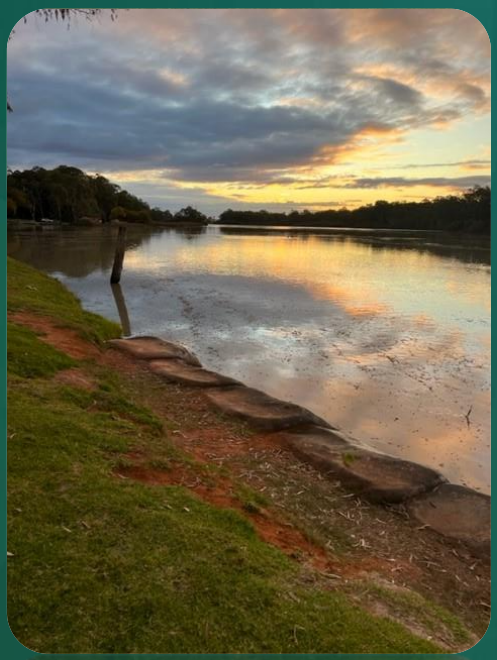
South Australia's River Murray Annual Operating Plan

2022-23



Government of South Australia

Department for Environment and Water

Foreword

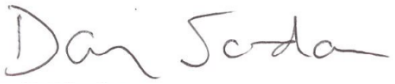
The Department for Environment and Water acknowledges and pays respect to the Traditional Owners and First Nations of the Murray-Darling Basin, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

South Australia's River Murray Annual Operating Plan 2022-23 is the key document that guides transparent and coordinated River Murray operational decisions in South Australia during the 2022-23 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 *2022-23 Water for the Environment Annual Plan for the South Australian River Murray* and the *Australian Drinking Water Guidelines*.

While the 2022-23 water year is not yet over, it will enter the history books as the year that South Australia experienced its highest River Murray flood in more than 60 years. The annual operating plan has been updated following the flood to incorporate relevant new information and learnings from this event to ensure that these are reflected in future practice.

I would like to thank all those who have been involved in the ongoing development and annual review of the annual operating plan for the 2022-23 water year, particularly members of the River Murray Operations Working Group and the Murray-Darling Basin Authority.



Dan Jordan, Acting Executive Director, Water and River Murray
Department for Environment and Water
22 May 2023

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1 Introduction

South Australia's Annual Operating Plan 2022-23 (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 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 *2022-23 Water for the Environment Annual Plan for the South Australian River Murray* (WFTE Annual Plan) (DEW 2022), 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 2013) and that South Australia meets its obligations for the protection of WFTE.

Annual updates of the SA AOP are reviewed by the River Murray Operations Working Group (RMOWG). This is a cross-agency group consisting of representatives with an interest in how the River Murray is managed and operated in South Australia and includes representatives from:

- DEW
- SA Water
- Primary Industries and Regions SA
- Environment Protection Authority
- Commonwealth Scientific and Industrial Research Organisation.

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 2022) for the 2022-23 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 June to May, whereas South Australia defines its water year as July to June.

The SA AOP uses the six inflow scenarios of the AOO, being 'extreme dry', 'dry', 'moderate', 'near average', 'wet' and 'very wet' to inform water delivery operations in South Australia. The MDBA has not included the 'worst case' inflow scenario determined under the Basin Plan in its AOO for 2022-23 (which is even drier than the 'extreme dry' scenario), as this would be impossible to occur in 2022-23 with the initial system conditions.

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 2022-23 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 where one month can be wet followed by a month of dry. The actual pattern of environmental water delivery during the 2022-23 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 2022-23 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), deliver a portion of South Australia's deferred water for Critical Human Water Needs (CHWN) and private carryover if required, seek opportunities to defer additional water should the conditions improve, and have regard for the Basin Plan targets and outcomes.

2 Resource conditions at commencement of 2022–23

2.1 Murray-Darling Basin inflows during 2021-22

Murray-Darling Basin inflows during 2021-22 were influenced by a La Niña event which developed during spring 2021 and continued until June 2022. La Niña conditions were also experienced during 2020-21, making 2021-22 the second consecutive La Niña year.

The River Murray System (southern Basin) and the Darling River (northern Basin) experienced varied rainfall depending on location within the basin. Large areas of northern NSW received above average to very much above average rainfall over 2021-22. The Lower Murray, including the length of the River Murray in South Australia, experienced average rainfall across 2021-22. The Upper Murray at the headwaters of the Southern Connected Basin experienced above average rainfall across the year (**Figure 1**).

Temperatures were above average across the Lower Murray and over some areas of the Upper Murray in 2021-22. The remainder of the Southern Connected Basin experienced average temperatures in 2021-22 (**Figure 1**).

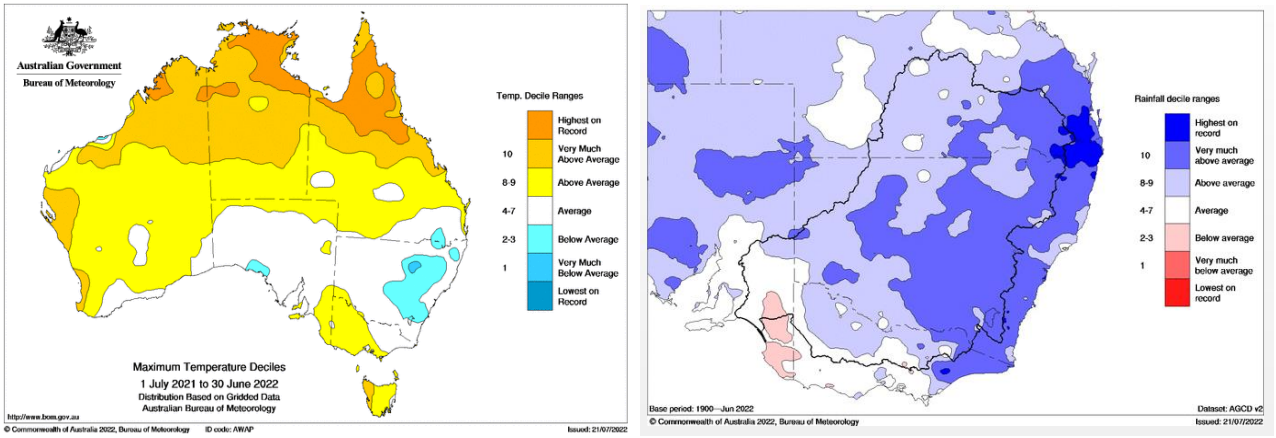

Figure 1. Maximum temperature across Australia and rainfall in Murray Darling Basin 1 July 2021- 20 June 2022

(Sources: http://www.bom.gov.au/jsp/awap/temp/index.jsp & http://www.bom.gov.au/climate/maps/rainfall/?variable)

In 2021-22, River Murray System inflow (excluding Menindee, Snowy Mountains Scheme, Inter-valley Transfers and environmental water inflow) was approximately 11 281 GL which is double the volume recorded for the same period in 20-21 and around 3 550 GL more than the long-term median inflow volume (**Figure 2**).

The inflow to the River Murray System exceeded the long term average for most of the 2021-22 water year.

