Australian Government

MURRAY–DARLING BASIN AUTHORITY

Salt of the earth

Salinity management in the Murray–Darling Basin

The significance of salt

Salt is a natural part of the Murray–Darling Basin landscape. There is more than one trillion tonnes of it in groundwater systems close to the River Murray, deposited over millions of years by ancient oceans, weathering of rocks and rainfall. As part of a natural process, some of this salt eventually finds its way into the river system where it can be carried downstream and flushed out into the ocean.

Human activity within the Basin over the past century has changed the way salt moves through the landscape. Water-intensive farming methods and land clearing have resulted in underground water tables rising closer to the surface, carrying salt that affects native vegetation, crops, pasture, wetlands and river systems. Increasing water use has also reduced river flows, leaving less water to dilute salt in rivers or flush salt out to sea.

Since the late 1960s there has been a concerted effort by governments and communities to manage salinity issues and reduce the impacts on people and the environment. By actioning a series of land and water management plans and strategies for dealing with salinity, and constructing salt interception schemes (SIS) to prevent saline groundwater from reaching our rivers, in-river salinity has been significantly reduced.

Solving the salt issue

Although salinity was a known problem within the Murray–Darling Basin, several droughts between 1965 and 1968 raised salinity to levels that drew the attention of State governments. In 1967 the River Murray Commission began a detailed study of irrigation, drainage, and salinity along the River Murray to identify potential ways of managing and reducing salinity impacts. Before this study was completed, Victoria constructed works at Barr Creek to limit the salt load reaching the River Murray. After a review of the Commissions report was completed, salt interception schemes (SIS) were built at Buronga in New South Wales and another at Mildura–Merbein in Victoria. Groundwater and drainage control schemes were also established on the Rufus and Wakool Rivers in New South Wales, and in the Shepparton region of Victoria.

In 1982 a revised River Murray Waters Agreement was signed. A key feature was the broadening of the River Murray Commission's role in water quality issues as part of its existing river management responsibilities. Despite this change, it was recognised that existing management arrangements were not able to meet the challenges of agricultural development and growing environmental water problems across the Basin. These concerns led to the establishment of the Murray–Darling Basin Ministerial Council in 1985 to coordinate effective planning and management of water resources.

One of the first issues for the Council was ensuring the coordinated management of the Basin's salinity and drainage problems. It was recognised that these issues posed a major threat to the health of the natural resources of the southern part of the Murray-Darling Basin.

The response was the Salinity and Drainage Strategy, which was adopted by the Ministerial Council in 1989. This strategy brought state governments together to effectively manage salinity and associated problems.

Under the strategy, $46.4 million was invested in constructing SIS at Mallee Cliffs in New South Wales, and in South Australia at Woolpunda, and two stages at Waikerie. Upgrades were also carried out at the two existing schemes (Buronga and Mildura–Merbein. The net result of these schemes was preventing nearly 150,000 tonnes of salt from entering the River Murray each year.

In 1999 a salinity audit was conducted for the entire Murray–Darling Basin. The audit indicated that salt previously stored in the landscape was being mobilised on a massive scale by rising groundwater tables, largely due to land use changes across the Murray–Darling Basin. This was likely to cause conditions to deteriorate further over the next 20 to 100 years.

Acting on the 1999 audit, the Murray-Darling Basin Ministerial Council adopted the Basin Salinity Management Strategy (BSMS) in 2001. Built on the success of the previous Salinity and Drainage Strategy, the BSMS established responses to the threats of salinity to water quality, environmental values, regional infrastructure and productive agricultural land.

The key target of the BSMS was to maintain the average salinity level at Morgan of less than 800EC for at least 95% of the time (based on modelled hydrology from 1975 to 2000).To ensure that this target was met, further reductions in salinity would need to be made through action in the Murray valley, where salt concentrations had the potential for the greatest impacts. Because some of the required improvement could be gained from within river tributaries controlled by Basin states, it was decided that all states should contribute to the construction and management of further SIS, and implement plans to improve land and water management in respective states.

