



Australian Government

Commonwealth Environmental Water Office

Commonwealth Environmental Water Office

Water Management Plan

Chapter 3.7 – Barwon-Darling River

2020–21



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Please visit: <https://www.environment.gov.au/water/cewo/publications/water-management-plan-2020-21> for links to the main document.

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For more information about Commonwealth environmental water, please contact us at:

1800 803 772

ewater@awe.gov.au

www.environment.gov.au/water/cewo

@theCEWH

GPO Box 858, Canberra ACT 2601

3.7 Barwon-Darling River

3.7.1 Region overview

(a) River system

The Barwon River flows south-west through a relatively narrow floodplain with a tightly meandering channel. It has a highly variable channel capacity and flow pattern. Channel capacity increases downstream of Collarenebri, after the Little Weir, Boomi, Moonie, Gwydir and Mehi rivers have joined the Barwon.

Downstream of Collarenebri, the Barwon River continues south-west, and is joined by more creeks and rivers including the Namoi River. Beyond Walgett the river turns in a westerly direction and flows unrestricted across alluvial plains. Further downstream there are many anabranches and effluent channels, which split and re-join the major channel. Upstream of Bourke, the Culgoa and Barwon Rivers join to form the Darling River.

The Darling River flows south-west within a deeply incised channel towards Wilcannia. Below Wilcannia the Darling reaches the Menindee Lakes, at the artificial storage of Lake Wetherell.

There are no major public water storages along the Barwon–Darling system, although large headwater storages exist in several tributaries. There are also large private off river storages that store water diverted or pumped from the Barwon and Darling Rivers or harvested from floodplain run-off. There are also 14 major weirs along the main stem of the Barwon–Darling system from Mungindi to upstream of Menindee Lakes, which create a series of barriers for fish passage. Only the Brewarrina Weir contains an effective fishway.

(b) Traditional Owners

The rivers and waterholes of the Barwon–Darling system hold significant spiritual and cultural importance for Aboriginal people from several nations including the Barkandji, Murrawarri, Ngemba and Ngiyampaa peoples.

(c) Important sites and values

The Barwon–Darling River channel connects the rivers, lakes and wetlands in the northern Murray–Darling Basin as well as providing connectivity with the southern Basin. Connectivity of the Barwon–Darling has been listed in the Basin environmental watering priorities in recent years. The Barwon–Darling provides a critical dry period refuge and movement corridor for fish and waterbirds, as well as habitats for other aquatic species including turtles, mussels, river snail and shrimp. Connectivity along the length of the Barwon and Darling Rivers is particularly important for regional communities of native fish and other aquatic species.

Diverse in-stream habitats including channels, deep pools, riffles, benches, snags, gravel beds and aquatic and riparian vegetation support a significant native fish community. There are more than 1 100 refugial waterholes between Mungindi and Wilcannia.

The fish community within the Barwon–Darling system includes 15 native species which have been recorded or expected to occur along the system, and up to five non-native species. Silver perch is listed as critically endangered and Murray cod as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The system is likely to contain remnant populations of olive perchlet, purple spotted gudgeon and freshwater catfish, all of which are listed under relevant threatened species legislation within NSW. Other important species found in the Barwon–Darling that are not widely dispersed across the Basin include Rendahl's tandan, Hyrtl's tandan, spangled perch, Darling River hardyhead and desert rainbowfish.

The Barwon–Darling also supports several species of river mussels, including *Alathyria jacksoni*, which is highly responsive to changes in low and zero flows.

(d) Stakeholder engagement

The Commonwealth Environmental Water Office (CEWO) works with the following to collect and collate relevant monitoring information and evaluation results that facilitates adaptive management and changing our practices where needed:

- the Murray–Darling Basin Authority
- state agencies in particular the Water and Environment, Energy and Science groups in the Department of Planning, Industry and Environment (DPIE)
- research organisations
- regional organisations, local groups and landholders.

This continual review of information and outcomes is helping to build knowledge about the best way to get positive outcomes across the Barwon–Darling system scale, based on what does and does not work across the system.

The CEWO funds a Monitoring, Evaluation and Research program, that includes a selected area at the junction of the Warrego and Darling rivers. This provides additional information to inform adaptive management.

