**Commonwealth Environmental Water**

Portfolio Management Plan

**Lachlan River**

2019–20

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

The Commonwealth Environmental Water Office respectfully acknowledges the Traditional Owners, their Elders past and present, their Nations of the Murray-Darling Basin, and their cultural, social, environmental, spiritual and economic connection to their lands and waters. In the Lachlan catchment the Traditional Owners include the Nari Nari, Ngiyampaa, Wiradjuri and Yita Yita Nations.

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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, the current Commonwealth Environmental Water Holder, is supported by staff of the Commonwealth Environmental Water Office, which 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
* 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 Lachlan catchment for 2019–20. 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, 2019–20* (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 NSW Office of Environment and Heritage.

## Your input

The management of Commonwealth environmental water relies on considerable advice and assistance from 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 Commonwealth Environmental Water Office via: [ewater@environment.gov.au](mailto:ewater@environment.gov.au).

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# Environmental watering in the Lachlan River

## The Lachlan catchment

*Ngangadha garraygu bila-galang-gu!*

*Yandhu garraybu bilagalangbu ngangagirri nginyalgir!*

Look after the land and the rivers!

Then the land and the rivers will look after you!

*Excerpt of Instruction given by Wiradjuri Elder Pastor Cecil Grant (Wongomaa)*

The Lachlan River is the fourth longest river in Australia at 1,448 kilometres, starting nearing Goulburn in the Great Dividing Range at an elevation of around 1,200 metres and terminating at the Great Cumbung Swamp nearly Oxley. Covering a catchment of around 90,000 square kilometres, in times of floods the Lachlan can connect to the Murrumbidgee through the Great Cumbung Swamp.

Flows in the Lachlan River valley (Figure 1) are driven by rainfall runoff in the upper catchment, which includes the Wyangala Dam catchment and three main unregulated tributary river systems; Mandagery Creek, and the Belubula and Boorowa Rivers. Delivering water in the Lachlan River valley is complex as it is a very long system with many meandering anabranches and distributary creeks that terminate in wetlands.

Flow attenuation in the system is high due to the low gradient of the system and it can take 90 days for a flow event from Wyangala Dam to reach the end of the river system at the Great Cumbung Swamp (BWR 2011). This creates a challenge for water managers when trying to deliver environmental water. Not all environmental water is sourced from dam releases – unregulated tributary inflows can be ordered and accounted for as environmental water and allowed to reach assets by bypassing regulating storages.

Water supplies in the Lachlan River are regulated by Wyangala Dam (1220 GL), Lake Cargelligo (36 GL) and Lake Brewster (154 GL) (MDBA 2012b). Lake Cargelligo and Lake Brewster are lower in the valley than Wyangala Dam and can reduce the travel times for water delivery to the lower reaches of the Lachlan River valley allowing more timely and more focused delivery downstream. However, storing water in these modified lake storages is less efficient than in the dam, due to the higher evaporation rates.

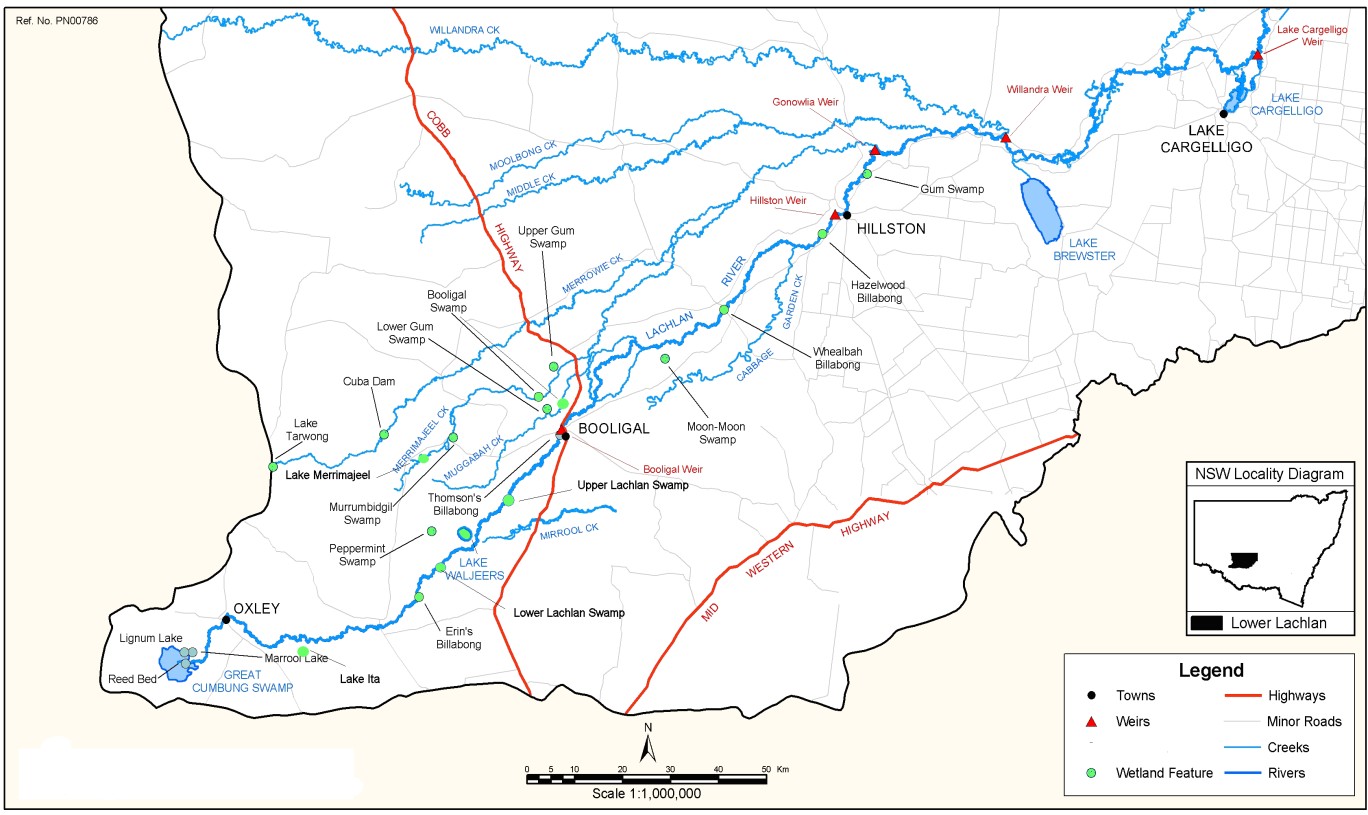
Environmental water delivery within the valley occurs in two main ways. During in-channel river flows, Commonwealth environmental water is gravity-fed or regulated using infrastructure into anabranches, creeks and wetlands. During high river flows water passes overbank into floodplain and wetland sites. Where possible, environmental water will be managed to benefit multiple sites en route to maximise the efficiency and effectiveness of water delivery.

Figure 2 shows the Lower Lachlan River catchment downstream of Lake Cargelligo. The major distributaries of the Lachlan are also shown, including Willandra Creek, Moolbong Creek, Middle Creek, Merrowie Creek, Merrimajeel Creek, and Muggabah Creek. The map includes the location of several key environmental assets including the Great Cumbung Swamp, Lower Lachlan Swamps and Booligal Wetlands, the site of a major colonial waterbird breeding event in recent years.

The traditional people of the Lachlan catchment are mainly the Wiradjuri nation with other parts of the catchment being the traditional lands of the Nari Nari, Ngiyampaa and Yita Yita nations. The cultural knowledge of Indigenous Elders have helped to shape watering events such as in the Booberoi Creek anabranch in 2017, 2018 and 2019, where populations of a culturally significant species and NSW listed endangered species, the eel-tailed catfish, persist.

