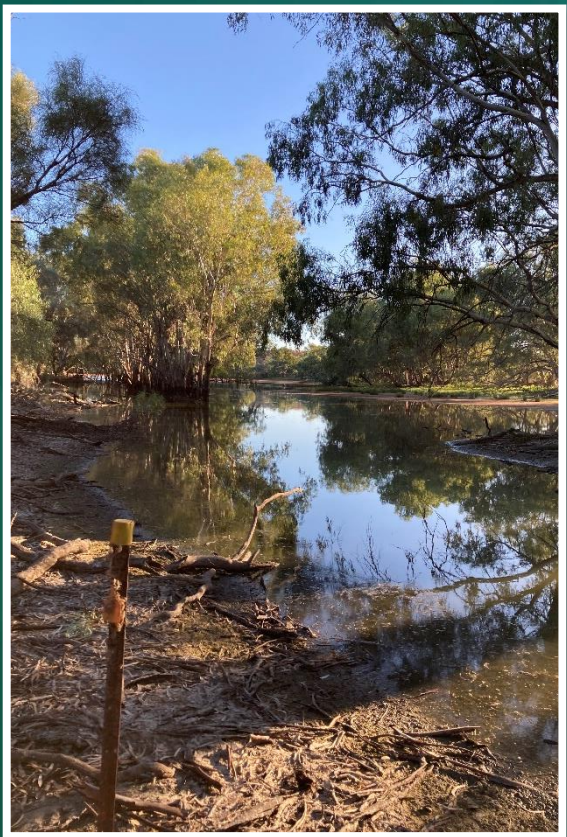
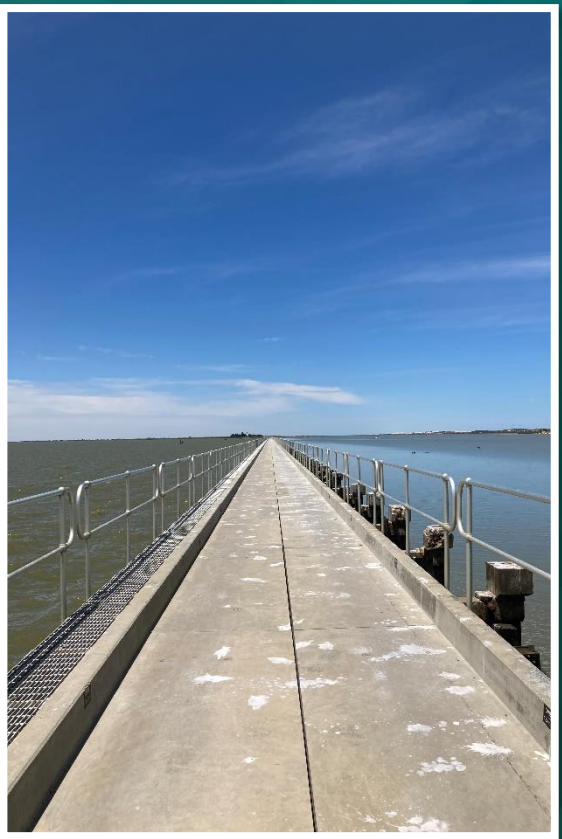
South Australia's River Murray Annual Operating Plan

2024-2025





Government of South Australia

Department for Environment and Water

Foreword

The Department for Environment and Water acknowledges and pays respect to the Traditional Owners and First Nations of the Murray-Darling Basin, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

South Australia's River Murray Annual Operating Plan 2024-25 is the key document that guides transparent and coordinated River Murray operational decisions in South Australia during the 2024-25 water year. It draws on flow outlooks for the upcoming water year provided by the Murray-Darling Basin Authority to identify how the River Murray in South Australia may be operated under a number of potential water availability scenarios to balance the benefits to all water users, including water for the environment.

Together with South Australia's *Objectives and Outcomes for Operating the River Murray in South Australia*, the annual operating plan contributes to meeting objectives and requirements in the *Basin Plan*, the *2024-25 Water for the Environment Annual Plan for the South Australian River Murray* and the *Australian Drinking Water Guidelines*.

The start of the 2024-2025 water use year has seen high levels of water in River Murray storages and below average inflows during June. The Bureau of Meteorology has forecast average to wetter than average rainfall over winter and spring 2024.

I would like to thank all those who have been involved in the development and review of the annual operating plan for the 2024-25 water year.

Sue Hutchings
Executive Director, Water and River Murray
Department for Environment and Water

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1 Introduction

South Australia's Annual Operating Plan 2024-25 (SA AOP) is prepared annually by the Department for Environment and Water (DEW). It identifies how the River Murray in South Australia may be operated for the current water year under a number of potential water availability scenarios (also referred to as inflow scenarios) to balance the benefits to all water users, including water for the environment (WFTE).

The SA AOP aligns with the *Objectives and Outcomes for Operating the River Murray in South Australia* (SA O&O) (DEW 2021) which aims to achieve some of the specific objectives in the *Basin Plan* (MDBA 2012). The SA AOP has regard for the SA O&O under a range of climate and inflow scenarios and identifies the objectives and outcomes sought for the River Murray and its water users. Where actions fall within normal operating parameters, they will be undertaken routinely. Where a proposed action falls outside of normal operating parameters, additional approvals will be sought from the relevant authority. Some actions within normal operating parameters may also require approval.

The SA AOP also contributes to meeting objectives in the *Long-term environmental watering plan for the South Australian River Murray water resource plan area* (LTWP) (DEW 2020), the *2024-25 Water for the Environment Annual Plan for the South Australian River Murray* (WFTE Annual Plan) (DEW 2024), and the *South Australian River Murray Water Resource Plan* (DEW 2019a) for areas including the Coorong and Murray Mouth. It also guides operations to help ensure they are consistent with the *Australian Drinking Water Guidelines* (National Health and Medical Research Council 2011) and that South Australia meets its obligations for the protection of WFTE.

The SA AOP is informed by the flow outlook scenarios contained in the Murray-Darling Basin Authority's (MDBA) *River Murray System Annual Operating Outlook* (AOO) (MDBA 2024) for the 2024-25 water year. The AOO receives input from the Australian, New South Wales (NSW), Victorian and South Australian Governments through the Water Liaison Working Group (WLWG). It should be noted that the MDBA uses a water year of 1 June to 31 May, whereas South Australia defines its water year as 1 July to 30 June.

The SA AOP uses the six inflow scenarios of the AOO, being 'extreme dry', 'very dry', 'dry', 'moderate', 'near average', 'wet' to inform water delivery operations in South Australia.

The MDBA provides monthly water resource updates to the Basin Officials Committee (BOC) and the WLWG. The MDBA also undertakes a midyear review of its AOO. Following receipt of the midyear AOO from the MDBA, the SA AOP may be updated (if necessary), for example, if there is a significant change in water resource conditions.

If dry conditions cause the water level in the River Murray below Lock 1 to fall below 0.4 metres (m) Australian Height Datum (AHD), River Murray operations in South Australia will be consistent with the *Drought Emergency Framework for Lakes Alexandrina and Albert* (MDBA 2014) to the extent that is practicably possible.

It is important to note that the actual conditions that occur during the 2024-25 water year will differ from the inflow scenarios described in the SA AOP, therefore river operations may vary from the projections in this document. This is in-part driven by the Murray-Darling Basin's highly variable climate. The actual pattern of environmental water delivery during the 2024-25 water year is also uncertain and variable, which may significantly change the distribution pattern provided in the scenarios. Nevertheless, the scenarios provide a useful indication of potential flow to South Australia during the 2024-25 water year. Ongoing decisions made during the year regarding river operations within South Australia will be consistent with the SA AOP and current operating policies and procedures as agreed under South Australia's Prerequisite Policy Measures approved by the MDBA.

The main focus of the SA AOP is to guide key processes to achieve the best outcome for the State (economic, environmental and social), defer a portion of South Australia's entitlement water for Critical Human Water Needs (CHWN) and private carryover and have regard for the Basin Plan targets and outcomes.

2 Resource conditions at commencement of 2024–25

2.1 Murray-Darling Basin inflows during 2023-24

Spring 2023 eventuated in the development of El Nino conditions and a positive Indian Ocean Dipole. The positive Indian Ocean Dipole persisted and returned to neutral conditions in early 2024, whilst the El Nino conditions continued through to April 2024, with both climate drivers in a neutral phase at the commencement of the 2024-25 water year. This had subsequent impacts on system inflows, as multiple successive years of La Nina conditions, which contributed to the 2022-23 River Murray flood came to an end.

The River Murray System (southern Basin) and the Darling River (northern Basin) experienced varied rainfall depending on location within the basin. Large areas of central NSW received above average to very much above average rainfall over 2023-24. The Lower Murray, including the length of the River Murray in South Australia, experienced below average to very much below average rainfall across 2023-24. The Upper Murray at the headwaters of the Southern Connected Basin experienced average to below average rainfall across the year (**Figure 1**).

