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Commonwealth Environmental Water Office

Commonwealth Environmental Water Office

Water Management Plan

Chapter 3.4 – Gwydir Valley

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.

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.

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3.4 Gwydir Valley

3.4.1 Region overview

(a) River valley

Copeton Dam is the major regulated water storage in the system (with a capacity of 1 364 gigalitres). Copeton Dam regulates on a long-term average of approximately 55 per cent of system inflows, however, this is highly variable from year to year. Several unregulated tributaries flow into the Gwydir River below Copeton Dam, including the Horton River. These unregulated tributaries can provide significant unregulated flows into the Gwydir River.

In the lower sections of the Gwydir system, re-regulating structures at Tareelaro, Boolooroo and Tyreel manage low to medium flows from the Gwydir River into the Mehi River, Carole Creek and the Lower Gwydir River/Gingham Watercourse. There are also re-regulating structures on the Mehi River at Combadello and Gundare, which control low to medium flows between the Mehi and the Moomin and Mallowa creeks.

(b) Traditional Owners

The rivers and wetlands of the Gwydir Valley hold significant spiritual and cultural importance for Aboriginal people. Most of the Gwydir system falls within the traditional lands of the Gomerioi/Kamilaroi people. The Gomerioi is a large Nation, which extends from around Singleton in the Hunter Valley through to the Warrumbungles in the west, and through the Namoi and Gwydir valleys to just over the Queensland border. The eastern headwater around Guyra, Uralla and Tenterfield is the traditional lands of the Anaiwan people.

(c) Important sites and values

The Gwydir Wetlands is a terminal wetland in the lower reaches of the Gwydir River and Gingham Watercourse. Four sites within the wetlands are listed as Wetlands of International Importance under the Ramsar Convention: Old Dromana on the Lower Gwydir Watercourse and Goddard's Lease; Windella; and Crinolyn on the Gingham Watercourse. These sites were recognised for their important habitat value for waterbirds, sustaining up to hundreds of thousands of breeding colonial waterbirds when flooded. This includes those listed under international migratory agreements (JAMBA, ROKAMBA, and CAMBA). The Ramsar site contains a range of habitats including large areas of coolibah woodland, water couch, and part of the largest stand of marsh club rush in New South Wales (NSW). These vegetation types have been identified as critical components of the Ramsar site that help support its ecological character.

Another key asset in the Gwydir River Valley is the Mallowa Wetlands. While it is not Ramsar-listed or as extensive as the Gwydir Wetlands, the Mallowa Wetlands have less lippia (weed) and support a diverse range of wetland and floodplain vegetation, which is representative of the Gwydir River valley's native vegetation. The native vegetation of Mallowa Creek also provides valuable habitat for waterbirds, woodland birds, and other fauna; and prior to river regulation supported large scale waterbird breeding events.

The Gwydir River system supports several native fish species identified as threatened in NSW and/or Commonwealth legislation. These include silver perch (critically endangered) and Murray cod (vulnerable) listed under the *Environment Protection and Biodiversity Conservation Act 1999*, and olive perchlet and freshwater catfish (endangered populations), and purple spotted gudgeon (endangered species), listed under the *NSW Fisheries Management Act 1994*.

The Mehi River and Carole Creek connect the network of rivers and creeks within the Gwydir valley to the Barwon-Darling system. Maintaining connection between these two river networks is important for native fish movement and recruitment. Flows from the Mehi and Carole systems into the Barwon River can provide critical low flows to downstream reaches, which can minimise the length of cease to flow periods. These flows help the survival of native fish and other river dependent fauna species by reconnecting the larger persistent pools and waterholes along the Barwon and Darling Rivers. Following the recent drought, connection between the Barwon-Darling system and its tributaries will be important to ensure the recovery of native fish communities across the northern Basin.

