Water for the environment

Southern Connected Basin Environmental Watering Committee

Annual Report 2019-20

Acknowledgement of the Traditional Owners of the Murray–Darling Basin

SCBEWC agencies would like to acknowledge and pay respect to the Traditional Owners of the Murray–Darling Basin and their Nations, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. SCBEWC agencies understand the need for recognition of Traditional Owner knowledge and cultural values in natural resource management in the Basin. SCBEWC agencies hope that by continuing to work closely with Traditional Owners and First Nations People we can help in the journey to heal the land, Country and Peoples of the Basin.

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

Photo above: Cat-tail (Myriophyllum caput-medusae) on Barmah Lake (Source: K Ward)
Cover photo: Bird watching, Hattah Lakes (Source: Mallee CMA)

Southern Connected Basin Environmental Watering Committee

Who we are

The Southern Connected Basin Environmental Watering Committee is the coordination forum that supports the delivery of water for the environment in the River Murray system and connected tributaries across multiple environmental water holders, managers and jurisdictions.

Why

Water for the environment improves the health and water quality of rivers, wetlands and floodplains. Healthier landscapes can support an abundance of native wildlife including fish, birds and frogs.

Healthy rivers benefit all river users and are vital to our economy as well as underpinning community and cultural health and wellbeing.

Tree response to water at Gunbower Forest. Flush in growth with water (left) versus no water and stressed tree canopy (right). (Source: G. Smith)

Our impact

Recovering the health of significant sites in the southern Basin will take time, however we are documenting steady improvements in areas that are regularly watered.

Increasingly, collaboration is seeing environmental water holders combine their water to achieve larger and more effective watering events. Coordination is improving outcomes along the length of the River Murray and its tributaries, as water is used and reused across multiple sites before reaching the Lower Lakes, Coorong and Murray Mouth.

When water is scarce everyone suffers. Prolonged hot and dry times impact rivers and the plants and animals that depend on them. In 2019-20 many of the small replenishment flows were captured in water storages, disrupting the natural seasonal pulse of the river which plants and animals need to survive, breed and thrive.

To tackle this, in 2019-20 water holders combined their water to support a Southern Spring Flow. The Southern Spring flow delivered 330 gigalitres from Hume reservoir to flow through thousands of kilometres of river and connected six major wetland sites on the way through. Scientists at CSIRO monitored how carbon and nutrients changed along the length of the river. They measured increases in carbon, nutrients and plankton, which are all important food for small yabbies, crays and fish. This demonstrated that the River Murray got a productivity boost from the delivery of water for the environment.

Southern Connected Basin Environmental Watering Committee

2019-20 in review

Hot and dry conditions

1,868 GL water available

2,038 GL delivered to multiple sites (use & re-use)

27 coordinated events between water holders

~ 39 % of flow in the lower River Murray

Watering overview

2019-20 was an innovative and successful year for the planning and delivery of water for the environment. Water holders collaborated to deliver a Southern Spring Flow – a river pulse which travelled the River Murray to the Lower Lakes, Coorong and Murray Mouth, watering 6 wetlands of international importance along the way. Monitoring is showing that sites that are receiving water are faring much better than those that have not. However, after a third year of dry conditions there are large parts of the floodplain suffering from lack of water.

Community overview

Many regional communities faced another difficult year in 2019-20 with continued dry conditions, bush fires and the COVID-19 pandemic. Virtual regional engagement events have supported community members to continue to see firsthand what a difference delivery of water can make. First Nations groups continue to be actively involved in the planning and delivery of water. Water holders have worked to improve transparency about the planning and use of water for the environment and the shared benefits.

Regent Parrot, Chowilla Floodplain (H Kieskamp)

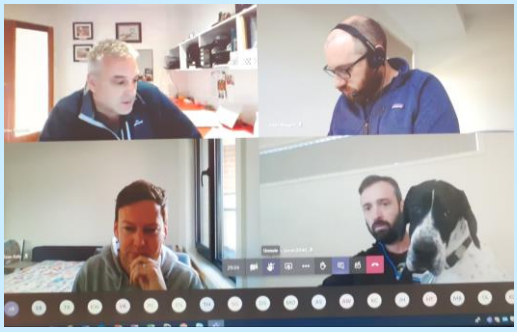
Note – The water available includes allocations against entitlements in 2019-20 (1,127 GL) and carryover from 2018-19. This figure is reported for all environmental water holders combined. The amount of water delivered to sites is sourced from Basin Plan Matter 9.3 annual reporting.

Key messages

We are maximising outcomes through improved coordination and planning

Water holders continue to work together throughout water planning and delivery to maximise shared community and environmental benefits. Large-scale watering events are planned in collaboration to maximise the effective and efficient use of all water, enabling the use and re-use of water at multiple sites along the River.

Improved coordination planning allows water holders to reach higher flow rates, adding water from multiple tributaries together while staying within current constraints. For example, in 2019-20 the Southern Spring Flow combined flow pulses from the Murray and Goulburn rivers to boost flows to just over 15,000 ML/d in the lower Murray.



SCBEWC virtual annual planning (Source: MDBA)

Environmental water holders are learning and improving through adaptive management

Environmental water holders are trialling the best techniques to plan and deliver water for the environment. As new knowledge is gained, water holders are able to incorporate these learnings into plans to maximise benefits for the environment and Basin communities.

Water holders have worked with river operators to improve how assumptions are included in the planning to run the river. 2019-20 showed that even under difficult dry conditions, delivery 2,038 GL of water for the environment, in conjunction with operational flows, can provide benefits to Basin communities, rivers, wetlands and native plants and animals.

We are strengthening our relationships with communities and First Nations groups

Learning together on the floodplain (Source: Mallee CMA)

New engagement initiatives were undertaken in 2019-20 to improve community understanding and involvement in planning and delivery of water for the environment.

Members of the Murray Lower Darling Rivers Indigenous Nations have been participating in SCBEWC meetings to strengthen links to First Nations objectives.

Improved transparency and understanding of water for the environment is essential to build stronger relationships with Basin communities and First Nations groups.

Southern Connected Basin Environmental Watering Committee 2019-20

Membership
MDBA, CEWO, DAWE, NSW DPIE, VEWH, Vic DELWP, SA DEW, River Operators, with MLDRIN observers/advisors

Collaborates
With a range of natural resource & waterway managers

Plans
with local communities including Traditional Owners

Coordinates
the planning and delivery of water for the environment with water holders across the southern connected Basin

Makes shared decisions
on the jointly managed Living Murray water portfolio and program, as well as River Murray Increased Flows from the Snowy

6 meetings

3 teleconferences

3 joint forums with Water Liaison Working Group

4 working groups: operations, communication, monitoring and Indigenous partnerships

River Murray system includes: the main course of the River Murray and all its effluents and anabranches downstream of Hume Dam to the sea including the Edward–Wakool River system, the Mitta Mitta River downstream of Dartmouth Dam and the Darling River and Great Darling Anabranch downstream of Menindee Lakes.

Healthy rivers benefit communities

Water for the environment

Water for the environment maintains and improves the health of rivers by providing water to protect plants, animals and iconic landscapes that rely on rivers.

Healthy rivers support communities and agriculture to thrive.

Many of the rivers and wetlands in the Murray–Darling Basin have been modified to provide water for towns, industries and to grow food. In some rivers, up to half of the water that would have naturally flowed down them each year is removed for human use.

As a result many rivers are not able to function as they would naturally. This means it is necessary to actively manage how water flows through rivers.

Water flows that meet environmental needs are called 'water for the environment'. Water for the environment keeps rivers healthy for people, plants and animals in the Basin.

Water for the environment is set aside in storages and released into rivers and wetlands to support them and the plants and animals that live, feed and breed in them.

Benefits of water for the environment

Water for the environment improves the health of rivers by providing water to support important ecosystems that improve water quality, like wetlands and floodplains.

Water for the environment also provides benefits to communities by:

- increasing opportunities for recreational activities such as fishing, boating and birdwatching
- improving water quality which supports a clean and healthy drinking water supply and brings economic benefits for farmers and industries, like manufacturing
- protecting Australia's iconic landscapes for current and future generations to enjoy.

Key facts

Water for the environment aims to provide enough water to keep rivers healthy. Healthy rivers benefit everyone.

Water is used **for towns, industry and agriculture.**

Water for the environment is set aside **to protect the plants, animals and iconic landscapes** of the Basin.

More than **60 native fish species** rely on rivers in the Basin to feed, grow and breed.

The Basin is home to **120 waterbird species** that depend on rivers to feed, nest and breed.

30,000 wetlands in the Basin filter water which improves water quality.

Environmental flows keep our rivers healthy and sustain plants, animals and fish – **which is also important to First Nations**.

Water for the environment **supports tourism and recreational activities.**

Good-quality water powers **$24 billion of primary production** across the Basin every year.

2019-20 in Review

Climate Conditions

Overall, conditions across the Basin in 2019-20 were very hot and dry. It was the third consecutive year of dry conditions placing communities and the environment under considerable strain. Mean annual temperatures were above average.

Higher evaporation rates were associated with the warmer conditions, reducing soil moisture and water storage levels.

Rainfall for 2019-20 ranged from average to very much below average, with very low rainfall recorded across much of the Basin during the winter and spring of 2019.

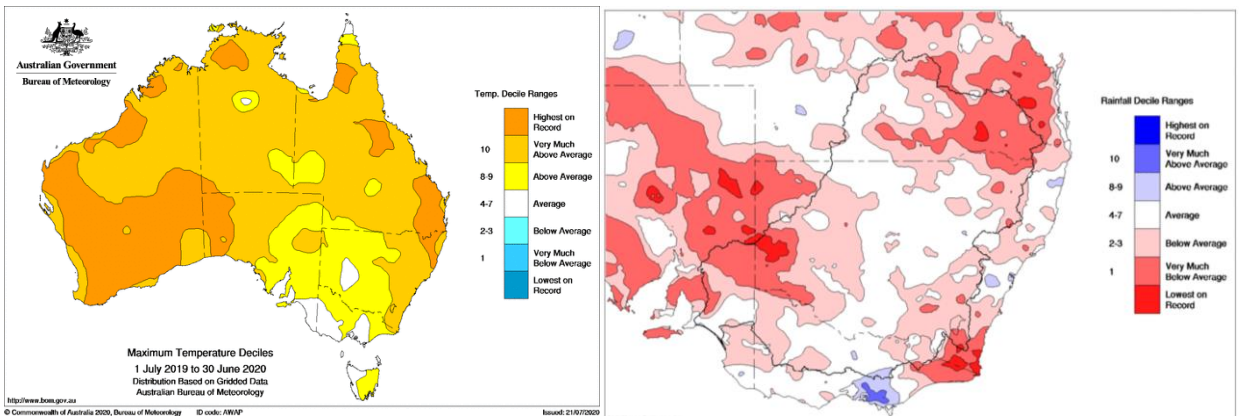
Conditions improved somewhat in summer and autumn with rainfall trending from average to above average, yet overall rainfall totals remained relatively small.