Temperatures were very much above average for the whole of the Murray-Darling basin catchment, with only some minor variation from this trend as detailed below (**Figure 1**)

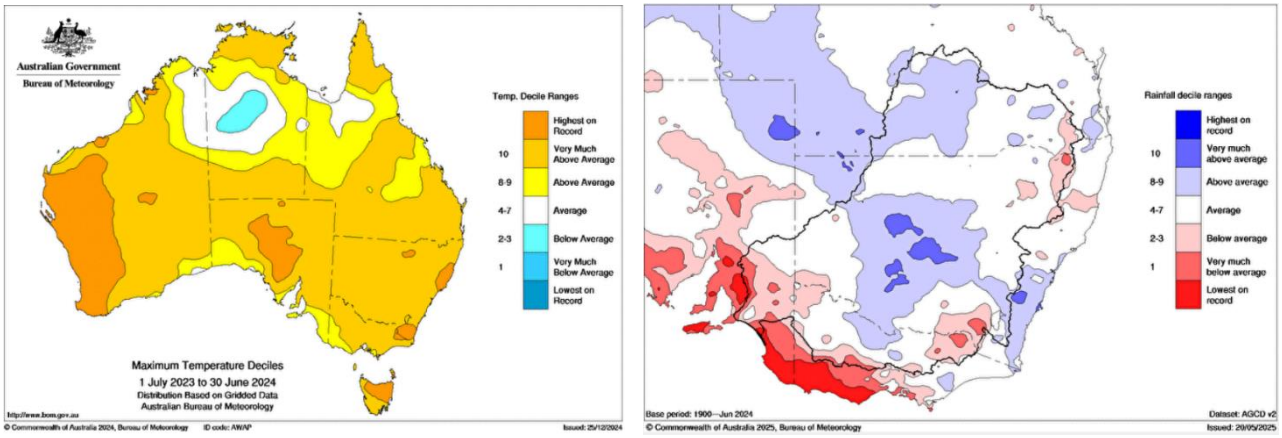

Figure 1. Maximum temperature across Australia and rainfall in Murray-Darling Basin 1 July 2023- 30 June 2024

(Sources: Climate Maps - Temperature Archive & Recent and historical rainfall maps, Australian Bureau of Meteorology)

In 2023-24, River Murray System inflow (excluding Menindee, Snowy Mountains Scheme, Inter-valley Transfers and environmental water inflow) was approximately 7 494 GL which is a significant reduction from the 2022-23 flood year of 23 384 GL and below the long-term median inflow volume of 9 980 GL (**Figure 2**).

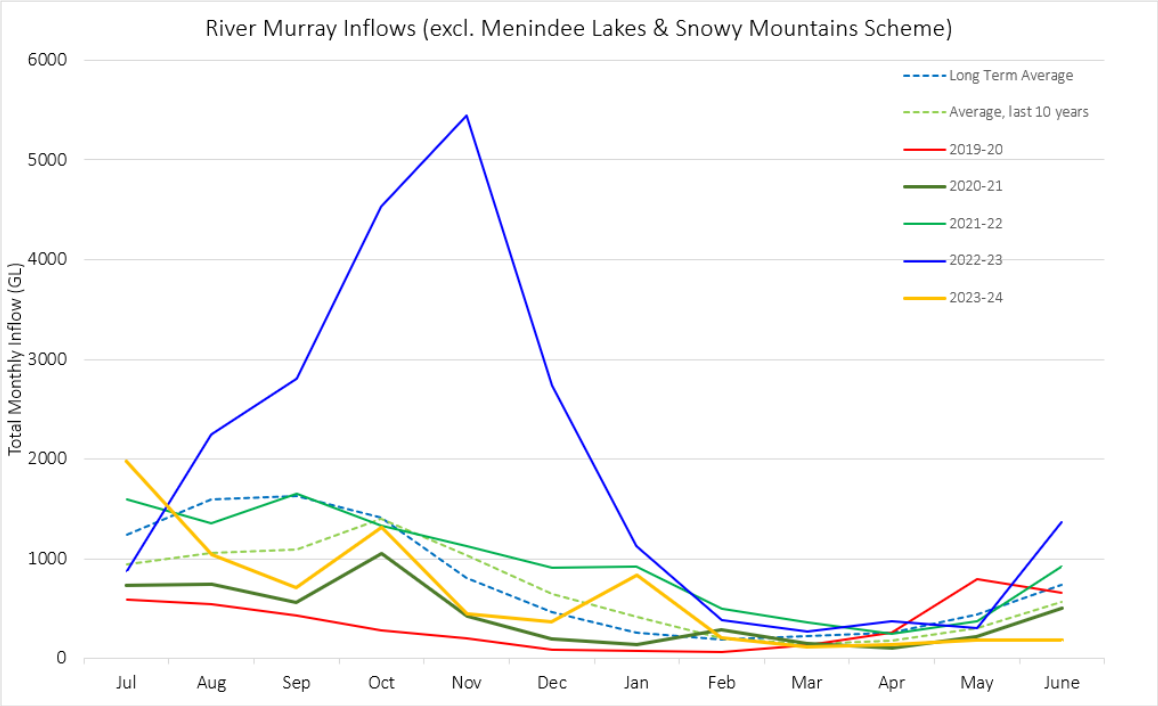

Figure 2. River Murray System Inflow (excluding inflow to Menindee and Snowy Scheme) recent years, long-term average and average over the last 10 years

In 2023-24, Menindee Lakes inflow was approximately 352 GL which is significantly below the long-term annual average inflow of around 2 080 GL (**Figure 3**). Comparatively in 2022-23, the inflow was approximately 6 218 GL.

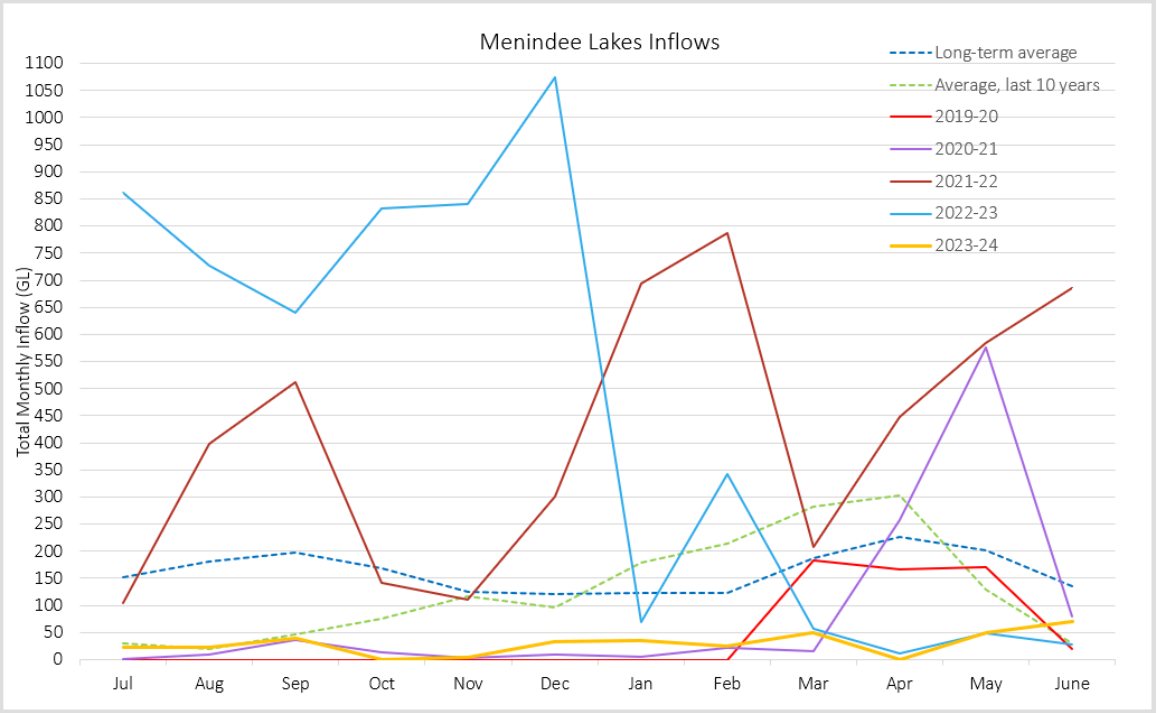

Figure 3. Inflows to Menindee Lakes in recent years, long-term average and average over last 10 years

2.2 MDB Storages at 3 July 2024

The water availability for the River Murray System and associated catchments (Murrumbidgee, Goulburn and Darling) at 3 July 2024 is identified in **Table 1**.

Table 1. Storage Volumes across MDB at 3 July 2024

	Total capacity (GL)	Active capacity (GL)	Water in storage (GL)	Percentage of total capacity %
River Murray Storage (MDBA Controlled)				
Dartmouth Reservoir	3 856	3 785	3 643	94%
Hume Reservoir	3 005	2 982	2 014	67%
Lake Victoria	677	577	524	77%
Menindee Lakes*	1 731	1 251	1 065	62%
Total	**9 269**	**8 595**	**7 246**	**78%**
Long term average at 1 July			6 174	67%
* When Menindee Lakes volume falls below 480 GL the resource is controlled by NSW. **When the volume next exceeds 640 GL it reverts back to MDBA control. *** Menindee Lakes can be surcharged above 1,731 GL (100% capacity)				
Murrumbidgee Storage (NSW Controlled)				
Burrinjuck Reservoir	1 028	1 023	771	75%
Blowering Reservoir	1 631	1 607	1 210	74%
Goulburn Storage (Victoria Controlled)				
Eildon Reservoir	3 334	3 234	2 939	88%

2.3 MDB Water Sharing Arrangements

As at 1 July 2024, the MDBA declared that the River Murray System will fall under **Tier 1** water sharing conditions as described in the Murray-Darling Basin Agreement (the Agreement). This indicates that normal water sharing arrangements will be put in place. Tier 1 water sharing operates when enough water is available for CHWN (NSW 61 GL, Victoria 77 GL and South Australia 204 GL) and conveyance water (1 596 GL).