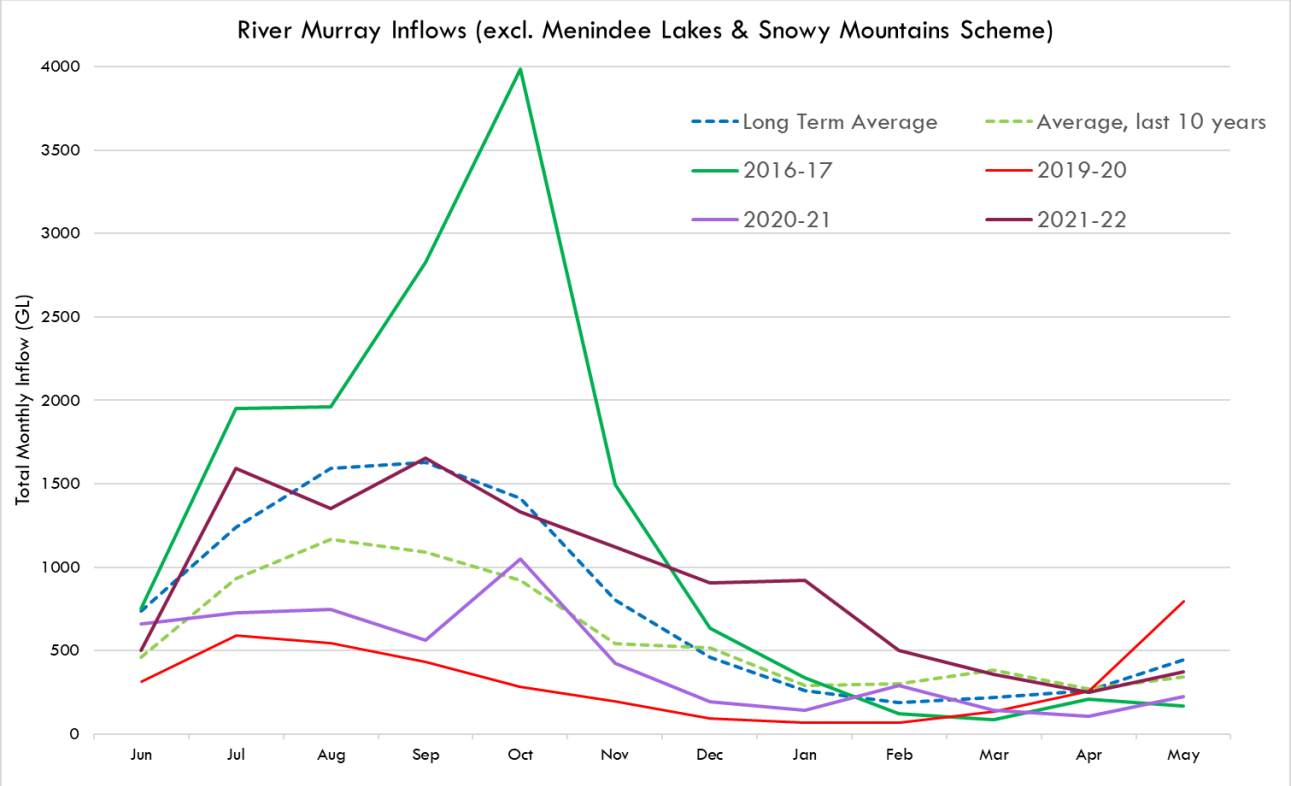

Figure 2. River Murray System Inflow (excluding inflow to Menindee and Snowy Scheme) recent years, long-term average and average over the last 10 years

In 2021-22, Menindee Lakes inflow was approximately 4 500 GL. Comparatively in 2020-21, the inflow was approximately 700 GL. Menindee Lakes long-term annual average inflow is around 1 940 GL (**Figure 3).**

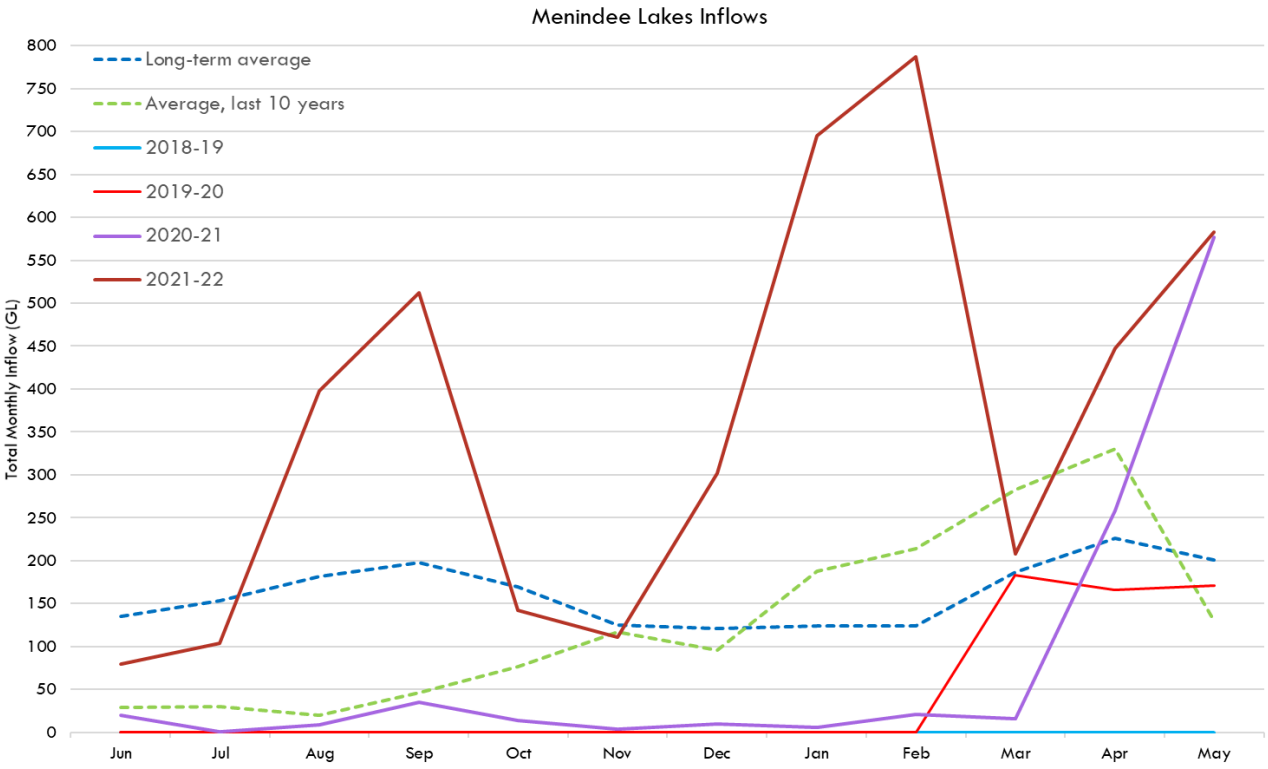

Figure 3. Inflows to Menindee Lakes in recent years, long-term average and average over last 10 years

2.2 MDB Storages at 1 July 2022

The water availability for the River Murray System and associated catchments (Murrumbidgee, Goulburn and Darling) at 1 July 2022 is identified in **Table 1**.

Table 1. Storage Volumes across MDB at 1 July 2022

	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	3 664	95%
Hume Reservoir	3 005	2 982	2 823	94%
Lake Victoria	677	577	384	57%
Menindee Lakes*	1 731	1 251	1 901	110%
Total	**9 269**	**8 595**	**8 772**	**95%**
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	1 026	1 023	925	90%
Blowering Reservoir	1 631	1 607	1 476	91%
Goulburn Storage (Victoria Controlled)				
Eildon Reservoir	3 334	3 234	2 871	86%

2.3 MDB Water Sharing Arrangements

As at 1 July 2022, 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 2022-23 has been set aside.

2.4 South Australia's Water Resource Availability and Allocation

The MDBA's Water Resource Assessment provided in June 2022 advised that South Australia would receive the full SA Entitlement of 1 850 GL (as defined in clause 88 of the Agreement) in 2022-23 under all water resource assessment scenarios, including with worst case inflows.

Accordingly, the opening allocation for South Australian River Murray irrigators for the 2022-23 water year was 100 per cent.

2.5 South Australia's Storage Right

On 1 July 2022, South Australia had a total of 336.2 GL of deferred water stored in accordance with Schedule G of the Agreement, as shown in **Table 2**.

Table 2. Volume of deferred water held in the South Australian Storage Right at 1 July 2022

	Lake Victoria (GL)	Hume (GL)	Dartmouth (GL)	Total (GL)
CHWN	0.0	0.0	235.7	235.7
Private Carryover	0.0	0.0	100.5	100.5
Total	0.0	0.0	336.2	336.2

2.6 Water Level and Salinity Conditions

During 2021-22, salinity remained well below Basin Plan target levels at Lock 6, Morgan and Murray Bridge. Salinity at Milang at Lake Alexandrina exceeded the Basin Plan target value of 1 000 EC for a total of nine days between 9 June and 22 June 2022. This was caused by high tides and storm conditions (wind and swell) which created reverse flows at the barrages, pushing seawater into Lake Alexandrina. Salinity levels measured throughout the lakes were in decline by the end of the water year, aided by continued high flows entering the lakes pushing higher salinity water out through the barrages.