Year-to-year variability
In River Murray System inflows

2017-18
4,100 GL inflows
Driest 13% of years on record

2018-19
2,810 GL inflows
Driest 7% of years on record

2019-20
3,810 GL inflows
Driest 12% of years on record



(Above average temperature and below average rainfall: Bureau of Meteorology)

Water availability

The combined River Murray system inflows for the 2017-18, 2018-19 and 2019-20 water years were in the lowest 2% of three-year sequences on record.

Year-to-year held environmental water allocation

2016-17
1,986 GL (wet year)*

2017-18
1,882 GL (dry year following wet)*

2018-19
1,259 GL (second dry year)*

2019-20
1,127 GL (third dry year)^

Following a wet 2016-17 with River Murray System inflows of 16,120 GL#, 2017-18 was much drier with inflows of 4,100 GL, roughly half the long-term average.

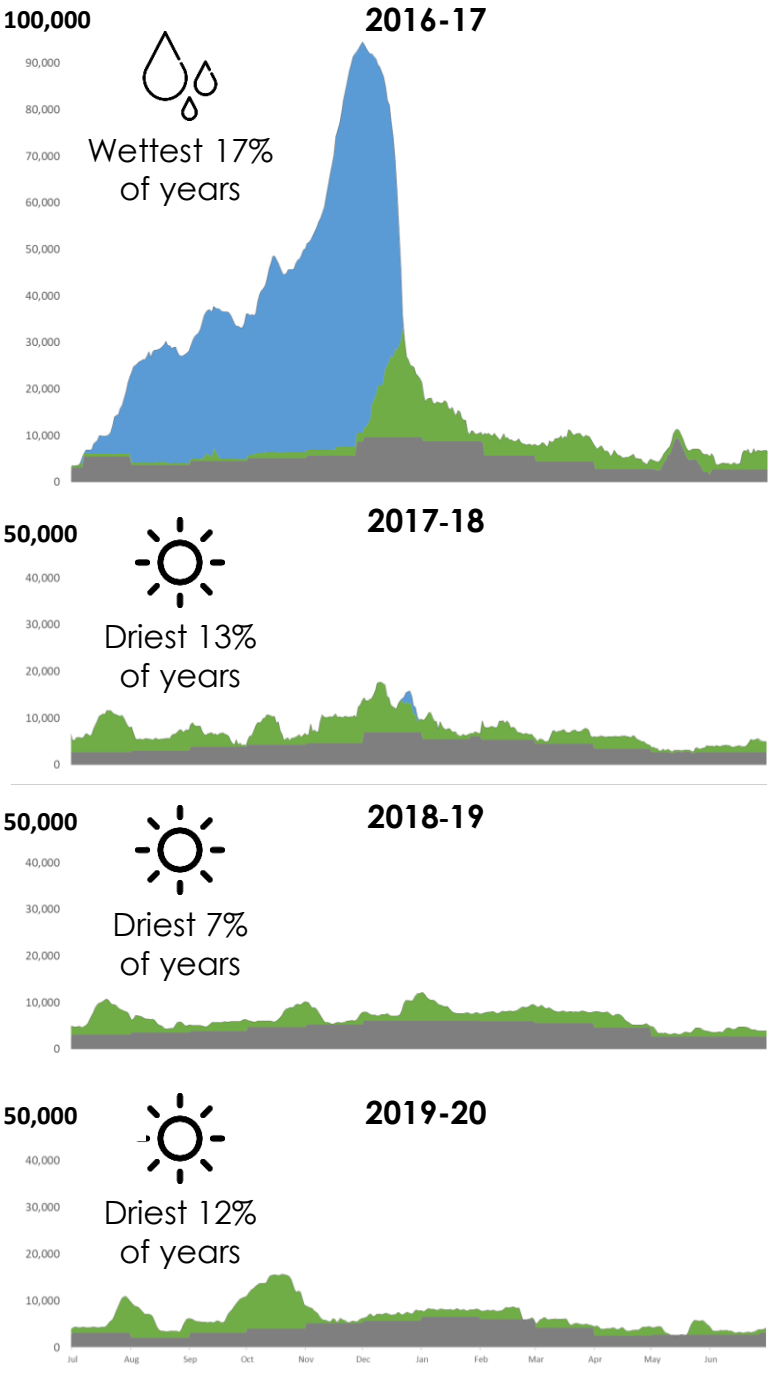
In 2018-19, inflows were 2,810 GL, less than one third of the long-term average.

The dry trend continued into 2019-20, with inflows of 3,810 GL. The third consecutive year of dry conditions meant allocations were lower than previous years.

#Exclude Snowy Hydro inflows, inter-valley transfers, managed environmental inflows and inflows to Menindee Lakes
*Held environmental allocations, as per the Transition Period Water Take reporting by MDBA for 2016-17, 2017-18 and 2018-19.
^Preliminary held environmental water allocation data from water holders. Excludes planned environmental water.

Every year is different

Flows to the Lower Murray, as measured at the South Australian border (ML/day)*



*The graphs represent the estimated environmental flows delivered in addition to the monthly averaged SA entitlement. The diagram should not be interpreted to infer that environmental water "sits on top" of other flows.
Note different y-axis scale between wet 2016-17 and following dry years.

Higher than average rainfall in 2016 resulted in high flows that watered parts of the floodplain for the first time in many years – including in the mid-Murrumbidgee wetlands and parts of the Murray and Goulburn floodplains. Water for the environment provided some local refuges for fish during the hypoxic blackwater event caused by the flooding. After the unregulated flows, environmental flows helped complete breeding cycles for plants, fish and birds.

The three years of dry conditions following 2016-17 resulted in lower river flows across the southern connected Basin. Water for the environment has been used to carefully shape flows and maintain a diversity of habitats along the length of the River Murray and its tributaries. Environmental flows have helped to maintain condition at sites of cultural and international significance and ensured that hard-won river health improvements from past years have not be lost.

During 2019-20, the third year in a row of dry conditions, environmental water holders planned and used their water to maintain the health and resilience of key sites in a drought-stressed landscape. This will help the river, key wetlands and lower parts of the floodplain to recover when the drought eases and wetter conditions return.
A coordinated spring fresh between the Murray and Goulburn Rivers resulted in a pulse of water passing through the system to the lower Murray in October and November 2019. This increased the productivity of the River Murray, providing more food and better water quality to improve conditions for plants, fish and birds.

Whose water is in the river?

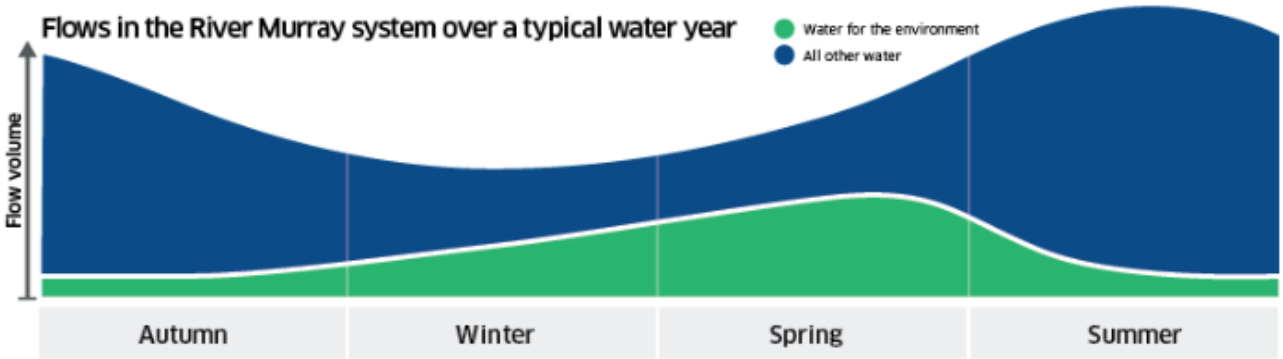
At any given time, water flowing through the river is destined for various uses, including irrigation, industry, communities, the environment, and meeting South Australia's flow entitlement. The exact mix of these flow components is determined by demand and water availability, amongst other factors.

River Murray at Yarran Regulator in Gunbower Forest (Source: MDBA)

Environmental water holders use water year-round, but their main delivery period is in late-winter and spring to align with growing and breeding season of many of the Basin's native plants and animals.

In comparison, the main delivery season for irrigation demands is over the warmer summer and autumn months when livestock and crops require consistent access to water.

Water flowing through the Murray is destined for various uses, including supporting Basin irrigation and industry, communities and the environment.



Overall, water for the environment is a small percentage of the total water used in the Murray–Darling Basin. The average environmental use over the last five years was 20.4% of the total water used in the Basin.

Importantly, water held for the environment uses the same entitlement framework as consumptive users. In any given year, the amount of water available for delivery to key environmental sites is determined based on the same rules that apply to all other consumptive water uses.

Working together to achieve better outcomes for the environment and communities

Collaboration is critical to the successful management of water for the environment. Local, state and Commonwealth government agencies, Traditional Owners, scientists and community groups all work together to deliver water for the environment to support the plants, animals and communities which depend on a healthy river.

The Southern Connected Basin Environmental Watering Committee (SCBEWC) is the coordination forum that enables the collaboration required to deliver water for the environment in the southern Basin.

SCBEWC enables the collaboration and cooperation between on-ground land and water managers and scientists, who provide detailed site knowledge, with the State and Federal environmental water holders and river operators who operate and manage events at a broader southern connected Basin scale.

SCBEWC brings together information from across the southern Basin to deliver water the length of the Murray and tributaries to improve system and local wetland health.

Agencies work directly with communities and First Nation groups on-ground to incorporate local knowledge and priorities into the management of wetlands and waterways. Strong engagement on-ground means that local knowledge and expertise is built into the environmental water planning process from the start. In determining the best use of water for the environment, SCBEWC is then able to look across the needs of each site and work together to deliver water which supports each site and the rivers that connect them.

Respectful relationships between government agencies, Traditional Owners, communities and scientists create opportunities to connect to Country, engage in the science, watch the landscape come to life with water and share stories about what our rivers and wetlands mean to different people.

Sharp-tailed sandpipers in Lake Littra, Chowilla (Source: H. Kieskamp)

Planning for delivery of water for the environment

Planning for the use of water for the environment occurs at multiple scales, from detailed site plans to coordinated southern Basin delivery plans. Significant effort is invested to ensure the best environmental outcomes, and shared benefits for Basin communities, can be achieved through the delivery of water for the environment.

