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Murray–Darling Basin Authority

Assessment of the salt export objective and salinity targets for flow management 2023-24

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Acknowledgement of the Traditional Owners of the Murray–Darling Basin

We acknowledge the Traditional Owners and Custodians of Country throughout the Murray–Darling Basin and their continuing connection to land, waters and community. We offer our respects to the people, the cultures and the Elders past and present.

Aboriginal people should be aware that this publication may contain images, names or quotations of deceased persons.

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Basin salinity management

Salinity management across the Murray–Darling Basin is a significant challenge with a range of strategic policy and intervention measures implemented to manage the ongoing salinity problem. Since 1988, Basin Governments have implemented three consecutive strategies to manage salinity, the most recent being the Basin Salinity Management 2030 strategy.

If not managed well, salinity poses an ongoing threat with risks to the Basin's land and water resources. While salt occurs naturally in the Basin's landscape, activities such as irrigation development and land clearing can cause salt to concentrate in certain places presenting management challenges and impacting agricultural production and, in some cases, potable water supplies, particularly during extreme low flow periods.

Water flowing through the River Murray system and out to the Southern Ocean through the Murray Mouth is the main natural process by which salt can be completely exported from the Basin. Salt interception schemes divert saline groundwater away from the river, however this salt doesn't leave the Basin as the saline groundwater is pumped to regional disposal basins where the water evaporates. High flow periods provide opportunities to flush more saline areas, which has the positive benefit of exporting larger volumes of salt from the Basin.

In order to maintain good salinity levels in the River Murray system, the Basin Plan includes an objective to flush out salt through the Murray Mouth and there are salinity targets for flow management at five sites. One of these sites is located on the lower Darling River and the remaining four sites are located on the River Murray in South Australia.

Generally, more salt is flushed out to the Southern Ocean during higher flow years and less in lower flow years. Discharge of salt is augmented by the delivery of environmental water recovered under the Basin Plan as it increases end of system flows and therefore additional opportunities to export salt. The provision of environmental water in dry years is often the primary driver of barrage flows and salt export. The amount of salt export is also impacted by river regulation, irrigation diversions and current levels of development, including salt interception works. The achievement of the salt export objective should therefore be viewed in the wider context of overall salinity management, including all the measures implemented in the Basin over the last three decades.

Unregulated flows increase the volume of salt mobilised when they are sufficiently high to engage the floodplains, wetlands and numerous creeks along the River Murray system. These flows provide an opportunity for the mass export of salt and nutrients from the River Murray system into the Southern Ocean. They also provide other significant benefits including the freshening of groundwater.

The estimated minimum annual discharge through the barrages required to achieve a salinity target of less than 1,000 EC in Lake Alexandrina for 95% of the time is 650 gigalitres (GL) for 95% of years. However, this depends on the starting salinity level in the Lower Lakes. Discharge of 650 GL following a dry period with low or no barrage releases is unlikely to reset the lake salinity levels. The 650 GL of flow also provides many additional benefits to the River Murray system enroute to South Australia and may be provided in the form of return flows from environmental watering actions and directed releases from headwater storages to meet a demand at the South Australian border.

River Murray System 2023-24 context

River Murray System inflows (excluding releases from Snowy Hydro, Inter-Valley Trade deliveries, managed environmental water from tributaries and inflows to Menindee Lakes) during the 2023-24 water year were approximately 8,715 GL (Figure 1). Inflows in 2023-24 were greater than the long-term median inflow volume but less than half the volume recorded for the same period in 2022-23, which was the fifth highest inflow water year on record. The flow to South Australia in 2023-24 was around 6,280 GL. Flows to South Australia remained above 20 GL/day for 166 days of the year, with a peak flow of around 53 GL/day in early September 2023. The flow remained mostly unregulated from June to November 2023 and then again for a period across January to February 2024.