The Basin Plan salinity target for Milang states that salinity should remain below 1 000 EC for 95% of the time. While salinity did spike above the target for a short period, it quickly returned to the acceptable range and is therefore unlikely to affect long-term compliance with Basin Plan targets. Over the last five water years including 2021-22, salinity has exceeded 1000 EC for 0.49% of the time.

Figure 4 shows the flow to South Australia (QSA) and salinity measured upstream of Lock 6, Morgan, Murray Bridge and Milang from July 2021 to July 2022. The dashed-lines identify the Basin Plan thresholds for the corresponding colour coded location.

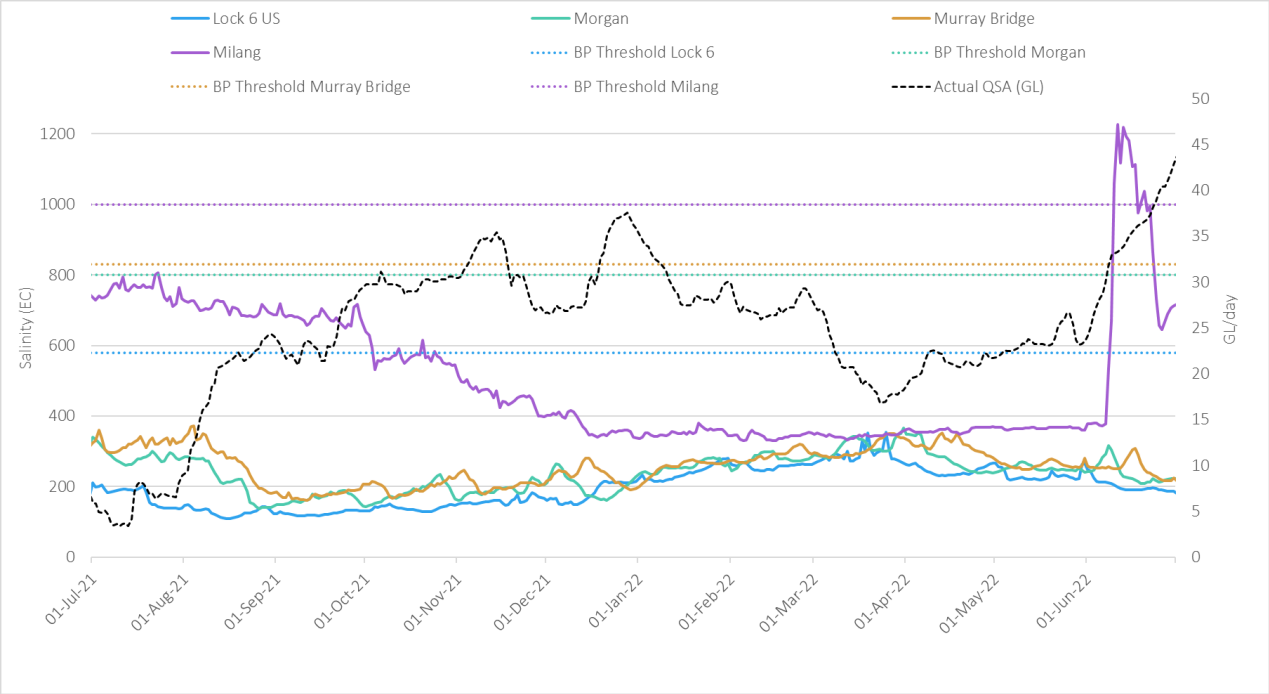

Figure 4. Salinity and water levels across Lock 6, Morgan, Murray Bridge and Milang from 1 July 2021 to 1 July 2022

Lake-averaged salinity and water level for Lake Alexandrina and Lake Albert during 2021-22 are shown in **Figure 5.** The average salinity ranged between 295 EC and 1 375 EC in Lake Alexandrina and 1 010 and 1 587 EC in Lake Albert. Lake Alexandrina water levels were in a range of 0.58 m AHD to 0.88 m AHD. Lake Albert water levels were in a range of 0.45 m AHD and 0.97 m 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.

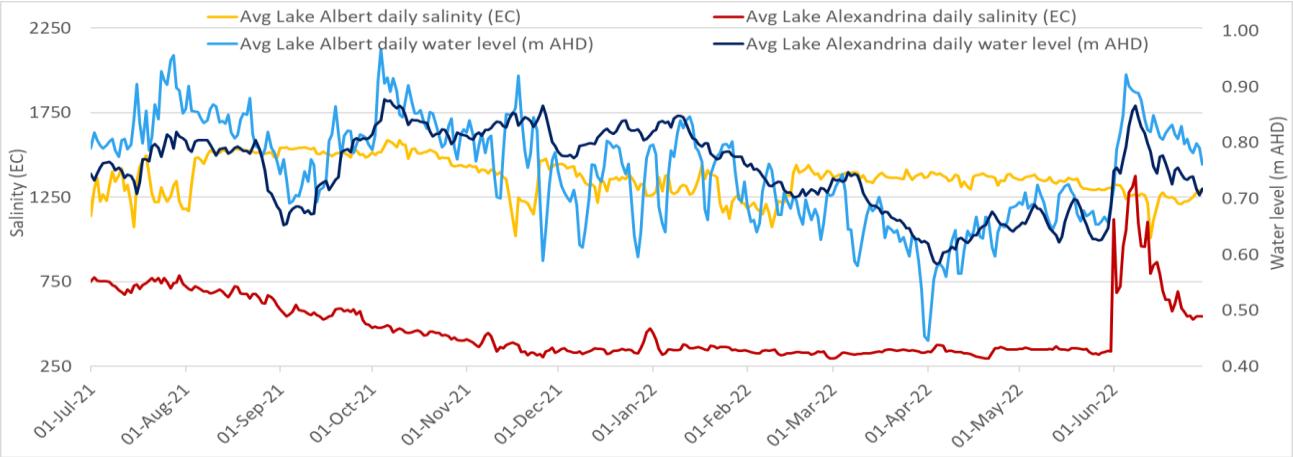

Figure 5. Lower Lakes average water and salinity levels from 1 July 2021 to 1 July 2022

Salinity levels in the North Lagoon remained within target levels during 2021-22 and were between 3 ppt and 41 ppt. In the South Lagoon salinity levels were within target levels 94% of the time and experienced periods of above 100 ppt 6% of the time remaining between 47 ppt and 103 ppt **(Figures 6 and 7).**