Environmental water managers work closely with site managers, Traditional Owners, community members and river operators to ensure activities are coordinated, mutually beneficial and informed by the best available information.

Each year, SCBEWC agencies plan for a range of conditions from very dry to wet to ensure they are prepared for all climate conditions and are aware of emerging risks, trade-offs, and key watch-points.

Detailed planning allows environmental water holders to respond to changing conditions, capitalising on opportunities and mitigating risks.

To inform consensus decision making on use of the jointly held portfolios (The Living Murray, River Murray Increased Flows and River Murray Unregulated Flows), SCBEWC considers Basin scale and regional annual environmental watering priorities, watering proposals developed by the states and site managers, the long-term watering plans of jurisdictions, and the potential activities and needs of river operators.

SCBEWC provides their environmental watering plans for the year ahead to river operators to assist with their planning. River operators can then factor these plans into their Annual Operations Outlook.

Millewa Forest, Aboriginal Waterways Assessment (Source: G. Currey)

Water for the environment is adaptively managed to respond to highly variable river and climate conditions.

For key sites and reaches throughout the southern Basin, Operational Advisory Groups (OAGs) or Technical Advisory Groups (TAGs) facilitate conversations between water managers, site managers and river operators. When a watering event is underway, regular meetings (often weekly) are established so that flow rates, ecological objectives, emerging risks, early monitoring results and on-ground observations are shared in real-time.

The Southern Spring Flow – using water to support the river system

Why was the water released

Environmental water holders worked together to plan and deliver a late-winter and spring flow in the Murray and Goulburn Rivers. This flow aimed to generate food and nutrients and provide benefits throughout the River Murray from Hume Dam all the way to down to the Coorong and Murray Mouth, as well as in the lower Goulburn River.

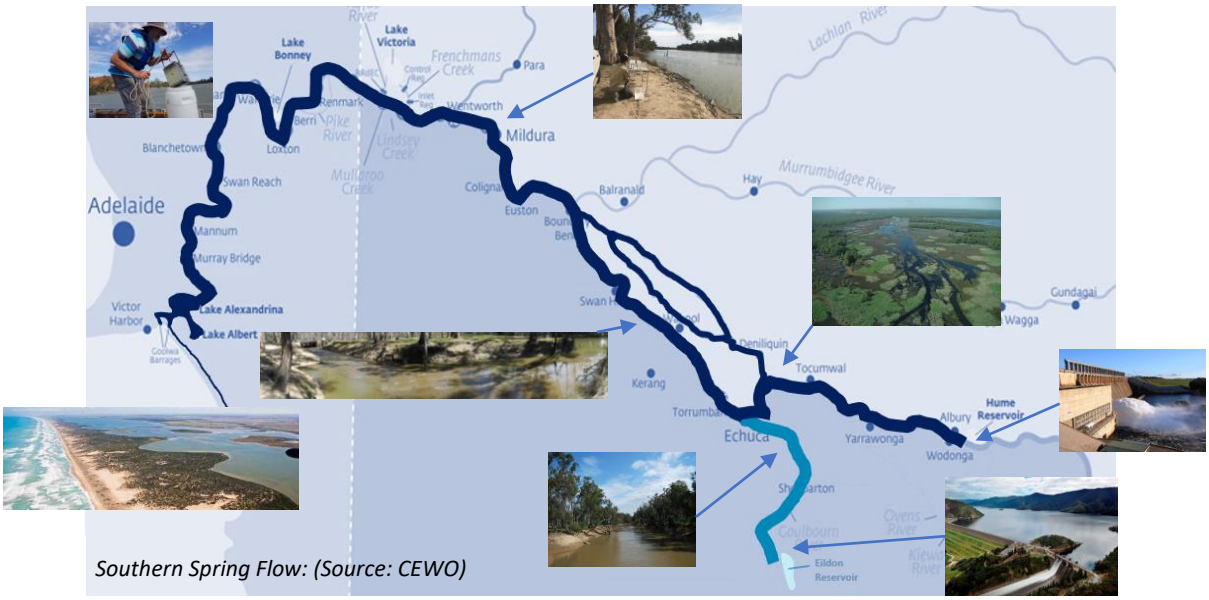
Even in dry times, small rainfall and flow events would historically have replenished the Murray with fresh food and nutrients as they flowed through the system. River flows in the southern basin were typically biggest in late-winter and spring (following rain and snowmelt), and many fish, birds and plants evolved to respond to these reliable spring pulses. The Southern Spring Flow was a managed event that aimed to mimic and reinstate a small flow along the length of the system at a time of year when the animals and plants most needed it.

Based on rain and inflows over winter-spring, the Murray would have naturally reached 30,000 ML/d downstream of Yarrawonga if there were no dams and weirs (compared to 15,000 ML/d for our managed Southern Spring Flow event)

Who was involved

The Southern Spring Flow was the result of months of careful planning by SCBEWC. Key to the success was the close collaboration with river operators and site managers to ensure flows were coordinated and well timed so water could be used multiple times at multiple sites along the river, and integrated effectively with system operations.

The event was made possible by environmental water holders deliberately carrying over water from the previous year to bolster the lower volumes of allocations, highlighting the critical importance of carryover especially for early season use.



Southern Spring Flow: (Source: CEWO)

What did we do?

Environmental water holders delivered flows of 15,000 ML/d downstream of Yarrawonga for six weeks using approximately 330 GL of water from CEWO and the joint government Living Murray portfolio. This flow provided an important drink to low-lying parts of the Barmah-Millewa Forest (highlight 1 on page 18), with the return flows, carrying on down through the rest of the system (page 30).

The delivery aimed to coincide with a spring fresh in the Goulburn River to maximise the flow height downstream of where the Goulburn River joins the River Murray. This increases the diversity of habitats available to native animals, by creating faster flowing waters, freshens groundwater and improves river red gum health.

This delivery created a spring pulse along the length of the River Murray and made water available for use at downstream environmental sites, in NSW, Victoria and South Australia, before finally supporting end of system flows at the Coorong and Murray Mouth. The event started in August and ended in November with the main coordinated flows delivered in September and October to align with the natural seasonality of higher flows in the Murray.

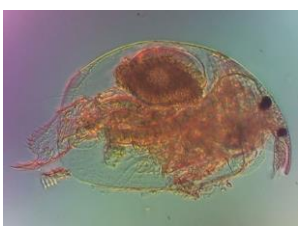
Much of the water in the river at the time was operational water en-route for consumptive users, with water for the environment building on and shaping flows in the river for a better outcomes.

Outcomes of the Southern Spring Flow

Water for the environment benefitted over 5,000 km of rivers and creeks as it passed through the river system, as well as providing targeted watering at key sites along the way including 6 Ramsar listed wetlands of international significance:

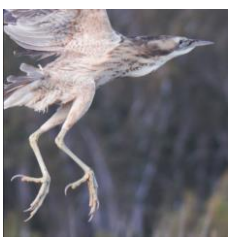
- Barmah Forest
- Gunbower Forest
- Millewa and Koondrook-Perricoota Forests (part of NSW mid-Murray Forests)
- Lake Kramen (part of Hattah-Kulkyne Lakes)
- Chowilla floodplain (SA Riverland Ramsar site)
- The Coorong and Lakes Alexandrina and Albert Wetland.

The Southern Spring Flow provided benefits to the different forests and wetlands and the species that depend on them. Monitoring detected benefits to the ecology including the provision of nutrients and food for aquatic life. Stories of some of the key highlights, findings and opportunities to improve identified from the event are outlined as case studies below.



Increased Zooplankton, food for fish (Source: D. Furst, Uni of Adelaide)

Aquatic and floodplain vegetation response, K. Ward and T. Barlow, GBCMA



The elusive Australasian Bittern in Millewa Forest, T. Ripon, NSW NPWS)

Community involvement

People are integral to improving the outcomes from the use of water for the environment. Community and Traditional Owner advice and views are included through active participation in regional and local groups. Examples include the Environmental Watering Advisory Groups in NSW and Victoria, and the Community Advisory Panel in SA.

A network of Local Engagement Officers has been established by the CEWO and a network of Regional Engagement Officers have been created by the MDBA. These networks support better two-way engagement across the Basin.

Wetland and river managers all along the River Murray and its tributaries are working to increase broader community awareness of the outcomes from delivering water for the environment and how improvements in river health in-turn benefits the community.

Engaging with the Southern Spring Flow

Communities have asked environmental water holders to share more information on how water for the environment is managed and for what outcomes. As part of our efforts to address this, the CEWO led a communication and engagement approach to support the delivery of the Southern Spring Flow.

A fact sheet, seven watering event updates, media releases and social media posts were used to provide regular information about the event. The updates tracked progress of the flow, stories of how sites were responding and scientific monitoring updates.

Several community meetings were held along the banks of the Murray, along with a series of radio interviews to help spread the news. Local and Regional Engagement officers provided information on-ground throughout the flow event and all delivery partners shared the information through their regional community networks.

Community Field Trip to Barham as part of the Southern Spring Flow (Source: MDBA)

Feedback on the engagement has been largely positive. The community meetings were well attended, and the effort made to visit regional areas was appreciated. While there is room for continued improvement, the real-time community engagement effort in 2019-20 is seen as an improvement to previous years. The approach and networks will continue to be built upon in coming years.

Science builds knowledge - Boosting productivity

Connectivity between wetlands, creeks, rivers and floodplains is vital to support healthy rivers. The movement of water between rivers, wetlands and the floodplain mixes nutrients and carbon into the water, providing energy for plants and animals to grow. The Southern Spring Flow event aimed to improve Murray River connectivity and productivity in two ways:

1. **Lateral connectivity**: by connecting the river with low-lying areas of the floodplain, wetlands and smaller waterways, bringing essential carbon and nutrients back into the river channel.
2. **Longitudinal connectivity**: by supporting the river to stay connected and flow along its entirety, mixing and moving nutrients and carbon down the length of the system.

To understand how the flows influenced the productivity or food available within the Murray River scientists measured:

- **Carbon, nutrient and algae levels** – the basic material that supplies energy to plants and animals, forming the base of all foodwebs.
- **Numbers and species of zooplankton** - tiny microscopic animals that feed on algae and bacteria and are an important food source for yabbies, crayfish and small fish.

The inundation of the Barmah-Millewa Forest floodplain created the highest increase of available carbon and nutrients during the Southern Spring Flow event. Immediately downstream of the forest, zooplankton numbers spiked, increasing the food available to support fish populations to feed, grow and breed.

In contrast, there was less of an increase in productivity in the mid and lower reaches of the Murray. This was due to the relatively small size of the flow in this part of the system, with most of the water remaining within the channel and not able to bring nutrients in from the nearby floodplain.