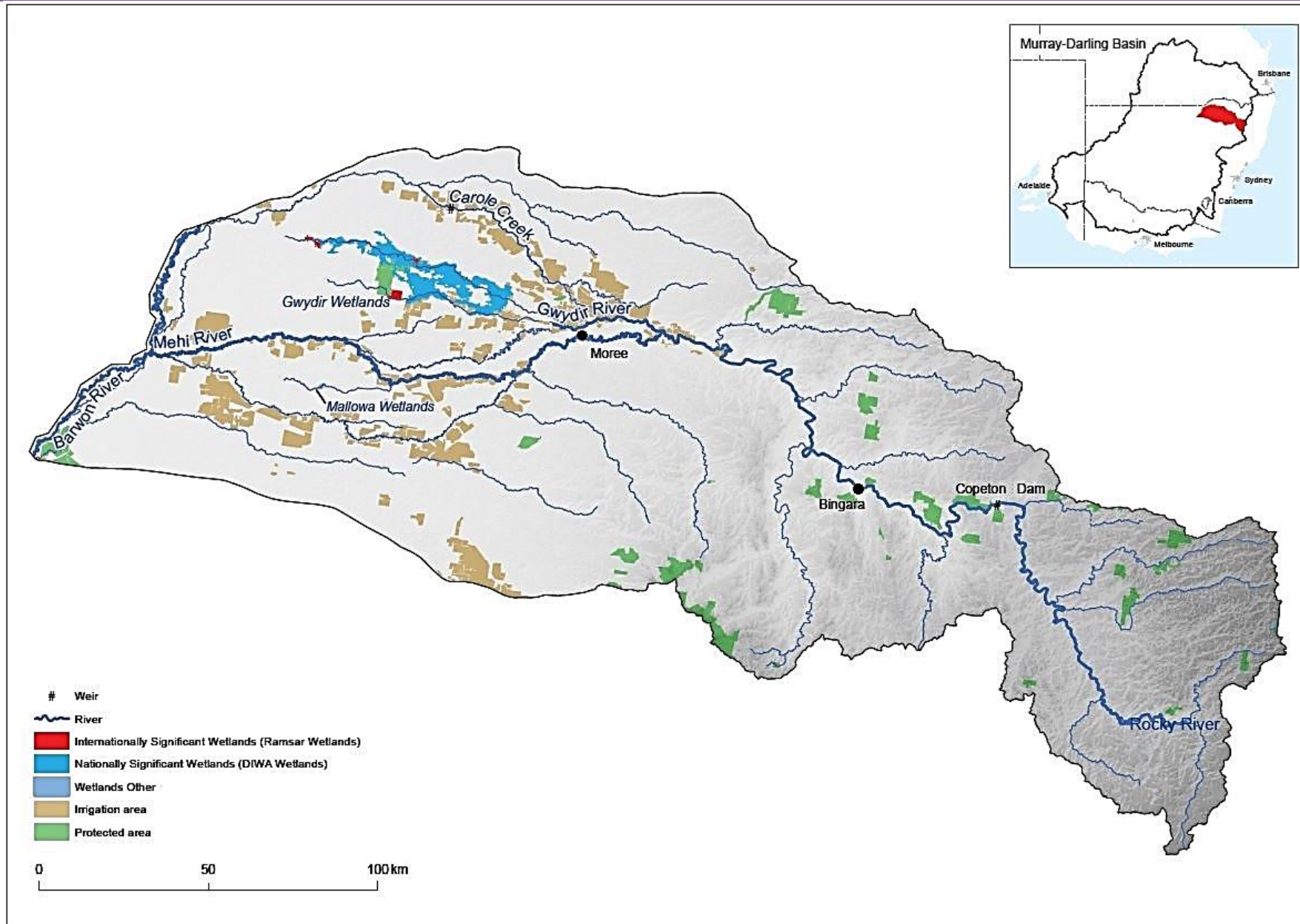


Figure 1: Map of the Gwydir River Valley (CEWO 2015).

(d) Stakeholder engagement

In the Gwydir River Valley, the planning, management, and delivery of Commonwealth water for the environment is undertaken in conjunction with a range of partners and stakeholder groups. Key stakeholders in the Gwydir include the NSW Department of Planning, Industry, and Environment (DPIE) – Environment, Energy and Science (EES), DPIE – Water, WaterNSW, and the Gwydir Environmental Water Advisory Group known as the Environmental Contingency Allowance Operations Advisory Committee (ECAOAC).

The ECAOAC provides advice to water managers on priorities for water use and includes representatives from local landholders, Gwydir Valley Irrigators, the local Aboriginal community, independent scientists, and environmental representatives, as well as Government organisations involved in water and environmental management (DPIE – Water, National Parks and Wildlife Service, DPIE – EES, North West Local Land Services, NSW DPI – Fisheries, and WaterNSW).

Local Engagement Officers (LEOs) from the Commonwealth Environmental Water Office (CEWO) also work with a range of stakeholders as part of a broader program of engagement around the management of the Commonwealth’s portfolio of environmental water entitlements. As part of this work, CEWO’s Local Engagement Officers engage directly with members of the local Aboriginal community, Local Aboriginal Land Councils (LALCs), and other Aboriginal community groups. This includes working with community around environmental water, to learn and improve on how environmental water may be able to support the local Aboriginal communities’ objectives for sites, values, and species significant to the Gomerroi/Kamilaroi Nation in the Gwydir catchment. Engagement with the local Aboriginal community is also being undertaken as part of the current CEWO Monitoring Evaluation and Reporting (MER) Program, which is being undertaken in the Gwydir by the University of New England (UNE) and 2rog.

3.4.2 Environmental objectives

Based on the 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 Gwydir River Valley.

The objectives that are targeted in a particular year may vary, depending on available water, catchment conditions, operational feasibility, and demand for environmental water. These objectives will continue to be revised as part of the CEWO’s commitment to adaptive management.

Vegetation: Maintain the condition, diversity and extent of riparian, floodplain and wetland vegetation.

Waterbirds: Increase waterbird abundance and species diversity, and support waterbird breeding events (reproduction and fledging) through to completion.

Native fish: Support viable populations of threatened native fish and maximise opportunities for range expansion and the establishment of new populations.

Macroinvertebrates: Support recruitment and maintain macroinvertebrate diversity and habitat.

Connectivity: Improve flow regimes and increase connectivity in the Gwydir River system, including with the Barwon River, and lateral connectivity between rivers and the floodplain.

Processes/water quality/resilience: Support key ecosystem functions including primary production, decomposition, nutrient and carbon cycling, and the mobilisation and dispersal of biotic/abiotic material; maintain water quality in channels and pools; and maintain drought refuge habitat.

3.4.3 First Nations environmental objectives

Representatives of the First Nations peoples of the Gwydir valley have identified environmental objectives for their country for 2020–21. These objectives have been developed through two processes. The first process was the First Nations Environmental Watering Guidance project undertaken by the Northern Basin Aboriginal Nations organisation. The second process was direct engagement by the CEWO’s Local Engagement Officers with members of the local Aboriginal community¹. These processes have identified objectives (Table 1) in more detail that most valleys across a range of sites, issues and values. These processes have also identified sites of special significance for First Nations in the Gwydir valley.

Some of these objectives are outside the scope of water for the environment to influence, while for others, the link between water for the environment and the site or issues is not well understood and needs further consultation with local Aboriginal groups to better define these links between environment, the site and Aboriginal cultural practice in relation to land and water. Environmental flows will then aim to further contribute to identified objectives, where possible. In addition, the Commonwealth Environmental Water Holder (CEWH) is committed to working with the local Aboriginal community to better understand their objectives and the environmental water requirements for key values and sites.

Table 1: First Nations environmental objectives for the Gwydir system for 2020–21

<p>River flows and Connectivity</p> <p><i>NBAN priority sites:</i> Gwydir River always needs to flow at a certain levelⁱ.</p> <p><i>Local Aboriginal community:</i> Water is life and connects all things, and all things are interconnected; rivers and wetlands need water, need flows; need to care for Country in a physical and spiritual sense; need to look after country and to fulfil cultural obligations; Need to look after own mob and for downstream mobs.</p>
<p>Native Vegetation</p> <p><i>NBAN indicator species:</i> Gidgee gumⁱ, blue gumⁱ, bulrush, water lily, sedges, tea trees, sandalwoodⁱ, iron barkⁱ, poplar boxⁱ.</p> <p><i>Local Aboriginal community indicator species:</i> Vegetation species that are resources growing in and along rivers and in wetlands and billabongs, and on floodplains – bush tucker, medicines and cultural practicesⁱ.</p>
<p>Native Birds</p> <p><i>NBAN indicator species:</i> Teal, crimson wing, storks, white long-legged heron.</p> <p><i>Local Aboriginal community indicator species:</i> Brolga, ducks, magpie geese.</p>
<p>Native Animals</p> <p><i>NBAN indicator species:</i> Dhufish (eel-tailed catfish), yellowbelly, codfish. black bream (silver perch).</p> <p><i>Local Aboriginal community indicator species:</i> Look after native fish, both own importance and resource for community; look after the critters, everything needs water, make sure things can survive and live; need to look after critters, care for all as part of whole picture, and to look after totem species and significant species.</p>
<p>Connecting with Country</p> <p><i>NBAN:</i> The Gomeroi people need to: tell and share our stories; be able to hunt and fish along the rivers; gather at the river as a Nation; go camping.</p>

¹ Objectives determined through recent and past engagement activities by LEOs from the CEWO as well as through reports completed based on input from local Aboriginal community members.