Under Tier 1, a conveyance reserve of 225 GL is required to be set aside by the MDBA to ensure that conveyance water can be met in the following year. The full conveyance reserve for 2024-25 has been set aside.

2.4 South Australia's Water Resource Availability and Allocation

The MDBA's Water Resource Assessment provided in May 2024 advised that South Australia would receive the full SA Entitlement of 1 850 GL (as defined in clause 88 of the Agreement) in 2024-25 under all water resource assessment scenarios, including with worst case inflows.

Accordingly, the opening allocation for South Australian River Murray irrigators for the 2024-25 water year was 100 per cent.

2.5 South Australia's Storage Right

Schedule G of the Agreement states that South Australia's Storage Right is the first to spill when dam storages begin pre-releases or spill. In October 2022 due to the River Murray flood, the 336.2 GL of South Australia's deferred water spilled from Dartmouth Dam. Recommencement of deferral occurred in late 2023 and again in early 2024. In May 2024, the volume of 33.4 GL accrued in the storage right spilled, reverting the storage right volume back to 0 GL

As a result of these events, on 1 July 2024 South Australia had a total of 0 GL of deferred water stored in accordance with Schedule G of the Agreement, as shown in **Table 2**. The 2024-25 water year will be used to rebuild South Australia's Storage Right to meet volumetric targets for critical human water needs and private carryover.

Table 2. Volume of deferred water held in the South Australian Storage Right at 1 July 2024

	Lake Victoria (GL)	Menindee (GL)	Hume (GL)	Dartmouth (GL)	Total (GL)
CHWN	0.0	0.0	0.0	0	0
Private Carryover	0.0	0.0	0.0	0	0
Total	0.0	0.0	0.0	0	0

2.6 Water Level and Salinity Conditions

During 2023-24, salinity remained below Basin Plan target levels at Lock 6, Morgan, Murray Bridge and Milang. Salinity levels measured at these four key sites decreased during the spring high flow event and they remained below target levels for the entire water year.

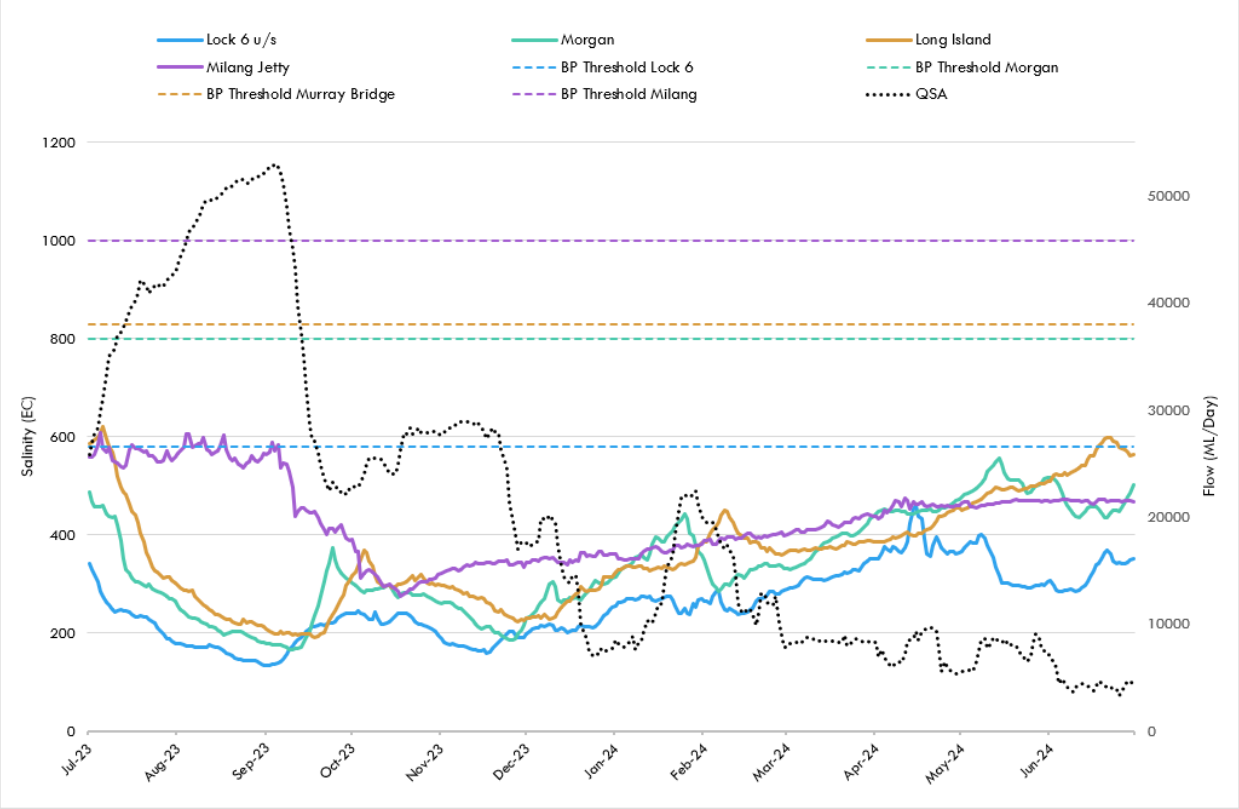

Figure 4. Salinity and water levels across Lock 6, Morgan, Murray Bridge and Milang from 1 July 2023 to 1 July 2024

Spatial averaged salinity and water level for Lake Alexandrina and Lake Albert during 2023-24 are shown in **Figure 5.** The average salinity ranged between 271 EC and 613 EC in Lake Alexandrina and 871 EC and 1,098 EC in Lake Albert. Lake Alexandrina water levels were in the range of 0.58 m AHD to 0.89 m AHD. Lake Albert water levels were in a range of 0.48m AHD and 0.93m AHD.

The following gauges are used to inform the figures below:

- **Lake Albert**: A4261155 Lake Albert 2km North Warringee Point, A4260630 Lake Albert at Meningie Sailing Club Jetty, A4261153 Lake Albert Near Causeway at Waltowa Swamp.
- **Lake Alexandrina**: A4260574 Lake Alexandrina near Mulgundawa, A4260524 Lake Alexandrina at Milang Jetty, A4260575 Lake Alexandrina at Poltalloch Plains, A4261156 Lake Alexandrina 3km West Point McLeay, A4261133 Lake Alexandrina at Beacon 97, A4260527 Lake Alexandrina at Tauwitchere Barrage.

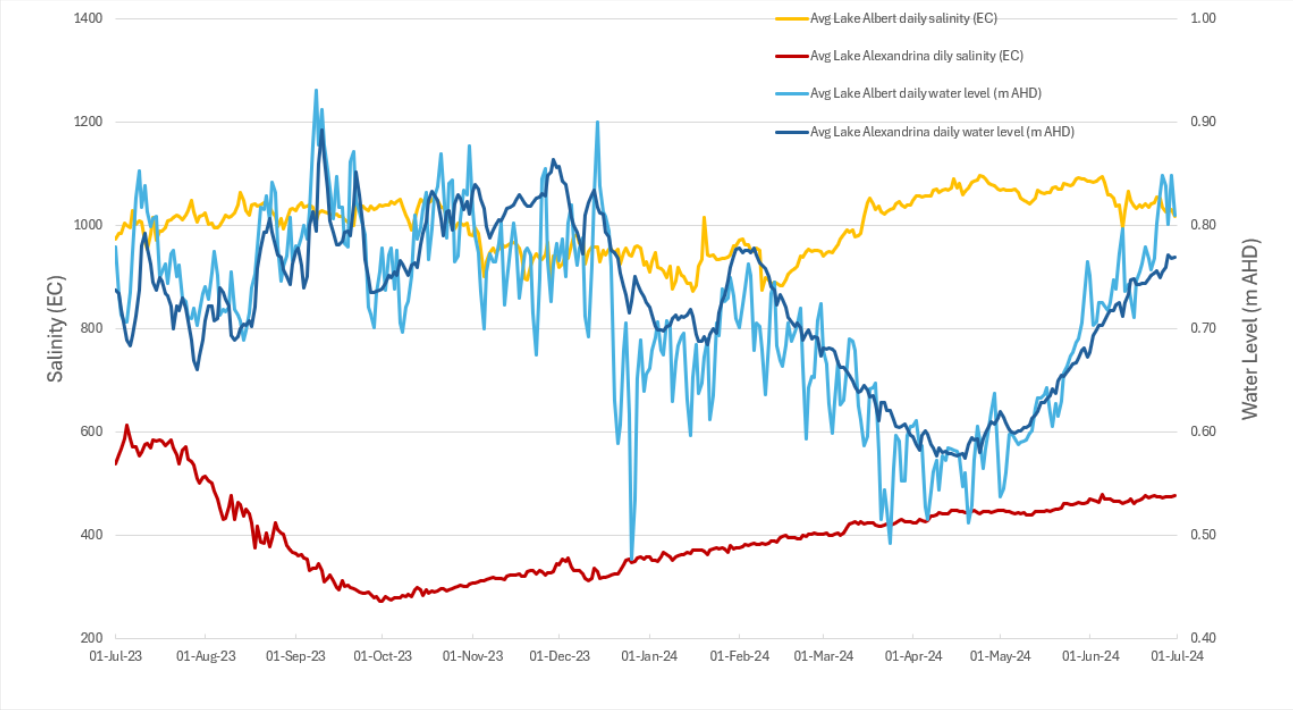

Figure 5. Lower Lakes average water and salinity levels from 1 July 2023 to 1 July 2024

