



Australian Government

Commonwealth Environmental Water Office

Commonwealth Environmental Water

Portfolio Management Plan

# Murrumbidgee River Valley

2018–19



**Front cover image credit:**

Mercedes swamp – Yanga National Park, Photo by Skye Wassens, Charles Sturt University.

**Back cover image credit:**

Back cover image credit: Macquarie River turtle, Wagourah Lagoon - Yanga National Park, Photo by Ben Wolfenden, Charles Sturt University.

**Acknowledgement of the traditional owners of the Murray-Darling Basin**

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# Commonwealth environmental water portfolio management planning

## Commonwealth Environmental Water Holder

The Commonwealth Environmental Water Holder is a statutory position established under the *Water Act 2007* and is responsible for managing the Commonwealth's environmental water holdings. This water must be managed to protect and restore the rivers, wetlands and floodplains (and the native animals and plants they support) of the Murray–Darling Basin. Ms Jody Swirepik is the current Commonwealth Environmental Water Holder. Ms Swirepik is supported by staff of the Commonwealth Environmental Water Office. The Office employs six local engagement officers who live and work in regional centres across the Murray–Darling Basin.

## Commonwealth environmental water

Commonwealth environmental water holdings are water entitlements that have been acquired by the Australian Government through investments in water-saving infrastructure and purchases on the water market. The holdings are a mix of entitlement types held across 19 catchments. The rules governing the entitlements vary across states and across catchments. Commonwealth environmental water entitlements are subject to the same fees, allocations, carryover and other rules as equivalent entitlements held by other water users.

There are broadly three options for managing Commonwealth environmental water:

- delivering water to a river or wetland to meet an identified environmental demand
- leaving water in storage and carrying it over for use in the next water year (referred to as 'carryover')
- trading water, that is, selling water and using the proceeds to buy water in another catchment or in a future year, or investing in complementary 'environmental activities'.

## Purpose of the document

This document sets out the plans for managing the Commonwealth environmental water portfolio in the Murrumbidgee catchment for 2018–19. Efficient and effective management of Commonwealth environmental water requires the utilisation of all portfolio management options. By taking a multi-year approach to planning, portfolio management tools such as use, carryover and trade can be managed for maximising environmental outcomes.

The portfolio management plans support transparent, coordinated and adaptive management of Commonwealth environmental water, consistent with the Basin-wide environmental watering strategy and having regard to the Basin annual environmental watering priorities.

To learn more about the planning approach see *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water, 2018–19* (available at: <http://www.environment.gov.au/water/cewo/publications> under 'Planning approach').

## Delivery partners

Commonwealth environmental water is managed in conjunction with and delivered by a range of partners. This portfolio management plan has been developed in consultation with our delivery partners, including New South Wales Office of Environment and Heritage, Department of Industries – Water, and Water NSW.

## Your input

The management of Commonwealth environmental water relies on considerable advice and assistance from local organisations, state governments and others. Individuals and groups within the Murray–Darling Basin community are encouraged to submit suggestions for the management of Commonwealth environmental water. Please contact the Office via: [ewater@environment.gov.au](mailto:ewater@environment.gov.au).

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# 1.Environmental watering in the Murrumbidgee catchment

## 1.1. The Murrumbidgee catchment

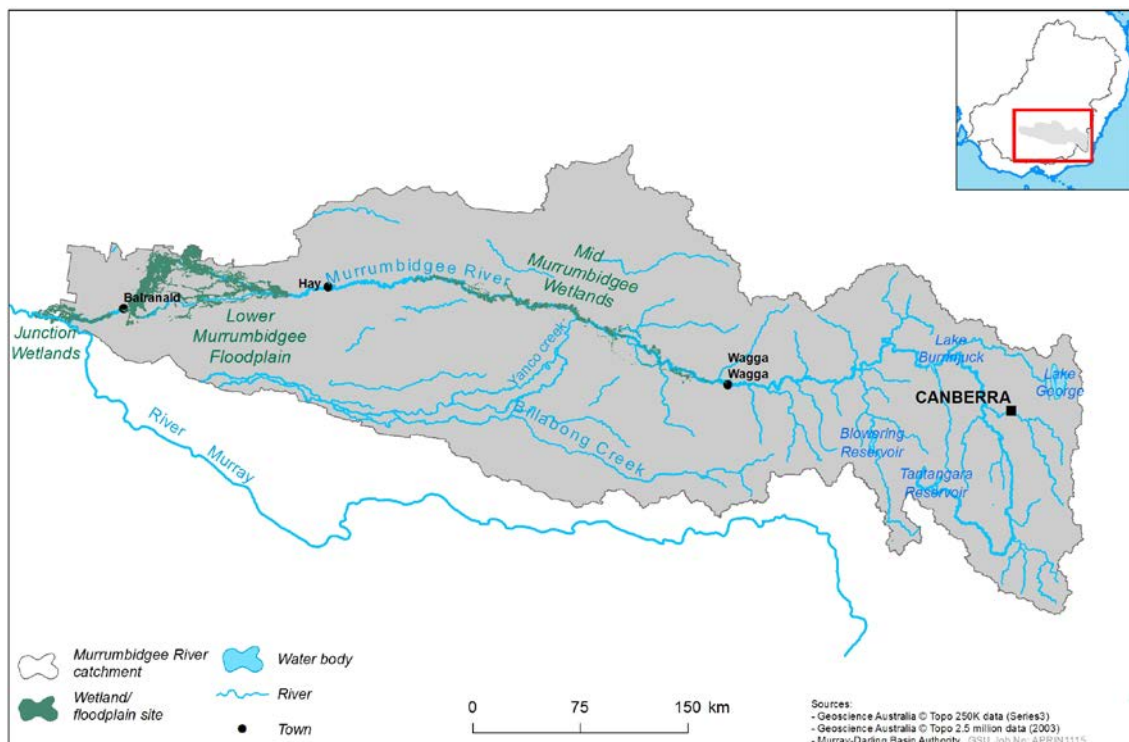
The Murrumbidgee catchment covers 84 000 square kilometres of southern New South Wales. It is bordered by the Great Dividing Range to the east, the Lachlan Catchment to the north and the Murray Catchment to the south (Green et al 2011). The river originates in the alpine area of Kosciuszko National Park and flows through the Monaro High Plains and the low-lying plains of the western Riverina, joining the River Murray south of Balranald.

Supporting a complex range of natural ecosystems, the Murrumbidgee catchment contains many significant in-channel and wetland habitats including the mid-Murrumbidgee and Lowbidgee wetlands, which provide important habitat for a range of aquatic and terrestrial species including frogs, fish and waterbirds.

The primary users of water in the region are the two major irrigation districts in the catchment—Murrumbidgee and Coleambally Irrigation Areas. Irrigation also occurs around Hay and Balranald in the west and in eastern parts of the catchment, including around Wagga Wagga.

Regulated water is provided by two major headwater storages, Burrinjuck Dam on the Murrumbidgee River and Blowering Dam on the Tumut River. Collectively these storages have a capacity of 2654 GL. Blowering Dam and Tantangara Reservoir catchments are also affected by the operation of the Snowy Mountains Hydro Electricity scheme.

Most of the flow in the Murrumbidgee River comes from the upper portion of the catchment, and is delivered by the main tributary rivers: Cotter, Yass, Molonglo, Queanbeyan, Bredbo, Numeralla, Goodradigbee and Tumut (Kingsford & Thomas 2001). Several tributaries located immediately downstream of the dams contribute significant inflows, including Adelong, Adjungbilly, Gilmore, Hillas, Tarcutta, Kyeamba, Jugiong, Muttama, Billabong and Houlaghans Creeks, and Goobarragandra River (Sinclair Knight Merz 2011). The middle and lower portions of the catchment do not contribute significant inflows.



**Figure 1:** A map of the Murrumbidgee River Catchment including major towns and headwater storage (courtesy of the Murray-Darling Basin Authority).

## 1.2. Environmental objectives in the Murrumbidgee catchment

The long-term environmental objectives for the Murray-Darling Basin are described in the Basin Plan's environmental watering plan and the Basin-wide environmental watering strategy, which includes 'quantified environmental expected outcomes' at both Basin-scale and for each catchment. In addition, the Basin annual environmental watering priorities (MDBA, 2017) represent annual steps to guide environmental watering to meet the long-term outcomes in the Basin-wide environmental watering strategy. The current priorities and expected outcomes relevant for the Lachlan catchment are described in Attachment A and Table 3.

Basin state governments are also developing long-term watering plans for each catchment. These plans will identify the priority environmental assets and ecosystem functions in the catchment, the objectives and targets for these assets and functions, and their watering requirements. Once developed, these plans will provide the key information on the long-term environmental water demands in the catchment. Prior to the development of long-term watering plans, the Office will continue to draw on existing documentation on environmental water demands developed by state governments, local natural resource management agencies and the Murray-Darling Basin Authority.

Based on these strategies and plans, and in response to best available knowledge drawing on the results of environmental watering monitoring program, the objectives for environmental watering in the Murrumbidgee catchment are summarised in Table 1 below. The objectives for water-dependent ecosystems will continue to be revised as part of the Commonwealth Environmental Water Office's commitment to adaptive management.

