



Australian Government

Commonwealth Environmental Water Office

Commonwealth Environmental Water Office Water Management Plan 2021–22

Chapter 6 Gwydir Valley Water Plan

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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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6 Gwydir Valley Water Plan

6.1 Region overview

6.1.1 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% of system inflows (MDBA 2012), 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, reregulating 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 reregulating structures on the Mehi River at Combadello and Gundare, which control low to medium flows between the Mehi and the Moomin and Mallowa creeks.

6.1.2 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 Gomeri/Kamilaroi people. The Gomeri 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. The Commonwealth Environmental Water Office (CEWO) respectfully acknowledges these Nations, their Elders past and present, as the Traditional Custodians of the lands on which this chapter is focused.

6.1.3 Important sites and values

The Gwydir Wetlands (Map GV1) is a terminal wetland in the lower reaches of the Gwydir River and Gingham Watercourse and provide habitat for waterbird species listed under international migratory agreements (JAMBA, ROKAMBA, and CAMBA). Four subsites 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 Ramsar subsites contain 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) (MDBA 2012). These vegetation types have been identified as critical components of the Ramsar subsites that help support its ecological character. The Ramsar subsites were recognised for their important habitat value for waterbirds. In combination with the mosaic of wetlands and floodplain vegetation communities spread across lower Gwydir floodplain, the four Ramsar subsites help sustain up to hundreds of thousands of breeding colonial waterbirds when flooded (MDBA 2012).

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 (Torrible et al. 2009). 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 (Torrible et al. 2009).

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 river 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 river system and its tributaries will be important to ensure the recovery of native fish communities across the northern Basin.