Overall the monitoring demonstrated a productivity boost from the Southern spring flow. However the response was modest compared to what we'd expect from higher flows that provide greater connection between the river and its floodplain. This supports the importance of easing current flow constraints so that even greater productivity benefits can be generated with water for the environment. Learnings from this monitoring will be used to inform future planning and delivery of water for the environment at both a local and system scale. Read more of the science **here.**

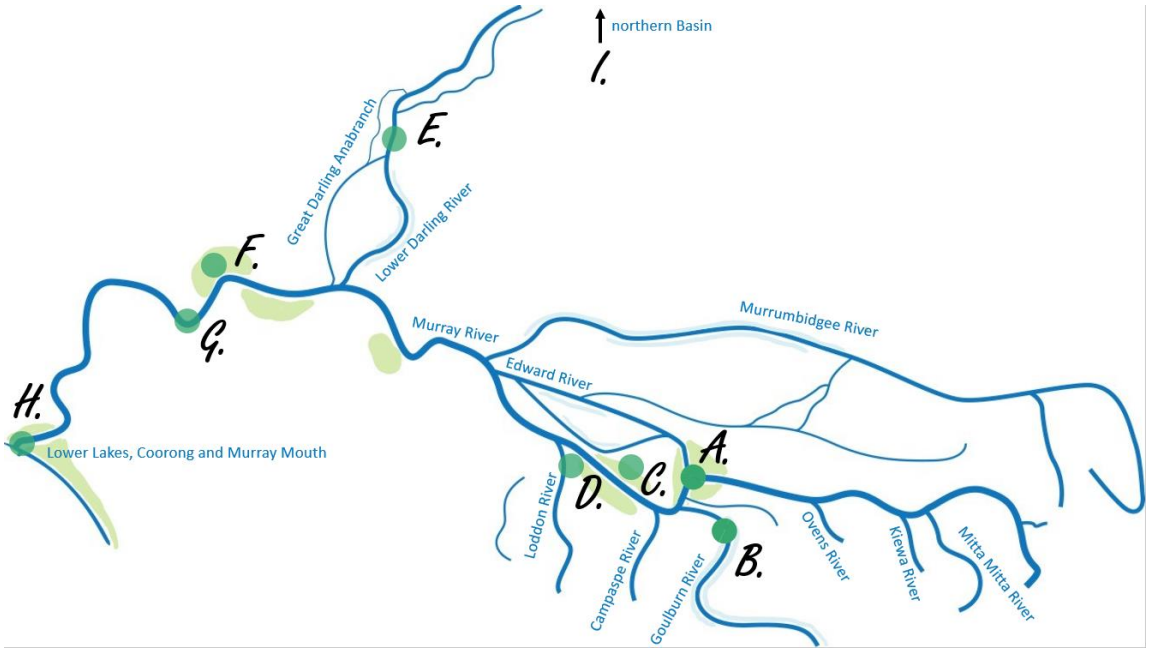
Sampling at Barmah township (Source: Charles Sturt University)
Insert - Zooplankton (Source: Uni of Adelaide)

Sampling the Lower Murray (Source: Uni of Adelaide)

2019-20 Watering highlights

Environmental water holders worked closely to coordinate the Southern Spring Flow with other deliveries of water for the environment in 2019-20. Collaboration between water holders is continuing to strengthen, resulting in more ambitious watering events and better outcomes for the environment being realised.

To illustrate some of the watering highlights from 2019-20, eight case studies from around the River Murray system are provided as well as some highlights from the northern Basin.



Watching water flow into Koondrook-Perricoota Forest (Source: MDBA)

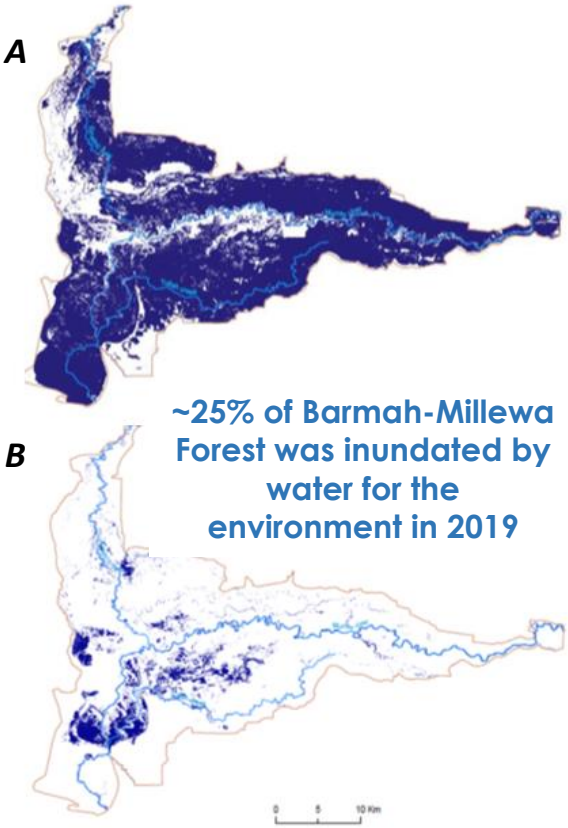
A.

Flows through Barmah-Millewa Forest

Barmah-Millewa Forest is a centuries-old redgum forest is in a naturally wet part of the landscape that thrives on frequent waterings in winter and spring. Based on its location the forest is accustomed to receiving water almost annually, even in dry years. For example under natural conditions (i.e. no dams), the forest would have been watered by flows in the Murray in 19 of the past 20 years.

Based on the observed rainfall and inflows in winter and spring 2019, if there weren't any dams River Murray flows would have naturally reached 30,000 ML/d downstream of Yarrawonga, and overbank flows into Barmah-Millewa Forest would have occurred from July through to October.

In the spring of 2019, environmental flows targeted 15,000 ML/d downstream of Yarrawonga, which inundated a relatively small proportion of Barmah-Millewa forest (about 25%). Monitoring has shown that the plants and animals in watered sites are in better condition than forest sites which did not receive water.



Satellite imagery of Barmah-Millewa Forest, illustrating the water footprints of different events (Source: MDBA)
***A:** Natural flood event in 2016, where flows peaked at 85,000 ML/d at Yarrawonga*
***B:** Managed water for the environment event in 2019, where flows peaked at 15,000 ML/d at Yarrawonga*

Bunyips are booming

This bunyip is not the scary mythical creature you might imagine when you hear its booming call. Instead it's the highly endangered 'bunyip bird', also known as the **Australian bittern**.

Bird surveys through Barmah-Millewa Forest recorded Australasian bitterns booming at 12 of 16 sites. This is an important result for this endangered and elusive wetland-dependent waterbird. As dry conditions continued in 2019-20, the wetlands in the Barmah-Millewa Forest were one of the most important sites in the country for bitterns this season.

The extended watering of Barmah-Millewa Forest has allowed Australian bitterns to nest safely in the shallow, reedy waters important for nesting birds.

This success is due to a huge team effort! Over ten government, First Nations and community groups worked together to support the delivery of water for the environment, enabling the bitterns' chicks to successfully grow into fledglings.

Bunyip bird on its nest in Barmah-Millewa Forest (Source: CSIRO)

B. Building flows – Combining flows in the Murray and Goulburn

The Goulburn River flows north for 570 km from the Great Dividing Range to the Murray east of Echuca, and has important environmental, Aboriginal cultural heritage and recreational values.

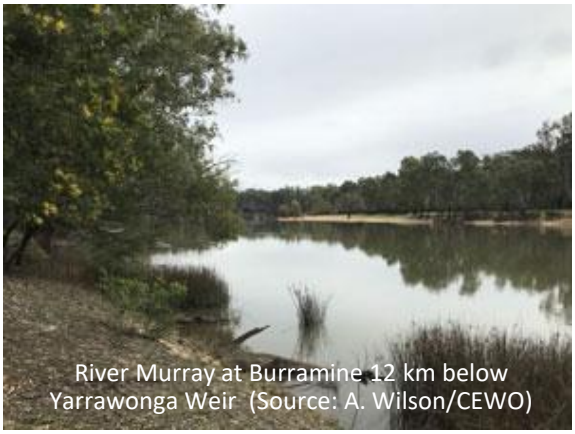
The Goulburn-Broken is a significant tributary of the River Murray, providing 11% of the Basin's water. This contribution is important to support the system scale flows through to the lower Murray.

In 2019-20, SCBEWC emphasised seeking to better coordinate and combine water for the environment deliveries between the Murray and Goulburn Rivers as part of the Southern Spring Flow.

Following dry conditions in winter and early spring, a spring fresh was delivered in the lower Goulburn from September to October 2019 to support native fish and to trigger the germination of bank vegetation, according to local environmental needs.

Delivery of the Goulburn spring fresh was incorporated into the planning of the Southern Spring Flow in the Murray, to provide a larger and longer duration flow along the length of the river system. Coordinating river flows in this manner helps to achieve the best possible environmental outcomes at the southern basin scale, particularly for native fish, river productivity and end of system flows to support the Coorong.

Checking in-stream vegetation in the Goulburn River (Source: Goulburn Broken CMA)



River Murray at Burramine 12 km below Yarrawonga Weir (Source: A. Wilson/CEWO)

Water for the environment releases in the Goulburn helped shape flows in the Murray for better system scale outcomes

A relatively small proportion of water for the environment entering the Murray from the Goulburn River spring fresh was re-used at multiple environmental sites as it passed downstream, with applicable losses deducted along the way (see page 33). This included re-use of the water to support native fish objectives in Gunbower Creek, inundate wetlands in the Gunbower and Guttrum forests, and support ecological objectives in the Lower Murray.

SCBEWC plans to build on the learnings obtained from coordinating the Goulburn and Murray water for the environment releases in 2019 by seeking to include additional tributaries in a coordinated spring flow event in 2020.

C. Delivering life saving flows to Koondrook-Perricoota Forest

Life is returning to Koondrook-Perricoota Forest following the delivery of water for the environment as part of the Southern Spring Flow in 2019.

The forest has been showing signs of increasing stress and its condition has not improved since the Millennium Drought. However early monitoring results are showing that the small-scale watering event of 2019 which inundated 3,500 hectares or **12%** of the forest is generating some localised improvements for the site.

Whilst 2019 provided a good start, the forest still has a long road to recovery as benefits to floodplain vegetation were limited to the area where water was delivered. Waterbird, frog and turtle numbers are increasing however further watering actions will be required to restore the forest to good health.

NSW Forestry worked closely with community and environmental water holders to deliver the event. Watering of sites such as Koondrook-Perricoota relies on the trust and goodwill from forest neighbours and agencies involved are grateful for the collaboration which is helping to bring Koondrook-Perricoota Forest back to life.