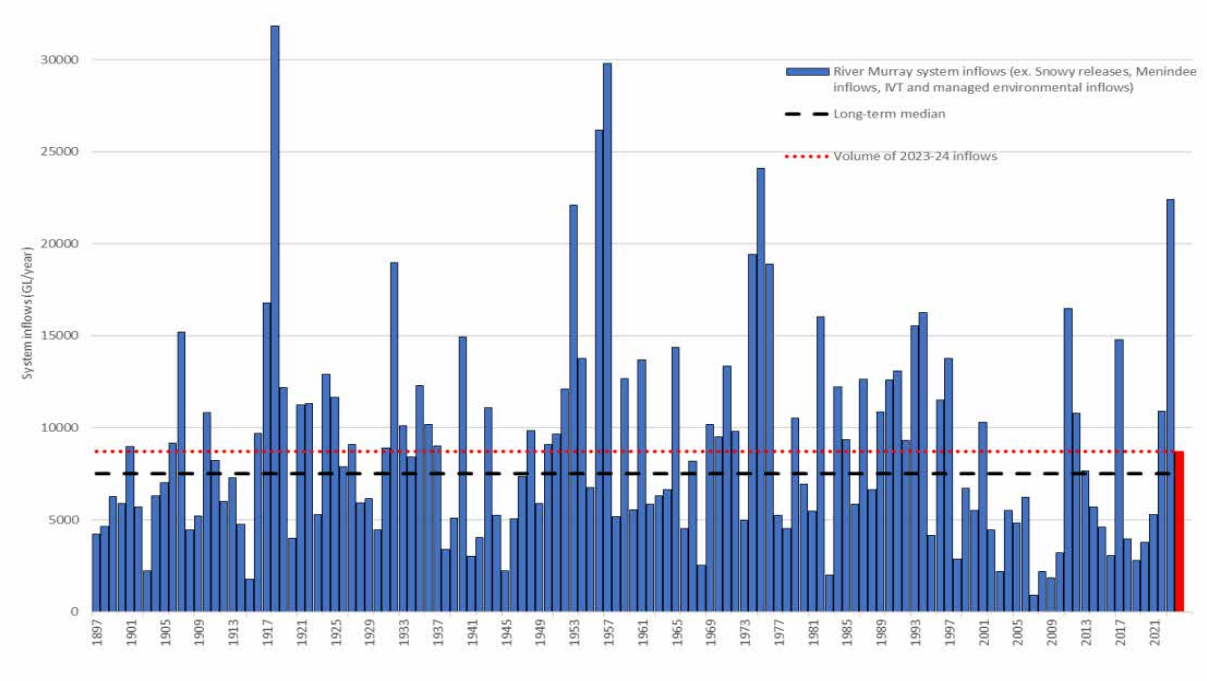

Figure 1 River Murray System inflows (to end May) since 1897 (excluding Snowy Hydro inflows, IVT delivery, managed environmental inflows and inflows to Menindee Lakes)

These unregulated flows along with environmental water deliveries had a positive contribution towards the export of salt from the Basin by increasing barrage outflows from Lake Alexandrina.

Salt export objective

The Basin Plan includes a salt export objective which aims to ensure adequate flushing of salt from the River Murray system. Achievement of the salt export objective is assessed each year by the MDBA.[1]

Over the three-year assessment period from July 2021 to June 2024, the annualised rate of salt export at the barrages was 2.63 million tonnes per year (Figure 2). This is greater than the Basin Plan's indicative figure of two million tonnes per year. In 2023-24, the estimated amount of salt exported was 1.35 million tonnes (Figure 2), noting this appears as a low value, however salinity levels were relatively low and therefore the volume of salt discharged is less. Just under 6,000 GL was released at the barrages in 2023-24.