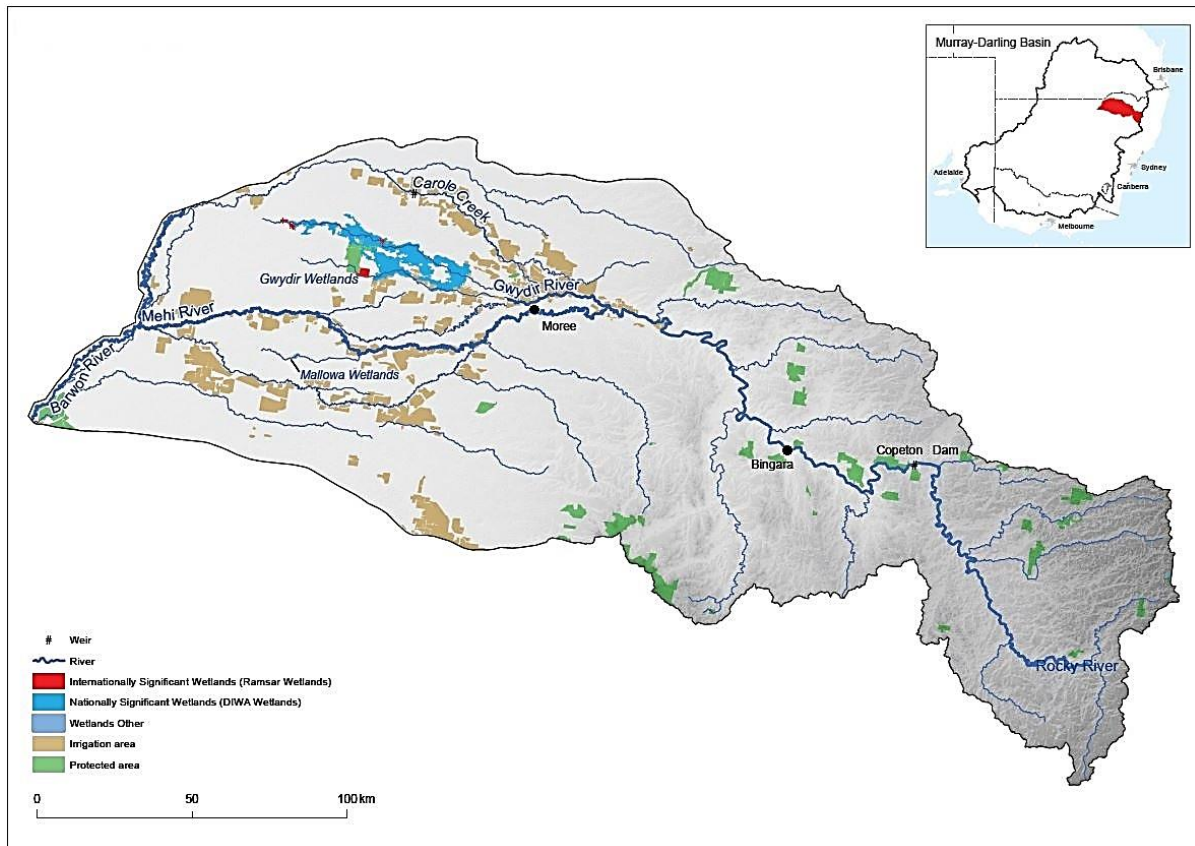
6.1.4 Stakeholder engagement

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 (EWAG).

The EWAG 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 LEOs 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 Zrog (CEWO MER 2020).

Map GV1 Gwydir River Valley



Source: Department of Agriculture, Water and the Environment (2015)

6.2 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 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. The objectives are:

- Vegetation – Maintain the condition, diversity and extent of riparian, floodplain and wetland vegetation.
- Waterbirds – Increase waterbird abundance and maintain 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 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.

6.3 First Nations environmental watering objectives

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.

As the next steps, CEWO will develop and implement a work program to work with First Nations groups in the northern Basin. The work program will refine and build on the work already undertaken by the Northern LEOs through engagement with members of the local Aboriginal community as part of the Gwydir Case Study (Table GV1). This work program will be developed in collaboration with First Nations groups and will be integral in continuing to build relationships and capacity within First Nations groups. It will also ensure First Nations groups actively participate in the planning and management of environmental flows. Key elements of the program will include:

- Completion of a seasonal calendar in collaboration with Traditional Owners from the Gomeri nation.
- Working with representatives from the Gomeri Nation to build on and refine objectives and values identified through the Gwydir Case Study.

Sharing the outcomes from environmental flows with First Nations Groups will be a key step in this process and will include a two-way exchange of knowledge. This information exchange and collaboration will improve the outcomes achieved from providing water for the environment, whilst also ensuring First Nations values are part of the environmental water decision-making and management processes.

Table GV1 First Nations environmental objectives for the Gwydir system

Category	Priority sites and indicator species
River flows and connectivity	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.
Native vegetation	Vegetation species that are resources growing in and along rivers and in wetlands and billabongs, and on floodplains – bush tucker, medicines and cultural practices.
Native birds	Important local indicator species include Brolga, ducks, magpie geese.
Native animals	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.
Connecting with Country	Sharing stories and knowledge are important to the Gomeri 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

Category	Priority sites and indicator species
	Country. Important values include modified trees, burial sites, scar trees, stone artefacts and a midden site.
Other notable water-dependent sites	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.

Source: Heritage Concepts (2009), Hudson Consulting and Woodlots & Wetlands (2009), NSW DECCW (2010) and NSW DPIE (2018). Identified through the Gwydir Case Study.

6.4 Recent conditions and seasonal outlook

6.4.1 Recent conditions and environmental water use

The 2019–20 water year in the Gwydir system began very dry and finished quite wet. Very low falls occurred between July and December 2019. The 2019 calendar year was the driest recorded since 1965. Above average rainfall occurred in January to April 2020, which saw several flows through the full length of the river system. Very heavy rainfall resulted in localised inundation of wetland areas along the lower Gwydir, Ginghams and Mallowa systems in February and March 2020 (BoM 2021c).

Monitoring of refuge pools during spring and summer 2019–20 showed that during no flow periods, water quality and depth within pools declines significantly. Maintaining water quality and depth is important within larger refuge pools to provide native fish species with the best chance of survival during dry times.

Results from monitoring undertaken along the Gwydir River between May to July 2020 showed most native fish species had spawned and recruited in the 2019–20 water year. Whilst the overall numbers of native fish were modest, most individuals sampled appeared in good health. (CEWO MER 2020).

Between April and October 2020, flows across the Gwydir system decreased, with some channels within the lower parts of the system ceasing to flow during September 2020. These cease to flow periods were broken by unregulated flows during mid-October 2020, these flows originating mainly from the Horton River (WaterNSW 2021a).