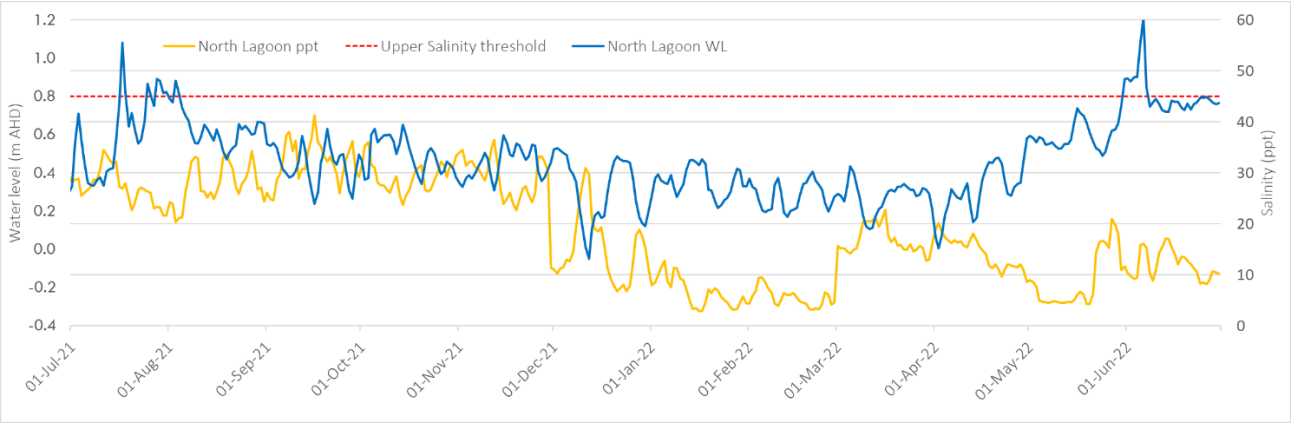

Figure 6. North Lagoon salinity levels from 1 July 2021 to 30 June 2022

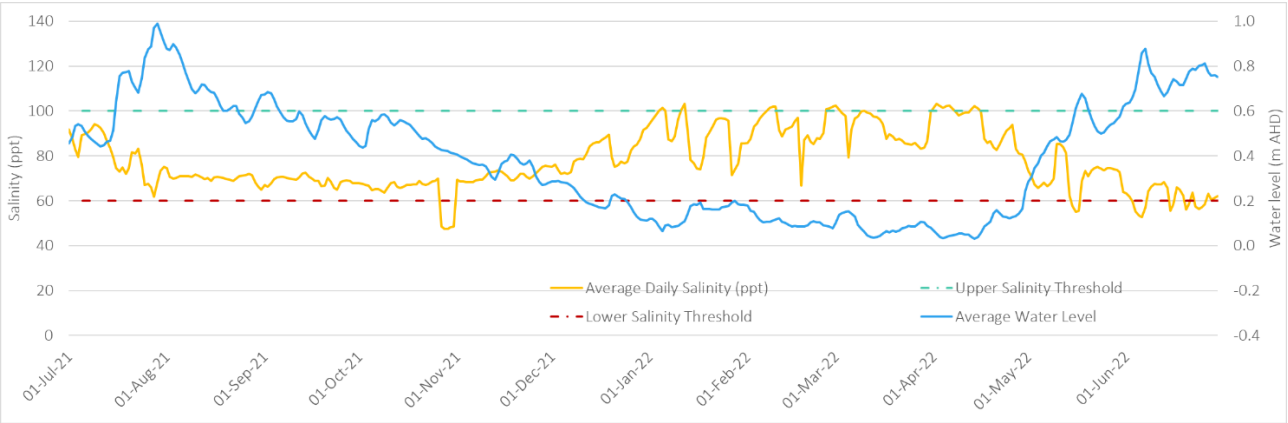

Figure 7. South Lagoon salinity levels from 1 July 2021 to 30 June 2022

3 Annual Outlook for 2022-23

3.1 Bureau of Meteorology Climate Outlook

In July 2022, the Bureau of Meteorology's (BOM) three-month climate outlook indicated a high likelihood of exceeding median rainfall across the Murray-Darling Basin, with low to average likelihood of exceeding median maximum temperatures. A La Niña watch was also declared in July 2022, indicating a 50% chance (double the normal likelihood) of La Niña forming later in 2022, increasing the likelihood of above average winter and spring rainfall across much of the Basin.