**Table 1:** Summary of objectives being targeted by environmental watering in the Murrumbidgee catchment

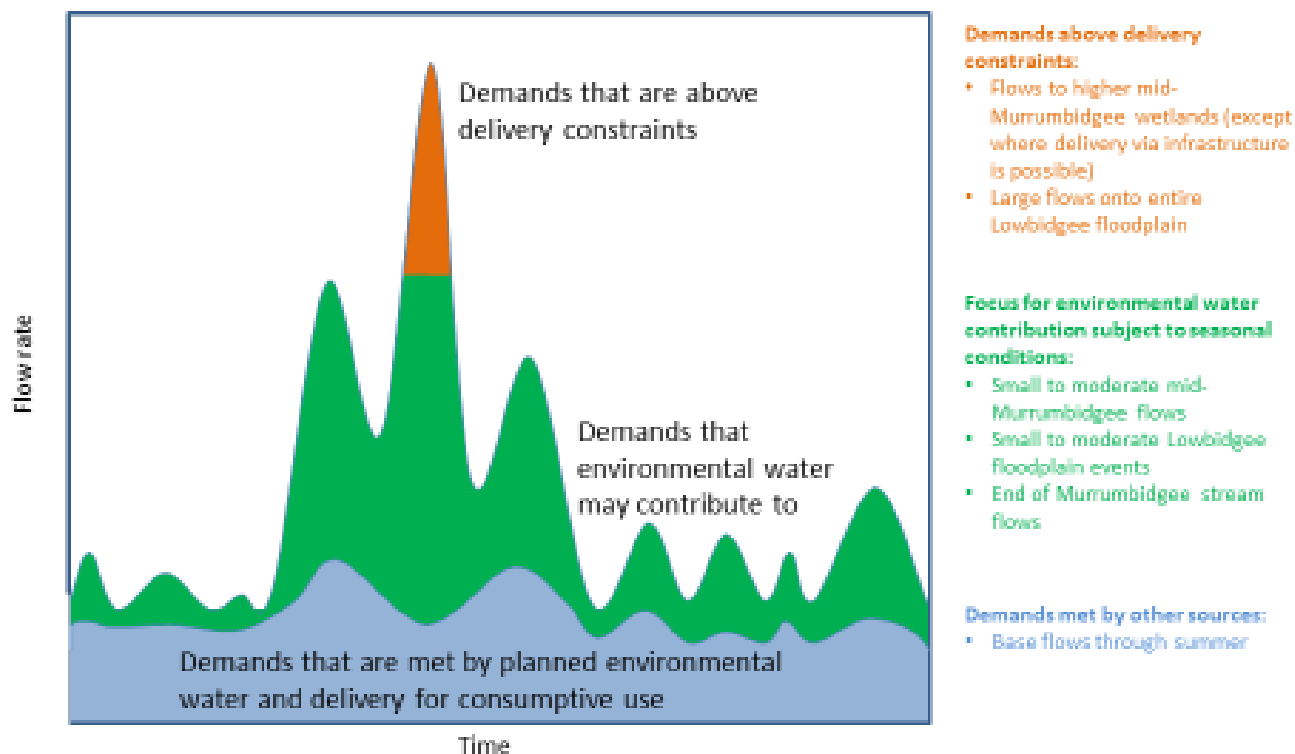
BASIN-WIDE OUTCOMES  (Outcomes in red link to the Basin-wide Environmental Watering Strategy)	OBJECTIVES FOR MURRUMBIDGEE ASSETS				
	IN-CHANNEL ASSETS	OFF-CHANNEL ASSETS			
	Murrumbidgee River channel	Yanco Creek system	Mid-Murrumbidgee Wetlands	Lowbidgee Floodplain Wetlands	Junction Wetlands
VEGETATION	Maintain and improve riparian and in-channel vegetation condition	Maintain and improve condition of wetland vegetation	Avoid further damage and to assist ecological capacity to recover	Maintain, improve and in some cases promote the recovery of wetland and floodplain vegetation diversity and condition	Avoid further damage and to assist ecological capacity to recover
WATERBIRDS		Provide habitat, including foraging habitat, to support survival and maintain the condition of waterbirds			
		Provide opportunities for waterbird breeding and support naturally triggered colonial bird breeding events that are in danger of failing due to drying.			
FISH	Provide flows, including restoring natural flow events that are affected by river regulation and/or extraction, to support habitat and food sources and promote increased movement, recruitment and survival of native fish.	Provide flows to support habitat and cues for increased movement, recruitment and survival of native fish (particularly for floodplain specialists).			
INVERTEBRATES	Provide habitat to support increased microinvertebrate and invertebrate survival, diversity, abundance and condition.				
OTHER VERTEBRATES	Provide habitat to support survival and maintain and improve the condition of frogs and turtles.				

BASIN-WIDE OUTCOMES  (Outcomes in red link to the Basin-wide Environmental Watering Strategy)	OBJECTIVES FOR MURRUMBIDGEE ASSETS				
	IN-CHANNEL ASSETS	OFF-CHANNEL ASSETS			
	Murrumbidgee River channel	Yanco Creek system	Mid-Murrumbidgee Wetlands	Lowbidgee Floodplain Wetlands	Junction Wetlands
CONNECTIVITY	Support longitudinal connectivity along the Murrumbidgee River, including end of system flows.  Support lateral connectivity (within constraints) to wetlands and floodplains	Support lateral connectivity (within constraints) between the river channel and wetlands and floodplains			
PROCESSES	Support primary productivity, nutrient and carbon cycling, biotic dispersal and movement				
WATER QUALITY	Provide refuge habitat from adverse water quality events (e.g. hypoxic blackwater)	Support water quality in off-channel assets in terms of Dissolved Oxygen (DO) and salinity  Support transport of salt and nutrients off the floodplain into the river channel and downstream.			
RESILIENCE		Provide drought refuge habitat			

Information sourced from: Charles Sturt University (2014); CEWO (2017); MDBA (2012a, b, c, 2014); DPI (2014); Roberts and Marston (2011); Sinclair Knight Merz (2011); and Wassens et al (2018)

### 1.3. Environmental flow requirements

Not all environmental demands can and will be met through the use of held environmental water. Some demands are met by regulated water deliveries for consumptive purposes and inter-valley transfers, while others are met by large unregulated/natural flows events or are beyond what can be delivered within operational constraints. Figure 2 shows the broad environmental demands that are in scope for Commonwealth environmental water. Importantly, these are broad, indicative demands and individual watering events may contribute to particular opportunities, such as using infrastructure to deliver water to individual wetlands that would otherwise not be possible due to constraints. Also, there may be opportunities for Basin State governments to remove or modify constraints, which will improve the efficiency and/or effectiveness of environmental watering. Further information on delivery constraints are described in [Attachment B](#).



**Figure 2:** A hydrograph showing the scope of demands that Commonwealth environmental water may contribute to in the Murrumbidgee region.

Low flows are often met by other sources of water, such as consumptive water deliveries. Conversely, very high flows are the result of unregulated or natural flows. Commonwealth environmental water cannot contribute to these high flows, as doing so would create unacceptable third party impacts. The focus for Commonwealth environmental watering is therefore on mid-range flows, such as small to moderate flows in the river and to assets such as the Mid-Murrumbidgee Wetlands and Lowbidgee Floodplain

Based on the above objectives and delivery constraints, specific watering requirements (flow magnitude, duration, timing and frequency) have been identified as being in scope for Commonwealth environmental water. These water requirements are described in Table 3. As with the objectives, the environmental water requirements will continue to be reviewed and revised in response to new knowledge.

#### 1.4. Monitoring and adaptive management

Operational monitoring is undertaken for all Commonwealth environmental watering actions and involves collecting on-ground data with regard to environmental water delivery such as volumes delivered, impact on the river systems hydrograph, area of inundation and river levels. It can also include observations of environmental outcomes.

The Long Term Intervention Monitoring (LTIM) Project is also being undertaken at sites in the mid-Murrumbidgee Wetlands, Lowbidgee Floodplain and Murrumbidgee River. It aims to understand the environmental response from Commonwealth environmental watering with respect to the targeted objectives.

Information on the monitoring activities is available at:

<http://www.environment.gov.au/water/cewo/catchment/murrumbidgee/monitoring>

Monitoring information is also provided by state governments and The Living Murray program.

Key findings and recommendations from the first three years (2014–17) of Long-term monitoring in the Murrumbidgee catchment (Wassens et al 2015, 2016, 2017) include:



- The addition of environmental water (including Commonwealth Environmental water) following the large un-regulated flow event of September 2016 and the subsequent blackwater event, is estimated to have resulted in dissolved oxygen levels beginning to increase to above lethal thresholds 18 days earlier than would have been the case if no environmental water had been delivered.
- The winter 2017 mid-Murrumbidgee wetland reconnection event, as well as successfully supporting wetland vegetation recovery in the mid-Murrumbidgee wetlands also inundated floodplains in the Lowbidgee and reconnected Yanga and Tala Lakes with the main river channel. This reconnection successfully supported the recruitment of very high numbers of golden perch in Yanga Lake in particular.
- Vegetation communities within wetlands that have received environmental water at least once over the past 3 years remain in very good condition. This is consistent with predictions that restoring a more natural inundation frequency through environmental watering will support the establishment and persistence of water dependent species to a far greater extent than unregulated flows alone.
- To increase opportunities for colonial waterbird breeding, environmental water should be used to inundate known colony sites and key foraging grounds for at least two months (August-September) before the commencement of the core breeding season; and where possible, maximise wetland inundation duration into summer with a slow rate of recession into autumn months (minimum of three to four months from egg laying plus post-fledgling care for most species). In following these recommendations, environmental water successfully supported waterbird breeding events to completion in 2014-15, 2015-16 and 2016-17, particularly for colonial waterbird breeding events in the Lowbidgee floodplain.
- Following colonial waterbird breeding events in the Lowbidgee floodplain and neighbouring wetlands (i.e. the Lower Lachlan and mid-Murray) environmental water should be prioritised for delivery to key foraging areas in months and the water year following large breeding events to promote the survival of first year birds which in turn will contribute to the maintenance of waterbird diversity and abundance across the MDB.
- Supporting the habitat requirements of waterbirds also creates conditions suitable for other native floodplain taxa, including microinvertebrates, fish, frogs, freshwater turtles and floodplain vegetation. Six frog species were recorded in 2016-17, including large numbers of southern bell frogs, which are listed as vulnerable under the EPBC Act.
- Three species of freshwater turtle and eight native fish species were recorded in wetlands that had received repeated environmental water. This demonstrates the value of repeat watering actions to improve refuge habitat for native fish, frogs and turtles.
- The maintenance of key refugia, in particular Telephone Creek, Wagourah Lagoon and associated creek lines through the Nimmie-Caria and Redbank systems, is critical to the long-term persistence of native fish, frog and turtle populations.

The outcomes from these monitoring activities are used to inform portfolio management planning and adaptive management decision-making as outlined in Section 2.

## 2. Portfolio management in 2018–19

In planning for the management of Commonwealth environmental water, the Commonwealth Environmental Water Office aims to maximize the outcomes achieved from the available water. This includes consideration of the urgency of demands (based on targeted objectives and watering requirements, watering history and asset condition) and the available supply under different resource scenarios. Plans for water delivery, trade and carryover are then made in a multi-year context, with an assessment also undertaken of need for water in future years.

This planning process is outlined in full in Table 3 below and summarised in the sections below.