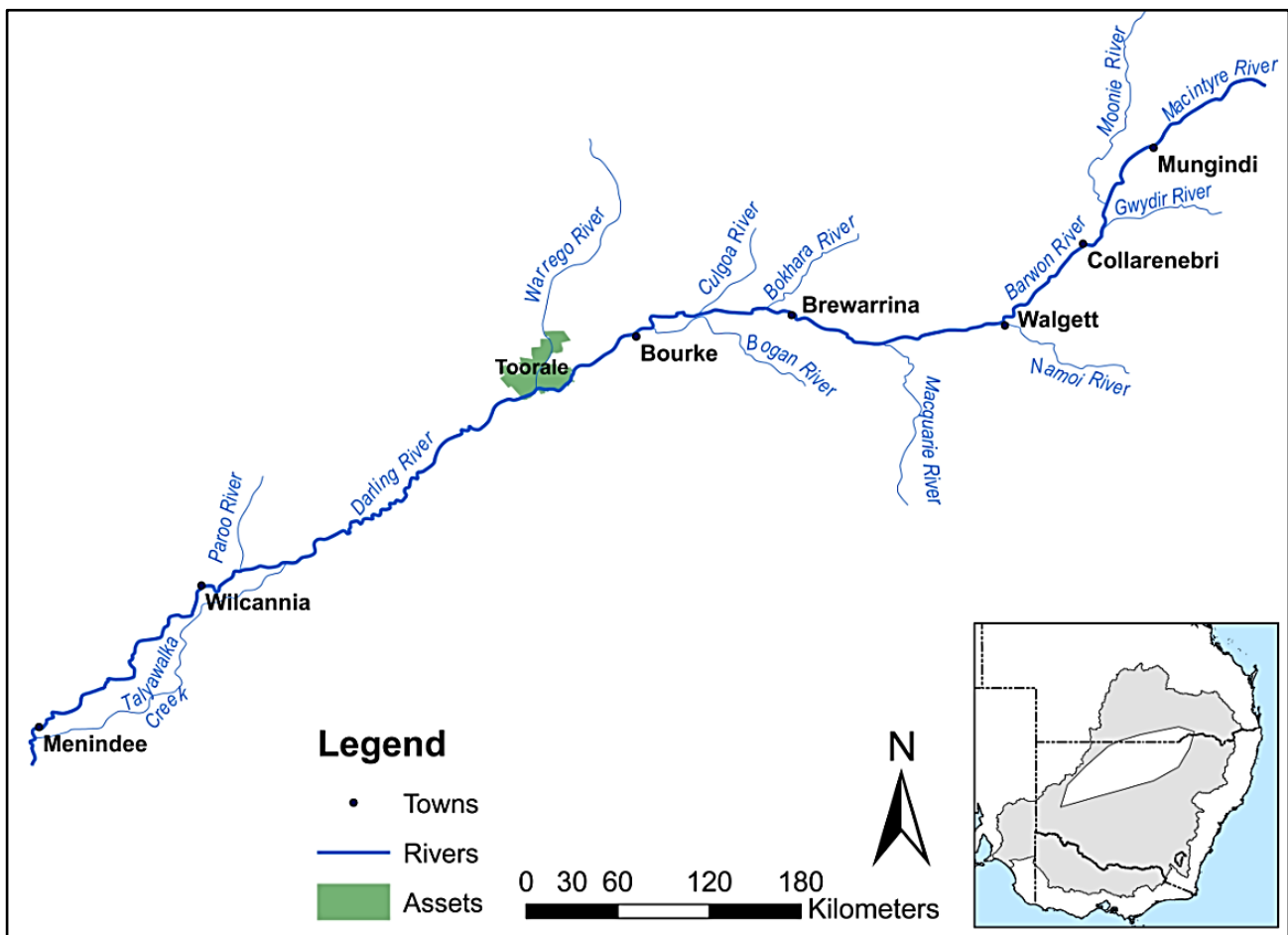


Figure 1: Map of the Barwon–Darling system.

3.7.2 Environmental objectives

Based on long-term environmental objectives in the Basin Plan, draft state long-term watering plans, site management plans, and best available knowledge, the following objectives are relevant for environmental watering in the Barwon–Darling system.