A: Water ribbons at Baldwins wetland
B: Little pied cormorant chicks at Pollack Swamp
C: Filling of the inlet channel
D: Differences in vegetation condition between areas within the water inundation footprint (left) and outside (right)
(Source: NSW Forestry)

D. Inaugural watering of Reed Bed Swamp, Guttrum Forest

In the spring of 2019, a wetland rescue mission was undertaken to deliver life-giving water to Reed Bed Swamp in Guttrum Forest. This follows more than twenty years of a severely reduced watering regime that has pushed the wetland ecosystem to the edge – but not beyond recovery.

The delivery was a long time in the making. After five years of patience, persistence and a collaborative effort from Traditional Owners (Barapa Barapa and Wemba Wamba) and water managers, water for the environment was finally delivered to start bringing this site back to life.

This event is the first step towards a long-term cultural and ecological goal of reinstating a more natural watering regime and improving the wetland health of Guttrum Forest.

As recently as the 1990s, the local Traditional Owners recall the swamps in Guttrum Forest having an abundance of important food, fiber and medicinal plants such as old man weed and giant rushes. However, environmental water managers and Traditional Owners were becoming increasingly worried that the wetland plants and large red gum trees surrounding the wetlands were being stretched beyond their limits under the persistently dry conditions and lack of water reaching the wetland.

Water bringing life to the wetland (Source: G Smith)

The delivery of water for the environment in the spring of 2019 was cause for great community celebration. The event saw a range of waterbirds return to the wetland in good numbers, including several threatened species such as glossy ibis, great egrets and Australasian shovelers, as well as thousands of ducks.

The canopies of the large old fringing trees – including scar and ring trees – that were in very poor condition put out new epicormic growth *(right)*, and the vibrant green of the watered trees was in stark contrast to the surrounding dry forest *(above)*.

New growth on old trees (Source: G Smith)

E. Recommencing flows in the Lower Baaka (Darling)

The north and south of the Basin have reconnected, as the Baaka (Darling River) began flowing into the Murray once again following the Lower Baaka restart. The Lower Baaka is of great environmental and cultural importance to the Barkindji nation and has historically been regarded as a stronghold for native fish, particularly Murray cod.

Welcome rains in early 2020 provided inflows from the northern Basin to Menindee Lakes, which in turn enabled the Lower Baaka to receive its first flows in over twelve months.

Flows fill the dry riverbed (Source: I Ellis, NSW DPIE Fisheries)

Releases from Menindee Lakes recommenced in March 2020, providing a reprieve for the local community and environment which had endured a sustained and difficult period of low and no flow conditions. The mass fish deaths of early 2019 and subsequent loss of more native fish during the long summer of 2019-20 were a tragic loss. Consequently the Lower Baaka restart, managed by WaterNSW, was carefully designed in a collaborative manner with input from fish ecologists, environmental water managers and the local community.

Freshwater flow arrives to remnant pool (Source: I Ellis, NSW DPIE Fisheries)

Whenever a dry river receives inflows there are risks that the stagnant water in remnant pools can create water quality issues, such as low dissolved oxygen and high salinities. This can cause environmental impacts when a flow front of poor water quality is pushed downstream. To mitigate these risks the Lower Baaka restart was carefully managed so that there was sufficient volumes released to flush and dilute poor water quality along the river. Operations in the Murray were also adjusted, with weir pool levels and releases varied to provide maximum dilution to the water entering from the Baaka.

The end result was highly successful, with the flushing flows providing respite to the drought-stressed environment of the Lower Baaka, whilst simultaneously restocking town water supply for the outback communities of Menindee and Pooncarie and providing urgent stock and domestic access for landholders.

With water again flowing continuously in the Lower Baaka, the focus of SCBEWC has turned to how we can best use environmental water allocations to help improve the health of the river and in particular rebuild the native fish population in this important river reach into 2020-21.

F. Chowilla Floodplain refuge watering

In spring 2019, water for the environment was delivered to Chowilla Floodplain as part of the Southern Spring Flow providing essential refuge wetland habitat for waterbirds and native fish. In Coombool Swamp over 850 waterbirds and over 50 calling male southern bell frogs were recorded.

During a follow-up field trip to Coombool Swamp in Autumn, Traditional Owners observed 19 Kungardi (swan) nests that would require additional water to protect their eggs from predators like foxes. Traditional Owners' worked with agency staff to see further water for the environment delivered to maintain higher water levels in the wetland, protecting the nests and allowing the Kungardi to finish their breeding cycle.

In less than a week, environmental water holders supplied the additional water for Coombool Swamp and the Kungardi chicks survived and fledged.

Kungardi eggs are a prized food source for Traditional Owners and their feathers are used in the traditional practice of making feather flowers.

Kungardi (swan) eggs (Source: F. Giles)

Place of spirits and ghosts

The word Chowilla (or 'Tjowilla') means 'place of spirits and ghosts' and the floodplain and its wetland riches is part of the living Culture of the First Peoples of the River Murray and Mallee Region. Living cultural heritage that is beautifully evident across Chowilla's landscape.

The First Peoples of the River Murray and Mallee recently invited younger generations and environmental managers to spend time on Country to pass on the valued cultural knowledge of Traditional Owners.

The result was a memorable two days on the Chowilla floodplain. First Peoples of all ages, from 7 months old through to Elders, were involved in traditional smoking ceremonies, wurley making, weaving, cooking and more.

Sharing knowledge with the younger generations (Source: A. Stokes)

9. Lamprey on the move

Lamprey are an ancient, eel-like fish that migrate from the ocean, through the Murray Mouth and up to 2,000km along the River Murray to breed. Lamprey can travel thousands of kilometres upstream, meaning it is important that the River Murray is connected along its entire length by the use of fishways on locks and weirs, and importantly with flows.

Born in fresh water, lampreys move to the sea as young adults where they spend most of their life as parasites on larger fish. They then return to fresh water to breed, lay eggs and die. As the lamprey moves through fishways on the River Murray they are captured, tagged, released and tracked along their journey so we can better understand this unique fish.

Pouched and short-headed lamprey (Source: SARDI Aquatic Sciences)

To kick start lamprey migration up the Murray River, freshwater cues are needed through the barrages and Murray Mouth. In winter 2019, a pulse of water was delivered to benefit the environment in the Goulburn River before making its way through the system to the Lower Lakes. This enabled barrage releases to be made to encourage fish to start moving ahead of the arrival of the Southern Spring Flow, which then provided prolonged flows to support lamprey migration.

Pouched and short-headed lamprey were abundant at the barrage fishways in winter and early spring 2019, with a total of 45 pouched and 16 short-headed lampreys detected. Numbers of both species were amongst the highest recorded since fishway monitoring began in 2006-07.

Pouched lampreys were detected migrating as far upstream as Lock 8, a journey of over 700 km! And for the first time, short-headed lampreys were tagged and tracked in the River Murray, with a single individual tracked all the way to Lock 10 – a journey of 825 km!

In the years following the Millennium Drought there were very few recordings of lamprey in the River Murray as the long period of disconnection between salt and fresh water likely impacted their migration and breeding. However, continuous connectivity at the barrages, the delivery of water for the environment as winter freshes to the end of the system and the provision of fishways at upstream locks and weirs has seen an improvement in lamprey numbers.

Lamprey teeth!
(Source: SARDI Aquatic Sciences)

4. Lower Lakes, Coorong and Murray Mouth

The Southern Spring Flow improved the connectivity along the entire length of the River Murray, creating better habitat for native fish and supporting native plants and wildlife before reaching the Lower Lakes, Coorong and Murray Mouth where water for the environment supported this internationally significant wetland.

The Lower Lakes, Coorong, and Murray Mouth is a site of significant cultural and environmental importance. It is one of the most important waterbird sites in Australia, supporting over 80 species of threatened or migratory birds, some of which travel from as far away as Siberia to feed.

It is also home to a range of native fish including diadromous species that require both fresh and saltwater habitat to breed. Flow through the barrages and out the Murray Mouth is the only natural way excess salt and nutrients can be flushed from the Murray-Darling Basin.

At the bottom of the Basin, the Lower Murray and Lower Lakes are often the first environmental sites to show indications of stress from low inflows and dry conditions.

Shorebirds: stilts, terns, pelicans, ducks and ibis at the Coorong (Source: A Caldwell)

The construction of upstream storages and water extraction for consumptive use has reduced end of system flows. During the Millennium Drought the site came under significant stress due to a lack of inflows. Salt and freshwater habitats were disconnected, parts of the site turned hypersaline and acid sulfate soils with a pH akin to battery acid were exposed. The drought and these impacts emphasised a critical need to keep lake levels above 0.4m Australian Height Datum (AHD – or height above sea level) and to support continuous flow connectivity between the Coorong and the lakes.

Water for the environment has successfully maintained lake levels above 0.4m AHD whilst providing continuous flow connectivity through the barrages over the past three years of dry conditions.

In recent years, the delivery of water for the environment through events such as the Southern Spring Flow have made a difference to this part of the southern connected Basin. By maintaining connectivity through the Lower Lakes, Coorong and Murray Mouth, supporting barrage releases and maintaining Lower Lake levels above 0.4m AHD, riverine and estuarine fish, waterbirds and plants have been able to continue their long road to recovery following the Millennium Drought.

Connections with the North

Coordination and collaboration are key aspects to the delivery of water for the environment, and in the north, this is being led by the newly formed Northern Basin Environmental Watering Group (NBEWG). Similar to SCBEWC, NBEWG focuses on collaboration across agencies and jurisdictions to coordinate available environmental water for system-scale outcomes in the north.

The Northern Basin Environmental Watering Group was established in November 2019 and will perform a similar function to SCBEWC for northern catchments.

In the summer of 2019-20, amidst record breaking heat and drought, the northern Basin received some promising rainfall, the first in three years.

Black Swan taking off on the Warrego (Source: 2rog)

Welcome rain returned to the Condamine-Balonne catchment in early 2020. Following this, the Lower Balonne section of the system recorded the Commonwealth's largest single watering event in the northern Basin to date. 163 GL of water for the environment helped reconnect rivers and floodplains along the Culgoa River as well as replenish important waterholes for native fish.

As part of this flow, around 90 GL passed into the internationally significant Narran Lakes (known as Dharriwaa to the Yuwaalaraay/Euahlayi First Nations people). This was the first decent flow for this important site after seven years of dry, with positive responses recorded for frogs, wetland plants and waterbirds.