Over the summer of 2020–21, water for the environment was provided across the Lower Gwydir, Gingham and Mallowa Creek systems, the Mehi and the Barwon River via Carole/Gil Gil creeks. This water complemented natural inflows following widespread rainfall and supported the recovery of wetland areas including the Gwydir Wetlands Ramsar subsites located on 'Old Dromana' and 'Goddard's Lease'. Flows also provided habitat for a range of waterbirds, fish, frogs and turtles. Natural flows in early summer triggered a small waterbird nesting event. Water for the environment was used to help several colonial nesting species finish their breeding.

Waterbird surveys were conducted in February in collaboration with NSW Department of Planning, Industry and Environment (DPIE), NSW National Parks and Wildlife Service (NPWS) and the University of New England (UNE). These surveys recorded around 1,000 magpie geese

in the Gingham watercourse gathering in flocks of 80 to 100, with some establishing nests in the area (DAWE 2021).

In late March 2021, the Gwydir Valley received significant inflows from widespread rainfall. This led to major flooding across much of the Lower Gwydir Floodplain with flows peaking at 10.43 on the Mehi River at Moree and 7.35 metres on the Gwydir River at Yarraman on 25 March 2021. These flows had a significant impact on communities across the valley. Although supplementary water was available, environmental water managers chose not to participate to minimise further flooding impacts to communities (DAWE 2021).

Following the floods, NPWS and DPIE EES staff observed several large (100+) groups of straw-necked and white ibis, great egrets, intermediate and little egrets, mixed flocks of ducks and lots of cootes and grebes (DAWE 2021).

Learn more about previous [Commonwealth environmental water use in the Gwydir catchment](#).

6.4.2 Seasonal outlook

According to the Bureau of Meteorology outlook in May, above median rainfall is forecast across the Gwydir River Valley from July to September (BoM 2021b). Maximum temperatures are also forecast to remain above average over the coming months (BoM 2021e).

These forecasts suggest weather patterns may help improve the condition of rivers and wetlands in the Gwydir. However, it is also possible that dry conditions may re eventuate over coming months, which may hinder recovery.

6.4.3 Water availability

Commonwealth environmental water is managed in conjunction with other held and planned environmental water managed by NSW. Other flows such as tributary flows, consumptive water and other water orders may also support environmental demands in the Gwydir Valley. As of 30 April 2021, there was 36.8 gegalitres in the Environmental Contingency Allowance (ECA) and 70.6 gegalitres of general and high security Held Environmental Water available out of the 548 gegalitres of active volume in Copeton Dam (NSW DPIE 2021).

The volume of Commonwealth environmental water carried over in the Gwydir River Valley for use in 2021–22 is 59.9 gegalitres. Full (100%) allocation for high security entitlements is expected to be announced at the commencement of the 2021–22 water year, which would add an additional 4.5 gegalitres of water for the environment. As of 20 May 2021, Copeton Dam was at 41% capacity (WaterNSW 2021b).

Based on the expected available volume of environmental water held by the Commonwealth and NSW, as well as recent and forecast catchment conditions, it is expected that the overall resource availability will be moderate in 2021–22. Forecast allocation of regulated (surface water) Commonwealth environmental water in 2021–22 under different water availability scenarios is provided in table 4 of [Chapter 2](#).

Due to the combination of recent flows, moderate storage levels and volumes of environmental water, environmental managers will provide water for the environment in response to natural flow triggers in the 2021–22 water year.

6.4.4 Environmental demands

Considering the prolonged drought conditions and the need to 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 Catchment in 2021–22, are shown in Table GV2.

Table GV2 Environmental demands and watering priorities, 2021–22, and outlook for coming year, Gwydir Valley