Salinity levels in the North Lagoon of the Coorong remained within target levels during 2023-24 and were between 12 ppt and 34 ppt (Figure 6). In the South Lagoon salinity levels stayed well below the upper salinity threshold. This was largely due to the volume of fresh water entering the Coorong from the 2022-23 flood and prolonged high flows. Salinity thresholds in the South Lagoon were between 42 ppt and 85 ppt **(Figure 7).**

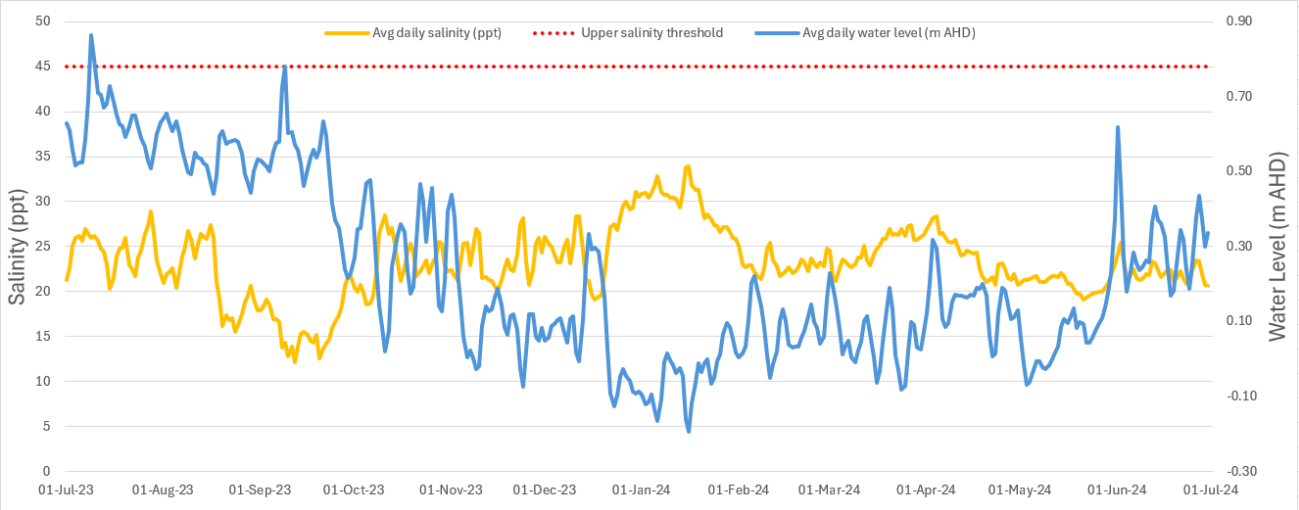

Figure 6. North Lagoon salinity levels from 1 July 2023 to 1 July 2024

Figure 7. South Lagoon salinity levels from 1 July 2023 to 1 July 2024

3 Annual Outlook for 2024-25

3.1 Bureau of Meteorology Climate Outlook

In July 2024, the Bureau of Meteorology's (BOM) three-month climate outlook indicates a moderate to high chance of above-median rainfall across much of the Murray–Darling Basin, particularly in central and eastern regions. The probability of exceeding median rainfall ranges mostly between 55 and 70 percent, with some pockets above 70 percent. Concurrently, there is a strong signal for warmer conditions, with a very high likelihood (greater than 70 percent) of exceeding median maximum temperatures across nearly the entire Basin, reinforcing expectations of a warmer-than-average winter and early spring period. BOM issued a La Niña Watch on 14 May 2024, indicating a 50% chance of La Niña developing later in the year, and increased likelihood of wetter than average conditions emerging later in the year, particularly during spring and summer.

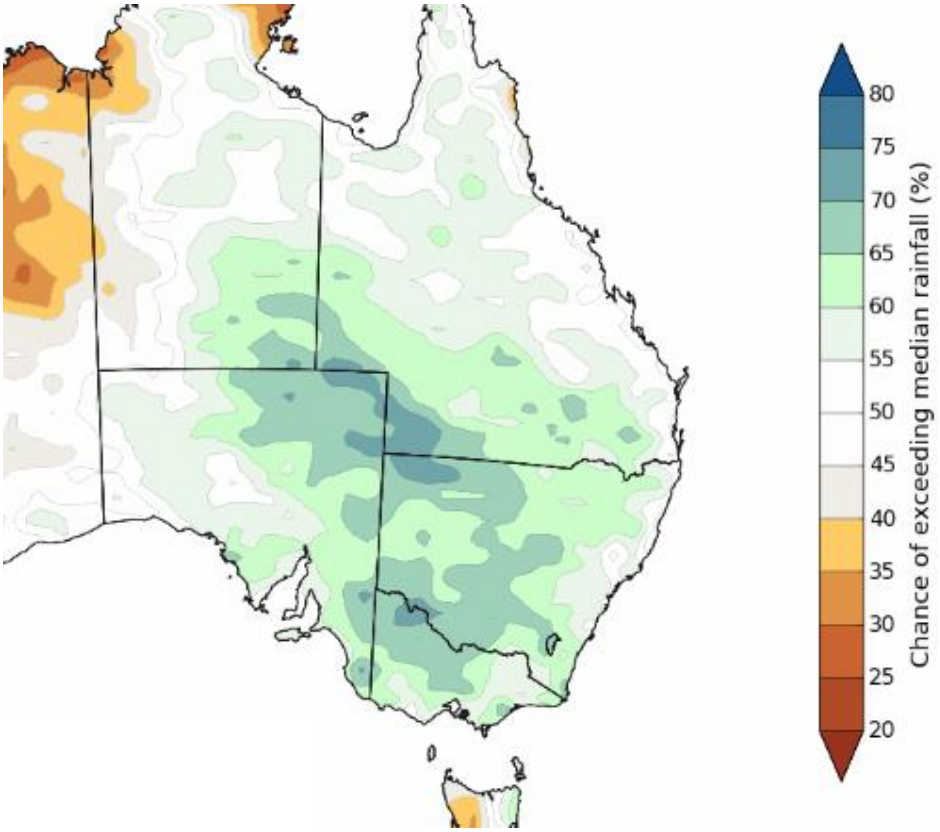

Figure 8. BOM Rainfall outlook from August to October 2024

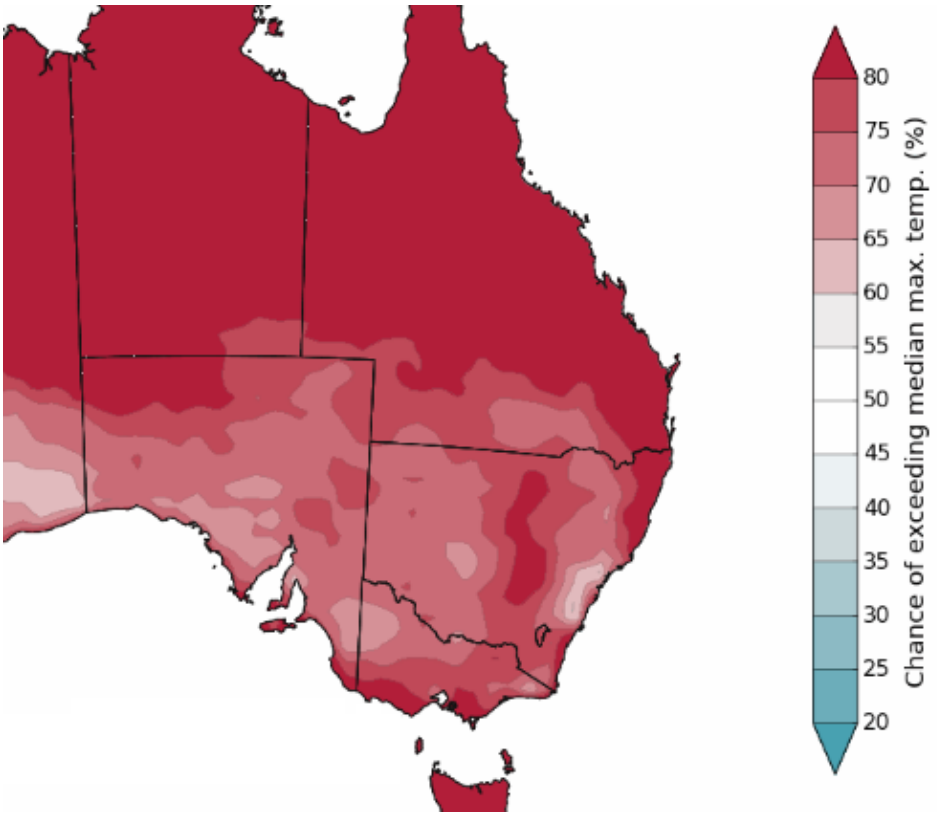

Figure 9. BOM Maximum temperature outlook from August to October 2024

3.2 MDBA Inflow Scenarios for 2024-25

The overall water availability for the River Murray System is determined by the MDBA at the start of each water year (1 June, which is different to South Australia's water year, which starts 1 July) and then at least monthly during the year.

