Australian Government
Commonwealth Environmental Water Office

Commonwealth Environmental Water

Portfolio Management Plan

Namoi River Valley

2019–20

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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.

The Namoi and Peel rivers are within the traditional lands of the Gomeroi/Kamilaroi people, and hold significant value for them.

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Commonwealth environmental water portfolio management planning

Commonwealth Environmental Water Holder

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

Commonwealth environmental water

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

There are broadly three options for managing Commonwealth environmental water:

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

Purpose of the document

This document sets out the plans for managing the Commonwealth environmental water portfolio in the Namoi River Valley for 2019–20. Efficient and effective management of Commonwealth environmental water requires the utilisation of all portfolio management options. By taking a multi-year approach to planning, portfolio management tools such as use, carryover and trade can be managed for maximising environmental outcomes.

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

To learn more about the planning approach see *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water, 2019–20* (available at: http://www.environment.gov.au/water/cewo/publications under 'Planning approach').

Delivery partners

Commonwealth environmental water is managed in conjunction with and delivered by a range of partners. Commonwealth environmental water planning and delivery in the Namoi River Valley is supported by advice from the New South Wales Office of Environment and Heritage (NSW OEH), Department of Industry (DOI) – Water, Department of Primary Industries (DPI) – Fisheries, and WaterNSW.

Your input

The management of Commonwealth environmental water relies on considerable advice and assistance from others. Individuals and groups within the Murray–Darling Basin community are encouraged to submit suggestions for the management of Commonwealth environmental water. Please contact the Commonwealth Environmental Water Office via: ewater@environment.gov.au.

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1. Environmental watering in the Namoi River Valley

1.1. The Namoi River Valley

The Namoi River Valley is located in north-eastern New South Wales, extending westwards of Nundle to Walgett. Rainfall in the upper catchment drives river flows and can be highly variable between years. Water for regulated delivery throughout the valley is stored in Split Rock and Keepit dams (Figure 1). There are also a number of smaller regulating weirs downstream of Keepit Dam.

The Namoi River is the primary riverine asset and is a major tributary of the Barwon River. Major tributaries of the Namoi include Cox's Creek and the Mooki, Manilla and the Peel rivers, which join the Namoi River upstream of Boggabri. Flows are confined in-channel until the floodplain begins to broaden at Gunnedah. The Pian (an anabranch of the Namoi River), Narrabri, Baradine and Bohena creeks contribute flows to the Namoi River downstream of Boggabri. The Namoi River connects with the Barwon-Darling near Walgett.

Flows in the Peel River are regulated out of Chaffey Dam and flow into the Namoi River slightly downstream of Keepit Dam. Major tributaries into the Peel River are Goonoo Goonoo Creek, the Cockburn River and Dungowan Creek.

The Peel and Namoi rivers support a number of threatened fish species including Murray cod, silver perch, freshwater catfish, olive perchlet, purple spotted gudgeon and the river snail. Riverine vegetation in the Namoi River Valley includes emergent aquatic plants and river oaks, rough-barked apple and river red gum.

The aquatic community of the Namoi River forms part of the *Lowland Darling River aquatic ecological community*, which is listed as endangered under the *NSW Fisheries Management Act 1994*. This community includes 21 native fish species and hundreds of native invertebrate species that are found within the Darling River and its associated streams, wetlands and anabranches within NSW.

The Namoi and Peel rivers are within the traditional lands of the Gomeroi/Kamilaroi people, and hold significant value for them.

Environmental watering in the Namoi River Valley is most likely to be delivered as baseflows or freshes, undertaken in conjunction with other flows in the system (e.g. a naturally occurring fresh flow, or consumptive water or block releases), or during prolonged low flow conditions.

Held environmental water in the Peel River can be made available from Chaffey Dam and either delivered alone (e.g. to top up refuge pools), or in combination with downstream unregulated tributary inflows, consumptive water or planned environmental water. For example, Commonwealth environmental water could be delivered in conjunction with the Peel environmental contingency allowance managed by the NSW Government.

In order to meet the Lower Namoi River in-channel fresh requirements, regulated releases from Keepit Dam could be to be timed to coincide with unregulated inflows from the Peel and Mooki rivers and Cox's Creek. The environmental benefits from these flows may also extend downstream to the Barwon-Darling River. Where possible, environmental water will be managed to provide environmental benefits to multiple sites in order to maximise the efficiency and effectiveness of water delivery.