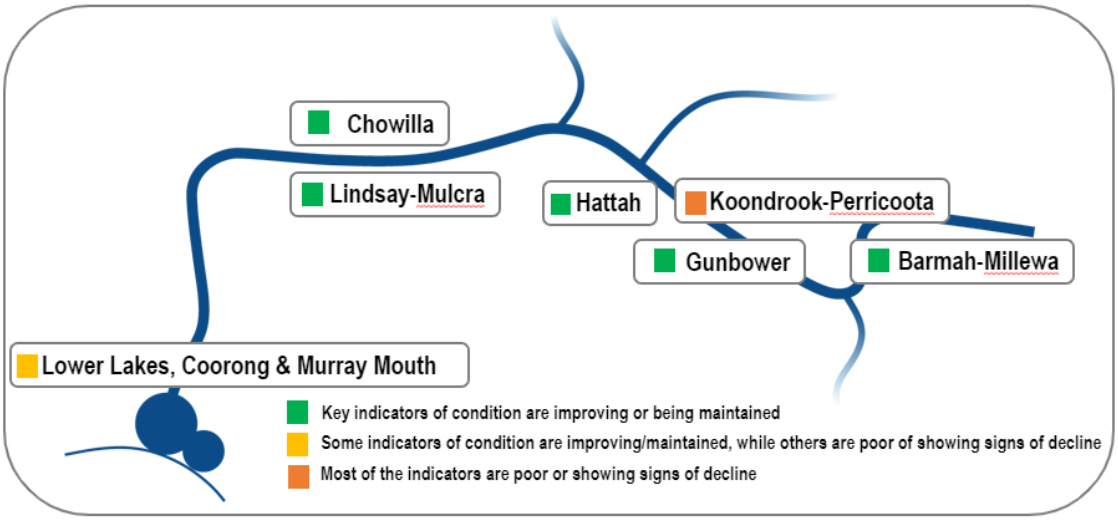
Back Lake within Narran Lales, April 2020 (Source: J Ocock NSW NPWS)

Elsewhere in the north, the welcome rainfall enabled water for the environment delivery across most catchments, including the Barwon-Darling, Gwydir, Macquarie, Warrego and Border Rivers. Although conditions have eased, further rain and inflows are needed in 2020-21 to support environmental recovery across the northern Basin following the record-breaking drought conditions of recent years.

Black-necked stork at Narran Lales, June 2020 (Source: N Foster CEWO)

Learning and adapting

Scientific monitoring across sites is showing that the delivery of water for the environment and the operation of environmental works during dry years are making a difference to the health of rivers and wetlands. Monitoring undertaken as part of the Living Murray program shows that sites which have received water for the environment over consecutive years have maintained or improved their condition, helping to build resilience for dry times.



Snapshot of the condition of six icon sites in the southern connected Basin as of 2018-19

In 2019-20, state partner agencies delivered around 100 monitoring projects as part of The Living Murray Program. The projects include condition monitoring to assess site health, and intervention monitoring to inform the real-time management of water use and to measure ecological responses to watering. The projects also monitor emerging risks such as the potential for poor water quality.

This monitoring is used by environmental water managers to report on and evaluate outcomes of watering actions and to improve the delivery of water for the environment in subsequent years. Monitoring reports are shared for each location on the MDBA website.

Birdwatching at the Pollack, Koondrook-Perricoota (Source: S Treby NSW Forestry)

Fish seining in Tarma Lagoon, Barmah-Millewa Forest (Source: K Ward)

TLM MONITORING
Site condition through time

	Barmah-Millewa Forest	Gunbower Forest	Koondrook-Perricoota Forest	Hattah Lakes	Lindsay-Mulcra-Wallpolla Islands	Chowilla	Lower Lakes Coorong Murray Mouth
2018/19	B	A	D	B	B	B	C
2017/18	A	B	D	A	B	B	C
2016/17	A	B	C	A	B	B	B
2015/16	B	B	D	A	B	C	C
2014/15	B	B	D	A	-	C	B
2013/14	C	B	D	B	C	C	B
2012/13	C	B	D	C	C	C	B
2011/12	C	C	D	B	B	C	B
2010/11	B	B	D	C	C	B	D
2009/10	C	C	D	D	D	C	D
2008/09	D	C	D	D	D	C	D
2007/08	D	D	D	D	D	-	D

Flood year

Environmental works used to deliver water to sites

A: Excellent – Most (75-100%) of ecological objectives have been met
B: Good – More than half (50-74%) of ecological objectives have been met
C: Fair – Fewer than half (25-49%) of ecological objectives have been met
D: Needs attention – Few (0-24%) of ecological objectives have been met

Barmah-Millewa uses regulators to deliver water into the forest, and LLCCMM uses barrage gates to deliver water to the Coorong. Both are used in most years, except extreme drought years

Water quality monitoring of wetlands at Gunbower Forest (Source: MDBA)

Using water efficiently – return flows

In the southern connected Basin, governments are making changes to the river management rules to protect and make better use of water for the environment as it passes through the river system. The use of environmental **return flows** allows water to be used and re-used at multiple sites.

Water delivered to a floodplain or wetland typically isn't completely lost from the river system. Often, some of the water flows back from the floodplain or out of the wetland to re-join the river. This returned flow is measured (with any losses deducted) and then made available to be used again downstream.

This provides for an efficient means to water multiple environmental sites from the top to the bottom of the catchment.

Return flows are in effect recycling water for the environment.

Return flows increase the connectivity of the river system. Carbon and nutrient-rich water from floodplains and forests returns to flow down the river. Carbon and nutrients form the basis of the food web, providing food to support a wide variety of plants, fish and waterbirds, and increasing productivity. Improved connectivity also transports seeds, eggs and young fish to other areas of the river system, increasing the spread of plants and animals.

Koondrook-Perricoota wetland, partially watered by using return flows from upstream in 2019-20 (Photo: J Dind)

Using return flows to build on the water flowing in the river enables Environmental Water Holders to get the best outcomes for the rivers, wetlands and the animals that rely on them.

Flows are coordinated

- from multiple tributaries
- between multiple environmental water holders
- to build on the back of unregulated and regulated flows
- in concert with land management
- with use of environmental works, built to improve floodplain water delivery
- with community needs and advice

Improvements detected in

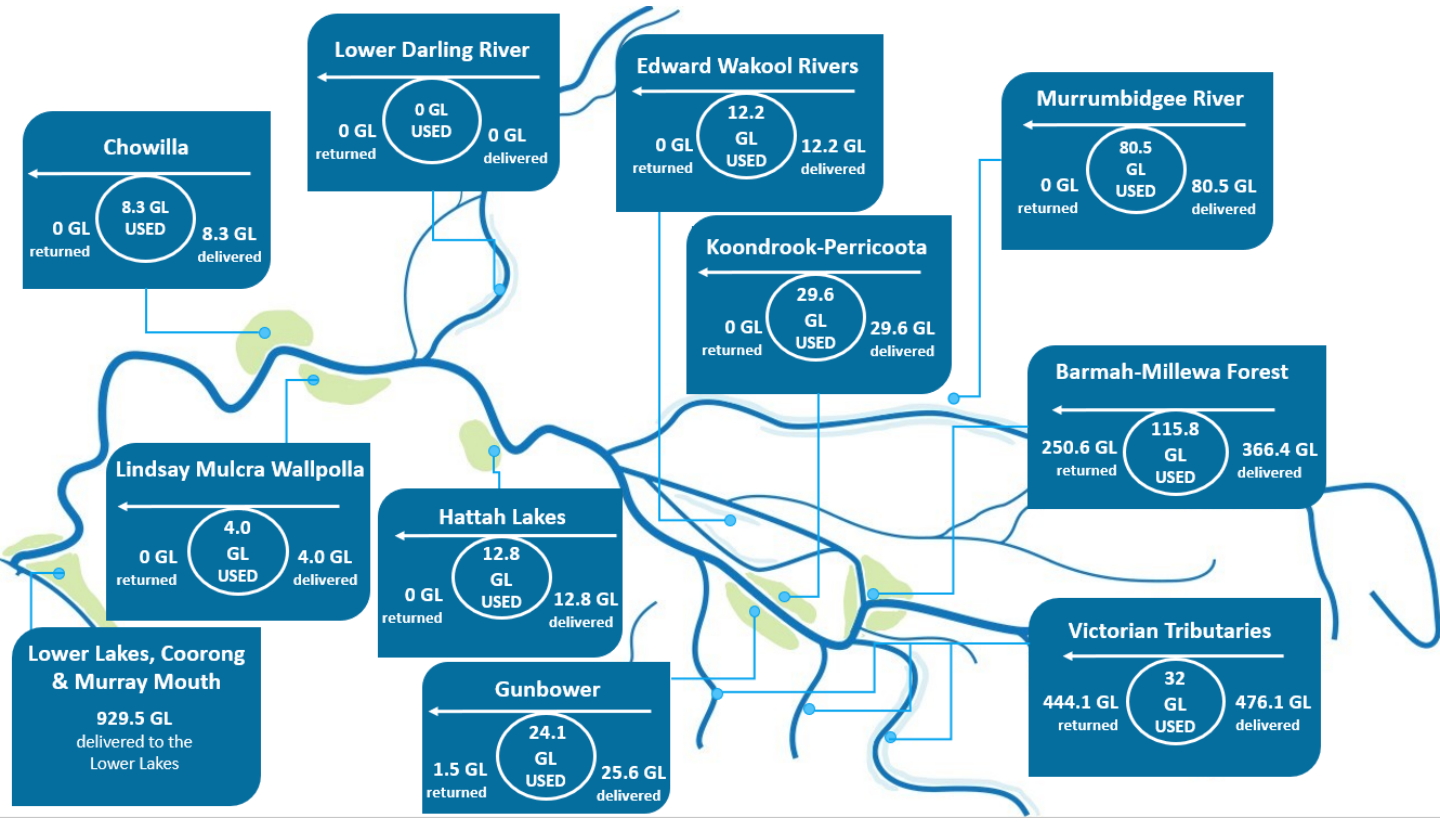
- productivity and connectivity in our rivers and creeks
- fish and bird movement, feeding and breeding
- river bank and wetland plant health
- water quality and salinity levels
- maintaining an open Murray Mouth
- providing flow between the Lower Lakes and Coorong - moving nutrients, sediment and salt out of the Basin and allowing fish passage

Return flows in 2019-20

Return flows were essential to the success of the Southern Spring Flow. Water was delivered from the headwater storage of Hume Dam and used and re-used along the length of the Murray River before reaching the Lower Lakes, Coorong and Murray Mouth.

Water was also delivered through the Goulburn River where it joined with the Southern Spring Flow in the Murray River creating higher river levels to support diverse flow habitats, plants and fish in the mid and lower Murray.

Return flows were delivered to the Edward Wakool, Koondrook-Perricoota Forest, Gunbower Creek, Gunbower Forest, Guttrum Forest, Hattah Lakes, Chowilla Floodplain and the Lower Lakes, Coorong and Murray Mouth.