It is not possible to accurately determine inflows to the River Murray System in advance, so the MDBA AOO defines six different inflow scenarios that cover the likely range of conditions that may be experienced during 2024-25. These scenarios are then used to guide general river operations and management actions that may be undertaken. River Murray System inflow scenarios are included in the SA AOP because they form the basis of the outlook for flow to South Australia.

At each assessment point throughout the water year, the volume of water available under the extreme dry and dry inflow scenarios will be progressively allocated to the States. The other scenarios are used to provide indicative quantities of water available to the States to assist in annual planning and management by water managers and customers, should those wetter scenarios eventuate.

As of June 2024, most upper Murray system catchments remain relatively wet and responsive to rainfall, following a year of below average inflows after the 2022-23 River Murray flood. While not as high as the extremely wet year in 2022–23, inflows over the 2023–24 water year supported continued high storage levels across the River Murray System.

Key headwater storages are entering the 2024–25 water year in a strong position. Dartmouth Reservoir is sitting at 94 percent capacity, while Hume Reservoir is at 66 percent and rising. These volumes provide a solid buffer heading into this water year. Despite this, the MDBA has included a 'very dry' scenario in the 2024–25 Annual Operating Outlook (AOO) and removed the previously used 'very wet' scenario. This decision reflects the BoM's climate outlook, including the La Niña Watch issued in May 2024, and the potential for hot and dry conditions to emerge through late winter and into summer. The dry scenario allows for early planning around high system demands, particularly given the need for environmental watering, maintenance drawdowns and downstream delivery requirements. However, if climatic drivers change substantially such that much wetter conditions continue, the scenarios in this outlook may be revised.

The six 2024-25 River Murray System inflow scenarios exclude inflow from the Menindee Lakes, Snowy Scheme, inter-valley trade deliveries and WFTE deliveries from tributaries. These inflow scenarios are based on observed system conditions in June 2024, which recorded 253 GL of inflow, equivalent to the 78th percentile for the month. From this starting point, each scenario transitions to a representative historic inflow percentile for the remainder of the water year. The six scenarios used in the MDBA Annual Operating Outlook (AOO) are:

1. **Extreme dry** scenario assumes total annual system inflows of 1,084 GL, based on transition to the 99th percentile of historic inflows. This scenario reflects a rapid deterioration from June's observed inflows to extremely dry conditions. Notably, this is still greater than the Basin Plan 2012 'worst case' scenario of 650 GL, which is not considered viable in 2024–25.
2. **Very Dry** scenario assumes annual River Murray System inflows of 1,991 GL, with inflows that recede to the 95th percentile inflows for remainder of 2024-25.
3. **Dry** scenario assumes annual River Murray System inflows of 2,821 GL, with inflows that recede to the 90th percentile inflows for remainder of 2024-25.
4. **Moderate** scenario assumes annual River Murray System inflows of 4,468 GL, with inflows that recede to the 75th percentile inflows for remainder of 2024-25.
5. **Near average** scenario assumes annual River Murray System inflows of 7,164 GL, with inflows that recede to the 50th percentile inflows for remainder of 2024-25.
6. **Wet** scenario assumes annual River Murray System inflows of 12,656 GL, with inflows that recede to the 25th percentile inflows for remainder of 2024-25.

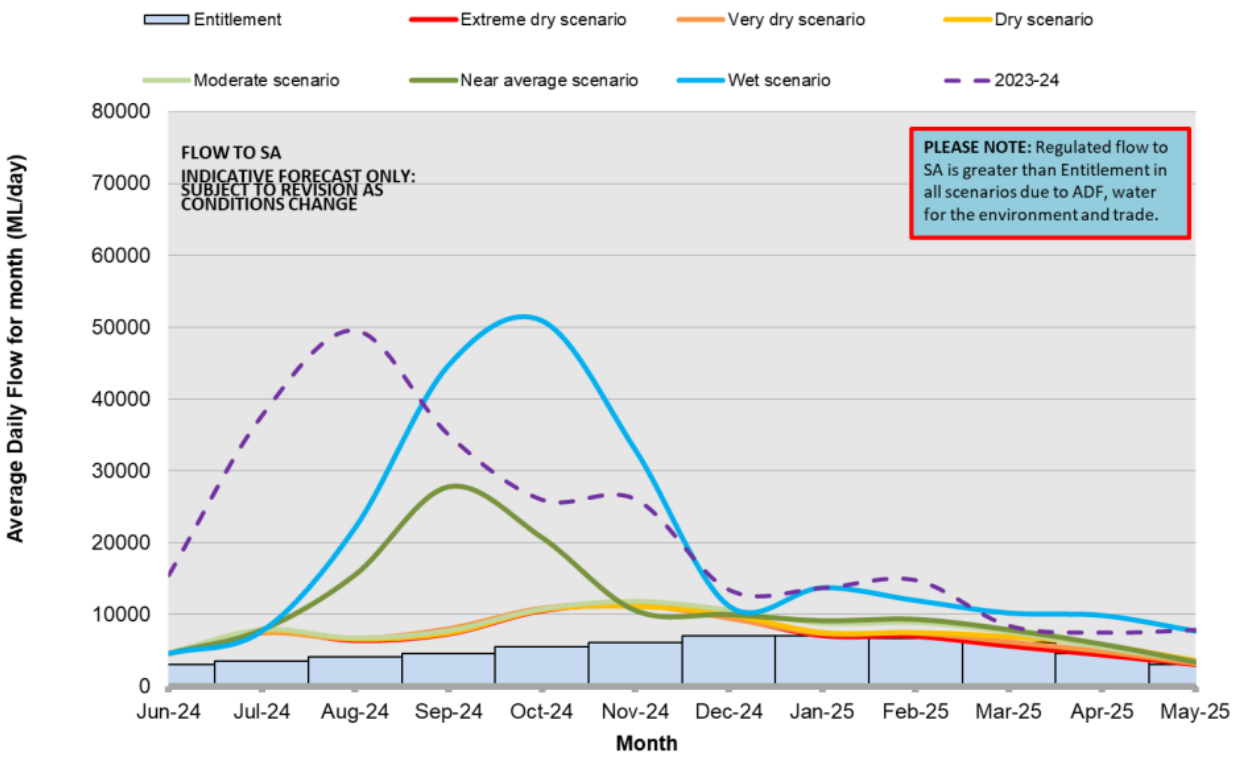

Figure 10. Flow to South Australia outlook from 1 June 2024 to 31 May 2025 (MDBA 2024)

3.2.1 Entitlement Flow

Consistent with the MDBA's water resource assessment, all AOO scenarios have South Australia receiving its full entitlement of 1,850 GL (696 GL Dilution and Loss (conveyance) + 1,154 GL Entitlement volume from which allocations are made) in all scenarios for 2024-25. When South Australia is allocated full entitlement, the monthly volume of entitlement is delivered as set out in clause 88 of the Murray–Darling Basin Agreement.

3.2.2 Unregulated Flow

Any unregulated flow entering South Australia will be used in accordance with the principles outlined in the *Water Allocation Plan for the River Murray Prescribed Watercourse* (Murraylands and Riverland Landscape Board 2021). The WFTE Annual Plan outlines potential environmental uses for unregulated flows in South Australia.

In the **extreme dry, very dry, dry**, and **moderate** inflow scenarios, unregulated flows to the South Australian border are not expected. Under these drier conditions, river operations will be managed to meet essential demands, and system inflows are not projected to exceed regulated flow requirements.

In the **near average** scenario, around 1,450 GL of unregulated flow may reach the South Australian border between August and November, depending on the timing and intensity of upstream inflow events. These flows could support environmental watering priorities and contribute to dilution flows through the lower system.

In the **wet** scenario, up to 3,750 GL of unregulated flow is projected for the same period (August to November), which may result in extended periods of surplus flow and increased potential for flooding along the River Murray in South Australia, particularly if further rainfall occurs during already high flow conditions.

3.2.3 Additional Dilution Flow (ADF)

ADF increases the entitlement flow to South Australia by 3,000 ML/day when specific storage triggers are met (SO&O 12.3). These include:

- Combined storage in Dartmouth and Hume Reservoirs exceeding 2,000 GL, and
- Monthly storage thresholds at Menindee Lakes.

In the 2024–25 Annual Operating Outlook, ADF is triggered only in the wet inflow scenario. It is not triggered under the **extreme dry, very dry, dry, moderate**, or **near average** scenarios due to insufficient system storage.

In the **wet** scenario, 560 GL of ADF is expected to be delivered between October and May. This volume supplements South Australia's Entitlement Flow and is treated as 'Planned Environmental Water'.

3.2.4 Shortfall

The Department for Environment and Water is developing a water delivery shortfall management plan for South Australia. The purpose of this plan is to describe the risk of a system or delivery shortfall impacting South Australia and to outline the approach for managing an event, should it occur.