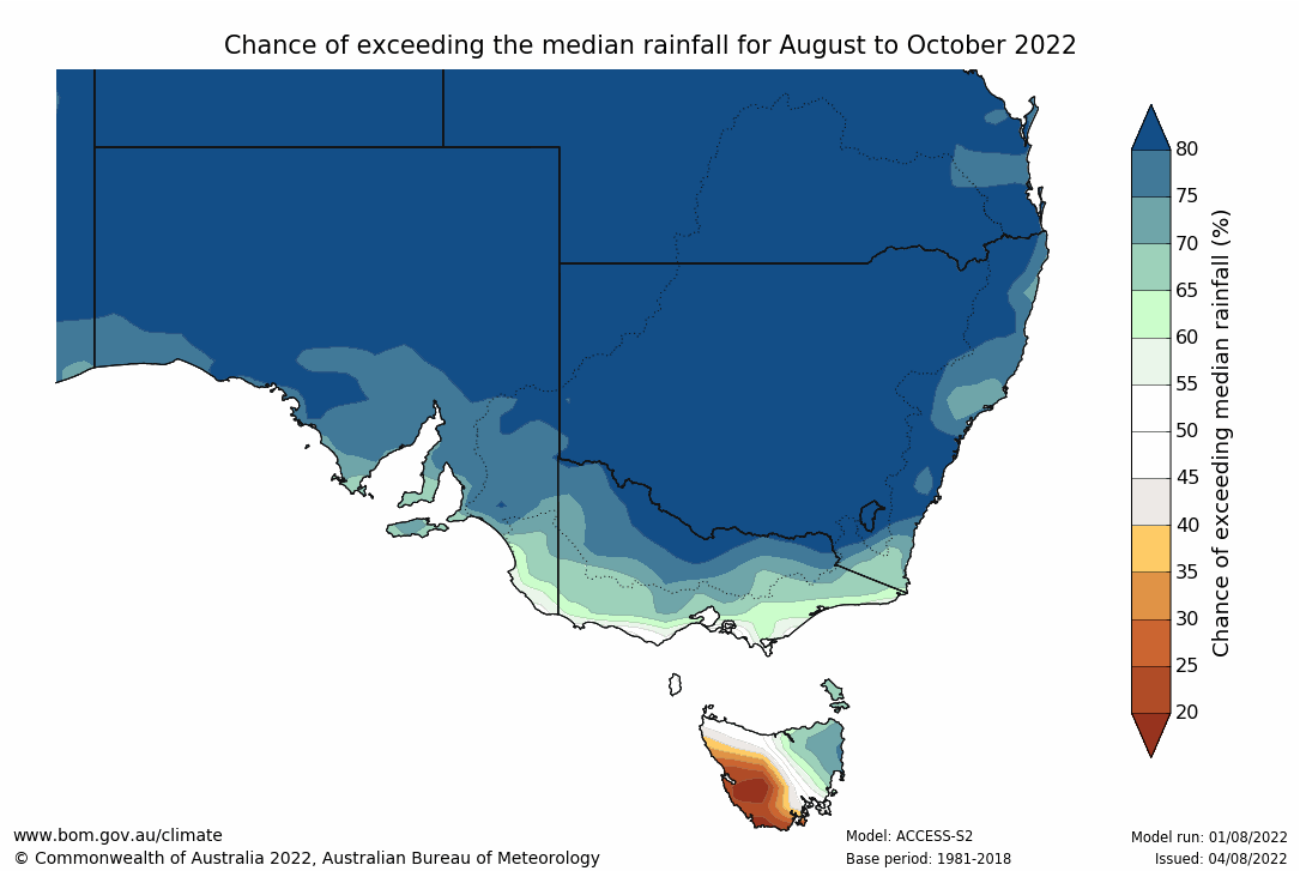

Figure 8. BOM Rainfall outlook from August to October 2022

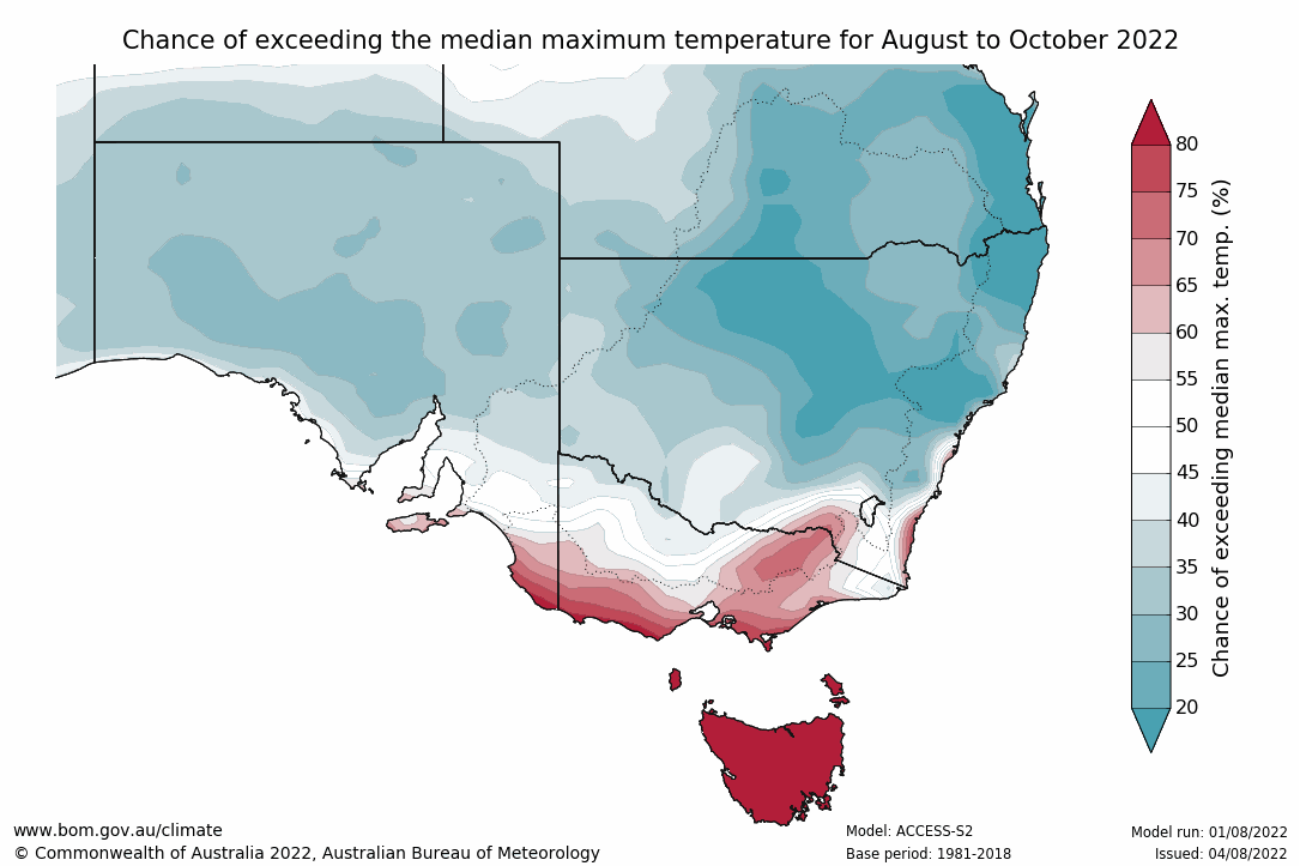

Figure 9. BOM Maximum temperature outlook from August to October 2022

3.2 MDBA Inflow Scenarios for 2022-23

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 2022-23. 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.

The six 2022-23 River Murray System inflow scenarios exclude inflow from the Menindee Lakes, Snowy Scheme, inter-valley trade deliveries and WFTE deliveries from tributaries. The inflow scenarios are based on historical observed inflow, with adjustments to provide a reasonable transition from the observed June 2021 inflow, trending towards the inflow scenario. The June 2022 inflow to the River Murray System was 1 600 GL which equates to 12th percentile system inflows. This leads to the 'extreme dry' scenario being significantly higher than the lowest inflow on record. The six scenarios are as follows (taken from MDBA AOO):

1. **Extreme dry** scenario assumes annual River Murray System inflows of 5 200 GL. This is significantly higher than the lowest inflow on record (914 GL in 2006-07) due to the high total observed inflow volume in June 2022 as a starting point for the first month of the water year. In this scenario, inflows gradually recede from 12th percentile inflows in June

2022 to historical minimum inflows for the remainder of 2022-23. This volume is comparable to total inflows in 2020-21.

2. **Dry** scenario assumes River Murray System inflows of about 6 600 GL (inflows recede from 12th percentile inflows in June 2022 to 90th percentile inflows for remainder of 2022-23). This volume is comparable to inflows in 2005-06.
3. **Moderate** scenario assumes River Murray System inflows of about 8 300 GL (inflows recede from 12th percentile inflows in June 2022 to 75th percentile inflows for remainder of 2022-23). This volume is comparable to inflows in 2012-13.
4. **Near average** scenario assumes River Murray System inflows of about 11 200 GL (inflows recede from 12th percentile inflows in June 2022 to 50th percentile inflows for remainder of 2022-23). This volume is comparable to inflows in 1984-85.
5. **Wet** scenario assumes River Murray System inflows of about 16 000 GL (inflows recede from 12th percentile inflows in June 2022 to 25th percentile inflows for remainder of 2022-23). This volume is comparable to inflows in 2021-22.
6. **Very wet** scenario assumes River Murray System inflows of about 25 600 GL (inflows remain near 12th percentile inflows for remainder of 2022-23). This volume is comparable to inflows in 2010-11.

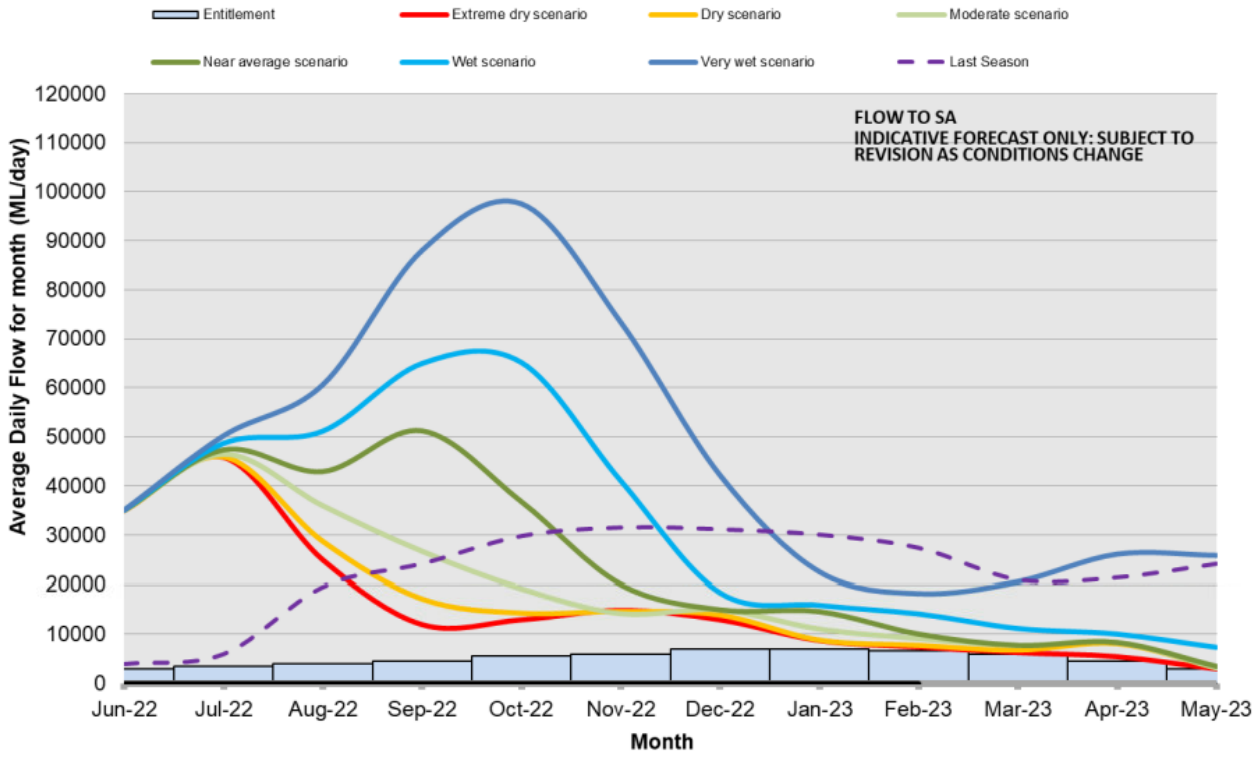

Figure 10. Flow to South Australia outlook from 1 June 2022 to 31 May 2023 (MDBA 2022)

3.2.1 Entitlement Flow

Consistent with the MDBA's water resource assessment, all AOO scenarios have South Australia receiving its full Entitlement Flow in 2022-23.

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 inflow scenario, unregulated flow is not expected to occur.

In the dry and moderate inflow scenarios, modest volumes of unregulated flow may result through small inflow events from upstream.

In the near average, wet and very wet inflow scenarios, large upstream inflow events may result in prolonged unregulated flow. Under the wetter scenarios, there could be a significant flood along the River Murray in South Australia.

3.2.3 Additional Dilution Flow (ADF)

Additional Dilution Flow (ADF) to South Australia is triggered in all scenarios and will also guide timing and releases from Menindee Lakes. ADF continues until December in the driest case and continues throughout 2022-23 in the wet cases.