Because of the unregulated nature of the Barwon–Darling system, the objectives that can be achieved in a particular year may vary and are highly dependent on catchment conditions and rainfall events within the systems tributaries. These objectives will continue to be revised as part of the commitment of the CEWO to adaptive management.

Vegetation: Maintain the condition, growth and survival of riparian, in-channel, floodplain and wetland vegetation.

Waterbirds: Increase waterbird abundance and maintain species diversity by supporting naturally triggered breeding events, and maintaining suitable refuge, feeding and breeding habitat.

Native fish: Prevent loss of native fish species and improve population structure and distribution, by supporting opportunities for movement, dispersal, reproduction, and recruitment.

Other vertebrates: Support opportunities for the reproduction and recruitment of other native aquatic species, including frogs and turtles.

Connectivity: Support longitudinal connectivity, along the Barwon and Darling rivers, and lateral connectivity within the river network and between the rivers and their floodplains.

Processes/water quality/resilience: Support key ecosystem functions and promote productivity; maintain water quality in channels and pools; and maintain drought refuge habitat.

3.7.3 First Nations environmental objectives

Representatives of the First Nations peoples of the Barwon–Darling river system have identified environmental objectives for their country for 2020–21 (Table 1). These objectives were developed through the First Nations Environmental Guidance project undertaken by the Northern Basin Aboriginal Nations organisation.

Some of these objectives sit outside the scope of water for the environment to influence, while for others, the link between water for the environment and the site or species is not well understood.

The CEWO is committed to working with First Nations groups to better understand their objectives. The CEWO will use environmental flows to contribute to these objectives where possible and where this is consistent with the Commonwealth Environmental Water Holder’s statutory responsibility of protecting and restoring environmental assets in the Basin.

Table 1: First Nations environmental objectives for the Barwon–Darling system for 2020–21 (NBAN Ltd. 2020)

River flows and Connectivity
<i>Priority sites:</i> The Big Warrambool.
<i>Other flows and connectivity:</i> Ensure there is flow at all times, which can then flow into smaller tributaries and rivers during flooding.
Native Vegetation
<i>Indicator species:</i> Lignum, river reed, quinine, river redgum, yam, dog wood, nardoo.
Native Birds
<i>Indicator species:</i> Pelican, duck, black swan, black shag, black cockatoo ⁱ .
Native Animals
<i>Indicator species:</i> Cod, booglie, yellowbelly, emu ⁱ , echidna ⁱ , silver bream (silver perch).
Connecting with Country
A place to teach culture and stories. A place of gathering for men, and women. Fishing and hunting.

ⁱ Water for the environment targeting other environmental outcomes may influence this species or objective

3.7.4 Recent conditions and seasonal outlook

(a) *Recent conditions and environmental water use*

Like much of the northern Basin, the Barwon–Darling system experienced very hot and dry conditions between January 2018 and January 2020. Rainfall was well below average, with 2018 and 2019 recording the two highest annual average maximum temperatures at Brewarrina for the 83 years of record. Flows along the system during this period have also been generally low, with long reaches of the Barwon–Darling ceasing to flow for extended periods. The hot and dry conditions over the last two years resulted in the Darling River downstream of Bourke not flowing for over 430 days between September 2018 and November 2019. Other river reaches such as downstream of Collarenebri and upstream of Wilcannia experienced low or no flow periods of over 170 days and 200 days respectively. These long periods of low or no flow saw a reduction in the number and quality of refuge pools within the Barwon–Darling systems. The reduction in extent and quality of drought refuges is likely to have had a significant impact on the aquatic communities of the system. Exceptions to these dry conditions were:

- Small flow events moving through the system in autumn 2018, winter 2019 (river reaches downstream of the Warrego/Darling River junction to just downstream of Wilcannia), and late spring 2019.
- Environmental flows from the Northern Connectivity Event along both the Barwon and Darling rivers to the Menindee Lakes during autumn/winter 2018, and Northern Fish Flow moving along the Barwon River during winter 2019.

During late summer and early autumn 2020 widespread rainfall occurred across most of the northern Basin with the upper parts of northern Basin valleys recording more than 300 mm of rainfall during January and February. This rainfall generated significant flows in most Barwon–Darling tributaries and corresponding inflows into the Barwon and Darling rivers. The contribution each tributary made to flows along the Barwon and Darling rivers varied, with the Condamine-Balonne contributing the most (205 gigalitres as measured at the end of system gauges on the Culgoa and Bokhara rivers).