Local Aboriginal community input: sharing stories and knowledge are important to the Gomeroi people and the following assist in doing this: being able to go out on Country to reconnect and share knowledge about landscape and resources, about spiritual and creation stories, and educate the younger generations; connecting to and Caring for Country – opportunities to go out on Country, and obligations to care for Country. Important values include modified trees, burial sites, scar trees, stone artefacts and a midden site.

Other notable water-dependent sites

Local Aboriginal community input: Gwydir Wetlands, including the Gingham and Lower Gwydir watercourses and wetlands and significant places in and along these wetlands including Gingham Waterhole, Bunnor Lagoon, Wandoona (Troy) Waterhole and Gin Holes. The Mallowa Creek and its wetlands, including Valetta swamps and wetlands. Moomin Creek sites. Mehi River sites (especially Top and Bottom Camps). Mid-section of the Gwydir River include Gravesend, Elcombe, and Gum Flat. Other lagoons and billabongs including Tillaloo, Baroona Waterholes, the Glen Swamp; Poison Gate (Derra) Billabong; Whittaker’s Lagoon and Collymungle.

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

3.4.4 Recent conditions and seasonal outlook

(a) Recent conditions and environmental water use

It is preferred to use natural flow triggers for a ‘reactive’ or responsive use of environmental water in the Gwydir system. Reactive use of environmental water can be in response to dry flow patterns leading to extended cease to flow periods or in response to rainfall and un-regulated (natural) flow events.

Where a ‘reactive’ approach is insufficient to achieve inundation of priority wetland and floodplain system in a three-year period, a ‘proactive’ approach is applied. Proactive environmental watering involves the delivery of a larger volume of environmental water to support the continued health of the wetlands. A proactive approach reflects the available water, constraints, and modifications of the system.

The Gwydir River Valley has experienced hot and dry conditions since 2017–18, with lowest on record rainfall and highest on record temperatures occurring during that time. Inflows to Copeton Dam were low for most of this period, with storage levels dropping to around 6 per cent of capacity in January 2020. No new allocations were made in 2019–20 for general security entitlements, and the delivery of water was restricted to block releases, including water for the environment.

Ongoing drought conditions meant many parts of the Gwydir River system stopped flowing in September and October 2019, and January 2020. During these drying phases, refuge pools began to dry and water quality declined. Responding to these dry conditions, Commonwealth and NSW water for the environment was delivered to the Gwydir and Mehi rivers and Carole Creek between October and January. This water helped refresh refuge habitat, improve water quality, and support native fish survival.

Conditions began to improve following significant rainfall events across parts of the northern Basin between January and February 2020. During this period, between 300-350 mm of rainfall was recorded across the Gwydir Valley with Copeton Dam receiving around 60 000 megalitres of inflow. Rainfall resulted in increased river flows during February and March 2020, with around 55 000 megalitres flowing past Pallamallawa on the Gwydir River and providing inflows into the Gingham and Lower Gwydir watercourse. These flows also provided connection between the Gwydir and Barwon systems via end of system flows in the Mehi River and Carole Creek.

In response to rainfall and natural flows, supplementary water for the environment was also provided in the February and March events. This portion of water was directed to the Gingham, Lower Gwydir and Mallowa systems to help improve river and wetland conditions. These inflows provided inundation of wetland areas including a section of the central Gingham Wetlands that had been burnt by wildfire in spring 2019. Mallowa Creek and Wetlands, along with Ballin Boora Creek and other floodplain systems received large inflows on up to four occasions from local runoff after localised heavy/intense rainfall events. Lower natural flows have continued in most parts of the system into May 2020.

Details of previous Commonwealth environmental water use in the Gwydir River Valley is available at: <http://www.environment.gov.au/water/cewo/catchment/gwydir/history>.

Monitoring undertaken during February–March 2020 revealed that the increased flows had enhanced the condition of the lower Gwydir system with:

- 40 water bird species observed across the system, with hundreds of birds recorded at some sites.
- The Gingham Waterhole providing important habitat for a range of aquatic species including Eastern longneck and Murray River turtles.
- Improved condition and diversity of species within important wetlands of the Gwydir Wetlands State Conservation Area.

(b) Seasonal outlook

According to the Bureau of Meteorology outlook in July, above median rainfall is forecast across the Gwydir River Valley from late winter into spring. While this forecast suggests that the recent severe dry conditions may ease somewhat, several months of above average rainfall are needed to see a recovery from the current severe drought. Stream flows may be less than expected during the recovery. However, 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

The volume of Commonwealth environmental water carried over in the Gwydir River Valley for use in 2020–21 is 12 gigalitres. The 1 July 2020, NSW water allocation statement indicated full (100) allocation for high security entitlements in 2020–21, which would add an additional 4.5 gigalitres of water for the environment against Commonwealth high security entitlements. However, there may be restrictions on deliverability.

As of 1 July 2020, Copeton Dam was at 13 per cent capacity. In the absence of further rainfall, there may be insufficient water available to meet all system requirements in 2020–21. This may limit the capacity to deliver water for the environment.

Based on the expected available volume of water held by the Commonwealth and other water holders, as well as recent and forecast catchment conditions, it is expected that the overall resource availability will be low to moderate in 2020–21. A moderate water resource availability scenario is only possible should more rainfall and inflows occur.

(d) Environmental demands

Considering the prolonged drought conditions and the need to avoid further damage, build resilience, and support the recovery of key assets in the Gwydir Valley, there are a number of environmental demands that require water urgently in 2020–21.