Environmental assets	Target values	Indicative demand (for all sources of water in the system) ^c			2021–22		Implications for future demands
		Flow/volume	Required frequency (maximum dry interval)	Watering history (from all sources of water)	Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2022–23 if watering occurred as planned in 2021–22
Gwydir Wetlands Areas of Ramsar listed wetlands ^a Nationally significant wetlands Waterbird breeding and habitat Habitat and breeding ground for frogs Native fish habitat Endangered ecological communities Lagoons and wetlands which have important values for the Gomeroi local Aboriginal community. Key sites include: <ul style="list-style-type: none"> • Old Dromana Wetland • Bunnor Wetland • Gingham Waterhole • Gin Holes 	Core wetland inundation Refuge habitat for native fish, waterbirds, frogs and other aquatic species Maintenance and Regeneration of Wetlands Ecosystem function	Small wetland (WL) inundation: WL1 (Protect Core Wetland) ^b : <ul style="list-style-type: none"> • >6 GL event over 3 to 6 months (Gwydir at Millewa) at any time. • >15 GL event over 1 to 3 months (Gingham at Teralba) at any time. • >15 GL event over 2 to 6 months (Gingham at Tillaloo) at any time. • >3 GL event 1 to 4 months (Gingham at Gingham Bridge) at any time. WL2 (Maintenance and Regeneration of Wetlands) ^b : <ul style="list-style-type: none"> • >36 GL over 3 to 6 months (Gwydir at Allambie) in Sept to Mar (but can occur at any time). • >30 GL over 1 to 3 months (Gingham at Teralba). • >30 GL over 2 to 6 months (Gingham at Tillaloo) in Sept to Mar (but can occur at any time). • > 15 GL over 1 to 4 months (this should have been 2 to 6 months) (at Gingham Bridge). 	WL1: 9 to 10 in 10 years (Max. interval: 1 year) WL2: 8 to 9 in 10 years (Max. interval: 2 years)	The Gingham and Lower Gwydir systems experienced moderate flow 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. During 2018–19 an extended environmental watering event (based on a proactive water delivery strategy) met all WL1 flow targets to be. This inundated most of the core wetlands across both the Gingham and Gwydir systems. 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 only a limited area in the Lower Gingham and for a limited duration in areas downstream from Gingham Waterhole. The Goddard’s Lease part of the Ramsar site was inundated but flows did not reach the Crinolyn or Windella Ramsar site areas. 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 2020. Natural flows occurred over summer and early autumn of 2020–21 completely inundating floodplain areas across the Lower Gwydir and Gingham system. These flows met all wetland demands. Flows necessary to protect core wetlands have occurred 3 to 5 times in the last 5 years, while the flows required to maintain and regenerate wetlands have occurred only 1-2 times in the last 5 years. Therefore the environmental demand has been assessed as high.	High	A high priority for CEW under moderate water resource availability scenarios, subject to occurrence of unregulated flow event and water availability. 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. Use of supplementary water to protect natural flow. Use will be assessed based on the likelihood of third part impacts.	High
	Maintenance and regeneration of floodplain vegetation (including lignum) Waterbird habitat and potential breeding Maintain native fish habitat Ecosystem function	Large wetland (WL) inundation^b: WL3 (Regeneration of Floodplain Vegetation): <ul style="list-style-type: none"> • >45 GL over 3 to 6 months (Gwydir at Allambie) in Oct to Apr. • >45GL over 1 to 3 months) Gingham at Teralba. • >40 GL over 2 to 6 months (Gingham at Tillaloo) in Oct to Apr. • >20 GL over 1 to 4 months (at Gingham Bridge). WL4 (Maintenance of Floodplain Vegetation)^b: <ul style="list-style-type: none"> • >65 GL over 2 to 6 months (Gwydir at Allambie) in Aug to Feb (but can occur at any time). • >60 GL over 2 to 6 months (Gingham at Tillaloo) in Aug to Feb (but can occur at any time). • >30 GL over 1 to 4 months (Gingham at Gingham Bridge) in Aug to Feb (but can occur at any time). 	WL3: 5–8 in 10 years (Max. interval: 3 years) WL4: 3–5 in 10 years (Max. interval: 5 years)	Dry to very dry conditions persisted during most of the 2017–18, 2018–19 and 2019–20 water years. Flows necessary to support regeneration and maintenance of floodplain flows did not occur. The condition of floodplain vegetation was improved by widespread rainfall, which occurred across the Gingham and Lower Gwydir systems in early 2020. The condition of floodplain vegetation was further enhanced by natural flows which occurred between summer and early autumn of 2020. Flows necessary to support the regeneration and maintenance of floodplain vegetation have only occurred in 1 to 2 of the 5 years. Therefore the environmental demand has been assessed as high.	High	System constraints (identified as part of the package of adopted ‘Northern Basin Toolkit measures’) will need to be addressed before Commonwealth environmental water can contribute to these demands.	High