To address critical water needs along the Barwon–Darling systems, temporary water restrictions were put in place by the NSW Government using Section 324 of the NSW *Water Management Act 2000*. These restrictions commenced on 4 November 2019 and prevented unregulated river licence holders along the Barwon and Darling Rivers upstream of Menindee from extracting water from the natural flow events. The temporary restrictions were in place along the Barwon River until 27 February 2020, while along the Darling River upstream of Menindee Lakes the restrictions were in place until 6 March 2020.

Details of previous Commonwealth environmental use in the Barwon–Darling catchment are available at: <https://www.environment.gov.au/water/cewo/catchment/northern-unregulated-rivers/history>

(b) *Seasonal outlook*

According to the Bureau of Meteorology outlook on 2 July 2020, above median rainfall is forecast across the Barwon–Darling system from August to October. While this forecast suggests that recent severe dry conditions may continue to ease somewhat, follow up rain over the forthcoming summer is needed to ensure continued recovery from the drought. Wetter conditions can return suddenly in the northern Basin. Maximum temperatures are also forecast to remain above average over the coming months.

*(c) Water availability**Unregulated held environmental water entitlements*

Commonwealth holdings of water for the environment in the Barwon–Darling system are exclusively made up of unregulated entitlements. These entitlements can only be sourced as a share of an unregulated flow event, determined by entitlement conditions. The list of unregulated entitlements held along the Barwon–Darling is shown in Table 2.

Table 2: Unregulated Commonwealth environmental water entitlements in the Barwon–Darling system.

Water Access License (WAL)	Water Management Zone	Class	Long-term Average Annual Allocation (ML)
37810	Boomi River Confluence to Mogil Mogil Weir Pool	B	3 731
33619	Downstream of Mogil Mogil to Collarenebri	B	9 252
33798		C	6 963
37461	Boorooma to Brewarrina	B	323
33701	Bourke To Louth	A	51
33704		A	22
33784		B	1 566
35944		B	1 188
35943		C	5 535

Available water for the environment using unregulated entitlements within the Barwon–Darling system depends on the nature of flow events that occur. Unregulated entitlements provide opportunistic access to unregulated river flows and overland flows when water resource plan rules are triggered. Each entitlement will contribute to restoring in-stream flows reflecting its flow class, daily take rates and location.

On a long-term average basis 28 631 megalitres of Commonwealth water for the environment is available in the Barwon–Darling system. The amount of water available in each water varies, with above average volumes of Commonwealth water for the environment available in wet years and very small volumes available during dry times.

Environmental water entitlements held in tributary systems

In addition to holdings within the Barwon–Darling system, held water for the environment delivered from within tributary systems of the Barwon–Darling can be delivered to the Barwon and Darling systems to enhance environmental outcomes in the Barwon and Darling Rivers. Active management enables water for the environment to be protected from extraction so it can remain in-stream and be used for environmental purposes.

Regulated and supplementary entitlements of water for the environment held within tributary systems of the Barwon–Darling can be delivered to increase flows in the Barwon and Darling Rivers. The Northern Connectivity Event and Northern Fish Flow are examples of this type of use. In most regulated tributaries of the Barwon–Darling system account volumes for regulated entitlements held by the Commonwealth are currently low. This means use of regulated entitlements held by the Commonwealth to meet environmental outcomes in the Barwon–Darling is unlikely to occur during the 2020–21 water year.

Supporting Policies

To maximise environmental outcomes resulting from environmental water delivered from regulated tributaries as well as from the activation of unregulated entitlements along the Barwon–Darling will require water for the environment to be protected from downstream extraction.

Through implementation of the Water Reform Action Plan, the NSW Government is committed to improving the way in which water for the environment is managed in the NSW northern Murray–Darling Basin. As part of the Plan, the NSW Government is exploring changes to existing operational arrangements along the Barwon and Darling rivers to increase the level of management across the system. Known as active management, this will allow water for the environment to be protected from extraction and used instream for environmental purposes (referred to as active environmental water). Active management presents new but complex opportunities for managers of water for the environment.

(d) Environmental demands

The environmental water demands for assets in the Barwon–Darling for the 2020–21 water year are represented in Table 3. These demands have been drawn from material presented in the draft Long-Term Water Plan, prepared by the NSW Government for the Barwon–Darling system.