The environmental water demands for assets in the Gwydir River Valley in 2020–21 are represented in Table 2. Please note that the capacity to contribute to many of these environmental demands is contingent on further improvements in water availability in the catchment.

Table 2: Environmental demands, priority for watering in 2020–21 and outlook for coming year in the Gwydir River Valley.

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 environmental demand in 2021–22 if watering occurred as planned in 2020–21
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water	Potential Commonwealth environmental water contribution?	
<p>Refuge pools along the Gwydir and upper Mehi Rivers as well Carole Creek</p> <p>Refuge habitat</p> <p>Native fish</p> <p>Water quality</p>	<p>Critical drought refuge habitat</p> <p>Native fish maintenance and survival</p>	<p>Cease-to-flow Triggers</p> <p><u>Gwydir River</u></p> <p>0 ML/d (Gwydir @ Yarraman) for around a maximum of 30–60 days (depending on conditions)</p> <p>Mehi River</p> <p>0 ML/d (Mehi @ Moree) for around a maximum of 40–80 days (depending on conditions)</p> <p><u>Carole Creek</u></p> <p>0 ML/d (Carole Creek near Garah) for a maximum of around 40–80 days (depending on conditions).</p>	<p>Cease to flow period should not exceed periods of 40–80 days</p>	<p>The Northern Connectivity Event in April–May 2018 and the Northern Fish Flow April–June 2019 contributed to meeting this demand in key reaches (mainly in the Mehi and to a lesser extent in the Carole).</p> <p>Reflecting the extremely dry conditions that persisted through most of 2018–19 and 2019–20, environmental water was delivered to protect critical aquatic and fish refuge habitat in the Gwydir, Carole and Mehi systems to help meet this demand between Oct 2019 and Jan 2020.</p> <p>Feb–March rainfall events have moved systems towards more moderate conditions. However, overall the system is still dry, and demand for water has been assessed as high.</p>	High	<p>A high priority for CEW under very low water availability scenario, subject to availability.</p> <p>Using regulated environmental water entitlements, respond to extended dry periods to protect critical floodplain refuge habitat</p>	High
<p>Gwydir Wetlands</p> <p>Areas of Ramsar listed wetlands*</p> <p>Nationally significant wetlands</p> <p>Waterbird breeding and habitat</p> <p>Habitat and breeding ground for frogs</p> <p>Native fish habitat</p> <p>Endangered ecological communities</p> <p>Lagoons and wetlands which have important values for the Gomeri local Aboriginal community. Key sites include:</p> <ul style="list-style-type: none"> • Old Dromana Wetland 	<p>Core wetland inundation</p> <p>Refuge habitat for native fish, waterbirds, frogs and other aquatic species</p> <p>Maintenance and Regeneration of Wetlands</p> <p>Ecosystem function</p>	<p>Small wetland (WL) inundation:</p> <p>WL1 (Protect Core Wetland)[^]:</p> <ul style="list-style-type: none"> • >6 GL event over 3–6 months (Gwydir @ Millewa) at any time. • >15 GL event over 1–3 months (Gingham @ Teralba) at any time. • >15 GL event over 2–6 months (Gingham @ Tillaloo) at any time. • >3 GL event 1–4 months (Gingham & Gingham Bridge) <p>WL2 (Maintenance and Regeneration of Wetlands)[^]:</p> <ul style="list-style-type: none"> • >36 GL over 3–6 months (Gwydir @ Allambie) in Sept–Mar (but can occur at any time). • >30 GL over 1–3 months (Gingham @ Teralba) • >30 GL over 2–6 months (Gingham @ Tillaloo) in Sept–Mar (but can occur at any time). • > 15 GL over 1–4 months (this should have been 2–6 months) (@ Gingham Bridge) 	<p>WL1: 9–10 in 10 years (Max. interval: 1 year)</p> <p>WL2: 8–9 in 10 years (Max. interval: 2 years)</p>	<p>The 2016–17 water year was the last time wetland maintenance and regeneration targets were met across the entire Gwydir Wetlands.</p> <p>Wetlands across the Gingham and Lower Gwydir systems experienced dry conditions during 2017–18 with WL1 flow targets at the Millewa in the Lower Gwydir and Teralba, Tillaloo and Gingham Bridge in the Gingham gauges met.</p> <p>During 2018–19 an extended environmental watering events (based on a proactive water delivery strategy) enabled all WL1 flow targets to be met. This enabled most of the core wetlands across both the Gingham and Gwydir systems to be inundated.</p> <p>Natural flows occurred during Feb–Mar 2020 meeting WL1 flow targets, at Millewa and Teralba. Large parts of core wetlands in the Upper and Central Gingham were inundated, but a limited area in the Lower Gingham and limited duration in areas downstream from Gingham Waterhole. The Goddard’s Lease part of the Ramsar site has been inundated but flows did not reach the Crinolyn or Windella Ramsar site areas. In the Lower Gwydir systems most, but not all, core wetland areas and with only with limited duration in some more western and higher sections of these wetlands were inundated. Most of the Old Dromana Ramsar area and most of the marsh club-rush areas received inundation. The inundation was supported by significant rainfall which fell across much of the lower Gwydir system during February and March.</p> <p>Core wetlands have been watered 2-3 times in the last three years, while the flows required to maintain and regenerate wetlands have exceeded their maximum flow interval.</p>	High	<p>A high priority for CEW under low to moderate water resource availability scenarios, subject to occurrence of unregulated flow event and water availability.</p> <p>A combination of entitlements may be used to respond to unregulated flow events, to protect (supplementary) and potentially restore (regulated) parts of a natural flow.</p> <p>Use of supplementary water to protect natural flow events will be a high priority. Given the low volumes of regulated environmental water available, using regulated releases to restore parts of a natural flow is currently a low priority for 2020–21.</p>	Moderate to High (subject to occurrence of unregulated flow events)
<ul style="list-style-type: none"> • Bunnor Wetland • Gingham Waterhole • Gin Holes 	<p>Maintenance and regeneration of floodplain vegetation (including lignum)</p> <p>Waterbird habitat and potential breeding</p> <p>Native fish</p> <p>Ecosystem function</p>	<p>Large wetland (WL) inundation[^]:</p> <p>WL3 (Regeneration of Floodplain Vegetation):</p> <ul style="list-style-type: none"> • >45 GL over 3–6 months (Gwydir @ Allambie) in Oct–Apr • >45GL over 1–3 months) Gingham @ Teralba • >40 GL over 2–6 months (Gingham @ Tillaloo) in Oct–Apr • >20 GL over 1–4 months (@ Gingham Bridge) <p>WL4 (Maintenance of Floodplain Vegetation)[^]:</p> <ul style="list-style-type: none"> • >65 GL over 2–6 months (Gwydir @ Allambie) in Aug–Feb (but can occur at any time) • >60 GL over 2–6 months (Gingham @ Tillaloo) in Aug–Feb (but can occur at any time). • >30 GL over 1–4 months (Gingham @ Gingham Bridge) in Aug–Feb (but can occur at any time). 	<p>WL3: 5–8 in 10 years (Max. interval: 3 years)</p> <p>WL4: 3–5 in 10 years (Max. interval: 5 years)</p>	<p>The 2016–17 water year was the last time a large wetland inundation event occurred across the Gingham and lower Gwydir systems.</p> <p>During 2019–20 very dry conditions persisted, with no significant inflows entering the central parts of the Gingham and Gwydir systems for much of the year. However, the condition of floodplain vegetation was improved by widespread rainfall, which occurred across the Gingham and Lower Gwydir systems in early 2020.</p> <p>The maximum flow interval for the regeneration of floodplain vegetation has now been exceeded, and water is required in 2020–21. Water will also be required in the next 1–2 years to support the maintenance of floodplain vegetation.</p>	Moderate to High	<p>Possible use of CEW under moderate to high water resource availability scenarios, subject to occurrence of unregulated flow event and water availability.</p> <p>Given the low volumes of regulated environmental water available, proactive delivery is currently a low priority for 2020–21, while use of supplementary water to protect natural flow events is a higher priority.</p>	Moderate to High (subject to occurrence of unregulated flow events)