### 2.1. Antecedent and current catchment conditions and the demand for environmental water in 2018–19

In 2017-18 the Murrumbidgee catchment experienced below average to average rainfall resulting in limited natural inundation along the Murrumbidgee system. Commonwealth and NSW environmental water successfully inundated low-level mid-Murrumbidgee wetlands in July and August 2017 to support their recovery. For the first time, return flows from the Commonwealth's held environmental water was recognised and protected from re-regulation in the Murray system downstream, contributing to outcomes for lamprey in the lower Murray and to maintenance of habitat and connectivity in the Coorong-Murray mouth.

Following the mid-Murrumbidgee wetland reconnection action, Commonwealth environmental water (together with NSW environmental water) focussed on and successfully provided flows to maintain refuge habitat for native fish and other aquatic fauna.

Environmental water demands for environmental assets in the Murrumbidgee catchment in 2018-19 are represented in Table 3 and summarised below:

**Mid-Murrumbidgee wetlands:** High demand. The mid-Murrumbidgee River Wetlands are a key environmental asset within the Basin. The condition of the mid-Murrumbidgee wetlands is generally poor due to a lack of repeated inundation. Natural flooding in September-October 2016 inundated many wetland assets, some for the first time in over four years and was followed up by the low-level inundation action in July-August 2017.

Environmental water is required this year to again reconnect low level wetlands with the main channel to continue the recent improvements in wetland vegetation condition; provide habitat for waterbirds, fish, turtles and frogs; and allow for movement and dispersal of aquatic animals.

Monitoring of ecological response at Yarradda Lagoon demonstrates the capacity for these assets to recover following repeat years of seasonal inundation.

Despite widespread natural flooding in 2016–17 and the low-level mid-Murrumbidgee inundation in 2017-18, the mid-Murrumbidgee wetlands and Lowbidgee floodplain water requirements remain out of phase. In the future, following further successful inundation and improvements in condition of the mid-Murrumbidgee wetlands it is anticipated environmental demand for these assets will be more closely aligned allowing a more whole of system watering strategy.

**Yanco Creek system:** Moderate demand. Wetland vegetation is generally in good condition, with inundation required this year or next to maintain this condition. Delivery for vegetation outcomes will also consider integration with native fish objectives.

**Lowbidgee floodplain wetlands:** Generally in moderate to good condition; environmental demand in 2018-19 at a system scale is driven by natural cues. Environmental water use in 2017-18 focussed on maintaining refuge habitat for vegetation, waterbirds, wetland fish, frogs and turtles. Environmental water use in recent years has improved the condition and resilience of water dependent vegetation in many wetlands across the Lowbidgee allowing them to respond to natural flood events.

Under a drier inflow scenario, the focus will be to maintain core refuge sites (a key recommendation from LTIM reporting (Wassens et al 2016)). Under moderate and wetter conditions, the aim is to continue to maintain and build resilience to wetland sites in the Redbank (including Yanga National Park), Nimmie-Caira, Fiddlers-Uara and Western Lakes management areas.

**Murrumbidgee River Channel, distributaries and anabranches:** Moderate demand overall; the condition of the native fish population in the lower Murrumbidgee River remains poor. Environmental water deliveries will focus on native fish condition and recruitment through improvements to fish passage and connectivity, aquatic habitat and riverine productivity.

Under very low or very high inflow scenarios Commonwealth environmental water will contribute to aquatic habitat refuge.

**Junction Wetlands:** High demand. Despite early environmental watering, followed by widespread natural flooding in 2016–17 the condition of the Junction Wetlands remains very poor due to a lack of repeated inundation. Any opportunity for inundation will help consolidate responses from environmental watering in 2015-16 and 2016-17, and unregulated flows in 2016-17.

### **Murray–Darling Basin Plan environmental watering priorities and the Murray–Darling Basin-wide environmental watering Strategy**

The Murray–Darling Basin Authority publish the *Basin annual environmental watering* priorities each year and in 2017–18 also published multi-year priorities. Commonwealth environmental water in the Murrumbidgee will contribute to the following multi-year environmental watering priorities and the 2018–19 Basin annual environmental watering priorities.

#### **Rolling, multi-year priorities**

- Support lateral and longitudinal connectivity;
- Maintain and improve the condition and promote recruitment of forests and woodlands;
- Improve the condition and extent of lignum shrublands;
- Improve the abundance and maintain the diversity of the Basin’s waterbird population;
- Support viable populations of threatened native fish, maximise opportunities for range expansion and establish new populations.

#### **2018-19 Annual Priorities**

- Support opportunities for lateral connectivity between the river and adjacent low-lying floodplains and wetlands to reinstate natural nutrient and carbon cycling process;
- Enable growth and maintain the condition of lignum shrublands;
- Provide flows to improve habitat and support waterbird breeding;
- Support viable populations of threatened native fish, maximise opportunities for range expansion and establish new populations.

In contributing to these demands, the Commonwealth Environmental Water Office will also be aiming to contribute to the expected outcomes in the Basin-wide environmental watering strategy (see [Attachment A](#)).

The Commonwealth Environmental Water Holder will not inundate private land without prior approval from land holders.

## **2.2. Water availability in 2018–19**

### **Forecasts of Commonwealth water allocations**

Allocations against Commonwealth water entitlements in the Murrumbidgee Catchment are determined by the NSW government and will vary depending on inflows. The following forecasts in Table 2 are based on the best available information including State forecasts and historical inflow scenarios.

**Table 2:** Forecasts of Commonwealth water allocations (including carryover) in 2018–19 in the Murrumbidgee River Valley as at 30 April 2018.

Entitlement type	Forecasts of Commonwealth water allocations (including carryover) in 2018–19 (GL) <sup>2</sup>					
	Very dry ←————→ Very wet					
	95 percentile	90 percentile	75 percentile	50 percentile	25 percentile	10 percentile
Murrumbidgee (general/high security and conveyance)	79	118	192	288	318	318
Murrumbidgee (supplementary) <sup>3</sup>	Nil	Up to 5	Up to 10	10 – 20	Up to 21.9	~ 21.9
Lowbidgee (supplementary) <sup>3</sup>	Nil	Up to 50	50 – 100	> 100	Up to 393	~ 393
<b>Total – Southern-Connected Basin<sup>1,4</sup></b>	<b>780</b>	<b>1123</b>	<b>1356</b>	<b>1578</b>	<b>1666</b>	<b>1595</b>

Notes:

1. The southern-connected Basin includes the Murrumbidgee, Murray, Lower Darling, Goulburn, Campaspe (excluding Coliban) and Loddon entitlements.
2. Forecasts for regulated catchments are given to the nearest whole gigalitre except where the entitlement held by the Commonwealth is below 1 GL.
3. Forecasts for Supplementary Access are indicative estimates only.
4. Total forecast water available in the southern-connected Basin assumes that in Victoria 100 per cent of water held in spillable accounts becomes available under a median or dry scenario and 50 per cent or less becomes available under wetter scenarios. These figures do not include supplementary, unregulated or ground water accruals in the southern-connected Basin.

The volume of Commonwealth environmental water likely to be carried over in the Murrumbidgee Catchment for use in 2018–19 is estimated to be approximately 41 GL. Total carryover in the southern-connected Basin is estimated to be 200-250 GL.

Information on allocations to Commonwealth environmental water holdings can be found at <http://www.environment.gov.au/water/cewo/portfolio-mgt/holdings-catchment> and is updated monthly.

### Water resource availability scenarios

Commonwealth environmental water is not managed in isolation. When considering the available resource to meet environmental demands, it is necessary to also factor in the resources managed by other entities and available to contribute to environmental objectives. Relevant resources include held environmental water managed by state government agencies, planned environmental water, natural and unregulated flows, conveyance water and consumptive water. Further detail on sources of environmental water in Murrumbidgee Catchment is provided in [Attachment C](#).

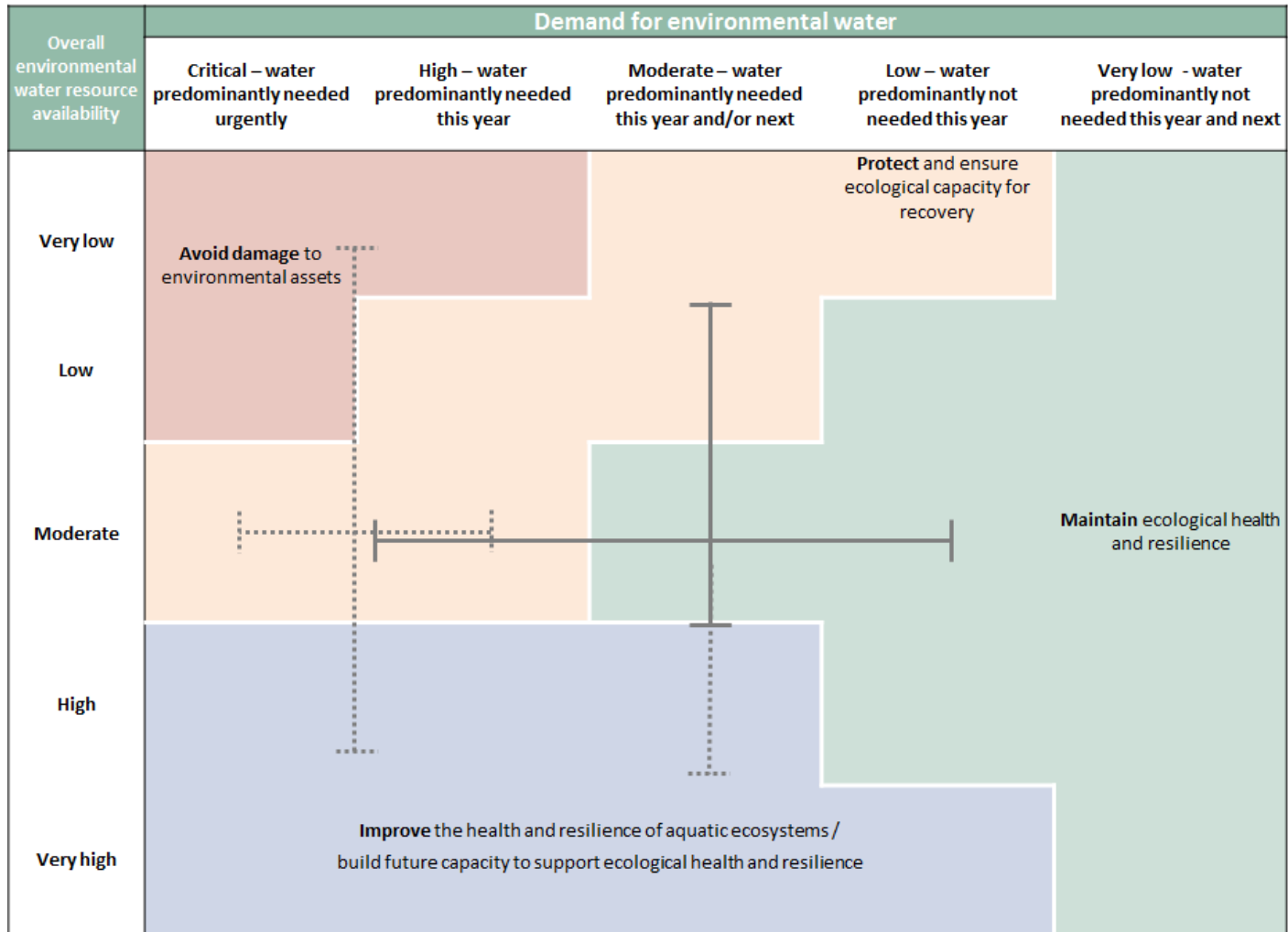
By combining the forecasts of water held by the Commonwealth with streamflow forecasts, as well as taking into account operational considerations, water resource availability scenarios can be developed ranging from very low to very high. Based on available information, low to moderate resource availability scenarios are in scope for 2018–19. High resource availability is only possible if conditions become wet.