The Lachlan catchment showing the division of planning units into Zone A and B as used in the draft Long Term Water Plan for the Lachlan catchment (OEH, 2018)


**Figure 1:** The Lachlan catchment showing the division of planning units into Zone A and B as used in the draft Long Term Water Plan for the Lachlan catchment (OEH, 2018)



**Figure 2:** Map of the Lower Lachlan catchment (BWR 2011)

## Environmental objectives in the Lachlan catchment

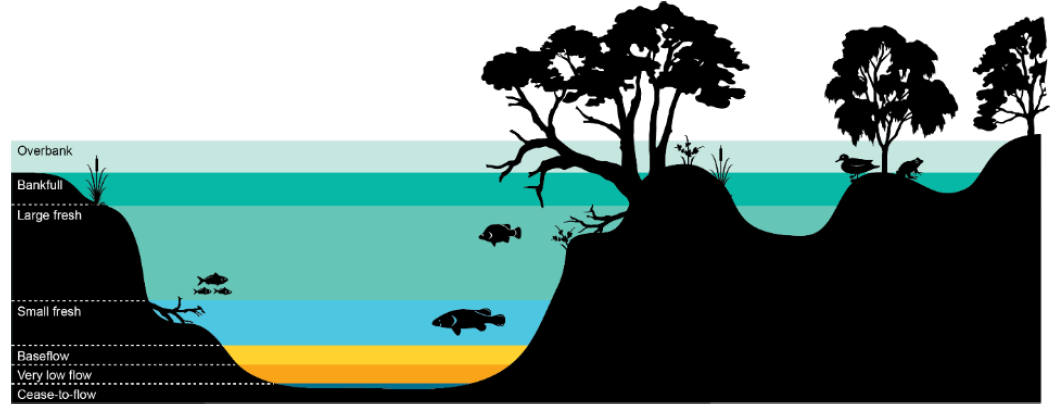
The long-term environmental objectives for the Murray–Darling Basin are described in the Basin Plan’s environmental watering plan and the Basin-wide environmental watering strategy, which includes ‘quantified environmental expected outcomes’ at both a Basin-scale and for each catchment. The expected outcomes relevant for the Lachlan catchment are summarised in Table 3 and described in detail in Attachment A.

Basin state governments are also finalising 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. In late November 2018 the NSW Office of Environment and Heritage released the Lachlan Long Term Water Plan for public comment until early February 2019. The draft plan can be found at: <https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan-consultation>*.*

While yet to be finalised the draft Lachlan Long Term Water Plan (Parts A and B, OEH, 2018) has been drawn upon as a key reference in this Portfolio Management Plan for the Lachlan River system.

Based on these strategies and plans, and in response to best available knowledge drawing on the results of environmental watering monitoring programs, the objectives for environmental watering in the Lachlan 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. Watering actions to achieve those objectives may be designed to include, but not be limited to, various components of a flow regime including those shown in Figure 3.

Natural river flows, prior to development of infrastructure to store, control and divert water would have provided the Lachlan River system with an increase in the number of connection events, particularly small to medium floods (Higgison et al, 2019). These connection events are where the river flows high enough to connect with and flow into the surrounding floodplain, swamps and woodlands. The river ecosystem naturally evolved to these conditions but with the regulation of flows these flows have largely been removed. Environmental water management seeks to replicate, where possible, natural flows as a trigger (‘natural cues’) for different ecological and biological processes.



**Figure 3:** An illustrative river cross-section showing components of a flow regime

Ref: LTWP – Part A, 4. Environmental water requirements, Figure 9, pg. 27.

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **BASIN-WIDE OUTCOMES**  **(Outcomes in red link to the Basin-wide Environmental Watering Strategy)** | **OBJECTIVES FOR LACHLAN ASSETS** | | | | | |
| **IN-CHANNEL ASSETS** | **OFF-CHANNEL ASSETS** | | | | |
| **Lachlan River** | **Great Cumbung Swamp** | **Lachlan Swamps** | **Booligal Wetlands** | **Merrowie Creek** | **Willandra Creek** |
| **VEGETATION** | * Maintain riparian, floodplain and in- channel vegetation condition * Maintain the recruitment of trees within river red gum communities * Maintained periods of growth for non- woody vegetation communities that closely fringe or occur within the river and creek channels | * Increase periods of growth for non-woody vegetation communities, including common reed (Phragmites) and cumbungi (Typha spp) * Maintain condition and extent of wetland, stream and riparian vegetation | | | | |
| **WATERBIRDS** | Provide opportunities for nesting and foraging habitat to 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 fluctuations in water levels | |  |
| **FISH** | Protect natural flow events that support habitat and food sources and provide natural cues to promote movement, reproduction, and larval dispersal of native fish | * No loss of native species * Provide flow cues to support habitat and food sources and promote increased movement, recruitment and survival of native fish (particularly for floodplain specialists) * Improved population structure of key species through regular recruitment, including:   1. short-lived species with distribution and abundance at pre-2007 levels - breeding success every 1-2 years   2. moderate to long-lived species with a spread of age classes and annual recruitment in at least 80 per cent of years | | | | |
| **OTHER VERTEBRATES** | Contribute to restoration/protection of frog diversity and populations through provision of habitat to support breeding and recruitment. Provide refuge habitat for frogs, turtles and other vertebrates | | | | | |
| **CONNECTIVITY** | * Support longitudinal connectivity along the Lachlan 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 and salinity * Support transport of salt and nutrients off the floodplain into the river channel and downstream | | | | |
| **RESILIENCE** | Provide drought refuge habitat where possible | | | | | |

Information sourced from: Roberts and Marston (2011), MDBA (2012a), MDBA (2012b), MDBA (2012c) and MDBA (2017)

## 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 4 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. 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 operational delivery including constraints is described in Attachment B.

A hydrograph showing the scope of demands that Commonwealth environmental water may contribute to in the Lachlan River catchment.
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 channel flows, including to wetlands and swamps in the Lower Lachlan, and contingency flows for bird breeding and water quality.


Figure 4: Scope of demands that environmental water may contribute to in the Lachlan catchment

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.

# Portfolio management in 2019–20

In planning for the management of Commonwealth environmental water, the Commonwealth Environmental Water Office aims to maximise 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.

## Lessons from previous years

Outcomes from monitoring and lessons learned in previous years is a critical component for the effective and efficient use of Commonwealth environmental water. These learnings are incorporated into the way environmental water is managed.

The Commonwealth Environmental Water Office works with the Murray–Darling Basin Authority, state agencies, research organisations, regional organisations, local groups and landholders to collect and collate relevant monitoring information and evaluation results that facilitate adaptive. This continual review of information and outcomes is helping to build knowledge about the best way to get positive outcomes on a larger scale, based on what works and what doesn’t work.

Key lessons and findings from the 2018-19 watering year and latest monitoring results in the Lachlan are included below. More detailed information on what environmental water has achieved in the Lachlan since 2014-15 is available from <http://www.environment.gov.au/water/cewo/catchment/lachlan>:

* A spring watering action (late August 2018 to October 2018) provided a ‘run of the river’ flow (from Wyangala Dam to the Great Cumbung Swamp) for a range of objectives including native fish and vegetation. It also successfully included a small fresh down the Booberoi Creek and provided an opportunity for Indigenous Elders to reconnect with country.
* The ‘run of the river event’ (as done in 2017-18 and 2018-19) requires a small portion of environmental water to be temporarily kept in Brewster weir pool for water accounting purposes. The management of this water in Brewster weir pool, and its eventual release, is being more actively managed to target outcomes for native fish, particularly Olive perchlet, wherever possible.
* Applying a learning from the 2017-18 watering event, a lower ‘minimum flow’ rate was set for the river height at Forbes (Cottons weir) during 2018-19 to determine if the same outcome could be achieved for native fish using less environmental water. The ‘minimum flow rate' is set during the nesting season for Murray cod and freshwater catfish to protect nests from rapid falls in river height and help prevent nest abandonment. The overall abundance of larval Murray cod appears to have increased from last year in the lower Lachlan, suggesting a slow recovery of the Murray cod population, impacted by the hypoxic event of 2016, may be underway.
* The CEWO’s partnership with NSW OEH continues to enable a whole of system approach to be provided in an efficient way (both in terms of water use and its administration). Watering actions across the system in 2017-18 and 2018-19 have included both the river channel (using mostly Commonwealth environmental water and NSW water quality allowance) and key off-channel habitats, such as Lake Brewster and flood plain wetlands (using mostly NSW environmental water).
* eDNA (environmental DNA) is being trialed by the Lachlan LTIM provider as a tool for monitoring the distribution of aquatic species. The use of this technique is hoped to provide additional information on fish species to complement the current sampling techniques, with key findings to be reported on in October 2019.

## Antecedent and current catchment conditions and the demand for environmental water in 2019–20

Total water storage in the Lachlan catchment will be very low going into 2019-20 with Wyangala Dam, the main Lachlan system storage facility, falling below 30% capacity in June 2019 (27% as at 19 June 2019, *Water Allocation Statement Lachlan Valley 19 June 2019*). Such low water storage levels will likely trigger a restriction on access to general security carryover volumes into 2019-20. Advice from WaterNSW (19 June 019) is that access to carryover could be restricted to 57% of carryover volume. If conditions remain dry further restrictions may follow.