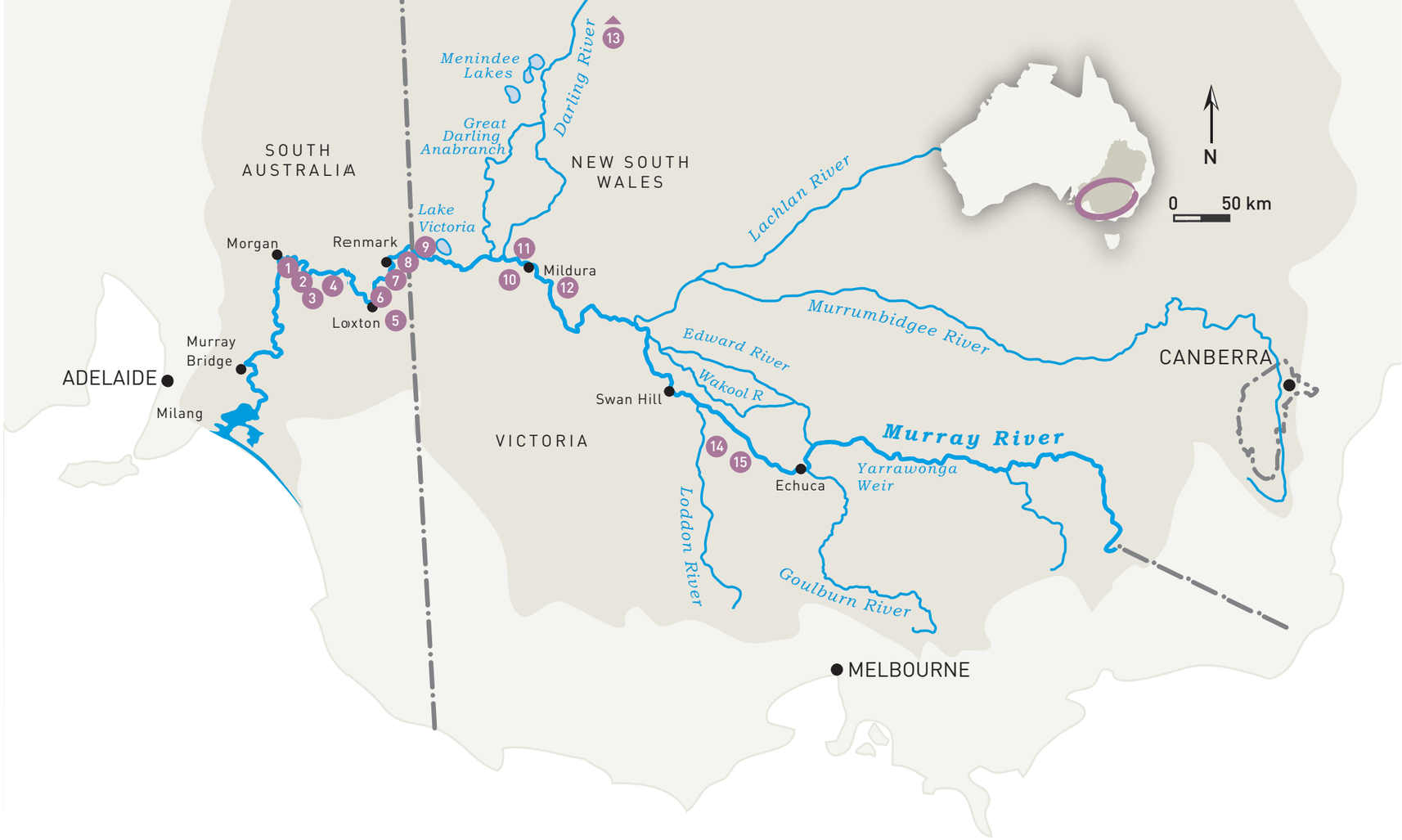
Due to uncertainty about the estimates of future salinity impacts, a seven year program was established to continue reducing salinity levels. This program also aimed to address problems caused by past actions, and to offset development within the Basin that could potentially increase salinity levels. A review after seven years would decide if any further work was required.