## 2.3. Overall purpose of managing environmental water based on supply and demand

Environmental water needs (demand) and water availability (supply) both influence the overall purpose of Commonwealth environmental water management. Under different combinations, the management

purpose can range from ‘avoiding damage’ to the environment to ‘improving’ ecological health. This in turn informs the mix of portfolio management options that are suitable for maximizing outcomes. Figure 3 shows how current demands and forecasted supply are considered together.

The overall ‘purpose’ for managing the Commonwealth’s water portfolio in the Murrumbidgee Catchment for 2018–19 is to maintain critical refuge habitats – particularly in the Lowbidgee; maintain the ecological health and resilience of other important sites in the catchment; and to restore ecologically significant flow components impacted by river regulation. Under wetter conditions, improvement in ecological condition of important habitats will be in scope. The mid-Murrumbidgee wetlands, to protect and ensure their ecological capacity for recovery, remains a priority under all resource scenarios subject to available allocations.



**Figure 3:** Range of potential water resource availability and environmental demands in the Murrumbidgee region for 2018–19. Note: dotted lines represent the mid-Murrumbidgee wetlands while unbroken grey lines represent potential range in demand and resource availability for other assets in the catchment for the 2018-19 water year.

Further detail on how the overall purpose for portfolio management changes under different supply and demand scenarios is provided in *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water, 2018–19* (available at: <http://www.environment.gov.au/water/cewo/publications>).

## 2.4. Water Delivery in 2018–19

Consistent with the demands and purpose described above, the Office is considering supplying environmental water to the following watering actions for 2018-19. In planning watering actions, the Office has prioritised actions that follow natural cues and inflow scenarios to mimic natural inundation of key



environmental assets, if these occur. Where key environmental assets are in poor ecological condition, the Office has prioritised actions to these assets if the inflow scenario does not meet the demand – subject to resource availability and other constraints. Refer to Table 3 and Table 4 for supporting information regarding the basis for determining these watering intentions.

A key priority for Commonwealth environmental water remains a low-level mid-Murrumbidgee wetlands reconnection event. The aim is to contribute to river flows and inundation of fringing wetlands to continue improvement and promote recovery of wetland vegetation communities, as well as maintain habitat and provide movement opportunities for waterbirds and native aquatic species (including fish, turtles, frogs and invertebrates). The action is subject to water availability, dam release capacities and assessment of potential third party impacts (refer Action 1 in [Attachment B](#) for operational considerations and limitations). The watering action would also contribute to downstream demands, including Yanco Creek, the Lowbidgee Floodplain including the Junction Wetlands and potentially the lower Murray. Subject to NSW government consideration and support, Commonwealth environmental water used in the Murrumbidgee River may again be credited as return flows for further environmental use downstream in the River Murray following the successful 2017-18 Bulk Entitlements Delivery trial. In the absence of such arrangements, the contribution the Murrumbidgee can make to the outcomes downstream in the Murray is limited except under very wet scenarios (where Lake Victoria is at capacity and the flow at the South Australian border is unregulated).

If the proposed reconnection action does not occur, Commonwealth environmental water may be pumped to individual high priority wetland assets in the mid-Murrumbidgee. See Action 2 in [Attachment B](#) for standard operational arrangements. It is important to note that it is not operationally feasible to pump to all wetland sites in the mid-Murrumbidgee as these are vast in number.

Commonwealth environmental water will also target environmental assets in the Murrumbidgee River, Yanco Creek and across the Lowbidgee Floodplain including the Junction Wetlands to maintain the condition and diversity of wetland vegetation communities, and provide habitat and recruitment opportunities for waterbirds, native fish, turtles and frogs. Timing and scale of these actions will be based on environmental demand and natural cues. Target species include, but are not limited to the southern bell frog (EPBC Act vulnerable), Murray cod (EPBC Act vulnerable), Australasian bittern (EPBC Act critically endangered) and eastern great egret (EPBC Act migratory).

Appropriate follow-up watering to floodplain assets will help to further improve the condition and resilience of assets that have been stressed as a result lack of inundation. Building greater resilience in the system will help assets to maintain condition and function in dry years, and to respond well in wetter years. Providing environmental water in the next year will also help to support the successful recruitment of vegetation, waterbirds, fish and frogs following an increase in growth and reproduction in 2018-19, which will help to improve abundance and diversity in the coming years.

Under low water inflow scenarios, Commonwealth environmental water use in the Lowbidgee will target critical refuge habitats (including Waugorah Lagoon, Telephone Creek, Avalon Dam, Nimmie and Talpee Creeks). Critical habitat watering will consider extending flows to connect to permanent refuge lakes to prevent stranding larvae and juvenile native fish on the floodplain. Larger scale wetland and floodplain inundation including river-floodplain connection will be targeted under moderate and wet scenarios and through potential Lowbidgee supplementary access. The scale of watering will be informed by natural cues, subject to water availability. Target sites will include wetland and floodplain assets in North Redbank system, South Redbank (including Yanga National Park), Nimmie-Caira (Eulimbah, Telephone and Suicide floodways and Nap Nap Swamp) and potentially Fiddlers Creek and Western Lakes. See Action 4 in [Attachment B](#) for standard operational arrangements. In addition Commonwealth environmental water will opportunistically target the Junction Wetlands where feasible (Action 9 in [Attachment B](#)).

Watering actions that contribute to maintaining waterbird habitat within the Murrumbidgee catchment, and potentially link to waterbird habitat in other parts of the Basin (e.g. across the Macquarie, Lachlan, and Mid-Murray catchments (see [Waterbird breeding & movements](#) (CSIRO, 2016))), may also be targeted under moderate - wetter scenarios.

River-floodplain connectivity in the lower Murrumbidgee may be supported by in-channel flows targeting native fish movement and recruitment and in-channel productivity.

## Stakeholder Feedback

Stakeholder feedback, particularly from the lower Murrumbidgee, has again endorsed watering actions for 2018-19.

Proposed watering actions have been developed in conjunction with the NSW Office of Environment and Heritage, other NSW agencies and Charles Sturt University, who are contracted to provide the Long Term Intervention Monitoring program in the Murrumbidgee.

### 2.5. Trading water in 2018–19

In 2018–19, administrative transfers may be required between Commonwealth environmental water accounts to enable environmental water delivery. Based upon water resource availability at the time of the watering event and scale of the event, this may include:

- transfers in the order of ~30 GL within, into or out of the Murrumbidgee trade zone 13, if required and allowable given trade limits at time; and
- under a high water availability scenario, transfers in the order of >100 GL within the Murrumbidgee, due to the large scale of environmental watering activities.

Planning on water trade considers supply and demand within the catchment and across the Basin. As part of the planning process, the Commonwealth Environmental Water Office undertakes a Basin-wide analysis to identify opportunities to use allocation trade to better match differing demands across catchments.

Potential for the commercial trade of Commonwealth water allocation will be reviewed throughout the water year. The Commonwealth Environmental Water Holder will inform the market of any intention to trade allocation if the conditions precedent for a sale or purchase are met.

Further information will be provided to the market ahead of any trade of Commonwealth environmental water at: <http://www.environment.gov.au/water/cewo/trade/current-trading-actions>

For more information on the rules and procedures governing the trade of Commonwealth environmental water, see the *Commonwealth environmental water Trading Framework* available at: <http://www.environment.gov.au/water/cewo/publications/water-trading-framework-nov2016>

### 2.6. Carrying over water for use in 2019–20

The volume of water carried over for use in 2019–20 will depend upon resource availability and demand throughout the year. As the 2018–19 water year progresses, a carryover target will be determined for the Murrumbidgee Catchment, sufficient to meet early season requirements. As documented in Table 3 below, potential demands in 2019–20 include:

- winter-spring watering of the mid-Murrumbidgee wetlands
- Lowbidgee Floodplain and Junction Wetlands watering actions
- restoring ecologically significant flow components impacted by river regulation to support native fish.

This volume is also reserved as a contingency volume for use in 2018–19 should there be insufficient allocations available and there is a critical need for environmental water (e.g. hypoxic blackwater or waterbird breeding event).

Carryover volumes will be adjusted throughout the year as the season unfolds in response to both current and future demands and the water available to meet these demands. These decisions will be based upon best information available at the time.

Given the connected nature of southern Murray–Darling Basin catchments and the varying carryover, account and use limits, carryover is considered at a broader scale than just the Murrumbidgee Catchment.

More information on how the Commonwealth makes decisions on carryover is here: <http://www.environment.gov.au/water/cewo/portfolio-mgt/carryover>

## 2.7. Identifying Investment Opportunities

Under the Water Act the Commonwealth Environmental Water Holder (CEWH) has the flexibility to use the proceeds from the sale of water allocations to fund environmental activities in the Basin. 'Environmental activities' should improve the capacity of the CEWH to meet the objectives of the Basin Plan environmental watering plan.

Environmental Activities must also be consistent with:

- o the CEWH's obligation to exercise its functions to protect and restore environmental assets; and
- o the requirement to use Special Account funds (including trade proceeds) to cover costs incurred in the performance of the CEWH's functions.

The CEWH is in the process of developing an Investment Framework to guide decisions on what types of environmental activities may be considered when investing the proceeds from the sale of environmental water allocations.