The continuation of dry conditions in 2018-19 into 2019-20 puts pressure on the environment and landholders. Drier conditions increase the need for water while reducing water storage levels means there is less water available for environmental and productive purposes. In such circumstance the Commonwealth Environmental Water Office seeks to focus on refugia sites to maintain resilience for key bird, fish and vegetation sites.

With limited available water due to the potential restriction on carryover into 2019-20, the Commonwealth Environmental Water Office will be limited in the watering actions it is able to undertake with a focus in 2019- 20 being placed on providing water to build resilience ahead of the potential continuation of the current dry spell.

Should there be substantial rains in 2019-20 and a lifting of the expected carryover restriction (and the potential for new allocation to general security licenses), more actions will be undertaken to take advantage of increased water availability, natural tributary inflows and higher river levels. Such water actions could include support for bird breeding events if they are naturally triggered, improving water quality where possible to do so (e.g. hypoxic events), provide whole of river flows and watering of anabranches, tributaries and wetlands, while balancing the need to maintain a volume of water for carryover into the following water year.

The following identifies major Lachlan catchment assets where Commonwealth environmental water could be used and includes reference to the Long Term Water Planning unit (PU) as shown in Figure 1.

**Lachlan River**

PU2: Upper Lachlan River

PU3: Lachlan River - Forbes to Condobolin (Lachlan River, Horseshoe Lagoon, Bumbuggan Creek)

PU6: Lachlan River - Condobolin to Lake Cargelligo (Lachlan River, Borapine & Kiagathur Creeks, Yarnel Lagoon)

PU8: Lachlan River - Lake Cargelligo to Willandra Weir (Lachlan River Box Creek)

PU14: Lower Lachlan watercourse (Lachlan River, Moon Moon Lake)

PU16: Western Lachlan watercourse including The Great Cumbung Swamp (Lachlan River, Great Cumbung Swamp, Lake Waljeers, Pimpara Creek, Lachlan swamp, Baconian swamp, Lake, Ita)

A larger whole of river fresh is unlikely should very dry conditions continue in 2019-20 due to the volume of water required for such an action. Such flows benefit native fish habitat, breeding and movement and have been undertaken on several occasions over the last five watering years. Recovery of large bodied native fish populations from the hypoxic conditions resulting from the 2016 floods continues and is an ongoing investment of environmental water when sufficient volume allows. Deliveries to support native fish lifecycle could be undertaken in most years, depending on environmental water availability.

**Wallaroi/Wallamundry/Nerathong anabranches**

PU5: Mid Lachlan anabranches (Island, Wallamundry, Wallaroi and Narrathong Creeks)

These systems have not previously received environmental water. Demand is currently being assessed but are not priority sites in low water availability years.

**Booberoi Creek**

PU7: Booberoi Creek

This anabranch receives replenishment flows annually for stock and domestic water and received environmental water for the first time in 2017 and again in Sep 2018 (CEW) and June 2019 (NSW OEH). Redirecting flows into this system in 2019-20 will be considered based on flows in the main channel and the size of environmental holdings. Return flows into the main channel may be protected from extraction or re-regulated downstream.

**Lake Cargelligo**

PU9: Lake Cargelligo

As a regulated water supply storage, Lake Cargelligo is not usually considered a priority for environmental water.

**Lake Brewster**

PU10: Lake Brewster (Lake Brewster, Lake Ballyrogan)

Watering is provided as a contingency for pelican breeding events and to support aquatic vegetation. Lake Brewster can act as a mid-Lachlan River storage as part of a whole of river run event. With the expected low water volumes available in 2019-20, this is not expected to be brought into use. Lake Brewster and Brewster weir provide fish refuge but this is expected to be maintained by operation flow

**Willandra Creek**

PU11: Willandra Creek

Willandra Creek is a distributary system that receives greater than natural flow volumes over the long term. Willandra Creek received water through translucent flows in 2015, and flooding in 2016 resulting in healthy vegetation responses. There is very low demand for water this year.

**Merrowie Creek**

PU12: Merrowie Creek (Cuba Dam, Chillichil swamp, Merrowie Creek wetlands, Box Creek)

Assets along Merrowie Creek received water during the flooding in 2016, resulting in waterbird breeding and positive vegetation outcomes. Commonwealth environmental water may be used to augment other flows but is unlikely in 2019-20 unless significant rains occur and water availability increases.

**Merrimajeel Creek**

PU13: Merrimajeel Creek (Merrimajeel Creek, Booligal Wetlands, Lake Merrimajeel, Murrumbidgil Swamp)

Watering may be required this year to continue to maintain habitat in Merrimajeel Creek. Commonwealth environmental water may be delivered in association with natural inflows to Merrimajeel Creek to contribute to the inundation of wetlands and aquatic vegetation, including the maintenance of waterbird habitat.

Booligal Wetlands watering is opportunistic. A contingency volume is planned to support the completion of waterbird breeding events if triggered by other flows in the system. In this case water availability is expected to be high due to significant runoff and other river flows acting as the breeding trigger. Waterbird habitat remain in healthy condition since large colonial breeding events occurred at multiple locations in 2016–17.

**Muggabah Creek**

PU15: Muggabah Creek

Watering may be required this year to continue to maintain habitat in Muggabah Creek. Commonwealth environmental water may piggyback natural inflows to Muggabah Creek to contribute to the inundation of wetlands and aquatic vegetation and the maintenance of waterbird habitat.

**Great Cumbung Swamp**

PU16: Western Lachlan watercourse, including The Great Cumbung Swamp (Lachlan River, Great Cumbung Swamp, Lake Waljeers, Pimpara Creek, Lachlan swamp, Baconian swamp, Lake, Ita)

The Great Cumbung Swamp Is one of the largest remnant examples of common reed swamps and a very important refuge site for many native plants and animals, particularly waterbirds, during dry times. Following the natural inundation in 2016, this site has benefitted from regular watering. Actions in 2018-19 included spring and winter watering actions and NSW’s Water Quality Allowance water from the start of 2019 for four months helped to mitigate the build up of blue-green algae. Should dry conditions continue throughout 2019-20 this site will again be targeted towards the end of 2019-20 to further sustain this important refuge site, subject to allocation availability.

**Murray–Darling Basin-wide environmental watering strategy and 2019–20 annual priorities**

The Murray–Darling Basin Authority publish the Basin annual environmental watering priorities each year and have published multi-year priorities since 2017-18. There are no specific 2019–20 Basin annual environmental watering priorities relevant to the Lachlan catchment, however the rolling annual priorities are applicable***.***

**Rolling, multi-year priorities**

The rolling, multi-year priorities for river flows and connectivity are to:

* Support lateral and longitudinal connectivity along the river systems.

The rolling, multi-year priorities for native vegetation are to:

* Maintain the extent, improve the condition and promote recruitment of forests and woodlands.
* Maintain the extent and improve the condition of lignum shrublands.

The rolling, multi-year priorities for waterbirds are to:

* Improve the abundance and maintain the diversity of the Basin’s waterbird population.

The rolling, multi-year priorities for native fish are to:

* Support Basin-scale population recovery of native fish by reinstating flows that promote key ecological processes across local, regional and system scales in the southern connected Basin.
* Support viable populations of threatened native fish, maximise opportunities for range expansion and establish new populations.

## Water availability in 2019–20

**Forecasts of Commonwealth water allocations**

The volume of Commonwealth environmental water likely to be carried over in Lachlan catchment in 2019– 20 is estimated to be approximately 37 GL.

Allocations against Commonwealth water entitlements in the Lachlan catchment are determined by state governments 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 2019–20 in the Lachlan catchment as at 31 May 2019.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Entitlement type** | **Forecasts of Commonwealth water allocations (including carryover) in 2019-20 (GL)1** | | | | | |
| **Very dry Very wet** | | | | | |
| **95 percentile** | **90 percentile** | **75 percentile** | **50 percentile** | **25 percentile** | **10 percentile** |
| Lachlan (general/high security) | 38 | 38 | 38 | 55 | 122 | 125 |

Notes:

1. Use of water carried over from 2018-19 will be restricted in 2019-20 and the potential water availiable will not be available for use.
2. Forecasts for regulated catchments are given to the nearest whole GL.
3. Allocation rate scenarios are based on long term average allocation rates.