Table 3: Environmental demands, priority for watering in 2020–21 and outlook for coming year along the Barwon–Darling system.

Environmental assets	Target values	Indicative demand (for <u>all sources of water</u> in the system)		Watering history (from all sources of water)	2020–21		Implications for future demands
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2021–22 if watering occurred as planned in 2020–21
Refuge pools along the Barwon and Darling rivers Refuge habitat Native fish Water quality Aquatic invertebrate species	Critical drought refuge habitat Native fish maintenance and survival Maintenance and survival of key invertebrate fauna	Cease-to-flow Triggers 0 ML/d (Barwon River @ Beemery) for a maximum of 50 days during very dry conditions 0 ML/d (Darling River @ Bourke) for a maximum of 100 days during very dry conditions 0 ML/d (Darling River @ Louth) for a maximum of 110 days during very dry conditions 0 ML/d (Darling River @ Wilcannia) for a maximum of 120 days during very dry conditions	Cease to flow period should not exceed periods of 50–120 days	The Northern Connectivity Event in April–May 2018 assisted in replenishing refuge pools along the entire Barwon and Darling system. With extremely dry conditions during the 2018–19 water year, the Northern Fish Flow in April–June 2019 assisted in replenishing refuge pools along the Barwon River to just downstream of the Culgoa junction. Reflecting the extremely dry conditions that persisted through most of 2018–19 and 2019–20, cease-to-flow triggers were exceeded at Bourke, Louth and Wilcannia. Rainfall events during late summer/early Autumn have moved the system towards more moderate conditions. However, a return to below average rainfall patterns across the northern Basin during the summer of 2020–21 will see the system return to dry conditions and possibly the return of prolonged periods of no or low flows.	High	A high priority for CEW under dry to very dry conditions. Protection of natural flow events through activation of unregulated environmental water entitlements held along the Barwon and Darling systems is a high priority. Using regulated environmental water entitlements to respond to extended periods of no flow is not expected to be an option until account balances improve in key regulated systems.	High
		Very Low flows >95 ML/d for a total of 230 days in a year at Dangar’s Bridge (near Walgett) on the Barwon River >105 ML/d for a total of 180 days in a year at Bourke on the Darling River >70 ML/d for a total of 180 days in a year at Louth on the Darling River >30 ML/d for a total of 175 days in a year at Wilcannia on the Darling River	Every year	These flows provide replenishment volumes to refuge pools along the Barwon–Darling system. Over the last 10 years the requirements for very low flows have been met around 6–7 times but have not been met since the 2017–18 water year. During dry years like the 2017–18 water years, held environmental water delivered from tributaries systems (through watering actions like the Northern Connectivity Event) can assist in achieving these environmental water requirements. Rainfall events during late summer/early Autumn 2020 have moved the system towards more moderate conditions. However, the extremely dry conditions that persisted for most of 2018–19 and 2019–20 mean the requirement for very low flows across the system remains a high priority.			
In-stream habitats (pools channels benches, snags, and gravel beds) along the Barwon and Darling Rivers Aquatic habitat Native fish Aquatic invertebrate species Water quality	Enabling native fish to access in-stream habitats Native fish movement Maintaining the condition/quality of in-stream habitat	Baseflows >320 ML/d for a total of 150 days in a year at Dangar Bridge (near Walgett) on the Barwon River >500 ML/d for a total of 135 days in a year at Bourke on the Darling River >450 ML/d for a total of 135 days in a year at Louth on the Darling River >350 ML/d for a total of 145 days in a year at Wilcannia on the Darling River	Every Year	These flows provide a flow depth to support movement for small and medium bodied fish as well as assist in managing water quality issues (destratification of waterholes and blue green algal blooms). During dry years like the 2017–18 water years, held environmental water delivered from tributaries systems (through watering actions like the Northern Connectivity Event) can assist in achieving these environmental water requirements. Active management of un-regulated environmental water entitlements held along the Barwon and Darling Rivers will also assist in achieving these environmental water requirements. Over the long term, baseflow requirements across the Barwon Darling system have been met 4–5 years in the last ten and more recently have not been met since the 2016–17 water year. Due to the extended dry period over the last 3 water years the need for Baseflows across the Barwon–Darling system is a high priority.	High	A high priority for CEW under moderate to dry conditions. Protection of natural flow events through activation of unregulated environmental water entitlements held along the Barwon and Darling systems is a high priority. Using regulated environmental water entitlements to respond to extended periods of no or low flow dry is not expected to be an option until account balances improve in key regulated systems.	High