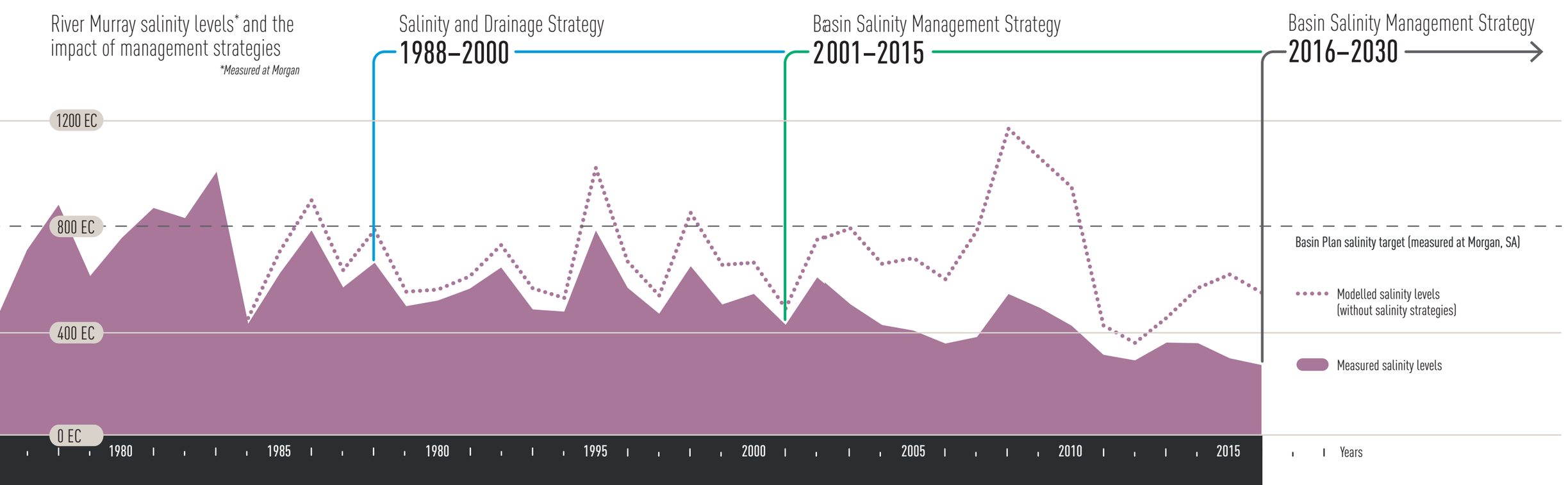
Under the BSMS, significant effort was made by states to improve land and water management practices, investigate new salt interception opportunities, and provide detailed business cases to the Murray–Darling Basin Commission. This work resulted in the construction of seven new salt interception schemes, and upgrades to existing schemes.

The BSMS construction and refurbishing program received a total capital investment of over $98 million by state and federal governments, creating positive effects for environments along with communities and local economies.

Salt interception schemes

	Location	Year completed	Salt diverted in 2015-16 (tonnes/yr)
14	Barr Creek	1968	14,828
11	Buronga	1979	57,104
10	Mildura–Merbein	1981	99,006
9	Rufus River	1984	1,100
4	Woolpunda	1992	91,828
3	Waikerie	1992	56,726*
12	Mallee Cliffs	1993	63,044
1	Waikerie (Stage 2A)	2003	*included in Waikerie figure
7	Bookpurnong	2006	22,374
15	Pyramid Creek	2006/2010	26,762
2	Waikerie (Lock 2)	2010	*included in Waikerie figure
6	Loxton	2011	20,820
5	Pike River	2012	12,707
13	Upper Darling	2012	34,144
8	Murtho	2013	24,285
		Total:	524,728





Managing salinity

There are two approaches to reduce the impacts of salinity on our river systems and surrounding landscapes. The first is to make improvements to development activities that mobilise salt into rivers and streams, such as land clearing and irrigation. Smarter development can also prevent water tables from rising, and keep saline groundwater from reaching plant root zones.