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 NSW OEH and their access to different environmental water entitlements and planned environmental water, natural and unregulated flows, conveyance water and consumptive water. Further detail on sources of environmental water in the Lachlan 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.

**NSW Extreme Events Policy**

The NSW Department of Industry released their *NSW Extreme Events Policy, Policy framework for the management of NSW Murray–Darling Basin water resources during extreme events* in October 2018. This document can be found at: <https://www.industry.nsw.gov.au/water/what-we-do/legislation-policies/eep>.

Should dry conditions continue throughout 2019-20 and water storages further decline to critical levels, there is a possibility that this policy could lead to further restrictions on the use of Commonwealth environmental water allocations carried over.

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

Environmental water needs (demand) and water availability (supply) both influence 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 maximising outcomes. Figure5 shows how current demands and forecasted supply are considered together.

The overall ‘purpose’ for managing the Commonwealth’s water portfolio in the Lachlan catchment in 2019-20 will be to maintain refuge habitats through current drought conditions and to continue to support the native fish populations remaining after the hypoxic conditions experienced in the mid-Lachlan in 2016-17. The dry conditions experienced in 2018-19 are forecast to continue, making the management of carryover volume into 2019-20 critical to the Commonwealth’s ability to maintain these habitats.

A figure depicting the range of potential water resource availability and environmental demands in the Lachlan River catchment for 2019–20.
Resource availability is expected to be  is moderate very low to low in 2019-202018–19, with moderate to high water resource availability scenarios only expected or high to very high if wet conditions eventuate. Considered together with environmental demands, which range from very low to criticalcritical to high, the overall purpose of environmental watering will be to maintain the ecological health and resilience of important sites in the catchment.


Figure 5: Determining a broad purpose for portfolio management in the Lachlan catchment for 2019–20. Note: grey lines represent potential range in demand and water resource availability.

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, 2019–20* (available at: <http://www.environment.gov.au/water/cewo/publications>).

## Water Delivery in 2019–20

Consistent with the demands and purpose described above, the Commonwealth Environmental Water Office is considering supplying environmental water to the following watering actions for 2019–20 (see also Table 3 for supporting information regarding the basis for determining these watering intentions).

With the expected continuation of dry conditions, low catchment inflows and the possibility of restrictions being placed on accessing carryover volumes, the ability to delivery environmental flows in the Lachlan will be limited in 2019-20.

With an expected small volume of water available for use in 2019-20 of the order of 21GL, the Commonwealth Environmental Water Office will again target multiple outcomes the length of the river, from Wyangala Dam to the Great Cumbung Swamp. Table 3 provides supporting information regarding the basis for determining these watering intentions. The outcomes being sought from this use may include:

* delivery that is integrated with other river flows (for example stock and domestic), noting that river operations may have moved to a ‘pulsing’ approach to delivering water orders during 2019-20 to reduce losses
* delivery during the cooler months of the year to further minimise losses and prevent the spawning of pulse triggered fish species (e.g golden perch) during drought when food resources for young fish may be limited
* providing connectivity to key off channel assets such as Burrawang West (providing refuge for native frogs and waterbirds) and Booberoi Creek (off-channel habitat for native fish)
* continue to develop and deliver the watering requirements identified to maintain the health of the core reed beds in the Great Cumbung Swamp

The Great Cumbung Swamp is listed on the Directory of Important Wetlands and covers an area of 20,000 hectares providing an important refuge site in dry times. Home to 131 bird species and more than 200 plant species, the Great Cumbung Swamp is the biggest area of reed-swamp in the Basin, providing a core habitat for wildlife. Watering of this site is consistent with the Commonwealth Environmental Water Offices objectives to avoid damage, and protect and ensure ecological capacity for recovery of key refuge sites during periods of drought.

The Commonwealth Environment Water Office will continue to monitor catchment conditions, inflows and changes to water availability and will undertake further watering actions should additional water become available (either through the lifting of the restriction on carryover water, increased water allocations following large rain events). Additional watering actions in 2019-20 will follow natural cues and could include a whole of river watering event and discrete off-river watering of important sites. Watering actions will be coordinated with NSW Office of Environment and Heritage to ensure actions are undertaken efficiently for common environmental objectives.

**Stakeholder Feedback**

The Commonwealth Environmental Water Office continues to work with NSW OEH in reviewing, coordinating and managing environmental watering actions in the Lachlan catchment, in conjunction with the Commonwealth’s Long Term Intervention Monitoring (LTIM) provider, the University of Canberra, the river operator WaterNSW and the Lachlan EWAG (Environmental Water Advisory Group). This work is further complemented by regular landholder visits and discussion.

## Trading water in 2019–20

The Water Act 2007, requires the Commonwealth Environmental Water Holder to trade for the purpose of protecting and restoring the environment. In addition to the obligations of the Water Act 2007, the CEWH and CEWO staff are required to comply with a wide range of existing legislative requirements. This includes: financial management arrangements for Commonwealth agencies; freedom of information; and policies relating to information management, auditing, employee conduct and accountability.

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. Consideration is given to the water available to meet both current and future environmental needs. Additionally these decisions are influenced by current climatic conditions, as well as implications of trade for commercial outcomes in communities.

Large parts of the northern Basin are currently experiencing pressures from water scarcity, with low storage levels and rainfall deficiencies evident in most northern catchments. It is likely that insufficient water resources will be a major constraint on achieving proposed actions however acquisition to meet environmental needs is unlikely to be feasible until water availability improves. Significant rainfall is required to break the drought and large shortfalls in reserves need to be captured in storage before new allocations can be made.

No specific trade of water in the [Namoi, Border River, Lachlan, Gwydir or Macquarie] Valley has been identified for 2019-20. Trade opportunities will be reviewed in the valley throughout the water year and as conditions change. 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>

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>

It is likely that insufficient water resources will be a major constraint on achieving proposed actions however acquisition to meet environmental needs is unlikely to be feasible until water availability improves. Significant rainfall is required to break the drought and large shortfalls in reserves need to be captured in storage before new allocations can be made.

No specific trade of water in the Lachlan Valley has been identified for 2019-20. Trade opportunities will be reviewed in the valley throughout the water year and as conditions change. 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>.

## Carrying over water for use in 2019–20

Water entitlements allocations in NSW are determined by the State government and depend on multiple factors such as current storage levels and catchment inflows. With access to carryover water forecast to be limited to 57% in the Lachlan and no General Security allocations expected in 2019-20, available Commonwealth Environmental Water in 2019-20 will be limited to 21GL.

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

## Identifying Investment Opportunities

Under the *Water Act 2007*, 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’ must be consistent with the CEWH’s obligation to exercise their function to protect and restore environmental assets. Environmental activities must also improve the capacity of the CEWH to meet the objectives of the Basin Plan environmental watering plan, and be directly linked to current or future delivery of water for the environment.

The option of investing the proceeds in environmental activities will be considered alongside other available water management options, such as purchasing water at another time or place. The CEWH is finalising an Investment Framework and an Annual Investment Plan to inform future investment in environmental activities.

**Table 3**: Environmental demands, priority for watering in 2019–20 and outlook for coming year in the Lachlan Catchment.