Flushing salt from the river system helps reduce salt accumulation and adverse impacts on water users. Flushing salt also supports healthy river and floodplain ecosystems including the environment of the Coorong, which substantially benefits from high flows reducing salinity levels. Salt interacts with in-stream biota (animals and plants), changing the ecological health of streams and estuaries. Reduced salinity levels help to build ecological resilience during droughts and low flow periods when flushing opportunities may be reduced.

The salt export objective is being reviewed as part of the Basin Plan Review and this review will consider potential options for improvement.

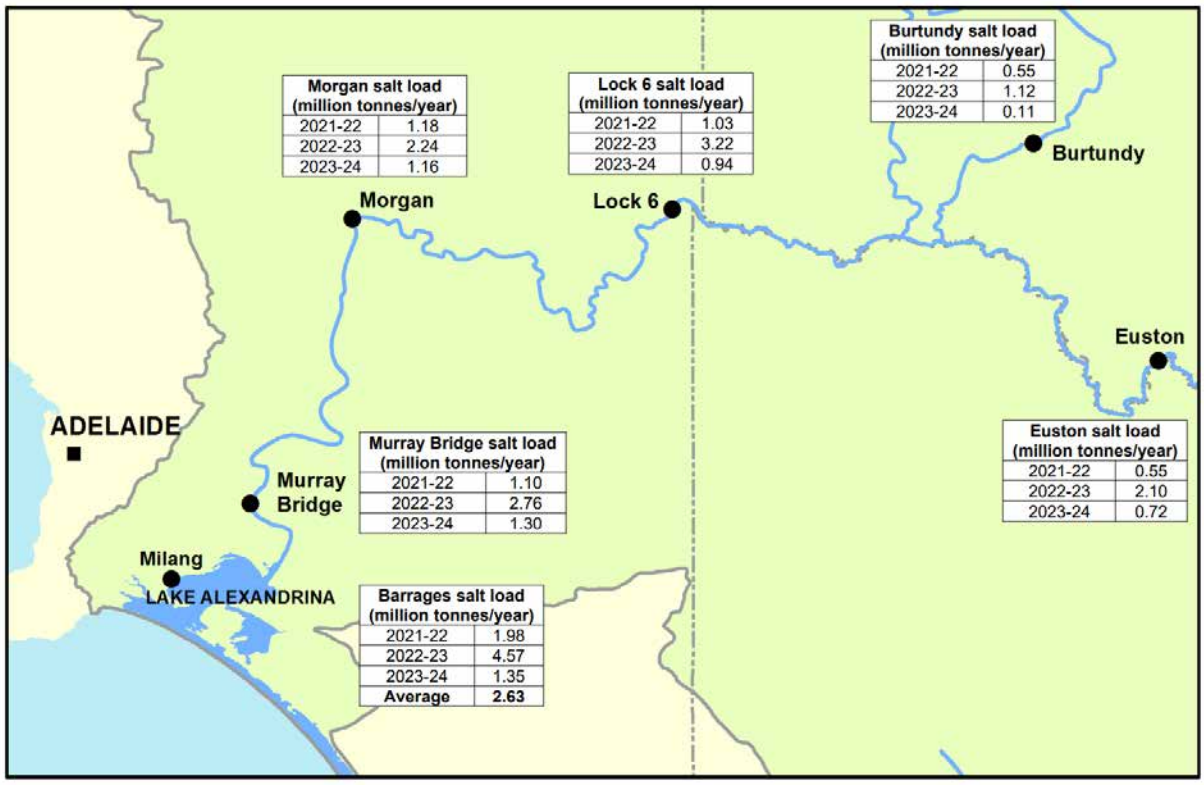

Figure 2 Salt loads at key locations in the Murray–Darling Basin

[1] A detailed description of the methodology is provided in the following report: MDBA 2013, Approach for estimating salt export from the River Murray System to the Southern Ocean, Murray–Darling Basin Authority, Technical Report 2013/09.