**Table 3:** Environmental demands, priority for watering in 2018–19 and outlook for coming year in the Murrumbidgee catchment.

Environmental assets	Indicative demand (for <u>all sources of water</u> in the system) <sup>1</sup>		Watering history	2018–19		Implications for future demands
	Flow/Volume	Required frequency (maximum dry interval)	(from all sources of water) The Murrumbidgee catchment benefited from a major rain (unregulated) event in spring (Sep) 2016 which resulted in good natural flow events during Sep-Oct 2016	Environmental demands for water	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2019–20 if watering occurred as planned in 2018–19
Mid-Murrumbidgee Wetlands <sup>2</sup>	Pumping to individual high priority wetland assets targeting wetland vegetation and maintenance of aquatic refuge habitat	8 in every 10 years – annual (2 years)	Demand met or partially met over the last 4 years	HIGH to maintain established aquatic habitat. However overbank connection is preferred	A high potential for water use under Low to Moderate inflow scenarios Up to 10 GL	HIGH
	Tombullen storage releases to augment flows over 12 GL/day at Darlington Point	7–8 in every 10 years (2 years)	Demand met or partially met over the last 3 years	HIGH. The condition of the mid-Murrumbidgee wetlands is generally poor due to a lack of inundation.	A high potential for water use under Low to High inflow scenarios Up to 10 GL per event	HIGH
	Minimum of 15 GL/day @ Darlington Point for 3–5 days plus a gradual recession targeting low-lying wetland vegetation and aquatic habitat up to 230 GL	7–8 in every 10 years (2 years)	Demand met over the last 2 years	HIGH. The condition of the mid-Murrumbidgee wetlands is generally poor due to a lack of inundation.	Up to 150 GL under Moderate to High inflow scenarios planned for autumn/spring 2019 subject to available allocations	HIGH
Mid-Murrumbidgee Ramsar sites (Fivebough and Tuckerbil wetlands)	Fivebough 500ML to inundate 60% of wetland.  Tuckerbil 500 ML to fill	Fivebough: Shallow water 9 in every 10 years.  Fill Tuckerbil 4 of every 10 years	Fivebough: Demand met over the last 4 years. Tuckerbil: Demand met over last three years	HIGH. Required to maintain ecological character under Ramsar	High Potential for water use Up to 1000 ML under Low to Moderate inflow scenarios	HIGH
Yanco Creek System	Up to 25 GL, targeting up to 1400 ML/day @ Yanco Creek off-take targeting low-lying wetland vegetation and aquatic habitat and native fish	3 in every 10 years (3 years)	Demand met over the last 3 years	LOW Watering, following natural cues, required to maintain the good condition of wetland-floodplain vegetation	Possible supplementary use under Low to Moderate inflow scenarios	MODERATE, subject to natural cues
Lowbidgee - Core refuge and permanent aquatic habitat sites	Up to 20 GL targeting critical refuge habitat requirements	Annual	Demand met over the last 4 years	HIGH Annual watering required for critical habitat requirements	High Potential only for critical/permanent habitats Up to 20 GL under Very Low to Moderate inflow scenarios	HIGH

<sup>1</sup> Volumes may be limited by current channel constraints. Roberts and Marston (2011), Hardwick and Maguire (2012), Alluvium (2013)

<sup>2</sup> Note: Difference in filling height (i.e. flows required to fill a wetland) vary among the lagoons that make up the mid-Murrumbidgee wetlands, and so their condition and watering requirements vary accordingly


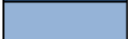


<b>Lowbidgee - North Redbank</b>	Up to 35 GL targeting wetland vegetation and habitat for native fish, frogs, turtles and waterbirds	River red gum forest and spike rush wetlands 1-3 years (3 years)	Met or partially met over the last 4 years	LOW Watering following natural cues, to maintain the good condition of wetland-floodplain vegetation	Low Potential for wetland inundation Up to 20 GL under Moderate to High inflow scenarios	MODERATE, subject to natural cues
<b>Lowbidgee - Yanga National Park</b>	Up to 40 GL targeting wetland vegetation and habitat for native fish, frogs, turtles and waterbirds	River red gum forest and spike rush wetlands 1-3 years (3 years)	Met or partially met over the last 4 years	MODERATE Watering following natural cues to maintain the good condition of wetland-floodplain vegetation	Moderate Potential for wetland inundation Up to 20 GL under Moderate to High inflow scenarios	MODERATE, subject to natural cues
<b>Lowbidgee - Nimmie-Caira</b>	Up to 55 GL targeting wetland vegetation and habitat for native fish, frogs, turtles and waterbirds	Refuge habitat annual Lignum dominated wetlands 1 to 5 years, with duration of up to 7 months	Met or partially met over the last 4 years	HIGH Watering following natural cues to maintain the good condition of wetland-floodplain vegetation	High Potential for wetland inundation Up to 30 GL under Moderate to High inflow scenarios	MODERATE, subject to natural cues
<b>Lowbidgee - Fiddler-Uara</b>	Up to 20 GL targeting wetland vegetation and habitat for native fish, frogs, turtles and waterbirds	Black box and lignum wetlands every 3 to 7 years	Met 2 out of the last 4 years	MODERATE Watering following natural cues to maintain the good condition of wetland-floodplain vegetation	Moderate Potential for wetland inundation Up to 10 GL under Moderate to High inflow scenarios	MODERATE, subject to natural cues
<b>Lowbidgee - Western Lakes</b>	Up to 15 GL to maintain open water habitats and floodplain vegetation	Wetland habitats and open water, black box and lignum wetlands every 3 to 7 years	Met or partially met over the last 4 years	LOW Watering following natural cues, to maintain the good condition of wetland-floodplain vegetation	Low Potential Up to 10 GL under High inflow scenario	MODERATE, subject to natural cues
<b>Lowbidgee full system watering</b>	Up to 180 GL for Basin-wide waterbird habitat and future population recovery. Improve overall condition of the floodplain	Opportunistic based on natural occurring rain and flow events	Met or partially met over the last 4 years	HIGH Improve the complexity and health of priority waterbird habitat to maintain species richness and aid future population recovery	Low Potential Up to 90 GL under High inflow scenario	HIGH
<b>Murrumbidgee River channel, distributaries and anabranches</b>	Winter-spring in-channel flows (base flows and freshes) in the Murrumbidgee River targeting critical flow components for native fish spawning, movement and recruitment and in-stream vegetation	7 in every 10 years	Met or partially met over the last 4 years	LOW Watering following natural cues, required to continue recovery of native fish populations.	Low Potential Likely to be achieved by other environmental watering actions and other sources of water	Low








	Moderate in-channel pulse targeting native fish movement and recruitment, productivity and in-stream vegetation (flows >3500 ML/day at Balranald) up to 50 GL	7 in every 10 years	Met 2 out of the last 4 years	HIGH Native fish populations in the lower Murrumbidgee River are in poor condition. Water required for improved fish passage and connectivity, aquatic habitat and riverine productivity	High Potential Up to 40 GL under Moderate to High inflow scenarios	MODERATE
	Distributary and anabranch freshes to restore flow components most impacted by river regulation and support native fish up to 15 GL	7 in every 10 years to annual	Demand met 2 out of the last 4 years	MODERATE Watering following natural cues to maintain the good condition of wetland-floodplain vegetation	Moderate potential subject to natural cues up to 10 GL	MODERATE, subject to natural cues
	Contribute to managing water quality issues within in-stream and wetland environments across the Murrumbidgee Catchment	Contingency in response to poor water quality	As required	HIGH Provide refuge habitat for aquatic animals due to poor water quality, including potential hypoxic conditions.	Contingency in response to poor water quality/aquatic habitat availability.	HIGH (Contingency)
Junction Wetlands	Flows greater than 5 GL/day @ d/s Balranald Weir and >10 GL/day @ Murrumbidgee confluence on the Murray targeting wetland vegetation and habitat for native fish, frogs, turtles and waterbirds	5 in every 10 years	Demand met in 3 of the last 4 years	HIGH The condition of the Junction Wetland is generally poor due to a lack of inundation	HIGH Potential for watering through No-Take of Lowbidgee Supplementary allocations under Moderate to High inflow scenarios	HIGH
	Flows greater than 7 GL/day @ d/s Balranald Weir targeting wetland vegetation and habitat for native fish, frogs, turtles and waterbirds	5 in every 10 years	Demand met in 3 of the last 4 years	HIGH The condition of the Junction Wetland is generally poor due to a lack of inundation	HIGH Potential likely to be achieved by other environmental watering actions and also through No-Take of Lowbidgee Supplementary allocations under Moderate to High inflow scenarios	HIGH
	Pumping to individual high priority wetland assets targeting wetland vegetation and habitat for native fish, frogs, turtles and waterbirds	7-8 in every 10 years (2 years)	Demand met in 3 of the last 4 years	HIGH To maintain condition of aquatic habitat. However overbank connection is preferred	HIGH Potential for water use up to 2 GL under very Low to Moderate in flow scenarios	HIGH
				Carryover potential	Moderate proportion of available allocations expected to be carried into 2019-20, subject to Commonwealth Environmental Water Holdings at 30 June 2019, water resource availability and environmental watering actions undertaken in 2018-19.	Available allocations to be carried into 2018-19 will be identified in Murrumbidgee environmental water holdings at <a href="https://www.environment.gov.au/water/cewo/about/water-holdings">https://www.environment.gov.au/water/cewo/about/water-holdings</a> .