| **Environmental assets and Long Term Water Plan unit (PU) reference number (see Figure 1)** | **Indicative demand (for all sources of water in the system)** | | **Watering history** | **2019-20** | | **Implications for future delivery** |
| --- | --- | --- | --- | --- | --- | --- |
| **Flow/Volume** | **Required frequency (maximum dry interval)** | **(from all sources of water)** | **Environmental demand for water** | **Potential Commonwealth environmental water contribution** | **Likely environmental demand in 2020-21 if watering occurred as planned in 2019-20** |
|
|
| **Lachlan River (PU 2, 3, 6, 8, 14, 16)**  Protect tributary inflows (natural trigger), or deliver upon environmental trigger (e.g. timing or temperature) being reached, to target outcomes for native fish. Population in recovery (particularly large bodied natives) from hypoxic blackwater in 2016. | Native fish flows.  Variable[[1]](#footnote-2), based on conceptual hydrographs provided by DPI Fisheries and available water allocations. | Seasonal | Flows specifically targeting native fish outcomes have occurred in 2014, 2015, 2017 and in spring (Aug) 2018 | Watering required most years | Watering required to support native fish populations. Option to be considered under all water resource availabilities. | Watering required most years |
| **Yarrabandai Lagoon (formerly known as Burrawang West, PU 3)**  Provide off-channel refuge habitat for native frogs and waterbirds | 400-800 ML in total | Linked to Lachlan River flows & Wyangala Dam releases | Previously watered by NSW. Watered in 2018-19 to create refuge habitat into 2019-20 and beyond. | Watering required most years | Watering required to support frog and waterbird populations. Option to be considered under all water resource availabilities. | Watering required most years |
| **Brewster Weir Pool**  Olive perchlet habitat | In 2017-18 and 2018-19 approximately 5-6 GL of water | Linked to Lachlan River flows & Wyangala Dam releases (for accounting purposes) | Wyangala to Cumbung flows in 2017-18 and 2018-19 influenced flows in Brewster Weir pool. | Watering required most years | Watering required to support native fish populations. Option to be considered under all water resource availabilities. | Watering required most years |
| **Wallaroi/Wallamundry/Nerathong anabranches (PU 5)**  Lateral connectivity to anabranch systems and refuges  Native fish outcomes | Nerathong and Wallamundry Creek >30ML/day, Wallaroi Creek >70ML/day for 10 days min annually, Oct to April (small fresh). | As required | These systems receive water from consumptive demand and replenishment flows however have not received managed environmental flows. During irrigation season may receive some flows depending on river height and operation of structures | Natural cues apply | Natural cues apply under all water resource availabilities. | Natural cues apply |
| **Booberoi Creek (PU 7)**  Maintains a population of eel-tailed catfish (*Tandanus tandanus*) and high biodiversity of small-bodied native fish and aquatic macrophytes, which has local cultural significance**.** | Up to 100 ML/day at Booberoi Offtake (412189) with return flows at Booberoi Creek return monitored. Delivery linked to pulses in the Lachlan River (see above) | A variable frequency and timing is desired, to create flow pulses above baseflow. Low winter flows may need to be supplemented by environmental flows at times | This anabranch is required to be supplied with a maximum 12,500 ML annually as a replenishment flow under the Lachlan Water Sharing Plan which is delivered as a daily average flow rate. Booberoi Creek has received environmental water every year since 2017. | Watering required most years | Watering to be considered to support native fish populations, particularly remnant eel-tailed catfish population. Option to be considered under a low or moderate water resource availability. | Watering required |
| **Lake Brewster (PU 10)**  Habitat for breeding pelican colony  Wetland vegetation support water quality outcomes | Flows into Lake Brewster are managed to avoid inundation of nests during pelican breeding | As required if needed to augment use of the Lake Brewster AEW account | This asset is primarily a managed storage. OEH have used small volumes to support pelican breeding in 2016 and 2017. Small volumes of CEW was re-regulated from a main channel event into Lake Brewster in 2017 to support wetland vegetation. | Contingency | Watering required to support breeding events to completion. Option to be considered under all water resource availabilities, however more likely to be triggered under moderate or high water resource availability. | Contingency |
| **Willandra Creek (PU 11)**  Lateral connectivity to major distributary | Small fresh event (up to 18GL) @ Homestead weir targeting low-lying wetland vegetation and habitat | 1-2 years every 10 years (unknown) | Distributary receives stock and domestic flows. Demand met in three of the last 4 years. | Natural cues apply | A low priority for environmental water. Asset receives more water under regulated conditions than naturally | Natural cues apply |
| **Merrimajeel Creek (PU 13)**  Lateral connectivity to major distributaries  Foraging and nesting habitat for waterbirds | Small fresh event (7-8 GL at Torriganny weir) targeting wetland vegetation and habitat | 7 years every 10 years (unknown) | Distributary system was extensively flooded, triggering a major bird breeding event in late 2016. Distributary receives stock and domestic flows and delivery is coordinated with these flows. | Watering required most years | Watering required this year or next. This event is saleable and is an option to be considered under all water resource availabilities. | Watering required |
| Medium scale event (50-60 GL Torriganny weir) targeting wetland vegetation and habitat | 3 years every 10 years (unknown) | This demand was last met in 2016-17. | Natural cues apply | This event is scalable and is an option to be considered under a moderate water resource availability. A low priority for CEW under a high water resource availability as demands will be met through other sources of water. | Natural cues apply |
| Large scale event (~100-125 GL Torriganny weir) targeting wetland vegetation and habitat | 2 years every 10 years (unknown) | Events of this magnitude have occurred in flood years (2012 and 2016). | Natural cues apply | A low priority for Commonwealth environmental water. Under a high water resource availability demand would be met through other sources of water. | Natural cues apply |
| **Merrowie Creek (PU 12)**  Lateral connectivity to major distributaries  Foraging and nesting habitat for waterbirds | Small fresh event (7-8 GL at Ganowlia weir(412196)) for targeting low-lying wetland vegetation and habitat, including Cuba Dam, Churchill Swamp, Merrowie Creek wetlands | 3 years every 10 years (unknown) | This demand was met in three of the previous four years. | Watering required this year or next | Option to be considered under moderate water resource availability. A low priority for CEW under a high water resource availability as demand will be met through other sources of water | Watering required |
| Medium scale event (13-15 GL at Ganowlia weir (412196)) for targeting low-lying wetland vegetation and habitat, including Cuba Dam, Churchill Swamp, Merrowie Creek wetlands | 2 years every 10 years (unknown) | An event of this magnitude to target assets at the end of the system such as Lake Tarwong have only been met in wet years, with a partial wetting of the system in 2013 and 2014. | Natural cues apply | Option to be considered under moderate water resource availability. A low priority for CEW under a high water resource availability as demand will be met through other sources of water | Natural cues apply |
| **Merrimajeel Creek (PU 13)**  Habitat for large scale waterbird colonies (100,000 + nests)  Nationally significant wetland complex | If colony indicates breeding is imminent (lignum trampling etc), provide a stable flow rate to Merrimajeel Creek at the Blockbank (412129) to provide at least 0.8 metres of depth below nests until chicks have fledged | As required | The traditional colony site for predominately straw-necked ibis was supported using environmental water during breeding events in 2012 and 2016. Was provided in 2015 but the colony did not progress. | Water to be provided if colony at risk of nest abandonment | Watering required, if feasible. Option is associated with moderate to high water resource availability (wet conditions). | Water to be provided if colony at risk of nest abandonment |
| **Muggabah Creek (PU15)**  Habitat for large scale waterbird colonies (100,000 + nests)  Nationally significant wetland complex | If colony indicates breeding is imminent (lignum trampling etc), provide a stable flow rate to Merrimajeel Creek at the Blockbank (412129) to provide at least 0.8 metres of depth below nests until chicks have fledged | As required | The traditional colony site for predominately straw-necked ibis was supported using environmental water during breeding events in 2012 and 2016. Was provided in 2015 but the colony did not progress. | Water to be provided if colony at risk of nest abandonment | Watering required, if feasible. Option is associated with moderate to high water resource availability (wet conditions | Water to be provided if colony at risk of nest abandonment |
| **Lachlan Swamps (PU 16)**  Lateral connectivity  (In practice, these assets would be targeted at the same time as watering of the Great Cumbung Swamp due to the volumes required) | Small fresh event (18 GL at Booligal (412005) days plus a gradual recession targeting low-lying wetland vegetation and habitat | 5 years every 10 years (unknown) | This demand was met in three of the previous four years. | Natural cues apply | A low priority for environmental water. Option to be considered under a moderate to high water resource availability in future years. | Natural cues apply |
| Medium scale event (50-60 GL) at Booligal (412005) targeting low-lying wetland vegetation and habitat | 3 years every 10 years (unknown) | This demand was last met in 2016-17. | Natural cues apply | A low priority for environmental water. Option to be considered under a high water resource availability in future years. | Natural cues apply |
| Large inundation event (~100-125 GL @ Booligal (412005)) to create overbank flows into wetland habitats | 2 years every 10 years (unknown) | This demand has been met in wet years (2011 and 2016) and partially met with translucent flows in 2015. | Natural cues apply | A low priority for environmental water. Option to be considered under a high water resource availability in future years. | Natural cues apply |
| **Great Cumbung Swamp (PU 16)**  Foraging and nesting habitat for waterbirds. Nationally significant wetland complex.  Connects the Lachlan to the Murrumbidgee in high flows providing dispersal opportunities for native fish, mainly floodplain specialists. | Small fresh event (18 GL) at Booligal weir (412005) targeting low-lying wetland vegetation and habitat | 5 years every 10 years (unknown) | This demand was partially met in three of the previous four years. CEW was delivered in winter 2018 and autumn 2019 with  Water Quality Allowance water provided in Jan-April 2019 combining to provide a good wetting of low lying wetland vegetation. | Watering required | A High Priority for a watering action to maintain condition as a refuge if drought conditions continue through 2019-20. | Watering required |
| Medium scale event (50-60 GL) at Booligal weir (412005) targeting low-lying wetland vegetation and habitat | 3 years every 10 years (unknown) | This demand was met in one of the previous four years. | Natural cues apply | A low priority for environmental water. This event is scalable and is an option to be considered under a moderate or high water resource availability in future years. | Natural cues apply |
| Large inundation event (~100-125 GL @ Booligal (412005)) to create overbank flows into wetland habitats and red gum and blackbox communities | 2 years every 10 years (unknown) | This demand has been met in wet years (2012 and 2016) and partially met with translucent flows in 2015. | Natural cues apply | A low priority for environmental water. This event is scalable and is an option to be considered under a moderate or high water resource availability in future years. | Natural cues apply |
| **Lake Cowal (PU 4) and other lake systems within the catchment**  Provide habitat for native fish and colonial nesting waterbirds | Demand yet to be assessed | Various and may be linked to delivery of operational flows | Various. Systems may receive natural inflows and be a source of floodwater return to the Lachlan River. | Various - may have limited capacity to deliver Commonwealth environmental water to some assets | | |
| **Weir pools (drought refuge)**  Provide refuge habitat for native fish and waterbirds | Demand yet to be assessed & anticpated to vary from site to site | As required | As of start of 2019-20 weir pools continue to be maintained by operational flows. | Contingency | Expected to be a low priority for environmental water in 2019-20 as operational flows are anticipated to meet this need. | Contingency – likely to be activated if operational flows are unable to meet this need in 2020-21. |
| **Water quality**  Provide diluting flows or manage flow regime and timing to mitigate against poor water quality | Variable | As required | Water Quality Allowance (WQA) used in 2016-17 along with NSW and Cth held water to create refuges and provide better quality water during a hypoxic blackwater event.  WQA used to mitigate the threat of blue green algae buildup in Jan-April 2019 | Contingency | Option to be considered under all water resource availabilities, if water quality poses a risk to assets or objectives. | Contingency |
|  |  |  |  | **Carryover potential** | The volume of Commonwealth environmental water likely to be carried over in Lachlan catchment in 2019– 20 is estimated to be approximately 37 GL, noting that restrictions might be placed on access to this in 2019-20 due to the continuation of drought conditions. | Available allocations to be carried into 2021-21 will be identified in Lachlan environmental water holdings at <https://www.environment.gov.au/water/cewo/about/water-holdings>. |
|  |  |  |  | **Trade potential** | No specific commercial trade of water has been identified for 2019-20. Trade opportunities will be reviewed in the valley throughout the water year and as conditions change | Potential to trade will depend on environmental demands, resource availability and market conditions. |