Environmental assets	Target values	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)	2020–21		Implications for future demands Likely urgency of demand in 2021–22 if watering occurred as planned in 2020–21
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	
Native fish habitat and aquatic communities along the Barwon and Darling Rivers Aquatic habitat Aquatic invertebrate species Water quality Breeding opportunities for native fish	Providing native fish with spawning and recruitment opportunities	Small Freshes (SF1) >700 ML/d for at least 10 days on the Barwon at Dangar’s Bridge near Walgett ideally in Oct–April (but can occur at any time). >1 500 ML/d for at least 10 days on the Darling at Louth ideally in Oct–April (but can occur at any time). >1 400 ML/d for at least 10 days on the Darling at Wilcannia ideally in Oct–April (but can occur at any time).	Annual	SF1 flows provide flow depths and velocities to support movement of large bodied fish. Small freshes, particularly along the Darling River need to be supported by natural flow events. Active management of unregulated environmental water entitlements held along the Barwon and Darling rivers will assist in achieving these environmental water requirements. SF1 flows along the Barwon River have occurred 7–9 out of the last 10 years, while along the Darling SF1 flows have occurred 5 out the last 10 years. Along the Darling River SF1 events have occurred only once (during the 2019–20 water year) over the last 3 water years. SF1 flows seek to provide opportunities for fish movement across each water year and are a high priority because of the infrequent movement opportunities for large bodied fish particularly along the Darling River over the last 3 years.	High	A high priority for CEW under dry to moderate conditions. Protection of natural flow events through activation of unregulated environmental water entitlements held along the Barwon and Darling systems is a high priority.	High
		Small Fresh (SF2) 700–6 500 ML/d for at least 14 days on the Barwon at Dangar’s Bridge near Walgett in Oct–April. 1 500–15 000 ML/d for at least 14 days on the Darling at Bourke ideally in Oct–April.	5–10 years in 10 (overall 75% of years)	SF2 flows seek to support spawning opportunities for native fish - preferred temperature range for fish spawning, >20°C for most native fish and >18°C for Murray cod). Small freshes, particularly along the Darling River need to be supported by natural flow events. Active management of un-regulated environmental water entitlements held along the Barwon and Darling Rivers will assist in achieving these environmental water requirements. SF2 flows along the Barwon River have occurred 6–7 out of the last 10 years, while along the Darling River small fresh flows have occurred 5 out the last 10 years. Along the Darling River SF2 events have occurred only once (during the 2019–20 water year) over the last 3 water years. SF2 flows seek to provide spawning opportunities for native fish in most water years. Along the Barwon River, the frequency of SF2 events has been within the specified range. While the along the Darling River, SF2 events have occurred at the bottom end of specified frequency range – overall SF2 flows across the Barwon–Darling are a moderate priority.	Moderate	A moderate priority for CEW under all water resource availability scenarios. Protection of natural flow events through activation of unregulated environmental water entitlements held along the Barwon and Darling systems is a secondary priority.	Moderate

Key - potential watering in 2020-21

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 because of constraints or insufficient water

Key - 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

3.7.5 Water delivery in 2020–21

Environmental water contained within unregulated flows is important in achieving ecological outcomes in the Barwon–Darling system. These natural flows (not delivered from dams) are particularly important for fish as they contain the natural cues and nutrients fish require for their lifecycles. Unregulated flows through the Barwon–Darling system can be enhanced using Commonwealth holdings both along the Barwon–Darling and within tributary systems.

The focus for Commonwealth environmental water use during the 2020–21 water year will be the protection and enhancement of unregulated flows along the Barwon–Darling to meet the following watering priorities:

- protection of dry spell breaking low flows along the Barwon–Darling to refresh refuge pools
- enhancing fresh pulses to maintain or improve water quality, enhance native fish condition, and support fish movement along the Barwon–Darling.