<b>Trade potential</b>	Subject to Inter-Valley Trade rules, availability and relative priority for use and carryover, it is expected that zero dollar portfolio transfers of Commonwealth water allocations between trade zones in the southern connected Basin will be examined to support environmental water delivery actions throughout the 2018-19 water year. Potential for the commercial trade of Commonwealth water allocation will be reviewed throughout the water year. The Commonwealth Environmental Water Holder will inform the market of any intention to trade allocation if the conditions precedent for a sale or purchase are met.	No expected urgency to augment available allocations in 2019-20. Potential to trade will depend on environmental demands and resource availability.
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**Key - potential watering in 2018–19**

	High priority for Commonwealth environmental watering (likely to receive water even under low water resource availability)
	Secondary priority for Commonwealth environmental watering (watering to occur only if natural trigger is met, or under moderate – high water resource availability); or water demand likely to be met via other means
	Low priority for Commonwealth environmental watering (under high – very high water resource availability)
	Unable to provide Commonwealth water due to constraints

**Key - urgency of environmental demands**

	critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage
	high demand for water i.e. needed in that particular year
	moderate demand for water i.e. water needed that particular year and/or next
	low demand for water i.e. water generally not needed that particular year
	very low demand for water i.e. water generally not needed that particular year or the following year

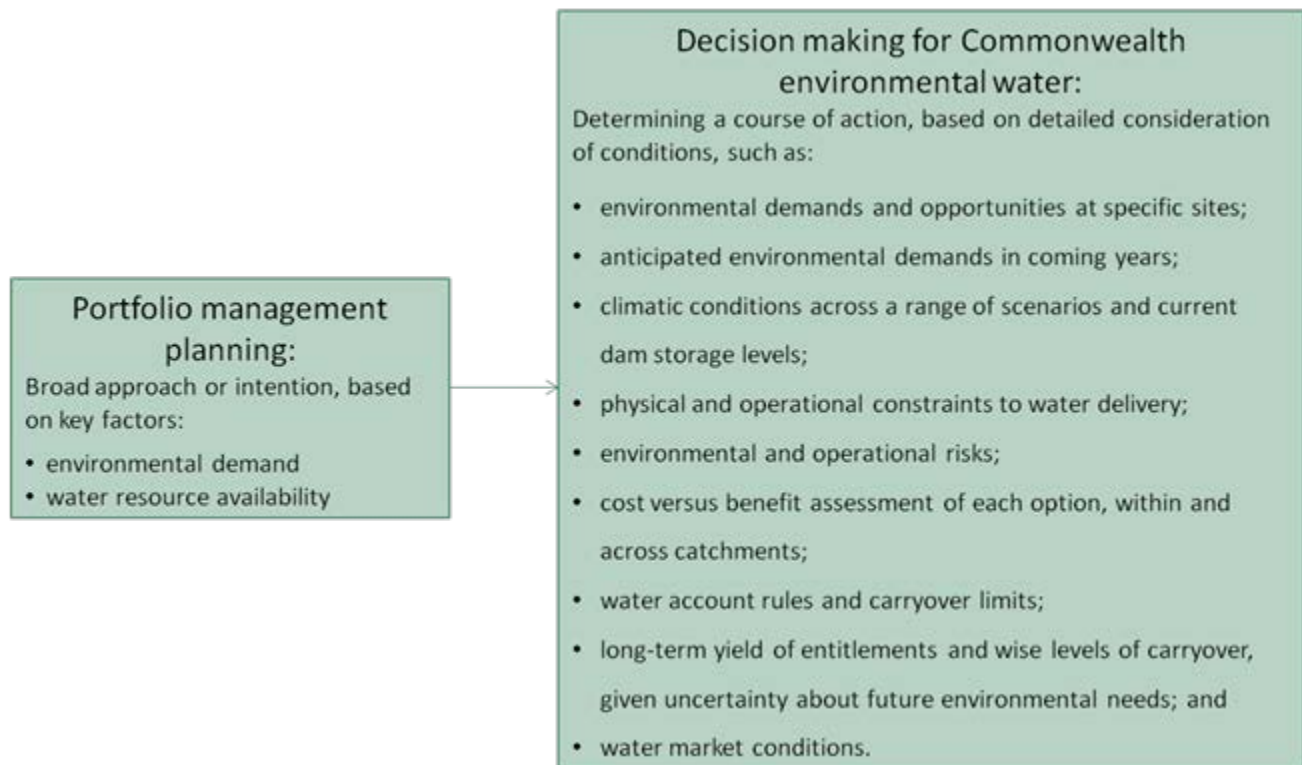
Note that demand is considered at a generalised scale; there may be specific requirements that are more or less urgent within the flow regime

## 3. Next steps

### 3.1. From planning to decision making

It is important to distinguish between planning and operational decision making. As shown in Figure 4, planning allows the Office to manage the environmental water portfolio in a holistic manner and is an exercise in developing a broad approach or intention, based on the key drivers (demand and supply).

Decision making throughout each year builds on the intention by considering in more detail the specific prevailing factors and additional factors such as costs, risks, and constraints to water delivery and market conditions.



**Figure 4:** A figure showing the factors which influence decisions involving the delivery, carryover and trade of Commonwealth environmental water, including known and anticipated environmental demands; the forecast climatic conditions; current dam storage levels; and opportunities for environmental watering at specific sites including a cost versus benefit assessment of each watering option. The physical and operational constraints to water delivery include environmental and operational risks, water account rules, carryover limits, long-term yield of entitlements and water market conditions

### 3.2. Further information

For further information on how the Office plans for water use, carryover and trade, please visit our web site: <http://www.environment.gov.au/water/cewo>

or the sites below:

- Water use: [www.environment.gov.au/topics/water/commonwealth-environmental-water-office/assessment-framework](http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office/assessment-framework)
- Carryover: <http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office/portfolio-management/carryover>
- Trade: <http://www.environment.gov.au/water/cewo/trade/trading-framework>

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# Attachment A – Expected outcomes from the Basin-wide environmental watering strategy

Expected outcomes from the Basin-wide environmental watering strategy (MDBA 2014) that are relevant to the Murrumbidgee catchment are described below.

## RIVER FLOWS AND CONNECTIVITY

- Baseflows are at least 60 per cent of the natural level
- Contributing to a 30 per cent overall increase in flows in the River Murray
- A 30–60 per cent increase in the frequency of freshes, bankfull and lowland floodplain flows

## VEGETATION

- Maintain the current extent of water-dependent vegetation near river channels and on low-lying areas of the floodplain.
- Improve condition of black box, river red gum and lignum shrublands
- Improved recruitment of trees within black box and river red gum communities
- Increased periods of growth for non-woody vegetation communities that closely fringe or occur within the river and creek channels

### Vegetation extent<sup>3</sup>

Area of river red gum (ha)	Area of black box (ha)	Shrublands	Non-woody water dependent vegetation
68 300	38 900	Lignum in the Lower Murrumbidgee	Closely fringing or occurring within the Murrumbidgee River, Billabong and Yanco creeks

### Black box condition

Vegetation condition score		Percent of vegetation assessed (within the managed floodplain)
0 – 6	>6 – 10	
54 per cent	46 per cent	73 per cent

### River red gum condition

Vegetation condition score					Percent of vegetation assessed (within the managed floodplain)
0 – 2	>2 – 4	>4 – 6	>6 – 8	>8 – 10	
3 per cent	8 per cent	22 per cent	40 per cent	27 per cent	93 per cent

## WATERBIRDS

- Maintain current species diversity
- Increase Basin-wide abundance of waterbirds by 20–25 per cent by 2024
- A 30–40 per cent increase in nests and broods (Basin-wide) for other waterbirds
- Up to 50 per cent more breeding events (Basin-wide) for colonial nesting waterbird species

<sup>3</sup> Area (ha) (+/- 10%) is based on Cunningham et al (2013), cited in MDBA (2014)

### Important Basin environmental assets for waterbirds in the Murrumbidgee

Environmental asset	Total abundance and diversity	Drought refuge	Colonial waterbird breeding	Shorebird abundance	In scope for Commonwealth watering
Fivebough Swamp	*			*	Yes
Lowbidgee floodplain	*	*	*	*	Yes

### FISH

- No loss of native species
- Improved population structure of key species through regular recruitment, including
  - Short-lived species with distribution and abundance at pre-2007 levels and breeding success every 1–2 years
  - Moderate to long-lived with a spread of age classes and annual recruitment in at least 80 per cent of years
- Increased movements of key species
- Expanded distribution of key species and populations

### Key species for the Murrumbidgee include:

Species	Specific outcomes	In-scope for Commonwealth water in the Murrumbidgee?
Flathead galaxias ( <i>Galaxias rostratus</i> )	Improve core range in additional locations, including the Murrumbidgee	Not until a population is established
Freshwater catfish ( <i>Tandanus tandanus</i> )	Expand the core range of current populations in Colombo-Billabong Creek	Yes
Golden perch ( <i>Macquaria ambigua</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Macquarie perch ( <i>Macquaria australasica</i> )	Expand current populations (candidate sites include Cotter River, Murrumbidgee above Cooma, Adjungbilly Creek).	No
Murray cod ( <i>Maccullochella peelii</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Olive perchlet ( <i>Ambassis agassizii</i> )	Olive perchlet are considered extinct in the southern Basin. Reintroduction using northern populations is the main option for recovery. Candidate sites may result from improved flow that reinstates suitable habitat in the mid-Murrumbidgee wetlands.	Restoration of flow to mid-Murrumbidgee wetlands could support the future reintroduction of the species.
River blackfish ( <i>Gadopsis marmoratus</i> )	Expand the range of current population in the Murrumbidgee River.	Yes

Species	Specific outcomes	In-scope for Commonwealth water in the Murrumbidgee?
Silver perch ( <i>Bidyanus bidyanus</i> )	Improve core range in Billabong–Yanco system and ACT reaches of the Murrumbidgee.	Yes, but only in the Billabong–Yanco system (ACT out of scope)
Southern purple-spotted gudgeon ( <i>Mogurnda adspersa</i> )	Establish 3–4 additional populations (candidate sites include the Murrumbidgee in Adjungbilly and Adelong Creeks).	No
Southern pygmy perch ( <i>Nannoperca australis</i> )	Establish additional populations in the lower Murrumbidgee wetlands	Only if additional populations are established
Trout cod ( <i>Maccullochella macquariensis</i> )	For the connected population of the Murrumbidgee–Murray–Edwards, continue downstream expansion.	Yes
Yarra pygmy perch ( <i>Nannoperca obscura</i> )	Establish additional populations (no specific locations identified)	Only if additional populations are established

#### Important Basin environmental assets for native fish in the Murrumbidgee

Environmental asset	Key movement corridors	High Biodiversity	Site of other Significance	Key site of hydrodynamic diversity	Threatened species	Dry period / drought refuge	In-scope for Commonwealth e-water
Lowbidgee Floodplain			*				Y
Murrumbidgee main channel (including upland reaches)	*		*		*		Y (d/s of storages)
Upland Murrumbidgee main channel	*		*		*		N
Cotter River			*		*		N
Billabong–Yanco–Colombo Creeks		*	*	*	*	*	Y

# Attachment B –Operational details for watering

## Operational considerations in the Murrumbidgee catchment

The delivery of environmental water in the Murrumbidgee River Valley is currently constrained by the release capacities from storages and channel capacities. The Water Sharing Plan for the Murrumbidgee River Regulated Water Source includes river channel capacity constraints on maximum flows (NSW Legislation 2003; DPI 2015). This includes:

- Flows in the Murrumbidgee River at Gundagai are limited to less than 29,500 ML/day to prevent inundation of Tenandra Bridge on the Mundarlo Road near Gundagai.
- Flows in Tumut River are limited to less than 9000 ML/day at Oddy's Bridge and 9300 ML/day at Tumut to minimise bank erosion.
- Yanco Weir diversion is currently limited by the Water Sharing Plan to 1400 ML/day to Yanco Creek. This limit reflects loss rates within Yanco Creek, not a flooding threshold, and may be relaxed subject to NSW Minister (or delegate) approval.
- Release capacities of storages may constrain the magnitude of augmentation.
- Environmental watering actions may inundate areas of low-lying private property and impact on riparian landholders by restricting access to land and/or stock or by causing damage to crops, stock, or private infrastructure.
- Channel capacity may limit environmental water delivery

In 2017, Water NSW managed environmental flows to a maximum of 23,000 ML/day at Wagga Wagga for the winter mid-Murrumbidgee wetland reconnection action with significant coordination and notification of potentially affected landowners by NSW OEH. No landholder complaints or third party impacts were reported or observed. Historically, releases for irrigation water supply have been made at flow rates of up to 23,000 ML/day.