Environmental assets	Target values	Indicative demand (for all sources of water in the system) ^c			2021–22		Implications for future demands
		Flow/volume	Required frequency (maximum dry interval)	Watering history (from all sources of water)	Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2022–23 if watering occurred as planned in 2021–22
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 Maintain wetland and riparian vegetation condition Ecosystem function	Small wetland (WL) inundation: WL1 (Protect Core Wetland): >3 GL over 2 to 4 months at the Mallowa Regulator in Oct to Mar (but can occur at any time). WL2 (Maintenance and Regeneration of Wetlands): >8 GL over 2 to 4 months at the Mallowa Regulator in Sept to Mar (but can occur at any time).	WL1: 9 to 10 in 10 years (Max. interval: 1.5 years) WL2: 7 to 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) met both flow targets, helping to protect, maintain and regenerate core wetland areas. The Mallowa wetlands experienced dry conditions again 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. High flows and use of Commonwealth supplementary entitlements during summer and early autumn met both flow targets during the 2020–21 water year. Flows necessary to protect core wetlands have occurred 3 times in the last 5 years, while the flows required to maintain and regenerate wetlands have occurred only 2 times in the last 5 years. Therefore the environmental demand has been assessed as high.	High	A high priority for CEW under moderate water resource availability scenarios, subject to occurrence of unregulated flow event and water availability. 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. Use of supplementary water to protect natural flow. Use will be assessed based on the likelihood of third part impacts.	High
	Maintain native vegetation condition (including lignum) Waterbird habitat and potential breeding Native fish Ecosystem function	Large wetland (WL) inundation: WL3 (Regeneration of Floodplain Vegetation): >15 GL over 2 to 4 months at the Mallowa Regulator in Oct to Apr. WL4 (Maintenance of Floodplain Vegetation): >22 GL over 2 to 6 months at the Mallowa Regulator in Aug to Feb (but can occur at any time).	WL3: 5 to 7 years in 10 (Max. interval: 3 years) WL4: 3 to 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) met the flow target for regeneration of floodplain vegetation. As noted above, dry conditions in 2019–20 resulted in no significant inflows entering the Mallowa system. However, widespread rainfall across the Mallowa Creek system in early 2020 improved the condition of floodplain vegetation communities. Heavy local rainfall and high flows along the Mehi River helped to inundate large sections of the Mallowa floodplain, however the duration of floodplain inundation was shorter than required to assist in the regeneration and maintenance of floodplain vegetation. Flows to support the regeneration of floodplain vegetation have only occurred once in the last three years but have not reached the maximum interval between events. Flows to support the maintenance of floodplain vegetation require natural flow events to occur to enable it to be achieved. This demand has not been met in the last 5 years. Therefore the environmental demand has been assessed as high.	High	Use of Commonwealth supplementary water to protect natural flow. Use will be assessed based on demands and the likelihood of third party impacts	High