Low resource availability in regulated upstream storages will significantly constrain the ability for regulated releases to further enhance environmental outcomes in the Barwon–Darling for the 2020–21 watering year.

3.7.6 Monitoring and Lessons learned

(a) Monitoring

Operational monitoring is undertaken for all Commonwealth environmental watering actions and involves collecting on-ground data about 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 Monitoring, Evaluation and Research (MER) Program (previously the Long-Term Intervention Monitoring Project 2014–2019) has the junction of the Darling and Warrego Rivers as a focus area. It aims to understand the environmental response from Commonwealth environmental watering with respect to the targeted objectives by carrying out monitoring of site condition over many years.

Information on the monitoring activities is available

<https://www.environment.gov.au/water/cewo/catchment/northern-unregulated-rivers/monitoring>.

Monitoring information is also provided by state governments and other organisations throughout the Barwon–Darling system.

(b) Lessons learned

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

Key findings from monitoring undertaken across the Barwon–Darling system is summarised in Table 4.

Table 4: Key lessons learned in the Barwon–Darling system

Theme	Lesson learned
Native fish and other aquatic species	<ul style="list-style-type: none"> • Over the last several years, the University of New England (UNE) with NSW DPI – Fisheries have been monitoring native fish responses to flow as part of the CEWO’s MER/LTIM Warrego–Darling selected area projects. • Preliminary results from monitoring undertaken in the 2019–20 water year have found juvenile golden perch in both the Warrego and Darling rivers, and several large Murray cod in the Darling River. Turtles were also common across most sites, with some larger specimens found at the confluence of the Warrego and Darling rivers.

Theme	Lesson learned
Connectivity	<ul style="list-style-type: none"> • Connectivity between the Barwon–Darling system and its tributaries can be enhanced using water for the environment. Connectivity is important for supporting native fish habitat and allowing the movement of native fish between rivers for spawning, dispersal and recruitment. • The Northern Connectivity Event and Northern Fish Flow delivered from the Gwydir and Border Rivers into the Barwon–Darling system during the 2017–18 and 2018–19 water years were critical actions. These events reconnected channel habitats and promoted fish movement. Protecting environmental water delivered in these events from extraction was essential for success. In the absence of appropriate protection, these watering actions would not have provided the same level of environmental outcomes. • Understanding the amount of water required to refill pools and wet up sections of river channel is a key element to estimating the environmental water requirements of the Barwon–Darling system during dry periods. • For the Northern Fish Flow, on a dry riverbed, the volume of water that passed Collarenebri was approximately 15 350 megalitres, of which 2 230 megalitres or about 15 per cent passed Brewarrina. This means about 5 000 megalitres per 100 river kilometres was used to fill pools and wet the dry river channel between Collarenebri and Brewarrina. • For the Northern Connectivity Event, where waterholes were full before the flow, the volume of water that passed Collarenebri was about 19 900 megalitres, of which approximately 15 700 megalitres or about 80 per cent passed Brewarrina. • This means that approximately three times as much water was used to refill pools and wet up sections of river channel between Collarenebri and Brewarrina during the Northern Fish Flow as compared to the Northern Connectivity Event.
Water Quality	<ul style="list-style-type: none"> • During summer months refuge pools located along the Barwon and Darling Rivers can stratify, reducing habitat quality. • The primary risk considered before the Northern Fish Flow (NFF) was the stratification of waterholes which may rapidly de-stratify when the NFF event arrived, resulting in deoxygenation of the waterholes and fish kills. Consultants (Ecological) were used to gather information about water quality risks. • Samples of dissolved oxygen were collected from refuge pools before, during and after the Northern Fish Flow. If dissolved oxygen falls below 4 mg/L then fish become stressed and may die. Before the Northern Fish Flow, dissolved oxygen concentrations at the Collarenebri Weir pool were found to be below 4 mg/L in places. Dissolved oxygen readings show that concentrations increased when the Northern Fish Flow passed. • The Northern Fish Flow was timed for the flows to reach the Barwon by late May and early June when temperature was significantly reduced, helping to reduce risks to water quality. • Commonwealth water for the environment delivered as part of natural flow events can improve water quality, nutrient cycling and provide access to in-channel habitats for other species. Additionally, Commonwealth water delivered as part of small flow events in the Barwon and Darling rivers may minimise algal productivity and the potential for blooms.

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