Other environmental sites that received water: other Vic Wetlands 20.2 GL (no return flows); other NSW Wetlands and creeks 22.5 GL (no return flows), other SA wetlands 49.9 GL (6.8 GL return flows); 0.8 GL NSW/Vic weirpool manipulations (no return flows). Delivery of water for the environment through the river system supported the River Murray Channel from Hume Dam to the Coorong

Definitions

Water available: how much water is available for environmental water holders to use, including start of year carryover and allocation for the year (allocations are based on catchment conditions, amount of water in storage and types of water licences)

Water delivered: how much water arrived at a site

Water use: how much water stayed or was used at a site

Return flows: how much water flowed out of a site to re-join the river and become available for re-use and delivery to other environmental sites downstream.

Opportunities to improve

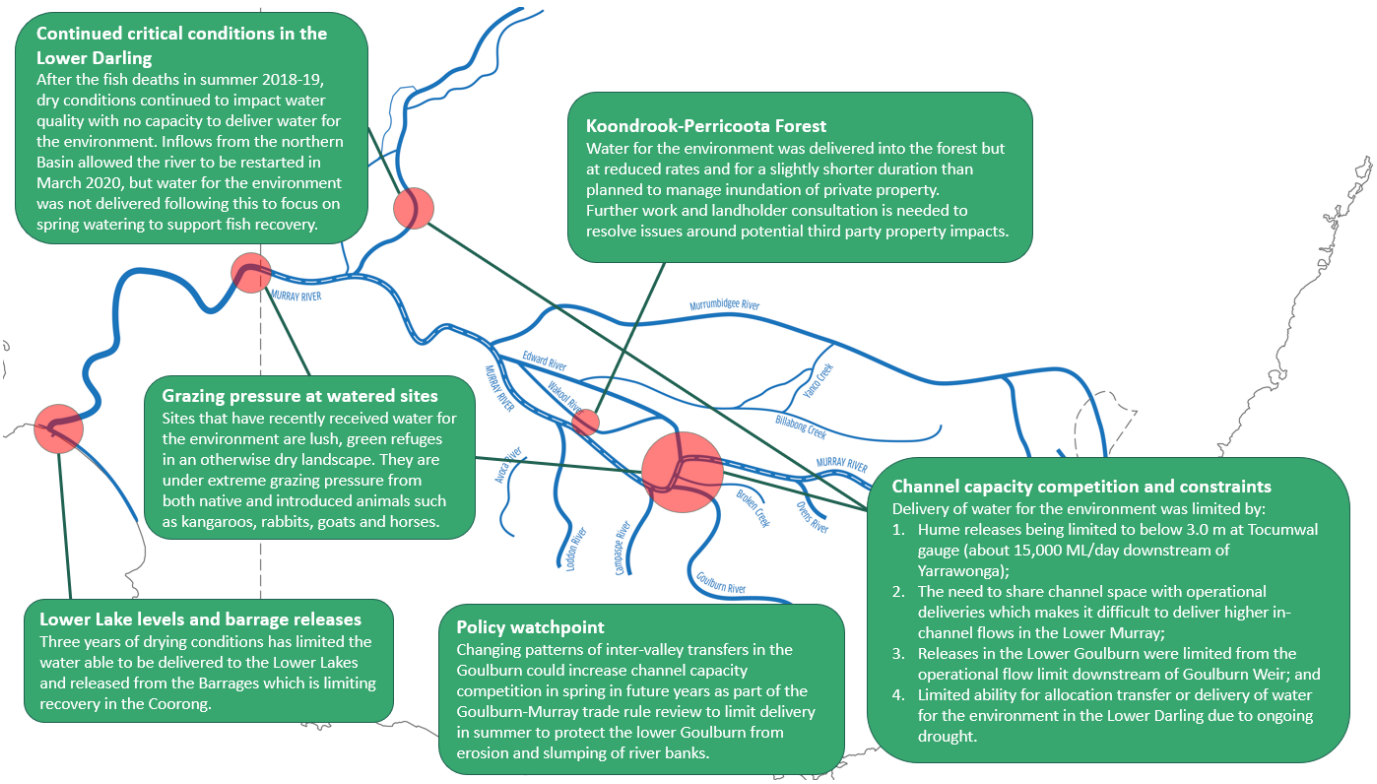
The successful implementation of the Basin Plan requires water for the environment to be fully integrated into the everyday management of water in the River Murray system. There are several key policy issues and operational challenges that State and Commonwealth governments are working through as part of implementing the Basin Plan. An update on the status of these key issues can be found in the MDBA's Basin Plan Report Card.

These challenges impact the delivery of water for the environment and limit the outcomes that can be achieved, hindering the full realisation of water reform and this significant public asset.

Challenges include:

- **Constraints relaxation** to allow water for the environment to reach higher levels on the floodplain and some of the Basin's key environmental assets
- Adapting and improving **pre-requisite policy measures** to better protect environmental flows from re-regulation and extraction
- Implementation of the **Sustainable Diversion Limit Adjustment projects** to allow Basin Plan environmental outcomes to be achieved with less water
- Completion and accreditation of all **Water Resource Plans** that set out the rules for the use of all water, including water for the environment

As well as stressful hot and dry weather conditions in 2019-20, several pressures limited the ability for environmental water holders to meet environmental water needs as outlined below:



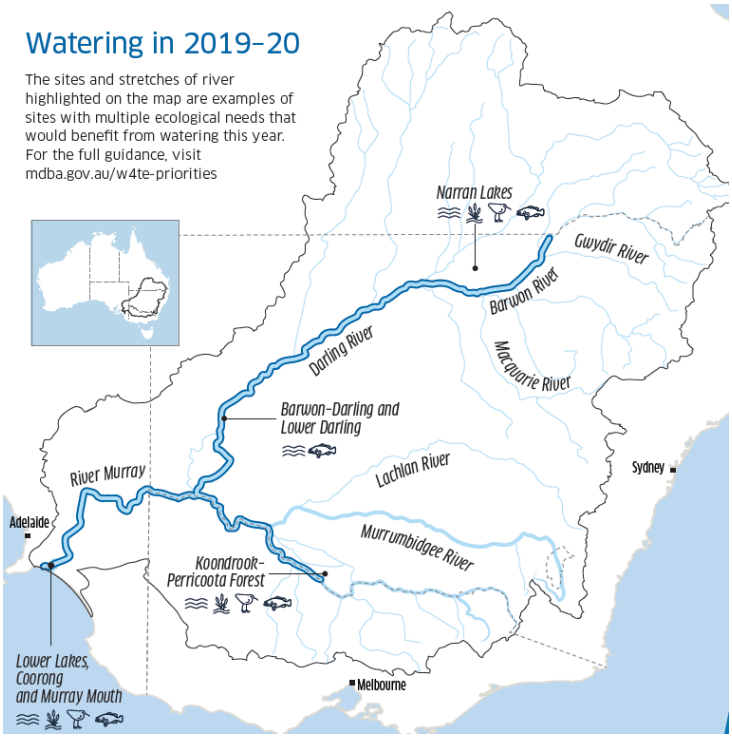
Location of key pressures that impacted the delivery of water for the environment in the southern connected Basin in 2019-20

Appendix – Basin environmental watering priorities and Regional watering priorities

The Basin Environmental watering priorities provide a whole-of-Basin perspective and help guide environmental water managers on where to focus water delivery. The key themes are river flows and connectivity, native vegetation, waterbirds and native fish. They are set out as rolling multi-year priorities to provide a medium term (3 – 5 year) step towards achieving the longer-term objectives of the Basin-wide Environmental Watering Strategy and the Basin Plan.

Under the dry to very dry conditions, the 2019-20 annual priorities aimed to **avoid irreversible impacts on species, vegetation and important sites**.

SCBEWC agencies supported the Basin annual priorities by: delivering a River Murray Channel multi-site event as the Southern Spring Flow; supporting a floodplain watering at Koondrook-Perricoota Forest; providing flows to the Coorong to support suitable habitat and water quality for migratory wading birds; and connecting southern rivers to support native fish recovery.



Regional watering priorities

Regional priorities guide the planning and delivery of water for the environment at a river reach and catchment scale.

Regional priorities are developed by states each year in partnership with site managers, local communities, Traditional Owners and other stakeholder groups. They identify environmental assets and ecosystem functions requiring water. They consider the objectives of the long-term watering plans, climate conditions, outlooks for the coming year and previous watering regimes.

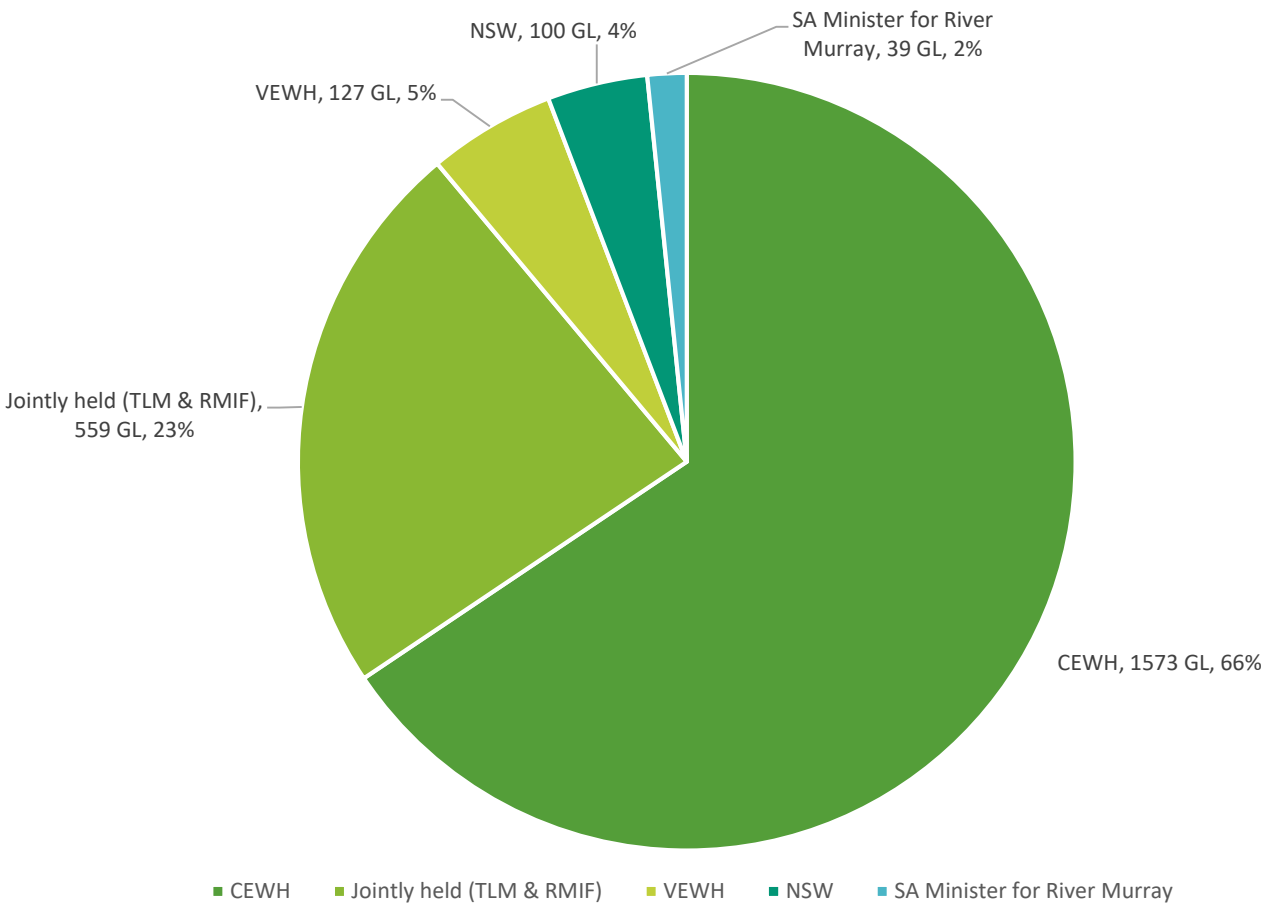
The Commonwealth Environmental Water Holder undertakes a similar approach to develop annual portfolio management plans. Regional watering priorities are then used as an input to inform the setting of Basin-scale annual priorities.