Environmental assets	Target values	Indicative demand (for all sources of water in the system) ^c			2021–22		Implications for future demands			
		Flow/volume	Required frequency (maximum dry interval)	Watering history (from all sources of water)	Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2022–23 if watering occurred as planned in 2021–22			
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) Maintain native vegetation condition Aquatic ecosystem function	Small fresh (SF): SF1: >200 ML/d for at least 10 days on the Carole near Garah, in Oct to Apr (but can occur at any time) (native fish condition and dispersal). SF2: 200 to 900 ML/d for at least 14 days on the Carole near Garah, in Sept to Apr (spawning of in-channel specialists and generalists)	SF1: Annually (Max. interval: 1 year). SF2: 5 to 10 in 10 years (Max. interval: 2 years).	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 and Mar 2020 and met the small fresh 1 flow target, but were insufficient to meet the small fresh 2 flow target. High flows and use of Commonwealth entitlements during summer and early autumn enabled both flow targets to be met during the 2020–21 water year. The small fresh 1 flow target has been met in 4 of the last 5 years, while the small fresh 2 flow target has been met in 3 of the last 5 years. Therefore the environmental demand has been assessed as low to moderate.	Low to Moderate	A secondary priority for CEW under moderate water resource availability scenarios. Use of supplementary water to protect natural flow may be considered. Use will be assessed based on the likelihood of third party impacts.	Low to Moderate			
		Small fresh (SF3): SF3:> 45 ML/d for at least 10 days on the Gil Gil at Galloway, in Oct to Apr (but can occur at any time) (native fish condition and dispersal).	Within 12 months of a flow >750 ML/day on the Gil Gil at Galloway (end of system gauge) for at least 5 days.	This flow target is closely aligned to the occurrence of large natural flows. The combination of a large natural flows followed by a small fresh only occurred in 2 of the last 5 years (2019–20 and 2020–21). Natural flows along the Gil Gil Creek during Mar 2021 achieved a flow of 750 ML/d for more than 5 days at Galloway. Provision of a small fresh during spring to summer in 2021–22 would provide native fish with an opportunity to move between the Gwydir and Barwon Rivers. This environmental demand has been assessed as moderate.				Moderate	Use of Commonwealth supplementary water to protect natural flow. Use will be assessed based on demands and the likelihood of third party impacts.	Low to Moderate
		Large fresh (LF): LF1: >900 ML/d for at least 5 days on the Carole near Garah, in Jul to 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 to Apr.	LF1: 5–10 years in 10 (Max. interval: 2 years). LF2: 3–5 years in 10 (Max. interval: 4 years).	Flow targets for large freshes along Carole Creek require large unregulated flows. Flows occurring in February 2020 and March 2021 met both targets, however these targets have not been met outside these two periods. Therefore the environmental demand is still low to moderate.				Low to Moderate	A secondary priority for CEW under moderate water resource availability scenarios. Use of Commonwealth supplementary water to protect natural flow may be considered. Use will be assessed based on the demands and the likelihood of third party impacts.	Low to 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 Gomeroi local Aboriginal community	Native fish dispersal and condition Native fish spawning (in-channel specialists and generalists, e.g. Murray cod) Maintain native vegetation condition 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)	SF1: Annually (Max. interval: 1 year). SF2: 5 to 10 in 10 years (Max. interval: 2 years).	Flow targets for small fresh flows (both SF1 and SF2) were met at Moree in each of the last 5 water years. Flow targets to support native fish condition and dispersal (SF1) have also been met downstream of Combardello and Gundare weirs in each of the last 5 water years. Flows required to support spawning of in-channel specialists and generalists (SF2) have been met downstream of Combardello and Gundare weirs in 4 of the last 5 years. Therefore the environmental demands is assessed as low.	Low	A secondary priority for CEW under moderate water resource availability scenarios. Use of Commonwealth supplementary water to protect natural flow may be considered. Use will be assessed based on the demands and the likelihood of third party impacts.	Low			
		<ul style="list-style-type: none"> 345 to 2 800 ML/d at Moree for at least 10 days 220 to 1 500 ML/d d/s Combadello for at least 14 days 100 to 850 ML/d d/s Gundare for at least 14 days 								