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 environmental demand in 2021–22 if watering occurred as planned in 2020–21
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water	Potential Commonwealth environmental water contribution?	
Mallowa Wetlands Waterbird breeding and habitat Habitat and breeding ground for frogs Endangered ecological communities Lagoons and wetlands which have important values for the Gomeri local Aboriginal community. Key sites include Valetta swamps and surrounding wetlands	Core wetland inundation Refuge habitat for native fish, waterbirds, frogs and other aquatic species Wetland and riparian vegetation Ecosystem function	Small wetland (WL) inundation: WL1 (Protect Core Wetland): >3 GL over 2–4 months at the Mallowa Regulator in Oct–Mar (but can occur at any time). WL2 (Maintenance and Regeneration of Wetlands): >8 GL over 2–4 months at the Mallowa Regulator in Sept–Mar (but can occur at any time).	WL1: 9–10 in 10 years (Max. interval: 1.5 years) WL2: 7–9 in 10 years (Max. interval: 2 years)	The Mallowa wetlands experienced dry conditions during 2017–18. During 2018–19 an extended environmental watering event (based on a proactive water delivery strategy) enabled all flow targets to be met, helping to protect, maintain and regenerate core wetland areas. The Mallowa wetlands again experienced dry conditions during 2019–20, with no significant inflows entering the system from the Mehi River. However, several intense high rainfall events across most of the Mehi, Mallowa and Moomin systems in early 2020 provided flows along and into the Mallowa Creek, improving the condition of wetlands across the Mallowa system. Because of system constraints, core wetland areas in the Mallowa require frequent inundation and are approaching the maximum interval between inundation events. Therefore, the demand for water has been assessed as high for flows necessary to support the protection of core wetland areas during 2020–21.	High	A high priority for CEW under low to moderate water resource availability scenarios, subject to occurrence of unregulated flow event and water availability. Use of supplementary water to protect natural flow events will be a high priority. Given the low volumes of regulated environmental water available, using regulated releases to restore parts of a natural flow is currently a low priority for 2020–21.	Moderate to High (subject to occurrence of unregulated flow events)
	Wetland vegetation (including lignum) Waterbird habitat and potential breeding Native fish Ecosystem function	Large wetland (WL) inundation: WL3 (Regeneration of Floodplain Vegetation): >15 GL over 2–4 months at the Mallowa Regulator in Oct–Apr WL4 (Maintenance of Floodplain Vegetation): >22 GL over 2–6 months at the Mallowa Regulator in Aug–Feb (but can occur at any time)	WL3: 5–7 years in 10 (Max. interval: 3 years) WL4: 3–5 years in 10 (Max. interval: 5 years)	Like wetland systems, floodplain areas within the Mallowa system experienced dry conditions during 2017–18. During 2018–19 an extended environmental watering event (based on a proactive water delivery strategy) enabled the flow target for regeneration of floodplain vegetation to be met. The Mallowa wetlands again experienced dry conditions during 2019–20, with no significant inflows entering the system. However, the condition of floodplain vegetation communities was improved by widespread rainfall, which occurred across the Mallowa Creek system in early 2020. Flows to support the regeneration of floodplain vegetation (WL3) have occurred once in the last three years but have not reached the maximum interval between events. WL4 requires natural flow events to occur to enable it to be achieved and has not been met in the last 3 years. Overall the demand for large wetland inundation flows was assessed as moderate.			
Carole Creek Waterbird habitat and refuge Habitat and refuge for frogs Native fish habitat, breeding, recruitment and refuge Aquatic communities	Native fish dispersal and condition Native fish spawning (in-channel specialists and generalists, e.g. Murray cod) Native vegetation Aquatic ecosystem function	Small fresh (SF): SF1: >200 ML/d for at least 10 days on the Carole near Garah, in Oct–Apr (but can occur at any time) (native fish condition and dispersal). SF2: 200–900 ML/d for at least 14 days on the Carole near Garah, in Sept–Apr (spawning of in-channel specialists and generalists)	SF1: Annually (Max. interval: 1 year) SF2: 5–10 in 10 years (Max. interval: 2 years)	The 2017–18 water year was the last time small fresh flow targets were met. The Carole Creek system experienced dry conditions during both 2018–19 and the initial parts of the 2019–20 water years, with no significant inflows entering the system for extended periods. During this period environmental water delivery focused on low flows to maintain drought refuges. Natural flows occurred during Feb–Mar 2020 meeting the SF1 flow target, resulting in this target being met 3 out of the past 4 years. Natural flows in the early part of 2020 were insufficient to meet the SF2 flow target. The SF2 flow target has not been met since the 2017–18 water year and the maximum interval for this flow requirement has now been exceeded. The importance of the SF2 flow target in providing potential spawning conditions for native fish means that the requirements for a small fresh event between September and August is high.	High	A high priority for CEW under low to moderate water resource availability scenarios, subject to occurrence of unregulated flow event and water availability. Use of supplementary water to protect natural flow events will be a high priority. Given the low volumes of regulated environmental water available, using regulated releases to restore parts of a natural flow is currently a low priority for 2020–21.	Moderate to High (subject to occurrence of unregulated flow events)
		Large fresh (LF): LF1: >900 ML/d for at least 5 days on the Carole near Garah, in Jul–Sept (but can occur at any time) (native fish condition and dispersal). LF2: >900 ML/d for at least 5 days on the Carole near Garah, in Oct–Apr (spawning flow specialists).	LF1: 5–10 years in 10 (Max. interval: 2 years) LF2: 3–5 years in 10 (Max. interval: 4 years)	Flows occurring in February 2020 met the LF1 flow target, however, during the previous 3 water years the LF2 flow target for has not been met. Flow targets for large freshes along Carole Creek require large unregulated flows. Overall the demand for large fresh flows was assessed as moderate, requiring water in the next 1–2 years.			

