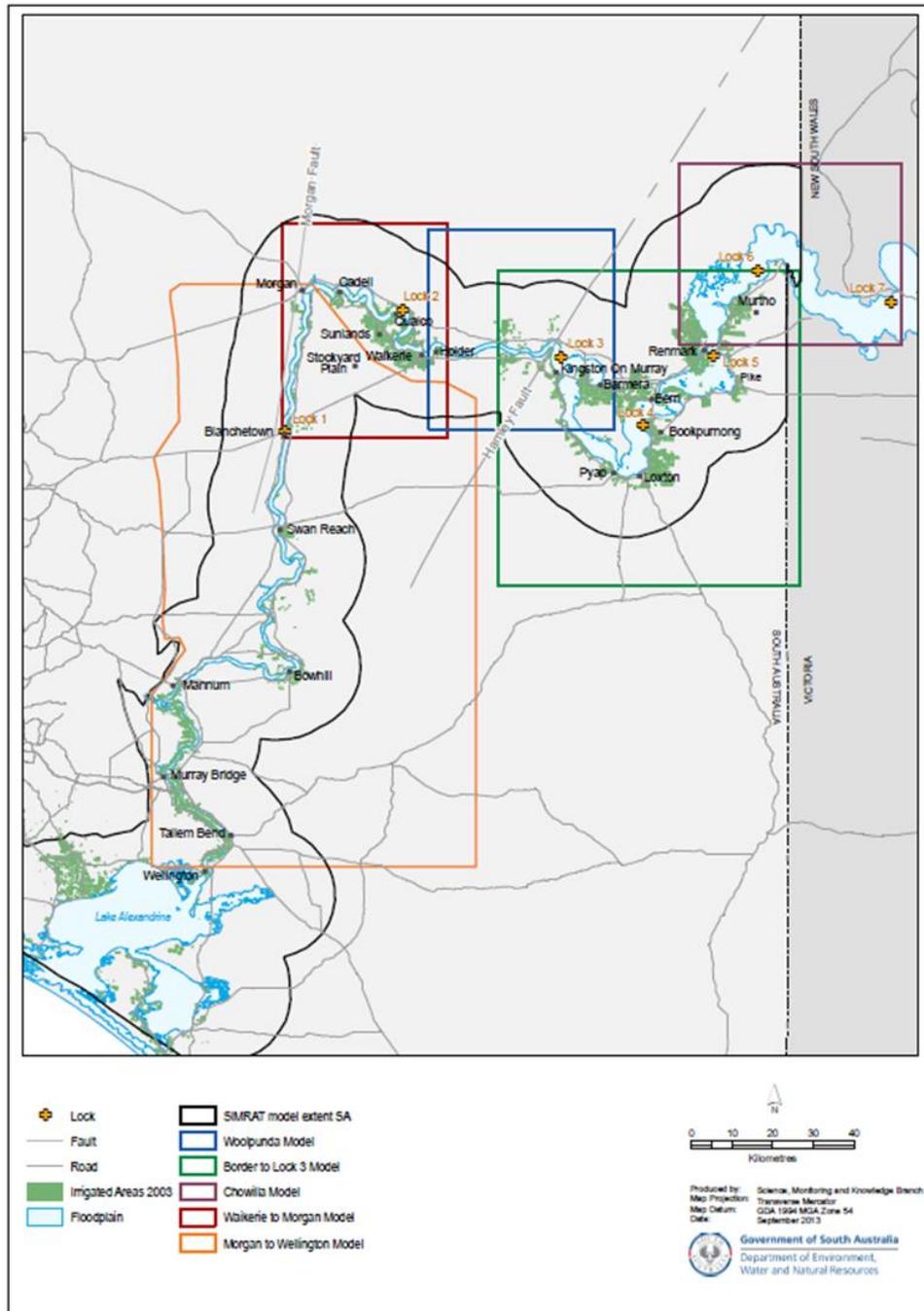
- A. surface water monitoring
- B. groundwater monitoring for SIS scheme operations
- C. regional and floodplain groundwater monitoring to inform salinity register models

The DEWNR is nominating a groundwater network consisting of 435 groundwater wells as part of the Basin-wide core monitoring network which forms part of component C regional and floodplain groundwater monitoring. The maintenance and monitoring of these groundwater wells is funded by the South Australian Government.