Appendix - Who holds and manages water for the environment

At 30 June 2019 the total volume of water for the environment held in the Murray-Darling Basin is 3,032 GL/year. Of this, 2,481 GL/year is held for use in the southern connected Basin (82 percent).

Importantly, these volumes are in long-term diversion limit equivalent volume terms, not what is actually allocated each year. The allocation in 2019-20 against held entitlements was much less at 1,127 GL, reflecting several dry years and low storage levels.

2,481 GL/year in the Southern Connected Basin:



Total long-term average volume of water for the environment held by each water holder in the southern connected basin as at June 30, 2019. Jointly held water volumes include 489 GL TLM and 70 GL RMIF.

Water holders include:
CEWH: Commonwealth Environmental Water Holder
VEWH: Victorian Environmental Water Holder
NSW DPIE: New South Wales Department of Planning, Industry and Environment
SA DEW: South Australian Department of Environment and Water
Jointly held: The Living Murray (TLM): Commonwealth, VIC, NSW, SA (489 GL)
Jointly held: River Murray Increased Flows, Snowy Scheme (RMIF) : VIC, NSW (70 GL)

Appendix – Measuring water used

Water held for the environment uses the same entitlement framework as consumptive users, including the same state allocation systems that apply to all other water users.

All environmental water delivered in the River Murray system from environmental entitlements is measured. Where this water is released from a storage, it is measured at the Dam wall. Where the water is delivered to a wetland via a pipe or regulator, it is measured using an Australian Standard meter or gauge. Where this water is delivered onto floodplains via overbank flows or multiple flow points, this water is measured using calibrated computer models that conservatively estimate how much water leaves the river channel and how much returns.

Water used in in wetlands and floodplain forests is debited against water entitlements held specifically for the environment. States have arrangements in place to ensure environmental water holders are responsible for any losses during overbank watering and these are factored into their orders. This means the environmental water holders can water wetlands and floodplain forests without impacting on the water availability of other water users.

Where the delivery of water for the environment results in an increase in the river conveyance loss for the River Murray System, this increase in loss is charged to environmental water holders to prevent any impact on other water users and entitlement holders.

Water is measured as it flows into Koondrook-Perricoota Forest at the inlet flow regulator (Photo: NSW Forestry)

Appendix – Water delivery by location

Table of 2019-20 environmental water use (GL) in the southern Basin. Figures drawn from Basin Plan Annual Reporting, Matter 9.3.

Site or watering event description	Primary ecological purpose	Joint (TLM & RMIF)	CEWH	VEWH	NSW	SA	Total
Ovens River	Fish; Longitudinal connectivity	0.0	0.1	0.04	0.0	0.0	**0.2**
Barmah-Millewa	Ecosystem processes; Waterbirds; Fish; Vegetation	122.0	238.8	0.0	5.7	0.0	**366.4**
Niemur; Yallakool-Wakool	Fish	0.0	12.1	0.0	0.04	0.0	**12.2**
Broken System	Fish; Vegetation	0.0	18.3	18.4	0.0	0.0	**36.7**
Goulburn System	Vegetation; Fish	24.9	320.8	57.4	0.0	0.0	**403.1**
Campaspe System	Water quality	0.0	3.6	17.2	0.0	0.0	**20.8**
Gunbower Creek	Fish	0.0	21.2	0.0	0.0	0.0	**21.2**
Gunbower Forest	Fish; Vegetation; Waterbirds; Lateral Connectivity	2.2	0.0	2.3	0.0	0.0	**4.4**
Koondrook-Perricoota Forest	Vegetation	27.6	0.0	0.0	0.0	0.0	**27.6**
Koondrook-Perricoota Forest: Pollack	Waterbirds	0.0	2.0	0.0	0.0	0.0	**2.0**
Loddon System	Fish; Other	0.0	1.1	14.3	0.0	0.0	**15.4**
Murrumbidge System	Waterbirds; Fish; Vegetation	0.0	48.3	0.0	32.2	0.0	**80.5**
Hattah Lakes	Vegetation	5.7	0.0	7.2	0.0	0.0	**12.8**
Lindsay-Mulcra-Wallpolla	Ecosystem processes	0.0	0.0	4.0	0.0	0.0	**4.0**
NSW/Vic Weirpool Manipulations	Ecosystem Processes	0.0	0.8	0.0	0.0	0.0	**0.8**
Other NSW Murray Wetlands and Creeks	Waterbirds; Resilience; Vegetation; Ecosystem Processes	0.0	5.2	0.0	17.3	0.0	**22.5**
Other Victorian Murray Wetlands	Vegetation; Fish; Waterbirds	0.0	0.0	20.2	0.0	0.0	**20.2**
Other South Australian Murray Wetlands	Fish; Vegetation; Lateral and Longitudinal Connectivity	0.0	9.8	0.0	0.0	40.1	**49.9**
Chowilla Floodplain	Vegetation	8.3	0.0	0.0	0.0	0.0	**8.3**
Lower Lakes, Coorong and Murray Mouth	End of Basin Flows; Waterbirds	112.6	749.9	60.4	0.0	6.5	**929.5**
Total		**303.1**	**1432.2**	**201.4**	**55.2**	**46.6**	**2038**

Appendix – Jointly held water portfolio overview

The Living Murray (208.7 GL was available for use)

Location	Entitlement volume (GL)	Net carryover (GL)	Allocation (%)	Allocation (GL)	Available (carryover + allocation) (GL)
NSW Murray High Security	5.1	0.0	97%	5.0	5.0
NSW Murray General Security	83.0	28.1	3%	2.5	30.6
NSW Murrumbidgee General Security	85.0	0.1	11%	9.4	9.4
NSW Lower Darling High Security	0.5	0.0	100%	0.5	0.5
NSW Lower Darling General Security	47.8	10.0	30%	14.3	24.4
Vic Murray High Reliability	21.9	14.6	66%	14.4	29.0
Vic Murray Low Reliability	101.8	0.0	0%	0.0	0.0
Victoria Goulburn High Reliability	45.2	13.6	80%	36.1	49.8
Victoria Goulburn Low Reliability	157.0	15.0	0%	0.0	15.0
Victoria Campaspe High Reliability	0.1	0.0	80%	0.1	0.1
Victoria Campaspe Low Reliability	5.0	0.0	0%	0.0	0.0
South Australia Murray Valley	45.0	0.0	100%	45.0	45.0
SUB-TOTAL	**597.5**	**81.4**	n/a	**127.3**	**208.7**
Supplementary & unregulated licences	397.3	0.0	0.0	n/a	n/a
GRAND TOTAL	**994.8**	**81.4**	n/a	**127.3**	**208.7**

River Murray Increased Flows (108.4 GL was available for use)

Location	RMIF carryover in River Murray Storages at beginning of 2019-20 (GL)*	RMIF used in 2019-20 (GL)	RMIF in River Murray Storages at the end of 2019-20 (GL)	RMIF in Snowy storages (as at 1 May 2020)# (GL)
NSW Murray	50.37	49.04	1.33	159.5
Victorian Murray	58.2	49.74	8.28	159.5
TOTAL	**108.39**	**98.78**	**9.61**	**319**

**RMIF available is associated with release of additional water by Snowy Hydro in 2017-18 which was classified as RMIF by SCBEWC (as per rules governing RMIF). 315 GL of RMIF was originally available which had reduced as a result of delivery in previous years.*
#RMIF in Snowy is made up of 278 GL from the start of 2019-20 plus 41 GL of new 2019-20 RMIF allocation transferred into the RMIF account.

Appendix - Acronyms used within this report

AWA	Aboriginal Waterways Assessment
AHD	Australian Height Datum
CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cwlth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment
GBCMA	Goulburn Broken Catchment Management Authority
GL	Gigalitre (GL) = 1 billion litres
IVT	Inter-valley transfer
Jurisdictions	Partner governments including the Commonwealth, NSW, VIC, and SA
LEO	Local engagement officer (CEWO)
LLCMM	Lower Lakes, Coorong and Murray Mouth
LTIM	Long Term Intervention Monitoring
MDBA	Murray-Darling Basin Authority
ML	Megalitre (ML) = 1 million litres; ML/d = megalitres per day
MLDRIN	Murray Lower Darling Rivers Indigenous Nations
NBAN	Northern Basin Aboriginal Nations
NCCMA	North Central Catchment Management Authority
NSW	New South Wales
NSW DPIE	New South Wales Department of Planning, Industry and Environment
QSA	Discharge of River Murray flow at the South Australian border
REO	Regional Engagement Officer (MDBA)
RMIF	River Murray Increased Flow
RMUF	River Murray Unregulated Flows
SA	South Australia
SA DEW	South Australian Department of Environment and Water
SARDI	South Australian Research and Development Institute
SCB	Southern connected Basin
SCBEWC	Southern Connected Basin Environmental Watering Committee
SDLAM	Sustainability Diversion Limit Adjustment Mechanism
TLM	The Living Murray
VEWH	Victorian Environmental Water Holder
Vic DEWLP	Victorian Department of Environment, Water, Land and Planning

Swans, at Coombool Swamp, Chowilla (Source: J Whittle)

Thank you

The effective management of water for the environment relies on the contributions and efforts of many land and water organisations and communities across the southern Basin.

Australian Government

Commonwealth Environmental Water Office