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 environmental demand in 2021–22 if watering occurred as planned in 2020–21
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water	Potential Commonwealth environmental water contribution?	
Ballin Boora Riparian Areas In-channel and riparian habitat Aquatic communities	Water bird habitat and refuge Habitat and breeding ground for frogs Native fish habitat	600–1 200 ML event delivered at 10–50 ML/d (via infrastructure) for 12–120 days. May occur at any time.	Frequency subject to further examination (Max. interval: 3 years).	Environmental flows were delivered for the first time to the Ballin Boora system during 2018–19. For the 3 water years preceding 2018–19 no environmental flows or other flows had been delivered. The Ballin Boora ran from local runoff following localised intense heavy rainfall several times in Feb–March 2020 (local landholder feedback as per Mallowa). The need for environmental watering in 2020–21 is subject to further examination of environmental demand and operational requirements. However, based on the maximum interval between flows to the Ballin Boora, the demand has been assessed as moderate, needing water in the next 1–2 years.	Moderate	Use of CEW would occur only if resource availability increases.	Moderate
Mehi River Waterbird habitat and refuge Habitat and refuge for frogs Native fish habitat, breeding, recruitment and refuge Aquatic Communities Reaches within the system contain important values for the Gomerioi local aboriginal community	Native fish dispersal and condition Native fish spawning (in-channel specialists and generalists, e.g. Murray cod) Native vegetation Aquatic ecosystem function	Small fresh (SF): SF1: for at least 10 days in Oct–Apr (but can occur at any time) for native fish condition and dispersal <ul style="list-style-type: none"> • >345 ML/d at Moree • >220 ML/d d/s Combadello • >100 ML/d d/s Gundare SF2: in Sept–Apr (spawning of in-channel specialists and generalists) <ul style="list-style-type: none"> • 345–2 800 ML/d at Moree for at least 10 days • 220–1 500 ML/d d/s Combadello for at least 14 days • 100–850 ML/d d/s Gundare for at least 14 days SF3: >90 ML/d d/s Collarenebri for at least 10 days in Oct–Apr (but can occur at any time)	SF1: Annually (Max. interval: 1 year) SF2: 5–10 in 10 years (Max. interval: 2 years) SF3: Within 12 months of a large fresh (LF5) (Max. interval: 4 years)	Flow targets for small fresh flows (both SF1 and SF2) were met at Moree in each of the last 4 water years. Flow targets to support native fish condition and dispersal (SF1) have also been met downstream of Combadello and Gundare weirs each year since at least 2016–17. However, the flows required to support spawning of in-channel specialists and generalists (SF2) were not achieved at those sites in 2018–19. To ensure the maximum interval is not exceeded, particularly for small freshes 1 and 2, water is required in the next 1–2 years. Therefore, the overall the demand for small fresh events along the Mehi River was assessed as low to moderate.	Low to Moderate	Environmental water for other actions could contribute to these demands	Low to Moderate
	Native fish dispersal and condition Native fish spawning (flow specialists, e.g. golden perch) Native vegetation Frog breeding Aquatic ecosystem function	Large fresh (LF): LF1: for at least 5 days in Jul–Sept (but can occur at any time) for native fish condition and dispersal <ul style="list-style-type: none"> • >1 500 ML/d d/s Combadello • >850 ML/d d/s Gundare LF2: for at least 5 days in Oct–Apr for spawning of flow specialists <ul style="list-style-type: none"> • >1 500 ML/d d/s Combadello • >850 ML/d d/s Gundare 	LF1: 5–10 in 10 years (Max. interval: 2 years) LF2: 3–5 in 10 years (Max. interval: 4 years)	Flow targets for large freshes along the Mehi River require large unregulated flows to pass the full length of the system. Each large fresh flow target has occurred once in the previous 4 years. Given the desired frequency range, the demand for large fresh events along the Mehi River was assessed as high.	High	Reliant on the use of supplementary entitlements to protect natural flow events	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 environmental demand in 2021–22 if watering occurred as planned in 2020–21
		Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water	Potential Commonwealth environmental water contribution?	
Gwydir River Downstream of Copeton Dam Native fish habitat, spawning and recruitment In-stream aquatic ecosystems Reaches within the system contain important values for the Gomerioi local Aboriginal community	Refuge habitat Native fish survival Aquatic ecosystem function	Very low flow: >30 ML/d for at least 200 days at Gravesend. May occur at any time.	Annually (Max. interval: 1 year)	The very low flow target is generally met by water delivered for a variety of purposes and has been met in 2 out of the last 3 years. The very dry conditions experienced during 2019–20 and implementation of drought management strategies for the Gwydir system meant the target was unable to be met last year. Feb–March rainfall events have moved the Gwydir system away from the dry or very dry conditions experienced over the last two water years. If recent rainfall patterns are maintained during 2020–21, current drought management strategies are likely to be relaxed, making it easier to attain the flow target.	Moderate to High	A secondary priority for CEW, as this demand is likely to be met through the delivery of water to meet other downstream demands, depending on conditions and water availability.	Moderate
	Native fish movement, condition and recruitment (in-channel specialists and generalists, e.g. Murray cod) Native vegetation Aquatic ecosystem function	Baseflow (BF): BF1: >440 ML/d for at least 160 days at Gravesend, at any time (native fish movement and condition). BF2: >440 ML/d at Gravesend for at least 100 days in Sept–Mar (recruitment of in-channel specialist and generalists).	BF1: Annually (Max. interval: 1 year) BF2: 5–10 in 10 years (Max. interval: 2 years)	The combination of timing and duration of required flows means that water for consumptive and environmental use as well as operational flows is required to meet the baseflow target. Recent drought conditions mean that baseflow targets have only been met 1 out of the last 3 years (last met in 2017–18). Feb–March rainfall events have moved the Gwydir system towards more moderate flow conditions. If these conditions continue, water for consumptive and environmental use as well as operational flows are likely to meet the small fresh flow targets during 2020–21. Overall the demand for baseflows downstream of Copeton Dam was assessed as high.	High	Copeton Dam can regulate a high proportion flows from upstream systems. Demand unable to be met at desired frequency	Moderate to High
	Native fish dispersal and condition Native fish spawning (in-channel specialists and generalists, e.g. Murray cod) Native vegetation Aquatic ecosystem function	Small fresh (SF): SF1: >990 ML/d at Gravesend for at least 10 days in Oct–Apr (but may occur at any time) (native fish condition and dispersal). SF2: 990–8 600 ML/d at Gravesend for at least 14 days in Sept–Apr (spawning of in-channel specialists and generalists)	SF1: Annually (Max. interval: 1 year) SF2: 5–10 in 10 years (Max. interval 2 years)	Small fresh flow targets were last met in 2018–19 (SF2) and 2019–20 (SF1). The very dry conditions experienced during 2019–20 meant the 14 day target for the spawning of in-channel specialists and generalists (SF2) was unable to be met. Freshes to support native fish condition and dispersal are required annually, so the demand for water to provide these flows has been assessed as high for 2020–21. Freshes to support the spawning of in-channel specialists and generalists are required 5–10 in 10 years and require water in the next 1–2 years. The demand for these small freshes has been assessed as moderate. Feb–March rainfall events have moved the Gwydir system towards more moderate flow conditions. If these conditions continue, water for consumptive and environmental use as well as operational flows are likely to meet the small fresh flow targets during 2020–21.	Moderate to High	A secondary priority for CEW as this demand is likely to be met through the delivery of water to meet other downstream demands, depending on conditions and water availability.	Moderate to High
Gwydir, and Gingham, and Mallowa systems Bird breeding	Support large scale colonial waterbird breeding events	10–15 GL	As required, All years	Colonial waterbird breeding requirement has not been triggered in the past 6 years and requires large scale natural flows event to trigger. Therefore, the demand has been assessed as moderate. However, under extended very dry conditions this contingency is likely to be used to meet critical environmental water needs.	Moderate	Respond to naturally triggered bird breeding, if required	Moderate