Work is continuing with the MDBA to settle the nomination of surface water monitoring sites (Component A). Component B is coordinated jointly by SA Water and the MDBA and will be nominated by the MDBA, however DEWNR has actively assisted in developing the network of core sites and removing duplication between the networks.

## 7.2 Review of salinity register models

A series of accredited groundwater models span the length of the River Murray in South Australia, as shown in Figure 4. The models underpin the estimation of salt loads entering the River Murray from the South Australian border to Wellington and are the basis for Joint Works and South Australia's accountable action entries on the Salinity Registers.



**Figure 4. Coverage of Groundwater Models in South Australia**

DEWNR has conducted reviews and updates of Waikerie to Morgan, Woolpunda and Pike-Murtho MODFLOW models. The Waikerie and Woolpunda SIS have also undergone technical review, as per Schedule B (clause 33 (4 and 5)).

The reviews have been completed in accordance with the current Basin Salinity Management Strategy Operational Protocols, and written advice received from the MDBA. The models were developed in consultation with a 5-year Review Modelling for Salinity Registers Project Team including representatives from the MDBA, SA Water, and DEWNR. The updated models and associated documents have been independently peer reviewed and found to be fit for purpose.

Given the large amount of work that had been completed over several years, BSM AP required DEWNR to submit a summary report of the reviews and their effect on the register entries. This report is currently being reviewed by BSM AP and an independent reviewer before it is finalised and formally submitted to the MDBA and any agreed changes to accountable actions will be made through the Salinity Registers.

### **7.3 Run of river salinity survey**

A closed space run of river salinity survey was conducted from Lock 7 to Morgan in June 2016. Run of river surveys measure salinity at each kilometre along a river reach on (nominally) five consecutive days. The difference in electric conductivity (EC) of a parcel of water on consecutive days is assumed to be due to saline inflow.

The data from the survey has been analysed by Australian Water Environments to assess salt loads and indicate SIS impact of in-river salinity. The findings of the Run of River have aligned with previous surveys and confirmed the effectiveness of SIS in reducing salt loads to the River Murray. The survey also indicates the remaining locations for notable salt inflow so that future efforts to manage salinity may be better targeted. Key Observations include:

#### **Lock 7 to Lock 5**

Salt inflow upstream of Lock 6 was 5 t/d, decreasing to 4 t/d between Lock 6 and the upstream side of the Chowilla outlet. The salt load flowing out of Chowilla was 25 t/d, highlighting the importance of careful management of environmental watering of the floodplain. Salt inflow downstream of Chowilla to Lock 5 was 7 t/d.