*Note that due to the extensive flooding in South Australia in 2022-23, data is missing for the Lock 1 flow for a period of 58 days. The salt load calculations for Morgan and Murray Bridge are impacted by this missing data and the salt loads are therefore underestimated compared to the values observed at Lock 6 (Figure 2).

Table 1 Estimated salt export over the barrages and salt diverted away from the river system by salt interception schemes

Variable	2021–22 (million tonnes/year)	2022–23 (million tonnes/year)	2023-24 (million tonnes/year)
Salt diverted away from the river and adjacent landscapes through operation of SIS	0.37	0.28	0.36
Estimated salt export through the lower lake barrages (annualised average over the three preceding years)	0.98	2.38	2.63

Salinity targets for flow management

The Basin Plan also includes salinity targets for flow management (operational targets) at five reporting sites between Burtundy (lower Darling River) and Milang at Lake Alexandrina. These targets seek to ensure River Murray water is suitable for drinking, agriculture, recreation and the environment. Salinity levels will vary significantly between years and are linked to both flow conditions at the reporting site and upstream conditions. For example, low to no flow periods on the lower Darling River can result in elevated salinity levels at Burtundy due to the absence of suitable flushing events to mobilise salt from the lower Darling River.

Salt can accumulate in Lake Alexandrina when sufficient water isn't flowing down the River Murray during hot-dry and low water availability years. The ability to discharge into the Coorong is also impacted by the downstream water levels. When water levels are high in the Coorong (often driven by a combination of wind and high tides) the barrages can be closed to partially mitigate the upstream estuarine intrusion. There are also regional groundwater influences around the Lower Lakes which can impact salinity levels when water levels reduce in the Lower Lakes.

Salinity levels at the five reporting sites listed in the Water Quality and Salinity Management Plan of the Basin Plan (Lock 6, Morgan, Murray Bridge, Milang and Burtundy) were monitored over the five-year reporting period (2019–2024). At some locations there were short periods of missing data, however this has no discernible impact on the calculations.

The salinity targets are deemed to have been met if the percentage of days above the target is less than 5%, or the salinity has been below the target 95% of the time. Over the reporting period (July 2019–June 2024), the assessment indicates that the targets have been met at four of the five reporting sites, being Lock 6, Morgan, Murray Bridge and Milang (Table 2).

The target value at Burtundy is 830 EC and the target was not achieved over the five-year reporting period. Salinity levels at Burtundy were above the target for 8.5% of days over the five-year reporting period. Following an extended period of low or no flow conditions, the lower Darling River re-commenced to flow at Burtundy in April 2020.

The target value for Milang is 1,000 EC and this was achieved with extended periods of unregulated flows to South Australia during 2023-24. The Milang site can also be influenced by reverse flows through and over the barrages from the Coorong with saline water intruding into Lake Alexandrina.

Table 2 Salinity levels at the reporting sites over the five-year period from 1 July 2019 to 30 June 2024, compared to the target values in Basin Plan (Section 9.14)

Reporting site	Target value (EC*) (µS/cm)	Non-exceedance salinity at 95% of the time (µS/cm)**	% of days above the target value
River Murray at Murray Bridge	**830**	356	0
River Murray at Morgan	**800**	319	0
River Murray at Lock 6	**580**	264	0
Darling River downstream of Menindee Lakes at Burtundy	**830**	897	8.5
Lower Lakes at Milang	**1,000**	984	2.7

* EC is an electrical conductivity unit commonly used to indicate salt concentration or the salinity of water. As a guide, EC > 800 µS/cm is marginal for drinking, EC > 1,600 µS/cm is brackish, EC > 4,800 µS/cm is saline.

** Salinity values are compiled from best available data (daily mean values derived from continuously logged data).

Office locations
Adelaide – *Kaurna*
Canberra – *Ngunnawal*
Goondiwindi – *Bigambul*
Griffith – *Wiradjuri*
Mildura – *Latji Latji*
Murray Bridge – *Ngarrindjeri*
Wodonga – *Dhudhuroa*

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