Planning Unit (PU) naming as per *Lachlan Long Term Water Plan Part B: Lachlan planning units (Draft for exhibition)*

PU1: Belubula River

PU2: Upper Lachlan River

PU3: Lachlan River - Forbes to Condobolin (Lachlan River, Horseshoe Lagoon, Bumbuggan Creek)

PU4: Upper and Mid Lachlan floodplain (Thurumbidgee Lagoon, Bundaburra Creek, Lake Cowal)

PU5: Mid Lachlan anabranches (Island, Wallamundry, Wallaroi and Narrathong Creeks)

PU6: Lachlan River - Condobolin to Lake Cargelligo (Lachlan River, Borapine & Kiagathur Creeks, Yarnel Lagoon)

PU7: Booberoi Creek

PU8: Lachlan River - Lake Cargelligo to Willandra Weir (Lachlan River, Box Creek)

PU9: Lake Cargelligo

PU10: Lake Brewster

PU11: Willandra Creek

PU12: Merrowie Creek (Cuba Dam, Chillichil swamp, Merrowie Creek wetlands, Box Creek)

PU13: Merrimajeel Creek (Merrimajeel Creek, Booligal Wetlands, Lake Merrimajeel, Murrumbidgil Swamp)

PU14: Lower Lachlan watercourse (Lachlan River, Moon Moon Lake)

PU15: Muggabah Creek

PU16: Western Lachlan watercourse including The Great Cumbung Swamp (Lachlan River, Great Cumbung Swamp, Lake Waljeers, Pimpara Creek, Lachlan swamp, Baconian swamp, Lake Ita)



# Next steps

## From planning to decision making

It is important to distinguish between planning and operational decision making. As shown in Figure 4, planning allows the Commonwealth Environmental Water 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.

Portfolio management planning:

Broad approach or intention, based on key factors:

* environmental demand
* water resource availability

Decision making for Commonwealth environmental water:

Determining a course of action, based on detailed consideration of conditions, such as:

* environmental demands and opportunities at specific sites;
* anticipated environmental demands in coming years;
* climatic conditions across a range of scenarios and current dam storage levels;
* physical and operational constraints to water delivery;
* environmental and operational risks;
* benefit assessment of each option, within and across catchments;
* water account rules and carryover limits;
* long-term yield of entitlements and wise levels of carryover, given uncertainty about future environmental needs; and
* water market conditions.

Figure 6: Planning and decision making for Commonwealth environmental water use

## Monitoring

Operational hydrologic monitoring is undertaken for all Commonwealth environmental watering actions and involves collecting 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 Commonwealth Environmental Water Office’s Long Term Intervention Monitoring (LTIM) Project (2015-19) and the current Monitoring, Evaluation and Reporting (MER) Project (2019-2021) has the Lower Lachlan region as one of seven focus areas. This works aims to understand the environmental response from Commonwealth environmental watering with respect to the targeted objectives by carrying out monitoring of site condition and responses over several years.

Information on the monitoring activities is available at:

https://www.environment.gov.au/water/cewo/catchment/lachlan/monitoring

Monitoring information is also provided by state governments.

## Further information

For further information on how the Commonwealth Environmental Water 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

The *Basin-wide environmental watering strategy* (24 November 2014) published by the Murray-Darling Basin Authority aims “is to bring about enduring environmental change through strategic use of the water set aside for environmental health. Importantly, the strategy identifies how we can best achieve the desired environmental outcomes in the Basin through better coordination and cooperation between agencies and across borders; and use our water as wisely as possible to maintain a river system that is resilient and healthy.”(ref: *Basin-wide environmental watering strategy*, pg. vii)

The Basin-wide environmental watering strategy can be found at: [*https://www.mdba.gov.au/sites/default/files/pubs/Basin-wide-e-watering-strategy-Nov14.pdf*](https://www.mdba.gov.au/sites/default/files/pubs/Basin-wide-e-watering-strategy-Nov14.pdf)

Expected outcomes from the strategy relevant to the Lachlan Catchment are described below.

**River flows and connectivity**

“The Basin Plan aims to at least partialy reinstate this connection between rivers and their lower-lying floodplains. Valleys with highly altered river flows and large areas of lowland floodplains are the most important places in which to improve lateral connectivity. Priority examples include the Condamine–Balonne, Gwydir, Macquarie, Barwon–Darling, Lachlan, Murrumbidgee, Murray, Lower Darling and Goulburn–Broken.”

Longitudinal connectivity: To keep base flows at least 60% of the natural level.

Lateral connectivity: A 10-20% increase of freshes and bank-full events.

**Vegetation**

The vegetation outcomes expected under this strategy are, at a minimum, to maintain the extent and to improve the condition of water-dependent vegetation on the parts of the Basin’s floodplain that can be actively managed.

The expected outcomes for forests and woodlands in the Basin are: by 2024, improved condition of river red gum in the Lachlan (and Murrumbidgee, Lower Darling, Murray, Goulburn–Broken and Wimmera–Avoca).

The outcomes expected for shrubland vegetation (in the Lachlan) are:

* to maintain the current extent of extensive lignum shrubland areas within the Basin
* by 2024, improvement in the condition of lignum shrublands

**Vegetation extent**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Outcomes for water-dependent vegetation** | **Area of river red gum (ha)** | **Area of black box (ha)** | **Shrublands** | **Non–woody water dependent vegetation** |
| |  | | --- | | Maintain extent of water-dependent vegetation near river channels and on low-lying areas of the floodplain. Improve conditioni of black box and river red gum | | 41,300 | 58,000 | Lignum in the Lower Lachlan | Closely fringing or occurring within the Lachlan River and Willandra Creek; and Common reed and Cumbungi in the Great Cumbung Swamp |

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, and for common reed and cumbungi in the Great Cumbung Swamp.