The Murray-Darling Basin Authority (2015) published the Murrumbidgee reach report: Constraints Management Strategy which provides further information about constraints in the Murrumbidgee catchment.

## Potential watering actions under different inflow scenarios

Under certain levels of water resource availability and inflow scenarios, watering actions may not be pursued for a variety of reasons, including that environmental demand may be met by unregulated flows and that constraints and/or risks may limit the ability to deliver environmental water. Table 4 identifies the range of potential watering actions in the Murrumbidgee catchment and the inflow scenarios that relate to these actions.

**Table 4:** Summary of potential watering actions for the Murrumbidgee catchment

Broad Asset	Indicative demand <sup>4</sup>	Applicable inflow scenario				
		Very Low	Low	Moderate	High	Very High
Mid-Murrumbidgee wetlands	Minimum (15.5 GL/d @ Darlington Point for up to 6 days plus a gradual recession  Tombullen storage releases to augment flows over 12 GL/day at Darlington Point	Option a priority but unlikely under these inflow scenario.		<i>Reconnection action:</i> Contribute to river flows (fresh) and inundation of fringing wetlands to continue recovery of wetland vegetation communities, and provide habitat to support survival and maintain the condition of waterbirds and native aquatic biota (including fish, turtles, frogs and invertebrates).		Objectives are likely to be achieved from unregulated flow under this scenario.
	Pumping to individual high priority wetland assets up to 10GL	<i>Infrastructure assisted:</i> Contribute to habitat to support survival and maintain the condition of waterbirds and native aquatic biota (including fish, turtles, frogs and invertebrates).			Option unlikely to be required under this scenario.	
Yanco Creek system	Yanco Wetlands (up to 20 GL action @ Yanco off-take). Prioritise use if reg river sup is available	Option a priority but unlikely under these inflow scenario.		<i>Yanco Creek System:</i> Contribute to flows reconnecting and refilling the anabranh creeks and lagoons located in the mid-Yanco Creek system. Prioritise SAL if available.		Option unlikely to be required under this scenario.
Lowbidgee - Core refuge and permanent aquatic habitat	Up to 20 GL	<i>Critical Habitat provision:</i> support critical fauna and flora habitat requirements and recruitment opportunities.			Option unlikely to be required under this scenario	
Lowbidgee - North Redbank	Up to 30 GL wetland and 5 GL rookery	Option a priority but unlikely under this inflow scenario.	<i>Wetland inundation:</i> Contribute to river flows (fresh) using regulators to inundate target wetlands in the Lowbidgee to maintain and improve wetland vegetation diversity and condition, provide habitat to support survival		<i>Bird breeding event contingency:</i> Maintain wetland water levels and acceptable levels of water quality to support the completion of a naturally-triggered breeding event, including	
Lowbidgee - Yanga National Park	Up to 30 GL wetland and 10 GL rookery					

<sup>4</sup> Volume limited by current channel constraints. Volumes will be scaled according to inflow scenario and resource availability.



Broad Asset	Indicative demand <sup>4</sup>	Applicable inflow scenario				
		Very Low	Low	Moderate	High	Very High
Lowbidgee - Nimmie-Caira	Up to 40GL wetland and 215GL rookery (key wetland and rookery sites)		and maintain the condition of native fish, waterbirds, and other aquatic vertebrates (e.g. frogs), hydrological connectivity between the floodplain and river, and contribute to processes such as nutrient and carbon cycling through return flows.  <i>Wetting-Drying cycle:</i> A decision may be made to not provide water to sites that require a drying phase or where target watering frequency has been achieved in recent years.		landscape scale watering with lower Lachlan.  <i>Lowbidgee Supplementary:</i> Utilise a portion of river flows to contribute to outcomes as per <i>Wetland Inundation</i> objectives for regulated allocations.	
Lowbidgee - Fiddler-Uara	Up to 20GL					
Lowbidgee - Western Lakes	Up to 15GL (Open water habitats and vegetation)					
Lowbidgee Full System Floodplain Watering	Up to 180GL (cumulative volume encompassing above Lowbidgee wetland actions)	Option unlikely to be required under these scenarios.			Improve or maintain the character, condition and resilience of floodplain vegetation communities. Basin-wide waterbird habitat & future population recovery	
Murrumbidgee River Channel, distributaries and anabranches	Winter-spring in-channel flows up to 10GL	Option a priority but unlikely under this inflow scenario.	<i>Restoring natural flow variability:</i> Contribute to river flows (base flows and freshes) in the Murrumbidgee River channel. Opportunistic connection to Lowbidgee lakes is predicted		Option unlikely to be required under these scenarios.	
	Moderate in-channel pulse (>3500 ML/day at Balranald) up to 50GL	Option a priority but unlikely under this inflow scenario	<i>Native fish flow:</i> Contribute to river flows (base flows and freshes) to provide suitable in-stream conditions for native fish breeding, recruitment, movement and dispersal.		Option unlikely to be required under these scenarios.	
	Distributary and anabranch freshes up to 15GL	Option a priority but unlikely under this inflow scenario	<i>Restoring natural flow variability:</i> Contribute to river flows (base flows and freshes) in the Murrumbidgee distributaries: Yanco-Colombo-Billabong Creek system, Old Man Creek system and/or other creeks.		Option unlikely to be required under these scenarios.	
	Water quality contingency	Provide localised refuge habitat for fish and aquatic	Option unlikely to be required under these scenarios.		Provide localised refuge habitat for fish and aquatic biota to prevent, or during, an adverse water quality event.	

Broad Asset	Indicative demand <sup>4</sup>	Applicable inflow scenario				
		Very Low	Low	Moderate	High	Very High
		biota to prevent, or during, an adverse water quality/water level event.				
Junction Wetlands	<b>Target flows &gt;5 GL/day @ d/s Balranald Weir and &gt;10 GL/day @ Murrumbidgee confluence on the Murray</b>  <b>Flows greater than 7 GL/day @ d/s Balranald Weir</b>	Option a priority but reduced likelihood of natural trigger events under this scenario.		<i>Reconnecting event:</i> Contribute to river flows (fresh) and inundation of fringing wetlands to continue recovery of wetland vegetation communities, and provide habitat to support survival and maintain the condition of waterbirds and native aquatic biota (including fish, turtles, frogs and invertebrates).		
	<b>Pumping to individual wetland assets for refuge sties</b>	<i>Infrastructure assisted:</i> Contribute to habitat to support survival and maintain the condition of waterbirds and native aquatic biota (including fish, turtles, frogs and invertebrates).			Option unlikely to be required under this scenario.	

## Potential watering actions – standard operating arrangements

Table 4 identifies the range of potential watering actions in the Murrumbidgee catchment in the Murray-Darling Basin that give effect to the long-term demands and flow regime identified as being in scope for the contribution of Commonwealth environmental water in any given year. The standard considerations associated with these actions are set out below.

### 1. Mid-Murrumbidgee Reconnection

Watering Action: Contribute to river flows (freshes) and inundation of fringing wetlands to avoid further damage and protect wetland vegetation communities, and provide habitat to support survival and maintain the condition of waterbirds and native aquatic biota (including fish, turtles, frogs and invertebrates).

Standard operational considerations:

The proposed event will involve the release of environmental water from upper storages when there are no significant rainfall-derived tributary flows. Infrastructure assisted delivery to individual wetlands will also be considered.

Typical extent:

- Inundation of low-level wetlands.
- This option will target a peak flow rate for three to five days and a recession that mimics a more natural recession rate (nominally a 10 to 15 per cent decrease in flow per day).
- Environmental flows likely to be delivered between late autumn and early spring (May to September) to avoid irrigation season.
- While the volume of environmental water required will depend on the volume of baseflows, the proposed maximum flow rate for 2018-19 planning is 23,000 ML/day at Wagga Wagga. The Office will continue to pursue opportunities to increase the flow rates to upper limits under the Water Sharing Plan of 28,000 ML/day (4.73 metres gauge height) at Gundagai and 27,500 ML/day (4.9 metres gauge height) at Wagga Wagga.
- This option is likely to contribute flows required to inundate the mid-Yanco Creek system wetlands (Action 3), could provide some of the required flows for, and provide additional benefits to, the proposed in-channel actions (Actions 5 and 6) and watering of the Junction Wetlands.

Approvals:

- Agreement from landholders whose properties might be inundated by environmental flows is required.
- Action may result in the 1400 ML/day Yanco Creek off-take constraint specified in the Water Sharing Plan being exceeded. Approval to exceed the 1400 ML/day constraint at the Yanco Creek off-take is required from the NSW Minister for Primary Industries (or Delegate).

## 2. Mid-Murrumbidgee wetland – infrastructure assisted delivery

Watering action: Contribute to wetland inundation, using existing water delivery infrastructure, to refill high priority low lying wetlands to provide habitat to support survival and maintain the condition of waterbirds and native aquatic biota (including fish, turtles, frogs and invertebrates).

Standard operational considerations:

- Delivery to mid-Murrumbidgee wetlands through pumping is not as ecologically effective as filling the wetlands with a reconnecting river flow. The purpose of this option is to continue/maintain recent improvements in wetland vegetation condition at these sites and provide habitat to maintain condition of waterbirds, native fish, other aquatic vertebrates (turtles, frogs) and invertebrates.