3.2.4 Shortfall

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 2022-23 water year, high storage in Lake Victoria, the availability of Menindee Lakes and Inter Valley Trades, a system shortfall is less likely to occur this year, particularly in the scenarios where Menindee Lakes continues as a part of the River Murray resource throughout 2022-23, 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.

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	800 EC	830 EC	1000 EC
River Murray at Lock 6	580	192	189	189	187	0			
River Murray at Morgan	800	296	295	295	294		0		
River Murray at Murray Bridge	830	346	345	345	345			0	
Lake Alexandrina at Milang	1000	693	692	691	691				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"*

4 Operating considerations for 2022-23

4.1 Conditions Outside the Manageable Flow Range

4.1.1 High Flow and Flood

At the commencement of 2022-23, 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 occurring along all reaches of the River Murray downstream of Hume Dam and on the Lower Darling River downstream of Menindee Lakes.

As noted in the MDBA AOO, there is an increased chance of widespread riverine flooding along the River Murray System during 2022-23. This is due to the combination of the relatively high storage levels in the Basin for this time of year (meaning dams have less spare capacity to mitigate inflows and spills are more likely) and the wet climate outlook.

The La Niña Watch issued by the BOM signals the possibility of a third consecutive La Niña event. Multi-year La Niña events are associated with an increased risk of flooding due to the likelihood that catchments are already wet and storages will be at higher levels due to above-average rainfall in preceding years, which is true for the start of 2022-23.

La Niña events have previously occurred over three consecutive years during 1954-57, 1973–1975 and 1998–2001. Of these, the 1954-57 and 1973–1975 "triple La Niña" events resulted in major flooding on the River Murray in South Australia.

4.1.2 Low Water Availability and Shortfall Management

Low water availability is not considered a risk during 2022-23.

Entitlement Flow is not expected to be impacted by the risk of delivery or system shortfalls during 2022-23 mainly due to high storage levels in Menindee Lakes.

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.

DEW is developing a policy for shortfall management which is anticipated to be completed in 2022-23.

4.2 Environmental Water Delivery

Planning for the 2022-23 water year was undertaken for six water resource availability scenarios: 95 per cent (very dry), 90 per cent (dry), 75 per cent (moderate), 50 per cent (near average), 25 per cent (wet) and 10 per cent (very wet) (**Figure 11**). These water resource availability scenarios correspond to scenarios used by the MDBA AOO. In March 2022, the MDBA provided a modelled hydrograph of average flows for a given month for each AOO scenario to assist with developing environmental watering proposals. These were based on the 2012-13 AOO planning, which was considered suitable as that water year had similar starting storage levels to those expected in 2022-23.

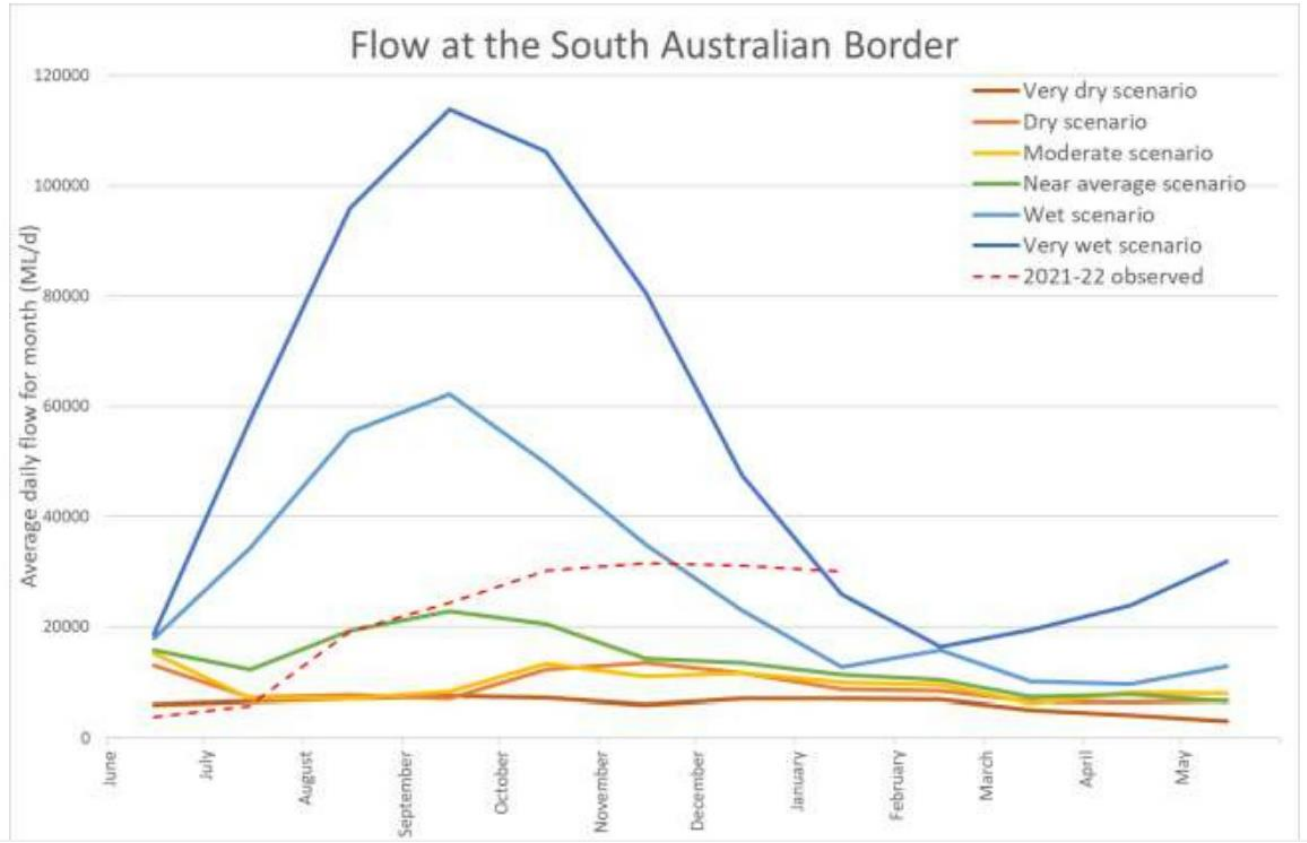

Figure 11. Annual operating outlooks provided by the MDBA in March 2022

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 2022-23

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]

DEW has developed a multi-site watering proposal for 2022-23, outlining the optimal delivery of WFTE for the South Australian River Murray under a range of scenarios based on the MDBA AOO. Section 3.3 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 WFTE required to deliver the 2022-23 multi-site proposal ranges from approximately 1 335 GL in the dry scenario to 1 110 GL in the wet scenario (**Table 5**). The multi-site volumes represent the volume of WFTE 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 WFTE 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. South Australia's multi-site volumes factor in return flows from site-based watering actions (e.g. Chowilla regulator operation) and their contribution to meeting other downstream demands. The volumes also factor in the contribution that the river channel water demand makes to the water demands of the Lower Lakes, Coorong and Murray Mouth (LLCMM).