Environmental assets	Target values	Indicative demand (for all sources of water in the system) ^c			2021–22		Implications for future demands
		Flow/volume	Required frequency (maximum dry interval)	Watering history (from all sources of water)	Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2022–23 if watering occurred as planned in 2021–22
		<p>Small fresh (SF): SF3: >90 ML/ Mehi near Collarenebri for at least 10 days in Oct to Apr (but can occur at any time) (native fish condition and dispersal).</p>	<p>Within 12 months of a flow >800 ML/day near Collarenebri for at least 5 days.</p>	<p>This flow target is closely aligned to the occurrence of large natural flows. The combination of a large natural flows followed by a small fresh only occurred in 3 of the last 5 years (2016–17, 2019–20 and 2020–21). Natural flows along the Mehi River during Mar 2021 achieved a flow of 800 ML/d for more than 5 days near Collarenebri. Provision of a small fresh during spring to summer 2021–22 would provide native fish with an opportunity to move between the Gwydir and Barwon Rivers. This environmental demand has been assessed as moderate.</p>	Moderate	<p>Use of Commonwealth supplementary water to protect natural flow. Use will be assessed based on the demand and likelihood of third party impacts.</p>	Low to Moderate
	<p>Native fish dispersal and condition Native fish spawning (flow specialists, e.g. golden perch) Maintain native vegetation condition Frog breeding Aquatic ecosystem function</p>	<p>Large fresh (LF): LF1: for at least 5 days in Jul–Sept (but can occur at any time) for native fish condition and dispersal. >1 500 ML/d d/s Combadello >850 ML/d d/s Gundare LF2: for at least 5 days in Oct to Apr for spawning of flow specialists >1 500 ML/d d/s Combadello >850 ML/d d/s Gundare</p>	<p>LF1: 5 to 10 in 10 years (Max. interval: 2 years). LF2: 3 to 5 in 10 years (Max. interval: 4 years).</p>	<p>Flow targets for large fresh flows for native fish condition and dispersal were met downstream of Combadello and Gundare weirs in 3 of the last 5 years. Flow targets for large fresh flows for spawning of flow specialists were met downstream of Combadello and Gundare weirs in 2 of the last 5 years. The environmental demand has been assessed as low to moderate.</p>	Low to Moderate	<p>A secondary priority for CEW under moderate water resource availability scenarios. Use of Commonwealth supplementary water to protect natural flow may be considered. Use will be assessed based on the demand and likelihood of third party impacts.</p>	Low to Moderate
Gwydir River Downstream of Copeton Dam	<p>Maintain refuge habitat Native fish survival Aquatic ecosystem function</p>	<p>Very low flow: >30 ML/d for at least 200 days at Gravesend. May occur at any time.</p>	<p>Annually (Max. interval: 1 year).</p>	<p>The very low flow target is generally met by water delivered for a variety of purposes and has been met in 4 out of the last 5 years. Therefore the environmental demand has been assessed as low to moderate.</p>	Low to Moderate	<p>Environmental water for other actions could contribute to these demands.</p>	Low to Moderate
<p>Native fish habitat, spawning and recruitment In-stream aquatic ecosystems Reaches within the system contain important values for the Gomerioi local Aboriginal community</p>	<p>Native fish movement, condition and recruitment (in-channel specialists and generalists, e.g. Murray cod) Native vegetation Aquatic ecosystem function</p>	<p>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 to Mar (recruitment of in-channel specialist and generalists).</p>	<p>BF1: Annually (Max. interval: 1 year). BF2: 5 to 10 in 10 years (Max. interval: 2 years).</p>	<p>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 2 out of the last 5 years. Therefore the environmental demand is assessed as moderate.</p>	Moderate	<p>Copeton Dam can regulate a high proportion flows from upstream systems. Demand unable to be met at desired frequency.</p>	Moderate
	<p>Native fish dispersal and condition Native fish spawning (in-channel specialists and generalists, e.g. Murray cod) Native vegetation Aquatic ecosystem function</p>	<p>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)</p>	<p>SF1: Annually (Max. interval: 1 year) SF2: 5–10 in 10 years (Max. interval 2 years)</p>	<p>Flow targets for small fresh flows to support native fish condition and dispersal (SF1) were met in each of the last 5 water years. Flows required to support spawning of in-channel specialists and generalists (SF2) have been met in 4 of the last 5 years. Therefore the environmental demands is assessed as low.</p>	Low	<p>Environmental water for other actions could contribute to these demands.</p>	Low

Table GV3 Contingency Watering Actions




<p>Refuge pools along the Gwydir and upper Mehi Rivers as well Carole Creek Refuge habitat Native fish Water quality</p>	<p>Maintain critical drought refuge habitat Native fish maintenance and survival</p>	<p>Up to 14 GL Triggers 0 ML/d on the Gwydir River at Yarraman Mehi River 0 ML/d on the Mehi River at Moree Carole Creek 0 ML/d on Carole Creek near Garah</p>	<p>Cease to flow period should not exceed: 30 to 60 days (depending on conditions) on the Gwydir at Yarraman 40 to 80 days (depending on conditions) on the Mehi River at Moree 40 to 80 days (depending on conditions) on Carole Creek near Garah</p>	<p>The Northern Connectivity Event in April–May 2018 and the Northern Fish Flow April to June 2019 contributed to meeting this demand in key reaches (mainly in the Mehi and to a lesser extent in the Carole). 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. Late winter and early spring 2021 received below average to very much below average rainfall leading to a number of river reaches across the lower Gwydir ceasing to flow.</p>	Moderate	<p>Environmental water for other actions could contribute to these demands. Using regulated environmental water entitlements, respond to extended dry periods to protect critical refuge habitat.</p>	Moderate
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				Cease to flow periods were broken by natural flows originating from unregulated tributaries. This environmental demand is assessed as moderate.			
Gwydir, and Gingham, and Mallowa systems Bird breeding	Support waterbird breeding events	5–15 GL	Respond to naturally triggered bird breeding, if required	Colonial waterbird breeding action has not been triggered in the past 7 years and requires large scale natural flows event to trigger. This environmental demand is assessed as moderate.	Moderate	Using regulated environmental water entitlements, respond to extended period of floodplain inundation to sustain bird breeding.	Moderate
Lower Gwydir, Gingham, Mehi and Carole Water Quality	Native fish maintenance and survival Maintain water quality within acceptable limits	Up to 5 GL	Respond to declining water quality following extended dry periods	This action has not been implemented over the last 5 years.	Moderate	Using regulated environmental water entitlements, respond to declining water quality.	Moderate
Barwon-Darling Connectivity Events	Maintain water quality within acceptable limits Native fish maintenance and survival	5 -25 GL	Respond to declining water quality following extended dry periods	The Northern Connectivity Event in April–May 2018, the Northern Fish Flow in April–June 2019 and the Northern Waterhole Top-up in January–February contributed to meeting this requirement. This environmental demand is still assessed as moderate as water may be needed this year or next.	Moderate	Using regulated environmental water entitlements, respond to declining water quality.	Moderate
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	Frequency subject to further examination Est. Max. interval: 3 years	Environmental flows were delivered for the first time to the Ballin Boora system during 2018–19. The Ballin Boora ran from local runoff following localised intense heavy rainfall several times in Feb–March 2020 (local landholder feedback as per Mallowa). Heavy local rainfall and high flows along the Mehi River in March 2021 helped to inundate large sections of the Ballin Bora system. Therefore this environmental demand is assessed as low.	Low	A low priority for CEW under given recent flows.	Low