The second approach is to intercept salt that is already moving through groundwater systems before it reaches the rivers. The intercepted groundwater is diverted to disposal basins where salt is harvested, or deposited in areas that pose minimal risk to rivers, productive land and natural environments. These systems are known as salt interception schemes (SIS) and consist of a series of bores located near rivers, connected to disposal basins by a network of pipes.

Measuring salinity

Salinity is measured by placing the two electrodes of a salinity meter into a water sample, and passing an electric current between them. The presence of salt in the water increases its electrical conductivity (EC), so a higher reading on the meter indicates that the salinity level is high. For reference, the electrical conductivity of drinking water is usually less than 800 EC. (Sea water is over 50,000 EC.)

The Murray–Darling Basin Authority measures salinity at various locations of the River Murray. One of the key monitoring sites is Morgan in South Australia. This site allows the net benefits of all salinity management strategies (including SIS) to be measured and evaluated.

The future for salinity

As a result of contributions from individuals and communities, and joint effort from governments, salinity levels within the Murray–Darling Basin have improved dramatically since 1990. This is demonstrated by the graph above, which compares actual salinity levels recorded in the River Murray against the salinity levels that would be expected if no management actions had taken place.

Continuing this legacy of achievement, the MDBA and Basin governments have developed *Basin Salinity Management 2030* (BSM2030) for managing salinity through to 2030. This strategy builds on the successes of previous work to deliver a strategic, cost-efficient and streamlined program of coordinated salinity management. It will enable partner governments and their communities to manage salinity, during a period of transition, as Basin Plan water reforms take effect.

Despite this, uncertainty remains about just how much salinity levels might increase as a consequence of past decisions and actions. For example, modelling has indicated that movement of saline groundwater towards the River Murray in the Mallee area has yet to reach peak levels.

Also, storing of salt in the landscape at disposal basins is not sustainable in the longer term. Salt harvesting activities at Pyramid Creek and Buronga are the only fully sustainable management solutions in action today. Studies have suggested that it would be feasible to construct a pipeline from Stockyard Plains (near Waikerie) to the Southern Ocean, with an extension to Noora Basin near Renmark, allowing saline groundwater to be pumped to the sea. This project would require significant investment, and is therefore unlikely to happen in the next fifty to one hundred years.

Achievements

Reflecting on the key achievements of the BSMS over the past 15 years, the partner governments and the MDBA can be justifiably proud of the many accomplishments that the program has achieved. Highlights include:

- investing over $98 million of capital in salt interception scheme works which have the capacity to divert over 450,000 tonnes of salt away from the River Murray and adjacent landscapes annually
- creating and successfully implementing an innovative and effective salinity accountability framework to manage salinity impacts
- advancing the scientific knowledge base to inform decision making and increase our understanding of salinity processes
- working collaboratively with governments and communities to create a powerful and compelling vision for salinity management in the Murray–Darling Basin
- several Engineering Australia awards for excellence and innovation in relation to salt interception works.

Published by the Murray-Darling Basin Authority (November 2016)

GPO Box 1801 Canberra ACT 2601
Phone: 02 6279 0100

MDBA publication no: 12/17
ISBN (print): 978-1-925599-27-5
ISBN (online): 978-1-925599-26-8

Photos - Arthur Mostead
Cover: Salt disposal basin, Buronga NSW

- Inside spread (clockwise from top):
- Salt affected creek, Lyrup Flats, Murray River NP SA
- Salt interception bore and pump, Buronga NSW
- Outlet from salt interception scheme to disposal basin, Buronga NSW
- Salt harvesting, Buronga NSW

MDBA921