Table 5. Indicative volume of environmental water required per month to deliver South Australia's multi-site action. 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 Jun-22 to Jun-23 (GL)	Total est. volume 2022-23 water year only (GL)
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		
Dry	15	74	75	151	257	287	209	62	35	63	31	31	59	**1,350**	**1,335**
Moderate	28	74	86	170	218	320	206	55	28	63	31	31	62	**1,373**	**1,345**
Near Average	28	94	119	94	285	271	269	77	28	63	51	31	62	**1,473**	**1,445**
Wet	12	17	56	68	149	150	217	225	56	52	30	0	90	**1,122**	**1,110**

Table 6. Proposed environmental watering actions for South Australian Priority Environmental Assets and weir pools

	Channel & Floodplain	Weir Pools	Chowilla	Pike	Katarapko	CLLMM	Wetlands
Very dry (95%)	↑ QSA to achieve 1 of the following options: - 15 GL for 60 days & 17 GL for 25 days; -15 GL for 60 days; -17 GL for 25 days.	↑ L1 +0.20 m & - 0.10 m ↑ L2 +0.55 m & - 0.08 m ↑ L3 +0.21 m & - 0.03 m ↑ L4 +0.3 m & -0.04 m# ↑ L5 +0.50 m &- 0.08 m# ↑L6 +0.42 m & -0.18 m#	Deliver eWater to priority wetlands; Manage inflows via Pipeclay & Slayney Cks	In channel rise to trial flow splits between Pike & Tanyaca regulators to support optimal outcomes	No action	↑& maintain lake levels in spring for wetland veg & fish/frog habitat; Deliver 6-8 GL/day to Coorong in spring to support Nth Lgn food web; ↓ rate of drawdown in lake levels, maintain fishway & attractant flows to Coorong for 4 mths; ↑lake levels by 5-10cm & support barrage releases to encourage winter migration of diadromous fish	Deliver eWater to 47 priority wetlands
Dry (90%)	↑ QSA to achieve 1 of the following options: -20 GL for 60 days & 23 GL for 25 days; -20 GL for 60 days; -23 GL for 25 days.	As above	Deliver eWater to priority wetlands; Manage inflows via Pipeclay & Slayney Cks; ↑ Chowilla Reg to get water level of 19.3 m AHD.	↑ infrastructure to get water level of 15.2 m AHD	↑ infrastructure to get water level of 11.3 m AHD	↑& maintain lake levels in spring for wetland veg & fish/frog habitat; Deliver 7-13 GL/day to Coorong in spring to support Nth Lgn food web & support estuarine fish recruitment; ↓ rate of drawdown in lake levels, maintain fishway & attractant flows to Coorong for 4 mths; ↑lake levels by 5-10cm & support barrage releases to encourage winter migration of diadromous fish	As above
Moderate (75%)		As above	↑ Chowilla Reg to get water level of 19.3 m AHD	↑ infrastructure to get water level of 15.9 m AHD	↑ infrastructure to get water level of 13.3 m AHD		As above
Near average (50%)	↑ QSA to achieve 1 of the following options: -25 GL for 60 days & 15 GL for 30 days; -25 GL for 25 days & 15 GL for 30 days. -23 GL for 25 days.	As above	↑ Chowilla Reg to get water level of 19.5 m AHD	As above	As above	Extend mod barrage flows into summer (12-23 GL/day) for Ruppia, waterfowl habitat & Coorong food web; Summer/autumn base flows to ↓ rate of drawn down in lakes levels & to maintain fishway & attractant flows to Coorong for 4 mths; Winter flows for diadromous fish migration & recruitment (4-5 GL/day)	Deliver eWater to 25-42 priority wetlands
Wet (25%)	↑ QSA to achieve 65 GL for 20 days with a 500 ML/day recession & maintain 15 GL for 30 days in January	As above	↑ Chowilla Reg to get water level of 19.85 m AHD	↑ infrastructure to get water level of 16.1 m AHD	No action	Extend high barrage flows into summer for Ruppia & support Coorong food web (20-40 GL/day); Maintain connectivity between Nth & Sth Lgns into early summer; Summer/autumn base flows to ensure adequate attractant flow (6-12 GL/day); Continue to maintain connectivity & mixing between Nth & Sth Lgns through to autumn; Winter flows for diadromous fish (5 GL/day)	Deliver eWater to 7 priority wetlands

The 2022-23 South Australian River Murray multi-site watering proposal aims to meet watering objectives at individual sites, as well as provide additional landscape-scale outcomes. The proposal is underpinned by the objectives, targets and environmental watering requirements in the LTWP and the expected outcomes in the *Basin-wide environmental watering strategy* (MDBA 2019).

Unregulated flows are considered in the WFTE Annual Plan as they are built into the AOO scenarios provided by the MDBA that form the basis of site-based planning.

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 2022-23 to achieve environmental outcomes, including detail of potential water levels and timing for each AOO scenario, can be seen in the table below (**Table 7**).

Table 7. Proposed manipulations for each weir pool in 2022-23 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	+0.20	-0.10	+0.55	-0.08	+0.21	-0.03	+0.30	-0.04	+0.5	-0.08	+0.42	-0.18
Dry	+0.20	-0.10	+0.55	-0.08	+0.21	-0.03	+0.30	-0.04	+0.5	-0.08	+0.42	-0.18
Moderate	+0.20	-0.10	+0.55	-0.08	+0.21	-0.03	+0.30	-0.04	+0.5	-0.08	+0.42	-0.18
Near Average	+0.20	-0.10	+0.55	-0.08	+0.21	-0.03	+0.30	-0.04	+0.5	-0.08	+0.42	-0.18

In a very dry scenario, where the flow at the South Australian border (QSA) during spring flows is expected to be less than 10,000 ML/day, it is preferred that lowering of weir pools occurs in winter, followed by weir pool raisings in spring. This would occur across all weir pools except weir pool 3. Raisings and lowerings are expected to be of low magnitudes to remain within the available volume of WFTE and water quality thresholds.

In dry, moderate and near average water resource scenarios, where the QSA during spring flows is expected to be between approximately 13,000 and 23,000 ML/day, the weir pool manipulations will be dependent on if the actions are undertaken independently or in association with floodplain regulator operations at Chowilla, Pike and Katarapko floodplains (**Table 8**). The spring lowering of weir pools 4, 5 and 6 in the dry, moderate and near average scenarios will only occur if the proposed Katarapko floodplain operations (which incorporate weir pool 4 raising), Pike floodplain operations (which incorporate weir pool 5 raising) and Chowilla floodplain operations (which incorporate weir pool 6 raising) cannot occur. If the planned floodplain actions do occur, then weir pool raising will extend through both winter and spring. The raising and lowering of weir pool 3 will only occur if there is sufficient flow to manage water quality risks associated with Lake Bonney salinity. Raisings and lowerings are expected to be of maximum possible magnitudes, but will be adaptively managed to stay within available water for the environment volumes and water quality thresholds.

Table 8. Proposed manipulations for each weir pool in meters above (+) or below (-) normal pool level (NPL).

Annual operating outlook	Proposed manipulation for each weir pool in metres above (+) or below (-) normal pool level		
	Lock 4 and Katarapko Floodplain	Lock 5 and Pike Floodplain	Lock 6 and Chowilla Floodplain
Dry	+0.30	+0.50	+0.40
Moderate	+0.30	+0.50	+0.40
Near Average	+0.30	+0.50	+0.60
Wet	No action	+0.50	+0.60

No independent weir pool manipulation actions are planned for the wet and very wet scenarios as the high flows will likely mean the weirs are removed. However, weir pool raisings at Lock 5 and 6 associated with Pike and Chowilla floodplain actions are planned through winter and spring under the wet scenario.

Weir pool manipulations are designed to support and enhance spring channel pulses and freshes. Weir pool raisings will increase the lateral inundation extent of flows; freshen groundwater and prevent/reduce vegetation drought stress during weir pool lowerings; provide water to rapidly growing vegetation; promote the germination and establishment of aquatic and flood-dependent plant species; stimulate carbon and nutrient cycling; improve the condition of long-lived, woody

vegetation; and increase the complexity of riparian, littoral, wetland and floodplain habitats and thus increase the diversity and resilience of the river bank foodwebs.

Small-scale weir pool lowerings in 2022-23 will: support the fast-flowing conditions along the channel that are created through delivery of spring pulses (see above; >0.2 m/s); transport carbon and nutrients from connected water bodies to stimulate a primary productivity pulse in the River; support propagule transport (including fish eggs and larvae); and support the germination of river red gums and black box on exposed, moist soils. Weir pool lowering will also: promote exchange of water between pool-connected wetlands, increase carbon and nutrient transport to the channel; promote the germination and establishment of plant species on the exposed banks; and provide marginal improvements to flow conditions. Overall, these weir pool manipulations will promote the creation of a wider and more diverse littoral, riparian, wetland and floodplain vegetation community, which includes a wide range of aquatic and flood-dependent plant species that germinate in winter on the higher elevations and in spring on the lower elevations.