* Four sites in the Lower Gwydir and Gingham are internationally recognised under the Ramsar Convention and other international agreements for migratory species and for their special habitat value for waterbirds. These are Old Dromana on the Lower Gwydir system as well as Goddard’s Lease, Windella and Crinolyn on the Gingham Watercourse. The primary ecological features of the wetlands include large areas of coolibah woodland, water couch and marsh club-rush. By maintaining this wetland vegetation, other critical components of the Ramsar site may be supported, including waterbird breeding and foraging habitat.

The Gwydir Long Term Water Plan (2018) sets out a series of 5, 10 and 20 year objectives to maintain and enhance the health of rivers and wetlands within the Gwydir system, however, some of these may need to be reviewed with improved knowledge. The Plan also describes the environmental water requirements (EWRs) needed to achieve the specified ecological objectives. The EWR’s defined within the Gwydir Long Term Water Plan have been used to inform indicative environmental demands for key assets located within the Gwydir system.

^ Volumes are net of any irrigation deliveries

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

3.4.5 Water delivery in 2020–21

Based on the demand for water for the environment, water availability (supply), and catchment conditions, the overall purpose for managing Commonwealth water for the environment in the Gwydir River Valley in 2020–21 is to:

- avoid damage or loss of significant communities and species
- protect the health and resilience of aquatic ecosystems
- maintain the long-term condition of core wetland and riparian areas.

Consistent with the demands and purpose identified, the CEWO is considering supplying water for the environment for the following actions in 2020–21.

Within the confines of environmental water availability during 2020–21, deliver water in the following ways:

- Should dry conditions return and rivers and creeks across the lower part of the system stop flowing, NSW and Commonwealth water for the environment would be used to maintain the condition of drought refuges across the lower Gwydir system pools. Refuges along the Gwydir River between Tareelaro weir and Brageen Crossing as well as the Mehi River upstream of Combadello and Carole Creek upstream of the Garah gauge would be the focus of this watering action.
- Should unregulated tributary flows enter the Gwydir River upstream of Pallamallawa, NSW and Commonwealth water for the environment may be used to restore the condition of core wetland and riparian areas in the lower parts of the Gwydir system, including along the Lower Gwydir and Gingham watercourses as well as Mallowa and Carole Creeks.

Four sites in the Lower Gwydir and Gingham are internationally recognised under the Ramsar Convention, these are Old Dromana on the Lower Gwydir as well as Goddard’s Lease, Windella and Crinolyn on the Gingham Watercourse. This watering action would seek to support the values of the Ramsar site by maintaining condition of wetland communities, including water couch and marsh club-rush communities within the Old Dromana and Goddard’s Lease sites.

As in previous years, the use of Commonwealth and NSW environmental water in the Gwydir River Valley will be adaptively managed throughout 2020–21, in response to changing water resource availability and environmental conditions and demands.

3.4.6 Monitoring and Lessons learned

(a) *Monitoring*

Monitoring and evaluation are key elements of the CEWO’s response to the requirements of the Water Act and Basin Plan. They support improved decision making through the application of adaptive management principles. Monitoring and evaluation are critical steps in the management of Commonwealth environmental water; supporting the efficient and effective use of Commonwealth environmental water within the planning framework and demonstrating the achievement of environmental objectives.