**Black box condition**

|  |  |  |
| --- | --- | --- |
| **Vegetation condition score** | | **Percent of vegetation assessed (within the managed floodplain)** |
| **0 –6** | **>6 –10** |
| 72 per cent | 28 per cent | 45 per cent |

0–6 are categorised as ‘severely degraded to poor’. >6–10 are ‘moderate to good’ condition

**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 | 21 per cent | 41 per cent | 26 per cent | 93 per cent |

0–2 are categorised as ‘severely degraded’; >2–4 are ‘degraded’; >4–6 are ‘poor’;

>6–8 are ‘moderate’; >8–10 are ‘good’ condition.

**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.

**Important Basin environmental assets for waterbirds in the Lachlan**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Environmental asset** | **Total abundance and diversity** | **Drought refuge** | **Colonial waterbird breeding** | **Shorebird abundance** | **In scope for Commonwealth watering** |
| Booligal wetlands | \* |  | \* |  | Yes |
| Great Cumbung Swamp | \* |  | \* |  | Yes |
| Lake Brewster | \* |  | \* |  | Yes\* |
| Lake Cowal | \* |  | \* |  | No\*\* |

\* As a regulated water storage that also support large Pelican colonies at times, environmental water may be used to manage the flow regime in Lake Brewster to avoid inundation of nesting colonies.

\*\* Lake Cowal is for the most part supplied via run-off from the unregulated Bland Creek tributary system. Environmental water requirements, and the feasibility of delivery, to the most downstream part of this system closest to the Lachlan Rive, are a target for investigation.

**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 fish species for the Lachlan include:

|  |  |  |
| --- | --- | --- |
| **Species** | **Specific outcomes** | **In-scope for Commonwealth watering in the Lachlan?** |
| Flathead galaxias (*Galaxias rostratus*) | Considered locally extinct. Reintroduction using southern populations may be an option in the longer term, with the Lachlan a potential candidate site. | Only if re-introduced. |
| Freshwater catfish (*Tandanus tandanus*) |  | Yes |
| Golden Perch (*Macquaria ambigua*) | A 10–15 per cent increase of mature fish (of legal take size) in key populations | Yes |
| Macquarie perch (*Macquaria australasica*) | Range expansion of at least 2 current populations in the Lachlan is a priority. Establish 1–3 additional riverine populations within the Lachlan catchment | Yes |
| Murray cod (*Maccullochella peelii peelii*) | A 10–15 per cent increase of mature fish (of legal take size) in key populations | Yes |
| Olive perchlet (*Ambassis agassizii*) | Expand the range (or core range) of existing populations in the Lachlan River. | Yes |
| River blackfish (*Gadopsis marmoratus*) | - | No |
| Silver perch (*Bidyanus bidyanus*) | - | Yes |
| Purple-spotted gudgeon (*Mogurnda adspersa*) | Establish/improve core range of populations in the Lachlan. | Only if populations are established |
| Trout cod (*Maccullochella macquariensis*) | Establish additional populations in the Lachlan | Only if additional populations are established |

**Important Basin environmental assets for native fish in the Lachlan**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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 C’th water** |
| Lachlan River – Condobolin to Booligal | \* | \* | \* | \* | \* | \* | Y |

# Attachment B – Operational details for watering

## Operational considerations in the Lachlan catchment

The Water Sharing Plan for the Lachlan Regulated River Water Source 2016 (current version 27 June 2018) notes the following:

**32 Water delivery and channel capacity constraints**

(1) Where necessary for determining numerical extraction components, managing water releases or providing water under access licences, the maximum delivery or operating channel capacity in this water source or in any section of this water source will be determined and specified in accordance with procedures established by the Minister, taking into account the following:

(a) inundation of private land or interference with access,

(b) the effects of inundation on the floodplain and associated wetlands,

(c) the transmission losses expected to occur,

**Note**. *Transmission losses* is defined in the Dictionary.

(d) capacities of water management structures controlled by the Minister.

**Note**. The capacities at the commencement of this Plan have been assessed as follows:

(a) 15,000 ML/day between Wyangala Dam and Jemalong Weir,

(b) 10,000 ML/day between Jemalong Weir and Condobolin,

(c) 7,000 ML/day between Condobolin and Lake Cargelligo Weir,

(d) 2,400 ML/day between Lake Cargelligo Weir and Willandra Weir,

(e) 2,000 ML/day between Willandra Weir and Middle Creek Offtake,

(f) 1,500 ML/day between Middle Creek Offtake and Hillston Weir,

(g) 1,500 ML/day between Hillston Weir and Whealbah,

(h) 1,000 ML/day between Whealbah and Torrigany Weir,

(i) 500 ML/day in Willandra Creek,

(j) 390 ML/day in the Wallamundry Creek system,

(k) 2,000 ML/day in Goobang/Bumbuggan Creeks,

(l) 800 ML/day between Booligal Weir and Corrong,

(m) 600 ML/day downstream of Corrong.

The notes below do not form part of the *Water Sharing Plan* but provide additional constraints information:

The maximum valve capacity of Wyangala Dam below Spillway is 6,000 ML/day. Once the dam is below 55% releases can only be made through the valves and the hydro scheme.

The commence to flow for Moon Moon Swamp is ~1,600ML/day @ Whealbah

The commence to flow for Lower Lachlan Swamp is 825-850ML/day @ Booligal

The commence to flow for Lake Ita is ~675ML/day @ Corrong

In order to release environmental water at required flow rates to meet hydrographs or timing requirements, the following storage considerations apply:

* 1. Releases from Brewster weir if controlled through the conduit is 1200 ML/day or if over the weir sill is 10,000 ML/day (releases over the spillway constrained due to operational/OH&S issues around the shutters, and also due to it being difficult to accurately measure volumes).
  2. Discharge capacity at Lake Cargelligo is 1000 ML/day. (declines significantly as lake level drops)
  3. Discharge capacity at Lake Brewster is 2000 ML/day. (declines as storage level drops)
  4. Wyangala Dam hydro-electric power station operating range is between 350 ML/day to about 3000 ML/day, rates above this are released from the valves.
  5. Achieving inundation of some off-channel assets, such as the Lower Lachlan Swamp system, requires overbank flows of a certain magnitude, which may not be achievable under very low water resource availabilities.

## Potential watering actions under different levels of water resource availability

Under certain levels of water resource availability, 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 inthe Lachlan catchment and the levels of water resource availability that relate to these actions.