#### **Lock 5 to Lock 3**

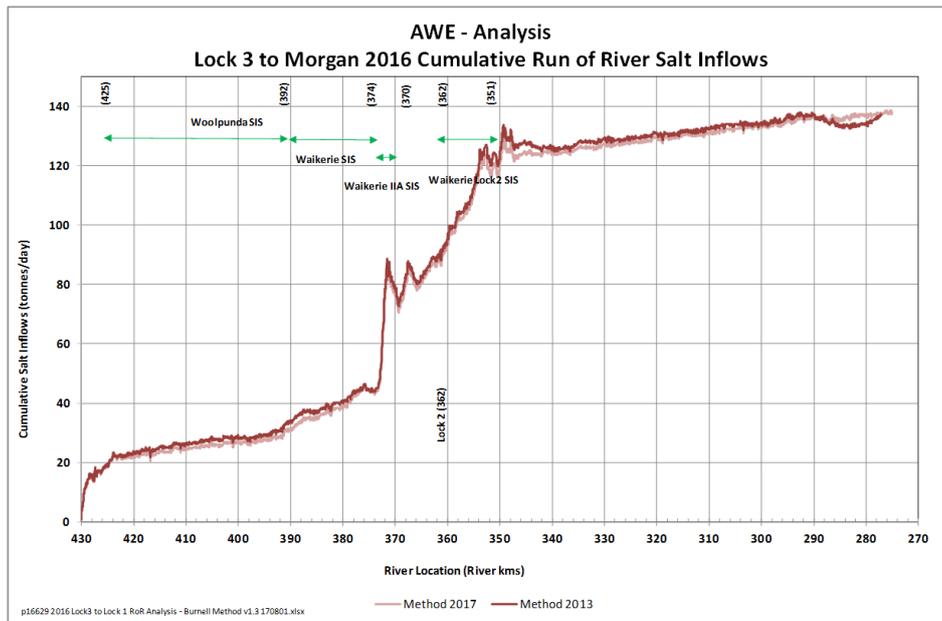
Pike River was a considerable source of salt load along this stretch, discharging about 20 t/d during the survey. In addition, a residual salt inflow of approximately 20 t/d was measured adjacent the Loxton SIS. Most of that inflow (10t/d in 1 km) occurs near the 492 km river reach. This is adjacent the horizontal drain and the zone immediately south of the drain and it may reflect responsive SIS trials. There was low salt inflow between the downstream end of Loxton SIS and Lock 3.

#### **Lock 3 to Morgan**

There was a notable 22 t/d of salt inflow between Lock 3 and the upstream end of Woolpunda (Figure 5). This is consistent with previous analysis of surveys and an extension of the SIS has previously been investigated. The Woolpunda SIS has proven highly effective with a residual salt inflow is approximately 8 t/d reduced from a pre-scheme value of around 180 t/d

Adjacent the Waikerie SIS a residual salt inflow of 14 t/d was observed, indicating its good performance of the scheme with residual salt inflow potentially entering from the northern side of the River.

During the survey at river distance 374 km to 373 km there was a salt inflow of 35 t/d which appeared to take about 7 km to fully mix in the River. This large salt inflow corresponds to the inlet/outlet of Ramco Lagoon and it is suspected that the lagoon was flowing out to the River during the survey. Downstream of river distance 346 km there appears to be a slow rate of salt inflow with just over 10 t/d over a distance of 70 km.



**Figure 5. Cumulative salt loads flowing into the River Murray between Lock 3 to Morgan**

An additional survey was undertaken in June 2017 as it provided a good opportunity to view salt fluxes from floodplains after the 2016–17 high-flow event. This information may also be of value to the trial of responsive SIS management being run by the MDBA. The results from 2017 survey are yet to be processed but will be available for discussion in the 2019 biennial report.

## 8 Strategic knowledge improvement

*'Knowledge is the key to salinity management in the Murray–Darling Basin. Steady improvements in knowledge about salinity processes in the Basin have underpinned three decades of successful adaptive management. From the first efforts at salinity management in the late 1960's through to the development of this strategy, knowledge has been critical.'* (BSM2030)

The BSM2030 strategy has identified four priority areas for strategic knowledge improvement. These are:

- Mallee legacy of history – improving our understanding of dryland clearing impacts and the impacts of past irrigation practices pre-1988.
- Environmental water management – improving our understanding of the salinity impacts of environmental watering and cumulative system scale salinity impacts.
- Predictive forecasting for in-river salinity – to reduce risks associated with responsive SIS and to inform other management actions.
- Responsive SIS management – improving our understanding of the floodplain and in-river response to reduced SIS operations to reduce operating costs.

The Mallee legacy of history knowledge priority has been the primary focus during 2016–17. DEWNR worked with the MDBA and the other states to support and provide input to this knowledge priority. Two reports were published on the topic, one on the salinity impacts and risks of dryland salinity and the other on the salinity impacts and risks of irrigation. Both reports include detailed discussion on how those processes have been represented in salinity register models.