A 'system shortfall' occurs when the combined capacity of the system is unable to supply all downstream requirements over the full season. Based on the inflow scenarios for the 2024-25 water year, high storage in Lake Victoria, the availability of Menindee Lakes and Inter Valley Trades, the risk of a system shortfall is less likely to occur this year. The probability of a shortfall is further reduced in the scenarios where Menindee Lakes continues as a part of the River Murray resource throughout 2024-25, which occurs in all but the 'extreme dry' scenario.

A 'delivery shortfall' occurs when actual water use is higher than it was forecast to be when river water is released from storages, weeks earlier, to meet the forecast needs for irrigation and WFTE. The availability of Menindee Lakes reduces required transfers from Hume, potentially lowering river levels along the Murray upstream of the Darling junction. Lower flows provide less buffer against short-term spikes in demand, elevating the risk of delivery shortfall. Avoiding a delivery shortfall upstream of the Darling junction will be a focus of MDBA operations over summer. However, this is unlikely to be a risk for water delivery to South Australia due to the buffering capacity of Lake Victoria and likelihood of receiving bulk water transfers from Menindee Lakes.

The basis of the South Australian Shortfall Management Plan will be a series of three management tiers with associated triggers and actions. The key objective of each tier is outlined below and the reduction in demand from the first and second tier options is likely to be sufficient to manage a shortfall at the South Australian border:

- First tier – no impact on water users (e.g. surcharge weir pools prior event, delay delivery of unallocated Entitlement)

- Second tier – delay delivery to those water users or purposes with an identified flexibility to manage a short delay (e.g. reduce delivery of SA held environmental water, dilution flow, transfers from the River Murray to major water supply storages)
- Third tier – temporary restriction on extractions for most water users using the powers of the *Landscape South Australia Act 2019*.

Full South Australian Entitlement has been secured for 2024-25 under normal water sharing arrangements and has been allowed across all scenarios. Additional Dilution Flow (ADF) to SA is only triggered in the wet scenario, increasing Entitlement by 3 GL/day, and continuing while storage triggers are met. In all scenarios, EWHs are planning to use environmental entitlements to increase summer and autumn flows across the SA border for ecological outcomes in the lower Murray to the sea.

3.2.5 Salinity

Salinity naturally occurs in the River Murray System but can be exacerbated by land and river management practices. A range of measures commenced more than three decades ago are helping to keep river salinity under control. However, during droughts, salinity in the lower Murray downstream of Lock 1 and in the Darling River, in particular, can increase and begin to impact water supply for human consumption, industries, and the environment. The likelihood of a high salinity event is low if river flows remain at or above Entitlement Flow. Nonetheless, prolonged inundation of floodplains can induce an increase in the rate of discharge of saline groundwater to the main river channel. This risk is greatest when there is a rapid return to Entitlement Flow following floodplain inundation.

A summary salinity outlook using modelled salinity for each flow scenario indicates that salinity is predicted to remain below the Basin Plan Salinity Targets (**Table 3**). The salinity outlook provides a range of likely river salinities over the outlook period. The model outputs should not be relied upon as absolute values but more so as an indication of the relative change between outlook scenarios.

Table 3. Salinity Outlook – Summary of maximum modelled salinity for each flow scenario compared to the Basin Plan maximum salinity threshold (paragraph (5)(c) of Section 9.14 of the Basin Plan)

Site	BP Target Value (EC)*	Maximum modelled salinity (EC)				Total No. days over BP maximum salinity threshold (for the 75% of AEP scenario)				
		90% AEP	75% AEP	50% AEP	25% AEP	580 EC	600 EC	800 EC	830 EC	1000 EC
River Murray at Lock 6	580	375	375	374	374	0				
River Murray at Morgan**	600/800	560	577	546	540		0	0		
River Murray at Murray Bridge	830	624	627	615	602				0	
Lake Alexandrina at Milang	1000	507	508	506	497					0

* Paragraph (5)(c) of Section 9.14 of the Basin Plan states that *"the levels of salinity at the reporting sites set out in the table should not exceed the values set out in the table, 95% of the time"*

** 600 EC at Morgan is the threshold for Responsive Management, as agreed by partner governments

4 Operating considerations for 2024-25

4.1 Conditions Outside the Manageable Flow Range

4.1.1 High Flow and Flood

During 2022-23 SA experienced its most significant flood event in 60 years. On 23 December 2022, flow into the SA River Murray peaked at around 190,000 ML/day. Locks 6 to 1 were progressively removed between late September 2022 and mid-October 2022. By early December 2022, all operable gates across all 5 barrages were opened (569 gates in total).

Following the flood peak in December 2022, the flow in the SA River Murray receded by approximately 20,000 ML/day each week until returning to within-channel (<50,000ML/day) in February 2023. By early February 2023, as flows receded, barrage gates and the locks and weirs were being reinstated.

At the commencement of 2023-24, high flow conditions (as defined in the O&O) were occurring on the River Murray in South Australia and a High Flow Advice was current. Unregulated flow was still occurring along all reaches of the River Murray downstream of Hume Dam and on the Lower Darling River downstream of Menindee Lakes.

In contrast to recent wetter years, for the 2024-25 water year the Bureau of Meteorology has forecast the return of neutral conditions for the Indian Ocean Dipole and El nino Southern Oscillation index.

4.1.2 Low Water Availability

Low water availability is not considered a risk during 2024-25.

Entitlement Flow is not expected to be impacted by the risk of delivery shortfall during 2024-25 mainly due to above average storage levels across the MDBA shared storages.

The MDBA in collaboration with the NSW, Victorian and South Australian governments (via the WLWG) will review operations of the River Murray system throughout the year. If at any stage a material risk of a shortfall is identified, the MDBA will refer the matter to WLWG, and if advised by WLWG will seek guidance from the BOC to determine appropriate arrangements for managing shortfalls.

4.2 Environmental Water Delivery

Planning for the 2024-25 water year was undertaken for four water resource availability scenarios provided by the MDBA, ranging from **Very Dry** to **Wet**. Planning for Very Dry and Dry scenarios was combined, as the MDBA advised that average monthly flows for these two scenarios were the same across the year. These scenarios were based on the MDBA's modelled hydrographs that were developed at the end of May 2024. No Very Wet scenario was provided, and as such it was not included in planning. However, if conditions improve, opportunities to support or enhance higher flows will be considered. These scenarios, referred to as Annual Operating Outlook (AOO) scenarios, are developed by the MDBA to support annual environmental water planning.

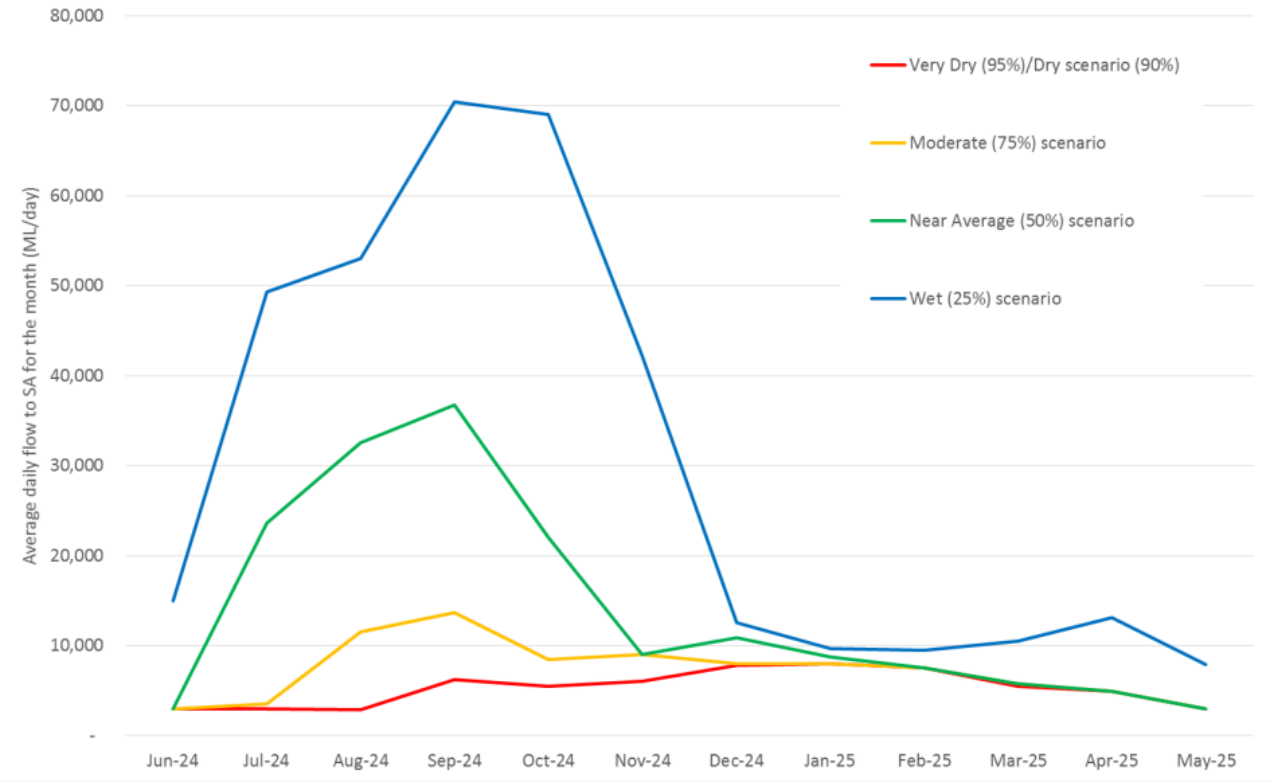

Figure 11. Annual operating outlooks provided by the MDBA in May 2024

River operations will facilitate where possible the delivery of WFTE to support actions identified in the WFTE Annual Plan, such as:

- the operation of regulators within floodplain anabranches, e.g. Chowilla, Pike and Katarapko floodplains
- weir pool manipulations, including raising and some lowering
- river channel and floodplain water via augmentation or unregulated flow or creation of in-channel flow events (e.g. spring pulses)
- pumping and water delivery via infrastructure into temporary wetlands
- wetting and drying of managed pool connected wetlands
- Lower Lakes, Coorong and Murray Mouth (LLCMM) management, including lake level variations, lake cycling, fishway operations and barrage releases.