Typical extent:

- It is not operationally feasible to pump to all sites; system scale objectives cannot be achieved with infrastructure assisted watering alone. The wetlands in the mid-Murrumbidgee that can be delivered to via existing infrastructure and without higher reconnecting flows include:
  - Yarradda Lagoon in the mid-Murrumbidgee
  - Gras Innes and Oak Creek via Bundidgerri Creek
  - Yanco Agricultural (McCaughey's) Lagoon, Turkey Flat and Gooragool Lagoon via Murrumbidgee Irrigation infrastructure
  - Coonancoocabil Lagoon (off Murrumbidgee Irrigation infrastructure or via Gogeldrie Weir pool)
  - A number of wetlands within the Yanco Creek system
  - Other privately owned wetlands and waterways to restore ecological function to these areas.

Approvals:

- In some cases, access to channels will need to be negotiated with landholders or irrigation corporations and agreement for inundation of privately owned wetlands will need to be sought.

## 3. Mid-Yanco Creek Anabranches and Wetlands

Watering Action: The option would aim to maintain riparian and wetland vegetation condition (including river red gums) by reconnecting and refilling the anabranch creeks, flood-runners, lagoons and wetlands in the Yanco Creek System.

Standard operational considerations:

- The proposed event will involve the release of environmental water from upper storages, possibly in conjunction with rainfall-derived tributary flows.
- Alternatively delivery via both Yanco Creek Offtake and Coleambally Catchment Drain may achieve some objectives and limit inconvenience to upper Yanco Creek landholders.
- A third option is to divert a high unregulated flow, possibly through supplementary access, down the Yanco Creek system.

Typical extent:

- The action will target sites in the mid-Yanco Creek (between Morundah and Yanco Bridge on Kidman Way). Target sites may include the 'Silver Pines' wetland complex and Wanganella Swamp.
- Flows above 1400 ML/day and/or additional volumes delivered through Coleambally Catchment Drain may be required to achieve desired outcomes.

Approvals:

- Agreement from landholders whose properties might be inundated by environmental flows is preferred.
- Target flows will result in the 1400 ML/day Yanco Creek off-take constraint specified in the Water Sharing Plan being exceeded. Approval to exceed the 1400 ML/day constraint at the Yanco Creek off-take is required from the NSW Minister for Primary Industries.

#### 4. Lowbidgee Wetlands

Watering Action: Using regulators, inundate target wetlands across the Lowbidgee to maintain, improve and in some cases promote the recovery of wetland vegetation diversity and condition (lignum, black box and river red gums and associated understory communities such as reeds, sedges and rushes), and provide habitat to support survival and maintain condition of native fish, waterbirds, other aquatic vertebrates (frogs) and invertebrates.

Standard operational considerations:

- The Lowbidgee contains suitable habitats for nationally important breeding colonies of threatened and internationally significant migratory waterbird species (MCMA 2009).
- Seasonal inundation of wetlands is important for the reproduction and survival of several frog species, including the EPBC Act vulnerable southern bell frog, in the Lowbidgee. Ensuring key southern bell frog sites receive flows over spring-summer and water levels are maintained over summer months is crucial for maintaining viable populations in the Lowbidgee system.
- Consideration will be given to the condition of individual sites as well as prevailing conditions to reinstate an appropriate wetting-drying cycle.
- Consideration will be given to using escapes to allow water to return to the river channel to improve hydrological connectivity and provide for transport of biota, nutrients, sediment and carbon and improve the health of the river system, and benefit fish and other organisms.
- Subject to occurrence and announcements, supplementary allocations may be used to protect a portion of river flows to inundate target wetlands in the Lowbidgee to maintain and improve wetland vegetation diversity and condition, hydrological connectivity between the floodplain and river, and contribute to processes such as nutrient and carbon cycling.

Typical extent:

- Possible target sites include: Core refuge and permanent aquatic habitat, North Redbank system, South Redbank (Yanga National Park), Nimmie-Caira and Fiddlers-Uara Creek systems and the Western Lakes. The scale of watering actions is dependent on environmental demand and water availability.

No additional approvals required.

## 5. Native fish flows

Watering Action: Contribute to base flows, freshes and the recession of natural bankfull and overbank flows to create favourable conditions for fish passage, reproduction and survival.

Standard operational considerations:

- This may involve contributing in-stream flows to improve movement opportunities (including off-channel recruitment), maximise available breeding habitat, create flow conditions favourable for reproduction, or contribute to the survival of native fish.

Typical extent:

- Target flow rates will be dependent on the prevailing flow conditions, target outcome and operational considerations.
- Environmental water will be delivered from storages and may target reaches along the length of the Murrumbidgee River and main distributaries.
- Subject to flow rates and lake water levels, connection to Tala and Yanga Lakes may be targeted
- Subject to announcements, supplementary allocations may be used to protect a portion of river flows.
- Environmental deliveries for this option will likely be delivered in late winter (movement and condition), spring and early summer (spawning and recruitment).

No additional approvals required.

## 6. Restoring natural flow variability

Watering Action: Contribute to river flows restore natural flow events that are affected by river regulation and/or extraction.

Standard operational considerations:

- This option will contribute to objectives of the native fish flows (Action 5).

Typical extent:

- Environmental water may be delivered to the Murrumbidgee River channel, Yanco-Colombo-Billabong Creek system, Old Man Creek system, and/or other creek systems.
- Target flow rates will be dependent on the prevailing flow conditions, target outcome and operational considerations.
- Subject to announcements, supplementary allocations may be used to protect a portion of river flows.
- Environmental releases would be kept in channel and are not intended to inundate floodplain or wetland habitat.

No additional approvals required.



## 7. Contingency to support significant bird breeding events

Watering action: Maintain wetland water levels to support the completion of significant waterbird breeding events.

Standard operational considerations:

- These contingency actions will only occur in response to developing issues/events.
- The bird breeding contingency is not to trigger a breeding event but for use when a breeding event is already underway and considered in danger of failure due to receding water levels.

Typical extent:

- Target flow rates will be dependent on the prevailing conditions, the nature of the water quality/falling water level issue and operational considerations.
- This option is contingent on conditions throughout the year, but is more likely to be required during warmer months.

No additional approvals required.

## 8. Contingency to support critical habitat requirements

Watering action: Contribute to managing water quality issues within in-stream and wetland environments across the Murrumbidgee catchment.

Standard operational considerations:

- Contingency actions will only occur in response to developing issues/events.

Typical extent:

- Target flow rates will be dependent on the prevailing conditions, the nature of the water quality/falling water level issue and operational considerations.
- This option is contingent on conditions throughout the year, but is more likely to be required during warmer months.

No additional approvals required.

## 9. Junction Wetlands

Watering Action: Contribute to river flows (freshes) and inundation of fringing wetlands to avoid further damage and protect wetland vegetation communities, and provide habitat to support survival and maintain the condition of waterbirds and native aquatic biota (including fish, turtles, frogs and invertebrates).

Standard operational considerations:

- Requires higher flows in the Murrumbidgee (flows >5000 ML/day @ d/s Balranald Weir) and the Murray (>10,000 ML/day @ Murrumbidgee confluence) to ensure inundation is achieved.
- Flows greater than 7000 ML/day d/s Balranald Weir, independent of flow rates in River Murray, can connect and fill low level creek systems (Waldaira, Peacock and Mainie Creeks) in the Junction Wetlands.

- The proposed action may be achieved by a decision to 'not take' Lowbidgee supplementary allocations during announced access periods to protect peak flows to achieve Junction Wetlands watering (rather than diverting supplementary flows into Nimmie-Caira, for example).
- The proposed action may also involve the release of environmental water from upper storages in conjunction with rainfall-derived tributary flows. Should river-floodplain inundation not be possible, infrastructure assisted delivery to individual wetlands will be considered.

Typical extent:

- Inundation of low-level wetlands and creek systems (for example Peacock and Mainie Creeks).

Approvals:

- Agreement from landholders whose properties might be inundated by environmental flows is preferred and would be required for infrastructure assisted watering of individual sites.

# Attachment C – Long-term water availability

## Commonwealth environmental water holdings

The Commonwealth holds the following entitlements in the Murrumbidgee catchment:

- Murrumbidgee high security
- Murrumbidgee general security
- Murrumbidgee Irrigation (Conveyance)
- Coleambally Irrigation (Conveyance)
- Murrumbidgee supplementary

The full list of Commonwealth environmental water holdings can be found at [www.environment.gov.au/topics/water/commonwealth-environmental-water-office/about-commonwealth-environmental-water/how-much](http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office/about-commonwealth-environmental-water/how-much) and is updated monthly.

## Other sources of environmental water

Other potential sources of held environmental water that may be used to complement Commonwealth environmental water delivery in the Murrumbidgee catchment include:

- Environment Entitlement - The Living Murray Programme (Murray-Darling Basin Authority)
- Environmental Water Allowance (New South Wales Office of Environment and Heritage)
- NSW licensed entitlement (New South Wales Office of Environment and Heritage)
- Yanga Lowbidgee entitlement (NSW Parks and Wildlife Service)
- Subject to Inter-Valley Trade rules and account balances, Commonwealth environmental water allocations from other Southern Connected Basin catchments may be transferred to the Murrumbidgee and visa-versa depending on availability and relative priority for use and carryover.

## Planned environmental water

In addition to water entitlements held by environmental water holders, environmental demands may also be met via natural or unregulated flows and water provided for the environment under rules in state water plans (referred to as 'planned environmental water').

The Water Sharing Plan for the Murrumbidgee Regulated River Water Source (2003) establishes releases of planned environmental water (under Part 3, Clause 15) under operating rules for Burrinjuck and Blowering dams.

- Transparent releases:
  - Transparent releases from Blowering Dam to the Tumut River are equal to 560 ML/day plus any water use expected to occur between the dam and the confluence with the Murrumbidgee River. When inflows fall below 560 ML/day, release volumes are equal to inflows in addition to expected use.
  - Transparent releases from Burrinjuck Dam are the lesser of either the volume of inflows to the dam over the previous 24 hours or 615 ML.

- Translucent releases:
  - Translucent releases are made from Burrinjuck Dam on each day between 22 April and 21 October. Daily release volumes are calculated based on catchment conditions and storage volumes in Lake Burrinjuck.
- Minimum daily end of system flow targets (including Murrumbidgee River at Balranald).



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