Table 4: Summary of potential watering actions for the Lachlan

| **Broad Asset** | **Indicative volume of CEW** | **Applicable level(s) of inflow scenario** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Very Dry** | **Dry** | | **Median** | | **Wet** | | | **Very Wet** |
| **Booberoi Creek** | Up to 5 GL | Providing increased flows above stock and domestic to increase variability and connectivity to the main channel to support remnant native fish populations and provide refuge | | | | |  | | | |  |
| **Lachlan River – main channel** | Scaleable use under all scenarios for fish outcomes  High - Very High – unregulated flows may contribute to demand, however delivery may need to be managed to create the desired hydrograph. | Protecting tributary inflows to provide a trigger for native fish to migrate and spawn and to support recruitment. Provide a release from storage, or augment natural flows, to meet species specific requirements for habitat or breeding (e.g. olive perchlet and golden perch) using environmental triggers for delivery (water temperature or inflows). Focus on known sites for native species such as eel tail catfish, silver perch and Murray cod.  This action contributes to the delivery volume for the terminal wetlands (Great Cumbung Swamp). | | | | | | | | |
| **Yarrabandai Lagoon (formerly known as Burrawang West)** | 400-600 ML per year | Provide off-channel habitat (e.g drought refuge) for native frogs and waterbirds | | | | |  | | | |
| **Brewster Weir Pool** | 5-6 GL per year | Maintain native fish habita, particularly Oliver perchlet. Linked to ‘run of the river’ releases from Wyangala Dam targeting the length of the river to the Great Cumbung Swamp | | | | | | |  | |
| **Booligal Wetlands** | Scaleable use under all scenarios for fish outcomes  High - Very High – unregulated flows may contribute to demand | Contributing to inundation of wetlands and aquatic vegetation condition via piggybacking replenishment flows or natural inflows to Merrimajeel or Muggabah Creek, and maintaining waterbird habitat. Provide hydrological connectivity to reconnect and refill low-lying wetlands, and support River red gum and lignum condition and recruitment. | | | | | | | | |
| Under 5 GL | | | | 25-50 GL | | | Unregulated flows sufficient | |
| Up to 10 GL |  | | | | Breeding event contingency: Maintain wetland water levels and acceptable levels of water quality to support the completion of a naturally-triggered waterbird breeding event, or other native aquatic vertebrates. | | | | |
| **Merrowie Creek** | Up to 10 GL |  | | Contribute to inundation of wetlands and waterbird habitat via augmenting natural flows/planned water. | | | | |  | |
| **Willandra Creek** | Up to 8 GL |  | Contribute to inundation of Willandra Creek and its in-stream habitat and fringing vegetation communities via augmenting natural flows/planned water. | | | | |  | | |
| **Water quality – hypoxic water conditions/cyanobacteria** | Variable | Manage flow rate to reduce stratification, and provide a diluting flow, if required. | | | Contribute to slowing the discharge of low dissolved oxygen water from the floodplain back in to the river channel, and maintain a steady in channel dilution flow until dissolved oxygen levels rise to safe levels for fish and other aquatic species. | | | | | |
| **Lower Lachlan swamps** | Moderate - High – between 10 - 60 GL  Very High – unregulated flows likely to meet demand, or demand has been met. | . | | | Providing flow to the wetlands in the Lower Lachlan to maintain vegetation condition, provide drought refugia and habitat for aquatic vertebrates | | | | Unregulated flows sufficient. | |
| **Great Cumbung Swamp** | Demand may be met through main channel action, or scalable if undertaken as a standalone action  Very Low - Low – up to 10 GL Moderate - High – up to 60 GL  Very High – unregulated flows likely to meet demand, or demand has been met. | Providing flow to the terminal wetlands of the Great Cumbung Swamp to maintain vegetation condition and waterbird habitat in core areas. Provide hydrological connectivity to reconnect and refill low-lying wetlands. Flows along the length of the system also provide improved condition and maintenance of aquatic and riparian vegetation, and maintains aquatic habitat for native fish. Primary production, decomposition, nutrient and carbon cycling may also be enhanced. | | | | | | | | |
| Up to 10GL | | | Up to 60GL | | | | Unregulated flows sufficient. | |

**Note:** Under Wet or Very Wet inflow scenarios, some options 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. Options that remain viable under a Very Wet scenario are those that require a specific hydrograph, or are timing specific

## Potential watering actions – standard operating arrangements

Table 4 identifies the range of potential watering actions in Lachlan 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.

**Watering Action: Lachlan River**

Watering action: Protecting natural tributary inflows from regulation to deliver natural flow variability and allowing it to flow the length of the Lachlan River system. This protects the integrity of natural chemical signatures that provide cues for native fish migration and spawning. Releases from storage or augmenting natural flows can also meet specific flow requirements for native fish species.

Standard operational considerations: Target volumes and flow rates will be dependent on the characteristics of inflow events in the upper tributaries, prevailing flow conditions and operational considerations. For releases from storage, meeting flow rates will be dependent on operational considerations e.g. other orders in the system. The managment of use through Brewster Weir pool (water temporarily retained for accounting puposes) would be incorporated into this watering action.

Typical extent: Lachlan River (channel only) below Wyangala dam to Great Cumbung Swamp, supplied from upper tributary creek inflows, planned water and/or releases from storage.

Approvals: N/A

**Watering Action: Booberoi Creek**

Watering action: Provide hydrological connectivity to the main channel.

Standard operational considerations: A variation to the standard delivery regime was undertaken in this system in 2017 to increase the daily flow rate. This type of action could be attempted in future if flows in the main channel support it.

Typical extent: This watering action could contribute flows required to increase connection of the anabranch to the main stem of the Lachlan River.

Approvals: Landholders supportive of action undertaken.

**Watering Action: Willandra Creek**

Watering action: Provide hydrological connectivity to reconnect and refill low-lying wetlands.

Standard operational considerations: See channel capacities (Attachment B).

Typical extent: This watering action could contribute flows required to inundate Morrisons Lake.

Approvals: Agreement from landholders whose properties might be inundated by environmental flows may be required.

**Watering Action: Merrowie Creek**

Watering action: Provide hydrological connectivity to reconnect and refill low-lying wetlands.

Standard operational considerations: See channel capacities (Attachment B).

Typical extent: This watering action could contribute flows required to inundate assets in the Merrowie Creek system supplied from Lake Brewster, directed by operation of Gonowlia Weir.

Approvals: Agreement from landholders whose properties might be inundated by environmental flows may be required.

**Watering Action: Contingency for breeding events**

Watering action: Maintain wetland water levels and acceptable levels of water quality to support the completion of a significant breeding event of waterbirds or other native aquatic vertebrates in a wetland. Adequate water account balance is required in order to undertake this action.

Standard operational considerations: This contingency is not to trigger a breeding event for waterbirds or other native animals but for use when a breeding event is already underway and considered in danger of failure due to receding water levels.

Typical extent: Booligal wetlands, Merrowie Creek, Lachlan Swamp, and Great Cumbung Swamp.

**Watering Action: Booligal Wetlands**

Watering action: Provide hydrological connectivity to reconnect and refill low-lying wetlands.

Standard operational considerations: See channel capacities (Attachment B) and Contingency for breeding events (below).

Typical extent: This watering action could contribute flows to assets in the Merrimajeel Creek and Muggabah Creek systems supplied from Lake Brewster, directed by operation of Torriganny Weir.

Approvals: Agreement from landholders whose properties might be inundated by environmental flows may be required.

**Watering Action: Lower Lachlan swamps**

Watering action: Provide hydrological connectivity to reconnect and refill low-lying wetlands.

Standard operational considerations: The Lower Lachlan swamps can be watered separately to the Great Cumbung Swamp, but in practical terms they are generally watered in the same watering action.

Typical extent: This watering action could contribute flows required to inundate the Booligal Wetlands, Lower Lachlan Swamp and Great Cumbung Swamp supplied from Lake Brewster. Water would be directed to Booligal Wetlands by operation of Booligal Weir.

Approvals: Agreement from landholders whose properties might be inundated by environmental flows may be required.

**Watering Action: Great Cumbung Swamp**

Watering action: Provide hydrological connectivity to reconnect and refill low-lying wetlands.

Standard operational considerations: To ensure flow predominantly in-channel in order to meet targets in the lower Lachlan, see Attachment B for channel capacity of distributaries.

Typical extent: This watering action could contribute flows required to inundate the Great Cumbung Swamp supplied from Lake Brewster if available, or Wyangala dam. Water would be directed to the Great Cumbung Swamp by operation of Booligal Weir.

Approvals: In order to achieve maximum duration of inundation in central lakes of the Great Cumbung Swamp including Clear Lake and Blindbungi, negotiation with landholders will be necessary to operate private regulating structures to maintain the water levels, and move water within the swamp.

Agreement from landholders whose properties might be inundated by environmental flows may be required.

**Water quality – hypoxic water conditions/cyanobacteria**

Watering action: Provide diluting or flushing flows to affected reaches. Provide flows to increase dissolved oxygen levels to reduce mortality of aquatic species.

Standard operational considerations: Dependent on volumes required.

Typical extent: Variable, depending on the source of the poor water quality.

Approvals: Agreement from landholders whose properties might be further inundated by environmental flows may be required.

# Attachment C – Long-term water availability

## Commonwealth environmental water holdings

The Commonwealth holds the following entitlements in the Lachlan catchment:

* High Security 0.9 GL
* General Security 86.9 GL

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 Lachlan catchment include held environmental water (New South Wales Office of Environment and Heritage).

Refer to: <https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/about-water-for-the-environment/current-water-holdings>

'Held' environmental water is allocated to water licenses held for environmental use.

## 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’).

'Planned' water for the environment is allocated through water sharing plans under the NSW Water Management Act 2000. Water sharing plans establish rules for sharing water between the environment and different types of water users. Within water sharing plans there are a number of rules and triggers for the use of 'planned' water for the environment. Water is allocated periodically according to inflows and dam levels.

Refer to: <https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/about-water-for-the-environment>

1. See Ellis et al (2016) [↑](#footnote-ref-2)