The WFTE Annual Plan presents the priorities for delivery and use of WFTE under the range of water availability scenarios as described above. This scenario-based approach is based on MDBA AOO and projected WFTE allocations and availability. The planning process includes the development of site based annual environmental watering proposals and a South Australian multi-site proposal describing the preferences for coordinated delivery of WFTE for all sites. WFTE delivered along the River Murray in South Australia is coordinated by DEW, with significant involvement from other government agencies including the Commonwealth Environmental Water Office (CEWO), non-government organisations, scientific bodies and community stakeholders (**Table 4**).

Table 4. Environmental watering proposals submitted to the MDBA and/or the CEWO for 2024-25

Watering Proposal	Site Manager
Lower Lakes, Coorong and Murray Mouth	SA Department for Environment and Water
SA River Murray Channel and Floodplain	SA Department for Environment and Water
Chowilla Floodplain (incl. Lock 6)	SA Department for Environment and Water
Pike Floodplain (incl. Lock 5)	SA Department for Environment and Water
Katarapko Floodplain (incl. Lock 4)	SA Department for Environment and Water
Weir Pool Raising and Lowering (Locks 6 to 1)	SA Department for Environment and Water
Various wetlands along the River Murray and Lower Lakes	Murraylands and Riverland Landscape Board
Wetlands in the Renmark area	Renmark Irrigation Trust[1]
Banrock Station wetlands	Accolade Wines[1]
Calperum Station lakes and wetlands	Australian Landscape Trust[1]

[1] Non-government organisations do not complete a SCBEWC watering proposal

DEW has developed a multi-site watering proposal for 2024-25, outlining the optimal delivery of WFTE for the South Australian River Murray under a range of scenarios based on the MDBA AOO. Section 5.1 of the WFTE Annual Plan sets out the multi-site proposal and seeks to align the site-specific watering actions identified, minimise risks, maximise the effectiveness of environmental water delivery and enhance ecological outcomes throughout the system.

Adaptive management practices are undertaken, such as Integrated Operations (IO) to mitigate risks that may have adverse impacts on water quality or quantity. A number of tools have been developed to assist with the coordination of events, including the Integrated Operations Strategy (IOS) which supports the decision-making complexity associated with an increasing number of large-scale watering opportunities and a hydrological modelling platform (Source Model). Both these tools assist in the development of the annual priorities within the WFTE Annual Plan and the development of South Australia's multi-site proposal.

The estimated volume of water for the environment required to deliver the 2024-25 SA multi-site proposal ranges from approximately 1,280 GL in the wet scenario to 1,500 GL in the near average scenario (Table 5). The SA multi-site volumes represent the volume of environmental water required to be delivered to the South Australian border to support all proposed watering actions in the South Australian River Murray for that scenario. These volumes are in addition to water for the environment on South Australian licences (approximately 250 GL), which is delivered as part of South Australia's Entitlement and therefore included in the base flow represented in the AOO scenarios. The SA multi-site volumes factor in the contribution that the river channel water demand makes to the CLLMM water demands.

Table 5. Indicative volume of environmental water required per month to deliver South Australia multi-site actions. Options under each scenario represent alternative demand profiles and are not cumulative

Annual operating outlook	Indicative volume (GL) of environmental water required per month												Total est. volume 2024-25 water year only (GL)
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	
Very Dry/Dry	62	32	109	270	364	232	55	13	44	43	33	60	1,317
Moderate	31	1	47	362	335	268	51	13	44	43	33	30	1,259
Near Average	8	79	239	263	377	286	58	12	44	43	33	60	1,500
Wet	0	1	38	278	346	495	53	12	12	12	32	0	1,280

South Australia has developed site-specific watering proposals for a number of locations throughout the SA River Murray system in the 2024-25 water year using a scenario-based approach (Table 4), with the scenarios represented by the AOO planning hydrographs (see section 4.2 Environmental Delivery). A summary of site-based actions is provided in the WFTE Annual Plan (see section 5.1 and Appendix A) and provides detailed lists of all proposed actions under each water resource availability scenario, including associated volumes and ecological objectives.

4.3 Weir Pool Manipulations

The SA AOP and associated operational decisions will balance the impacts of weir pool manipulation within South Australia on water users, while acknowledging and exploring other opportunities to balance ecological needs with the required water supply within more flexible river management regimes. The normal operating range for each weir is described in the SA O&O.

Manipulation of weir pool water levels may be implemented for a number of reasons including:

- for environmental benefit including the wetting and drying of riparian areas and adjacent wetlands and floodplains;
- the need to supply downstream water requirements when there are very hot conditions and demands are high;
- to minimise evaporation rates;
- to temporarily store water rather than allow it to pass downstream;
- for construction and maintenance programs; and
- to provide variation in water levels to minimise bank erosion.

Potential weir pool manipulations that are being considered to be undertaken during 2024-25 to achieve environmental outcomes, including detail of potential water levels and timing for each AOO scenario, can be seen in the table below (**Table 6**).

Table 6. Proposed manipulations for each weir pool in 2024-25 under the different AOO scenarios as set out in the WFTE Annual Plan.

Annual operating outlook	Proposed manipulation for each weir pool in metres above (+) or below (-) normal pool level											
	Lock 1		Lock 2		Lock 3		Lock 4		Lock 5		Lock 6	
	Winter	Spring	Winter	Spring	Winter	Spring	Winter	Spring	Winter	Spring	Winter	Spring
Very dry	0.00	0.10	0.00	0.30	0.00	0	0.00	0.30	0.00	0.13	0.00	0.25
Moderate	0	-0.10 OR 0.10	0	-0.08 OR 0.30	0	0	0	-0.04 OR 0.30	0	-0.08 OR 0.13	0	-0.08 OR 0.25
Near Average	0.00	0.10	0.00	0.30	0.00	0.21	0.00	0.30	0.00	0.13	0.00	0.25
Wet	0	0	0	0	0	0	0	0	0	0	0	0

Within the '**Very Dry', 'Dry**', and '**Moderate**' scenarios for 2024–25, moderate weir pool raising (within normal operating range) is proposed at all weirs except Weir 3 during spring. These actions aim to improve lateral connectivity with the floodplain, stimulate frog breeding through water level increases, and support recruitment of long-lived vegetation seedlings at higher floodplain elevations. Weir 3 is excluded due to the limited dilution capacity under low flows and the associated risks of salt mobilisation from Lake Bonney.

Under the '**Moderate**' scenario, if QSA remains below 10,000 ML/day, the same raising actions will apply. However, if QSA exceeds 10,000 ML/day during spring, modest weir pool lowering is proposed at all weirs except Weir 3. This lowering will help maintain and extend lotic conditions (>0.2 m/s) in key fast-flowing habitats downstream of each weir and support the ecological outcomes of any spring pulse, including matter transport and connectivity for flow-dependent species.

In the '**Near Average'** scenario, QSA is expected to peak at approximately 37,000 ML/day in early spring, and weir pool raising is proposed across all weirs to the top of the normal operating range. This will enhance both lateral and longitudinal connectivity, inundate high-value habitats for frogs, waterbirds and vegetation, and support sustained lotic conditions across the system.

No weir pool manipulation is proposed under the '**Wet**' scenario, as AOO flows are expected to exceed the thresholds at which weirs are removed, rendering manipulation unnecessary.

All proposed actions remain subject to change based on actual in-channel pulse timing, flow conditions, and the coordination requirements for major floodplain watering actions, particularly at Weirs 4, 5 and 6 where regulators may also be operated.

Proposed manipulations for each weir pool in meters above (+) or below (-) normal pool level (NPL) are provided the WFTE Annual Plan (see Appendix A) and provides detailed lists of all proposed actions under each water resource availability scenario, including associated volumes and ecological objectives.

4.4 Lake Victoria Directed Release

Directed releases of upper state water entitlements (such as environmental water) from Lake Victoria during unregulated flows is a strategy used to "boost" the flow to South Australia to enhance environmental outcomes. At the commencement of the 2024-25 water year, unregulated flows are not occurring.

In collaboration with environmental water holders, directed releases from Lake Victoria may be considered during 2024-25, where appropriate, particularly for targeting higher flow-rate dependent outcomes. Releases may be made to boost or extend flows or manage the rate of recession. Operational factors that may be taken into account include impacts to the planned operations of infrastructure such as floodplain regulators and locks/weirs, disruption to construction and maintenance works on the floodplain, inundation of public and private property, and future flow conditions and opportunities for releases.