The Monitoring, Evaluation and Research (MER) Program (previously the Long-Term Intervention Monitoring Project 2014-2019) has sites in the Gwydir River Valley. In particular, the program focuses on the Lower Gwydir and Gingham Watercourse wetlands, sections of the Mehi River, the Mallowa Creek and wetlands, and the Gwydir River downstream of Copeton Dam. The MER program is completed jointly with NSW DPIE – EES with support from NPWS for the monitoring of vegetation and waterbirds. The MER program aims to understand the environmental response to Commonwealth environmental watering over a number of years, to help inform future water management.

Details of monitoring activities funded by the CEWO in the Gwydir River Valley can be found at:

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

Monitoring information is also provided by NSW agencies, including NSW DPIE – EES (vegetation, waterbirds and frogs), NSW DPI – Fisheries (native fish), and WaterNSW (hydrology and flow delivery data).

(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 water delivery and monitoring in the Gwydir River Valley is summarised in Table 3.

Table 3: Key lessons learned in the Gwydir River Valley

Theme	Lesson learned
Native fish	<ul style="list-style-type: none"> The fish population in the Gwydir River system remains under stress, with many native species and endangered species in low abundance. This may reflect the carrying capacity of the system in its current state. While some species appear to be breeding and recruiting, others, especially some of the more iconic species such as golden perch, freshwater catfish and Murray cod, are not recruiting sufficiently to improve their populations. Flow events delivered earlier in the water year (winter/spring) improve water quality, stimulate fish to move through the system and encourage the development of diverse invertebrate communities. Primary and secondary production during flows at this time of year are limited by colder water temperatures. Along with providing environmental flows, other options such as habitat rehabilitation, restocking and barrier remediation should be considered to improve fish community condition.
Vegetation	<ul style="list-style-type: none"> Delivery of water for the environment, in combination with natural inflows, has been effective in improving the extent and condition of wetland vegetation. In particular, water couch-spike rush meadows, cumbungi and marsh club-rush tall sedgeland and wetland areas of coolibah woodlands have benefited from watering. These areas are key to maintaining the ecological condition of Ramsar sites within the Gwydir.
Wetlands	<ul style="list-style-type: none"> Providing flows to wetlands in the Gwydir system promotes invertebrate production and supports waterbird populations and vegetation condition. While small frequent flows to the Gingham and Lower Gwydir wetlands can occur both from protected portions of natural flows and small deliveries of water for the environment, these small flows tend to only reach into the more eastern portions, and do not result in effective inundation of the central and western portions of wetlands in the Gingham and Lower Gwydir. A larger volume event, be it by natural flooding or a larger delivered volume from dam accounts is required at least once every three years to preserve and conserve the water dependent assets over time. The Mallowa wetlands rely almost solely on environmental water deliveries for all inflows except for inflows that occur from the larger natural flooding events. While it is preferred to use natural flow triggers for a 'reactive' use of water for the environment to inundate the east, central and western portions of the wetlands in the western Gwydir catchment, it is important to ensure that the wetlands within valley receive water across their entire length at least once every three years. Where a 'reactive' approach is insufficient to achieve inundation in the three-year period, a 'proactive' approach, involving the use of a larger delivered volume from dam accounts into the wetlands, is then undertaken to ensure the continued health of the wetlands. This proactive approach reflects the available water, constraints and modifications of the system. Larger scale proactive environmental watering in 2014-15 and 2018-19 successfully contributed to the recovery of wetland vegetation in the Lower Gwydir and Gingham Watercourses. The Old Dromana and Goddard's Lease Ramsar sites, can be successfully inundated with a large-scale

Theme	Lesson learned
	<p>proactive watering action (60 gegalitres with around 30 gegalitres each to the Gingham and Lower Gwydir), helping to support areas of coolibah woodland, water couch, cumbungi and marsh club-rush.</p>
Ramsar sites	<ul style="list-style-type: none"> • Four sites within the wetlands are listed as a Wetland of International Importance under the Ramsar Convention: Old Dromana on the Lower Gwydir Watercourse, and Goddard’s Lease, Windella and Crinolyn on the Gingham Watercourse. The inundation extent achieved by environmental water deliveries varies between the four Ramsar parcels. • Environmental water deliveries during the 2018–19 water year effectively inundated the two upstream Ramsar parcels on Old Dromana and Goddard's Lease. However, environmental water deliveries did not spill into the wetland areas located on Crinolyn and Windella but continued past these sites and reached Morialta Road downstream. These deliveries have demonstrated that while the upstream Ramsar parcels can be watered relatively easily, the two downstream sites require rehabilitation to allow flows to inundate them. This is because channelisation and works in the mid and lower sections of the Gingham Watercourse has resulted in a deepening of the old stock and domestic channel. This means that higher flow rates and/or remediation works are required for environmental water to be able to flow out onto the wetlands at the Crinolyn and Windella parcels.
Survival (Managing extended Cease to Flow Periods)	<ul style="list-style-type: none"> • Avoiding extended cease to flow periods is important in key river and creek reaches. Guidelines would help to understand how water for the environment could be managed to help prevent maximum intervals between flows from being exceeded, and how to manage low dissolved oxygen/water quality when restarting rivers. For example, cease to flow conditions reached ~100 days in the Mehi River in 2019, and the outcomes of this experience could be used to guide future water delivery during dry conditions.
Productivity	<ul style="list-style-type: none"> • Flows delivered over the summer/autumn period tend to improve water quality and promote primary and secondary production. This supports animals further up the food chain such as fish, frogs and waterbirds.
Connectivity	<ul style="list-style-type: none"> • Connectivity between Gwydir and Barwon rivers can be achieved using water for the environment, and 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 via the Mehi River and/or Carole Creek systems 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 among the channels of the lower Gwydir system via the Mehi and Carole and between the Gwydir and Baron Darling systems. Protecting environmental water delivered in these events from extraction was essential for success. In the absence of appropriate protection, these watering action would not have provided the same level of environmental outcomes.
Other	<ul style="list-style-type: none"> • The principle management strategies employed in the lower sections of the Gwydir system of multi-year wetting and drying and using multiple flow types to target a range of wetland and channel outcomes, is helping to sustain the ecology of the system.

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