The floodplain regulator operations will provide improved soil moisture conditions within creek banks and across areas of wetlands and floodplains, supporting the growth and condition of floodplain trees, lignum and understorey vegetation that have suffered from lack of overbank flooding and salt accumulation in the soils. The watering will also promote improved diversity of native amphibious and aquatic understorey plants along the riparian zone, provide feeding and breeding habitat for waterbirds small-bodied fish, frogs and turtles, and help transfer nutrients and carbon from the floodplain to support the River channel food web.

Additional detail on proposed actions is included in the WFTE Annual Plan.

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 2022-23 water year, unregulated flows were entering South Australia and likely to continue for some months due to high volumes held in storages and forecast wet catchment conditions. It is expected that this year will present opportunities for boosting the flow to South Australia while flow is unregulated yet still below flow rates at which unacceptable flood impacts could occur.

In collaboration with environmental water holders, directed releases from Lake Victoria may be considered during 2022-23, 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.

A summary of the proposed LLCMM actions for the 2022-23 water year, as submitted to Southern Connected Basin Environmental Watering Committee in 2022, are shown below (**Table 9**).

Table 9. Proposed LLCMM actions for water year 2022-23

Water Availability Scenario	Watering action description	Delivery Details		
		Trigger flow (ML/day at a gauge or other trigger)	Vol (GL)	Optimal timing & alternate (if flexible) (months)
Very Dry – 95%	**Action A:** Flows to raise and maintain Lower Lakes water levels in spring to support wetland vegetation and threatened fish/frog habitat; Deliver 6-8 GL/d of flow to the Coorong in spring and early summer to support the North Lagoon food web (fish, invertebrates, waders) **Action B:** Flows to minimise the rate of draw-down in Lower Lakes water levels, and to maintain fishway and attractant flows (1-2 GL/d) to the Coorong for 4 months **Action C:** Flows to raise water levels in the Lower Lakes by 5-10 cm and to support barrage releases (1.5-2 GL/d) to encourage winter migration of diadromous fishes	ADF ends 1 October and QSA returns to entitlement	**Action A:** 934 GL **Action B:** 202.9 GL **Action C:** 106.75 GL **TOTAL additional QSA: 1,244 GL**	**Action A:** Jul – Dec **Action B:** Jan – Apr **Action C:** May-Jun
Dry – 90%	**Action A:** Flows to raise and maintain Lower Lakes water levels in spring to support wetland vegetation and threatened fish/frog habitat; Deliver 7-13 GL/d of flow to the Coorong in spring and early summer to support the North Lagoon food web (fish, invertebrates, waders) and support estuarine fish recruitment **Action B:** Flows to minimise the rate of draw-down in Lower Lakes water levels, and to maintain fishway and attractant flows (1-3 GL/d) to the Coorong for 4 months **Action C:** Flows to raise water levels in the Lower Lakes by 5-10 cm and to support barrage releases (2-3 GL/d) to encourage winter migration of diadromous fishes	Predicted >10,000 ML/day at SA border in spring	**Action A:** 930 GL **Action B:** 189 GL **Action C:** 89.5 GL **TOTAL additional QSA: 1,209 GL**	**Action A:** Jul - Dec **Action B:** Jan – Apr **Action C:** May - Jun
Moderate – 75%	**Action A:** Flows to raise and maintain Lower Lakes water levels in spring to support wetland vegetation and threatened fish/frog habitat; Deliver 7-13 GL/d of flow to the Coorong to support the North Lagoon food web (fish, invertebrates, waders) and support estuarine fish recruitment **Action B:** Flows to minimise the rate of draw-down in Lower Lakes water levels, and to maintain fishway and attractant flows (1-3 GL/d) to the Coorong for 4 months **Action C:** Flows to raise water levels in the Lower Lakes by 5-10 cm and to support barrage releases (2-3 GL/d) to encourage winter migration of diadromous fishes	~13,000 ML/day at SA border Oct-Nov	**Action A:** 959 GL **Action B:** 174.2 GL **Action C:** 93.2 GL **TOTAL additional QSA: 1,226 GL**	**Action A:** Jul - Dec **Action B:** Jan – Apr **Action C:** May - Jun
Near Average – 50%	**Action A**: Extend moderate barrage flows into summer (12-23 GL/d) for *Ruppia tuberosa* growth and recruitment, waterfowl habitat throughout the Coorong, and Coorong food web (fish, invertebrates, waders) **Action B:** summer/autumn baseflows to minimise the rate of draw-down in Lower Lakes water levels, and to maintain fishway and attractant flows to the Coorong for 4 months **Action C:** winter flows for diadromous fish migration and recruitment (4-5 GL/d)	~22,000 ML/day at SA border in Sep-Oct Widespread ruppia growth in South Lagoon in late winter	**Action A:** 965.5 GL **Action B:** 217 GL **Action C:** 93.2 GL **TOTAL additional QSA: 1,276 GL**	**Action A:** Jul - Dec **Action B:** Jan – Apr **Action C:** May - Jun
Wet – 25%	**Action A:** extend high barrage flows into summer for *Ruppia tuberosa* growth and recruitment & support the Coorong foodweb (20-40 GL/d); maintain connectivity between North and South Lagoons into early summer **Action B:** summer/autumn baseflows to ensure adequate attractant flow adjacent to fishways (6-12 GL/d); and continue to maintain connectivity and mixing between North and South Lagoons through to autumn **Action C:** winter flows for diadromous fish migration and recruitment (5 GL/d)	~60,000 ML/day at SA border in Sep-Oct	**Action A:** 592 GL **Action B:** 138 GL **Action C:** 90 GL **TOTAL additional QSA: 820 GL**	**Action A:** Nov-Jan **Action B:** Feb-Apr **Action C:** Jun
Very Wet – 10%	**Action A:** extend high barrage flows into summer to ensure *Ruppia tuberosa* recruitment & support the Coorong foodweb (30-60 GL/d); maintain connectivity between North and South Lagoons into early summer; scour the Murray Mouth **Action B:** winter flows for diadromous fish migration and recruitment (10-15 GL/d)	>100,000 ML/day at SA border Sep-Nov	**Action A:** 397 GL **Action B:** 150 GL **TOTAL additional QSA: 547 GL**	**Action A:** Dec-Feb **Action B:** Jun

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 CEWO/DEW 2022-23 watering schedule, and in subsequent 3-month forward planning documents that DEW produces for the CEWO. Actions include:

- Seasonal lake level manipulation
- Rapid lake level manipulation for salinity export from Lake Albert (i.e. lake level cycle)
- 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 reduce Coorong salinity levels
- Leaving open barrage bays during smaller to moderate-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. Blackwater is also associated with high river flows and inundation of floodplains, which has an increased likelihood of occurrence during 2022-23. For poor water quality that originates from upstream of the South Australian border, in some circumstances Lake Victoria may be used to improve water quality 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. However, the increased likelihood of flooding during 2022-23 raises the risk of post-flood saline groundwater intrusion due to floodplain inundation. Any potential salinity impacts are difficult to predict and will be highly dependent on the magnitude and duration of a flood and the flow conditions that follow.

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 in storage up to an equivalent of 150 percent (306 GL) of its annual CHWN, in case it is required ahead of any year where the full Entitlement volume of 1,850 GL will not be 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.

As at July 2022, the MDBA has advised there is a high likelihood of South Australia's stored water spilling during 2022-23 due to high storage levels and wet climate outlook. In the event that stored water is spilt, private carryover is spilt before CHWN.

4.7.1 Deferral

South Australia's Deferred Water Storage and Delivery Plan for July 2022 has proposed the deferral of 70 GL of Entitlement Flow during 2022-23, with the entire volume to be stored for CHWN.

Deferral and storage of Entitlement Flow will only be undertaken if practical under prevailing conditions. It is expected that opportunities to defer water in South Australia's preferred storage of Dartmouth Dam may be limited during 2022-23 due to the anticipated periods of unregulated flow and the reduced likelihood of bulk water transfers between Hume Dam and Lake Victoria because of high storage levels in Menindee Lakes.

In the event that the entirety of South Australia's stored water is spilt and deferrals are possible, the deferral plan may be revised to reflect the priority to re-accumulate the minimum drought reserve volume of 131 GL.

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.

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
CEWO	Commonwealth Environmental Water Office
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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