4.5 Lower Lakes, Coorong and Murray Mouth Operations

Barrage operations are guided by the *Barrage Operating Strategy* (BOS) (DEW 2019b) and the *Barrage and Water Level Management Policy* (DEW 2019c). The BOS guides the operation of the barrages to achieve ecological outcomes for the Lower Lakes, Coorong and Murray Mouth (LLCMM). It includes management tools, rules and procedures for the operation of barrages under different operating conditions. The BOS also provides formal decision-making processes for transparent and efficient management of barrage operations. The BOS outlines typical barrage management actions in consideration of water level and availability.

Proposed LLCMM actions for the 2024-25 water year, as submitted to Southern Connected Basin Environmental Watering Committee in 2024, are provided the WFTE Annual Plan (see Appendix A) and provides detailed lists of all proposed actions under each water resource availability scenario, including timing, associated volumes and ecological objectives.

To achieve a targeted objective(s), there may be multiple smaller-scale operational actions that can be undertaken. Many of these operational actions are outlined in the CEWH/DEW 2024-25 watering schedule, and in subsequent 3-month forward planning documents that DEW produces for the CEWH. Actions include:

- Seasonal lake level manipulation
- Lake level cycling which involves a rapid lake level manipulation for salinity export from Lake Albert
- Targeted seasonal barrage releases to achieve outcomes in either the Murray estuary (i.e. black bream recruitment downstream of Goolwa barrage) or the Coorong (i.e. high flows from Tauwitchere barrage to maintain higher water levels in spring and early summer to support *Ruppia tuberosa* recruitment).
- Pulsing of releases from Tauwitchere barrage under certain wind, tide and swell conditions to lower Coorong salinity levels
- Leaving barrage bays open during appropriate sized reversing events in spring and summer, to allow the dynamic estuarine interface zone to remain intact
- Flow releases from Salt Creek to the Coorong South Lagoon, to provide fish migration between the Coorong and the South East drainage network, and for salinity reduction in the Coorong South Lagoon.

Additional detail on proposed actions for the LLCMM is contained in the WFTE Annual Plan.

4.6 Water Quality

Operation of floodplain regulators may introduce water quality risks (salinity, low dissolved oxygen, algae) and are monitored as per event plans to ensure that measured interventions can be undertaken.

Low-oxygen blackwater events or algae outbreaks are more likely to occur in the South Australian River Murray during summer. In some circumstances, Lake Victoria may be used to improve poor water quality that originates from upstream of the South Australian border by diverting and/or diluting the flow in the main channel. ADF and the delivery of water for the environment in warmer months (for example, spring flows) also assist in lowering water temperature, limiting stratification, increasing mixing and therefore reducing algae outbreaks.

Salinity levels are expected to remain below targets for Lock 6, Morgan and Murray Bridge, assisted by unregulated flow. Any potential salinity impacts are difficult to predict and are highly dependent on flow conditions.

Where possible, the weir pool level downstream of Lock 1 will be maintained above +0.50 m AHD to generally retain access by irrigation pumping or diversion infrastructure, also noting that, below this level, water quality may deteriorate at some extraction points around the Lower Lakes.

Refer to the SA O&O for more detail on water quality targets and obligations.

4.7 Deferral, Storage and Delivery of South Australia's Storage Right

In accordance with the South Australian River Murray Water Resource Plan, South Australia aims to have up to an equivalent of 150 percent (306 GL) of its annual CHWN in storage, in case it is required ahead of a year with less than 1,850 GL of Entitlement Flow available.

Any proposed changes to the delivery of the monthly Entitlement Flow to South Australia and the use of South Australia's Storage Right under Schedule G of the Agreement will be identified through the Deferred Water Storage and Delivery Plan, which is updated on a monthly basis and found here: https://www.environment.sa.gov.au/topics/water-and-river-murray/water-information-and-data/water-resources-and-environments/south-australias-storage-right

On 1 July 2024, South Australia had a total of 0 GL of deferred water stored in accordance with Schedule G of the Agreement, as shown in **Table 2**. In August 2022 due to the unprecedented increased flows in the Murray-Darling Basin pre-releases began at Dartmouth Dam where the total 336.2 GL of South Australia's deferred water was stored. In accordance with Schedule G of the Agreement, South Australia's Storage Right is the first to spill when dam storages begin pre-releases or spill. By October 2022 the total volume stored in the Storage Right had spilled. The 2024-25 water year will be used to rebuild South Australia's Storage Right.

4.7.1 Deferral

South Australia's Deferred Water Storage and Delivery Plan for 1 July 2024 has proposed the deferral of 143.4 GL of Entitlement Flow between September 2024 and April 2025. Of this volume 140.1 GL will be set aside for CHWN and 3.3 GL for Private Carryover. All deferral volumes are subject to operational constraints and approvals.

Deferral and storage of Entitlement Flow will only be undertaken if practical under prevailing conditions. South Australia's preferred storage is Dartmouth Dam. Actual deferrals may be limited during 2024-25 due to forecast Lake Victoria spill probabilities.

4.7.2 Delivery

With full South Australian Entitlement, it is not expected that South Australia will request delivery of any of its deferred water throughout the water year.

5 Glossary of Terms Used

Additional Dilution Flow (ADF): is released to South Australia at a rate of 3 GL/day once storage volumes in Hume and Dartmouth and the Menindee Lakes Scheme exceed specified triggers. Delivery of ADF continues while the trigger levels are maintained.

Annual Exceedance Probabilities (AEP): represents the percentage likelihood of a flow, or greater flow, occurring based on the historical record

Conveyance Reserve: for a year, means water set aside by the MDBA to supply conveyance water for the following year, determined in accordance with clause 102 D of the Agreement

Conveyance Water: is the volume required to physically deliver water to where it is needed for use such as CHWN.

Critical human water needs (CHWN): are the minimum amount of water required to meet core human consumption requirements in urban and rural areas; and those non-human consumption requirements that a failure to meet would cause prohibitively high social, economic or national security costs

Deferred water: Water that South Australia has requested the MDBA to not deliver and instead store in upstream storages under Schedule G of the Agreement. South Australia can request this water to be delivered in a subsequent dry year

Entitlement Flow: minimum monthly River Murray flow to South Australia specified in clause 88 of the Agreement

Environmental flow: any change to the flow regime that is intended to maintain and improve river health. It seeks to make better use of the water currently available in the system, as well as any new water made available, for the environment

Gigalitre (GL): 1 gigalitre is a thousand million (1 000 000 000) litres or 1 000 megalitres. 1 gigalitre would cover Adelaide oval to a depth of 50 metres (about a 15-storey building)

Integrated Operations (IO): a term used to describe the coordination of water delivery to South Australia with large scale environmental watering involving infrastructure operation, to manage the potential risks of adverse impacts and, where possible, achieve cumulative benefits across the South Australian River Murray.

Megalitre (ML): 1 megalitre is one million litres (about half an Olympic swimming pool)

Private carryover: means a volume of allocation made available in a year for use under an entitlement and not used in the year, but that may be made available to the holder of the entitlement for use in a subsequent dry year (clause 2 of the Agreement)

Salinity: concentration of salts in soil or water, usually sodium chloride

South Australia's Storage Right: South Australia's limited right to defer a portion of its Entitlement Flow and store it in the Murray-Darling Basin storages for delivery in a future dry year, which is set out by Schedule G of the Agreement

The Agreement: The Murray-Darling Basin Agreement, incorporated in the *Water Act 2007* (Cwth)

Unregulated flow: flow to South Australia that cannot be captured (regulated) in Lake Victoria. Unregulated flow is preserved for the purpose of achieving environmental outcomes unless required in emergency circumstances

Water access entitlement holder: a natural person or body corporate that holds the right to a share of the consumptive pool for the River Murray Prescribed Watercourse

Weir pool: water that is held back by the presence of a weir

Wetland: land inundated with temporary or permanent water that is usually slow moving or stationary, shallow and either fresh, brackish or saline

6 Glossary of Acronyms Used

ADF	Additional Dilution Flow
AEP	Annual Exceedance Probabilities
AHD	Australian Height Datum
AOO	Annual Operating Outlook
BOC	Basin Officials Committee
BOM	Bureau of Meteorology
BOS	Barrage Operating Strategy
CEWH	Commonwealth Environmental Water Holder
CHWN	Critical Human Water Needs
DEW	Department for Environment and Water
EC	Electrical Conductivity
EWR	Environmental Watering Requirements
FSL	Full Supply Level
GL	Gigalitres
LLCMM	Lower Lakes, Coorong and Murray Mouth
LTWP	Long-Term environmental Watering Plan
m	metres
MDBA	Murray-Darling Basin Authority
NOR	Normal Operating Range
NPL	Normal Pool Level
ML	Megalitres
PIRSA	Primary Industries and Regions South Australia
PPT	Parts per Thousand
QSA	Calculated River Murray flow at the South Australian border (gauging station A4261001)
RMOWG	River Murray Operations Working Group
SA AOP	South Australia's River Murray Annual Operating Plan
SA O&O	Objectives and Outcomes for Operating the River Murray in South Australia
SA Water	South Australian Water Corporation
WFTE	Water for the Environment
WLWG	Water Liaison Working Group

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