DEWNR will continue to support input to other knowledge priorities under the BSM2030 strategy. Environmental water management is a key topic for the development of the new procedures during 2017–18 and it has been identified as an area where strategic knowledge improvement is required. DEWNR is developing advanced groundwater models of the Pike and Katarapko floodplains that will allow us to analyse floodplain processes in greater detail.

Predictive forecasting of in-river salinity will be pursued once the new Source model of the Murray-Darling Basin is implemented. This will be assisted by improved floodplain modelling and information gathered by the MDBA from the Responsive SIS 3-year trial.

# 9 Community engagement and communication

*'Achieving the best salinity management outcomes for the Basin requires the involvement and engagement of a diverse range of stakeholders and communities. Effective engagement can leave a lasting legacy of informed, involved and confident communities who understand the value of salinity management. It can also help to ensure that each agency involved in environmental water management, river management, waterway management and land management can appreciate how their own contributions can improve salinity management for the Basin as a whole.'* (BSM2030)

## **Regular reporting**

DEWNR publishes a weekly [River Murray Flow Report](#) and also a monthly Water Resources Update. Both documents are emailed to approximately 1,000 recipients and published on the DEWNR WaterConnect website. The River Murray Flow Report provides information on the flow across the South Australian border, environmental watering activities, Murray Mouth dredging operations, and barrage and weir pool operations. The monthly Water Resources Update provides additional information on water entitlement, water held in storage and salinity at the Basin Plan Target sites.

## **Media releases**

Regular media releases are one tool that DEWNR use to inform river users of issues, including salinity issues, that may affect or interest them. The Minister for Water and the River Murray, DEWNR and the Murray Darling Basin Natural Resources Management Board made at least 24 media releases relating to the River Murray in 2016–17 alone, plus additional releases from SA Water and PIRSA. Notable media release topics in 2016–17 were:

- The on-farm irrigation efficiency improvement programs
- Works relating to the South-east flow restoration project
- High-flow events at the end of 2016, including water quality issues during the high-flows
- Salinity level increases as water levels receded in January
- The effect of environmental watering of the Pike Floodplain
- Murray mouth dredging operations pre and post high-flows

## **Community consultation and engagement**

In 2016–17 extensive community consultation was undertaken as part of the Review of Irrigation Salinity Management project in South Australia. Community consultation is being undertaken in two phases. The first phase took place in May 2017 with the aim of seeking stakeholder feedback on an Issues Paper.

The issues paper was released and different types of communication materials and forums were used to engage with the community and stakeholders including media releases; an [animated video on salinity](#), letters addressed directly to key stakeholders and community groups, face to face meetings and presentations, the issues paper and four fact sheets providing background information were loaded onto the [YourSAy](#) website, and updates to the SA MDB NRM Board website

The second phase of consultation will be undertaken in late 2017 when an Options Paper is released.

# 10 Priorities for future work

## **Strategic Knowledge Priorities – Floodplain processes**

Floodplain processes have been identified as a knowledge priority in BSM2030, noting the system-scale salinity impacts that may arise from environmental water regimes. Understanding salinity retention and discharge from floodplains during watering-cycles will be critical to support predictive forecasting of in-river salinity and it will assist to reduce the risks associated with responsive SIS management and other management actions.

During 2017–18, DEWNR will use the Pike Floodplain groundwater model to improve our understanding of the effects of evapotranspiration, changing river levels, inundation recharge and solute transport assumptions on salinity fluxes from the floodplain.

## **Basin Salinity Management procedures**

DEWNR will work with the other states and the MDBA to develop new Basin Salinity Management (BSM) Procedures to replace the Basin Salinity Management Strategy (BSMS) Operational Protocols. The BSM Procedures will provide the operational detail and consistency to guide the implementation of the accountabilities under Schedule B.