Note: Data and information from NSW Department of Planning, Industry and Environment and WaterNSW realltime data website (WaterNSW 2021a) has informed the watering history in this table. A) 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. B) The Gwydir Long-Term Water Plan (NSW DPIE 2020a) 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. C) Volumes are net of any irrigation deliveries

Key

Potential watering in 2021–22

-  High priority for Commonwealth environmental watering (likely to receive water even under low water 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); or unable to provide water because of constraints or insufficient water

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

-  High to critical demand for water (needed in that particular year or urgent in that particular year to manage risk of irretrievable loss or damage)
-  Moderate demand for water (water needed in that particular year, the next year, or both)
-  Low demand for water (water generally not needed in that particular year)

6.5 Water delivery in 2021–22

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 unregulated (natural) flow events.

Where a ‘reactive’ approach is insufficient to achieve inundation of a 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.

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 2021–22 is to:

- Maintain the long-term condition of core wetland and riparian areas.
- Enhance connection between the Barwon and Gwydir systems.
- Protect the health and resilience of aquatic ecosystems.
- Avoid damage or loss of significant communities and species.

Consistent with the demands and purpose identified, the CEWO is considering supplying water for the environment for the following actions in 2021–22.

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

- Commonwealth water for the environment is likely to be provided to restore the condition of core wetland and riparian areas along Mallowa Creek.
- 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 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.

- Should unregulated tributary flows enter the Mehi River and Carole Creek, Commonwealth supplementary entitlements may be used to enhance connection between the Barwon and Gwydir systems. Use will be assessed based on the environmental demands and the likelihood of third party impacts.
- 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.

As in previous years, the use of Commonwealth and NSW environmental water in the Gwydir River Valley will be adaptively managed throughout 2021–22, in response to changing water resource availability and environmental conditions and demands.

6.6 Monitoring and lessons learned

6.6.1 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.

Learn more about [monitoring activities funded by the CEWO in the Gwydir Catchment](#).

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) (WaterNSW 2021a).

6.6.2 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 Catchment are summarised in Table GV4.

Table GV4 Key lessons learned in the Gwydir River Valley

Theme	Lessons 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 character 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 proactive watering action (60 gigalitres with around 30 gigalitres each to the Gingham and Lower Gwydir), helping to support areas of coolibah woodland, water couch, cumbungi and marsh club-rush.
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 Mordialta Road downstream. These deliveries have demonstrated that while the upstream Ramsar parcels can be watered relatively easily, the two downstream sites require higher flow rates and/or remediation works are required to enable environmental water to flow out onto the wetlands at the Crinolyn and Windella parcels.
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.

Theme	Lessons learned
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, Northern Fish Flow and Northern Waterhole Top-up 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 and 2020–21 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. During the 2020–21 water year active management arrangements were implemented in the Barwon–Darling for the first time. These arrangements enabled held environmental water delivered from the Gwydir and Border Rivers systems (as part of the Northern Waterhole Top-up) to be protected from extraction as it flowed along the Barwon–Darling.
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.

Source: CEWO MER (2020) & Eco Logical (2019)

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