This BSM Procedures will include a suite of modelling procedures that is seen as an essential means of ensuring a consistent approach to model development, application, interpretation and management that can be applied across the MDBA and Jurisdictions. The modelling procedures are vital for consistent application of BSM2030.

## **Groundwater model updates**

Groundwater model updates are scheduled according to a Review Plan accepted by the Basin Officials Committee in December 2015. The next model due for update is the Loxton-Bookpurnong Model, due in 2019. DEWNR has commenced gathering and organising all the necessary information to update the model in 2018–19, noting that the new modelling procedures are being developed.

In addition, during 2017–18, DEWNR will work to ensure that accountable actions estimated using accredited groundwater models are updated on the Salinity Registers. It also proposes to transfer older models to new software platforms, undertake data-gap analysis of existing models and update our estimates of irrigation extent ready for updates in the 2019–2021 period.

## **South Australia's irrigation salinity management policy**

DEWNR will undertake consultation with stakeholders and the broader community on policy options for irrigation salinity management in 2017–18. Following consultation on the options paper proposals to update the current policy will be provided to the Minister for Water and the River Murray for consideration.

## **Water Quality Management Plans**

Water Quality Management Plans for South Australia's three water resource plan areas are currently under development as part of the state's Water Resource Plan development program. In 2017–18 South Australia will continue to advance the draft Water Quality Management Plan for the South Australian Murray Region, integrate feedback from the MDBA into the draft Water Quality Management Plan for the Eastern Mount Lofty Ranges and continue development of the South Australian River Murray Water Quality Management Plan.

## **Environmental watering for SARFIIP**

The SARFIIP program aims to construct environmental regulators and levee banks to inundate large areas of the floodplains, groundwater management schemes to improve salinity related issues at the Pike floodplain, and deliver monitoring and management tools and systems to support optimized and defensible environmental watering for the future.

As part of the program delivery DEWNR is developing advanced groundwater models of Pike and Katarapko floodplains in order to understand how revisions to their environmental watering regime and modifying associated infrastructure may affect salt load discharge to the River Murray. DEWNR will work with the MDBA to ensure these models are accredited as fit for purpose.

# 11 Glossary

## Units of measurement commonly used

Name of unit	Symbol	Definition in terms of other metric units	Quantity
day	d	24 h	time interval
Electrical conductivity	EC	$\mu\text{S cm}^{-1}$	
gigalitre	GL	$10^6 \text{ m}^3$	volume
hectare	ha	$10^4 \text{ m}^2$	area
kilogram	kg	base unit	mass
kilometre	km	$10^3 \text{ m}$	length
megalitre	ML	$10^3 \text{ m}^3$	volume
metre	m	base unit	length
second	s	base unit	time interval
tonne	t	1000 kg	mass
year	y	365 or 366 days	time interval
parts per thousand	ppt	$10^{-3} \text{ kg}$ (gram equivalent)	concentration

## Shortened forms

**mAHD** – metres above the Australian Height Datum

**BOC** – Basin Officials Committee

**BSM2030** – Basin Salinity Management 2030

**BSM AP** – Basin Salinity Management Advisory Panel

**BSMS** – Basin Salinity Management Strategy 2001–2015

**COFFIE** – Commonwealth On-Farm Further Irrigation Efficiency

**DEWNR** – Department of Environment, Water and Natural Resources

**MDB** – Murray-Darling Basin

**MDBA** – Murray–Darling Basin Authority

**SARFIIP** – South Australian River Floodplain Integrated Infrastructure Program

**SARMS** – South Australian River Murray Sustainability program

**SA MDB NRM** –South Australian Murray–Darling Basin Natural Resource Management Board

**SEFRP** – South-East Flows Restoration Project

**SRWUIP** – Sustainable Rural Water Use and Infrastructure program

**SIS** – Salt Interception Scheme





**Government of South Australia**  
Department of Environment,  
Water and Natural Resources