The Namoi River provides good hydrological connection with the Barwon-Darling at various times. The Barwon-Darling connects rivers, lakes and wetlands across the northern Basin, providing critical drought refuge and a movement corridor for fish and waterbirds, and habitat for other aquatic species including turtles, mussels, and shrimp. Flows that connect the Barwon-Darling and the northern tributaries may help to support healthy and diverse populations of native fish and other fauna, including in the Namoi and Peel rivers. More information about the Barwon-Darling is described in the *Commonwealth Environmental Water Portfolio Management Plan: Barwon-Darling 2019–20.*

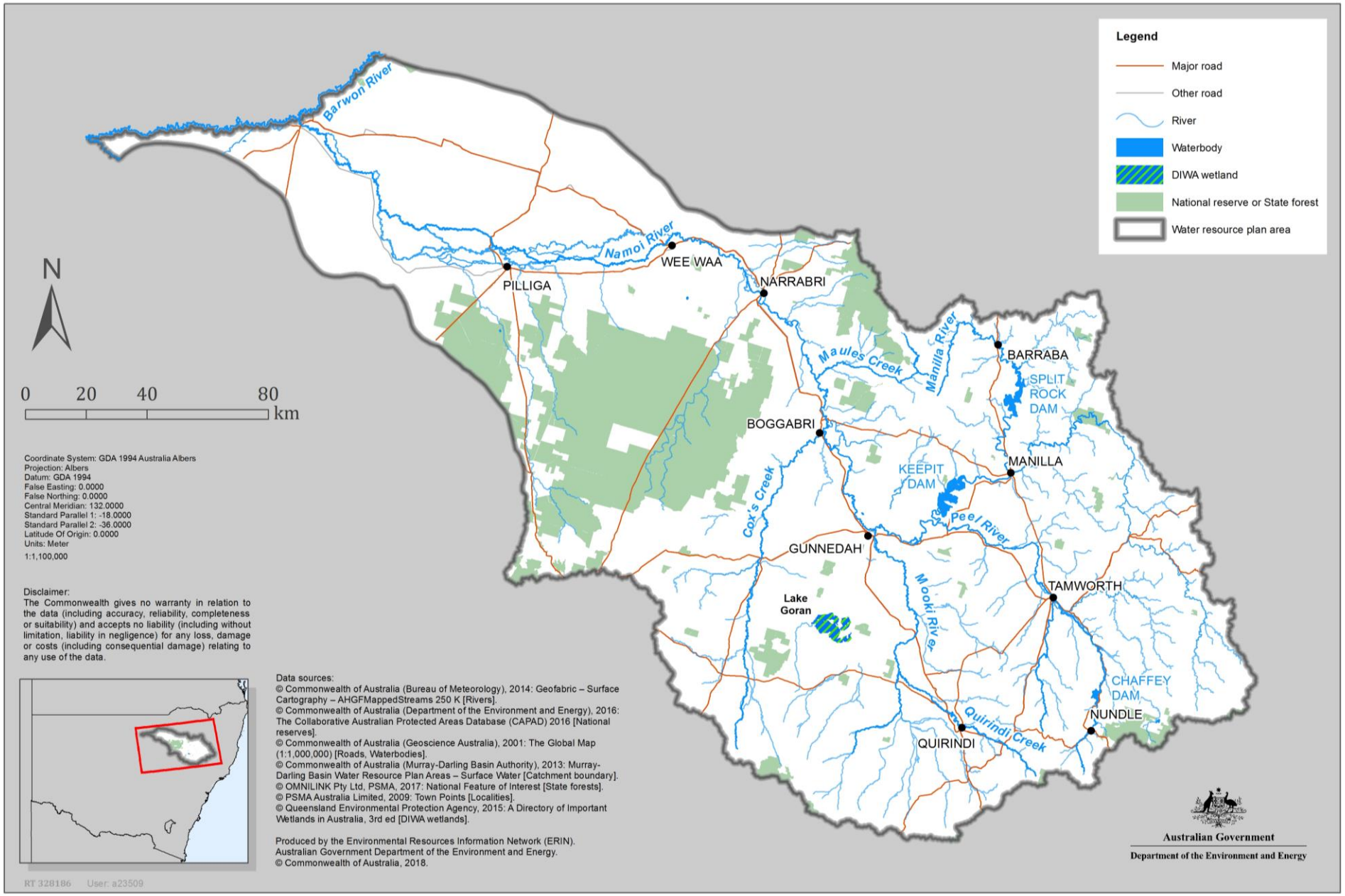


Figure 1: Map of the Namoi River Valley produced by the Department of Environment and Energy, June 2018.

1.2. Environmental objectives in the Namoi River Valley

The long-term environmental objectives for the Murray–Darling Basin are described in the Basin Plan's environmental watering plan and the Basin-wide environmental watering strategy, which includes 'quantified environmental expected outcomes' at both a Basin-scale and for each catchment. The expected outcomes relevant for the Namoi River Valley are summarised in Table 1 and described in detail in Attachment A.

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

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

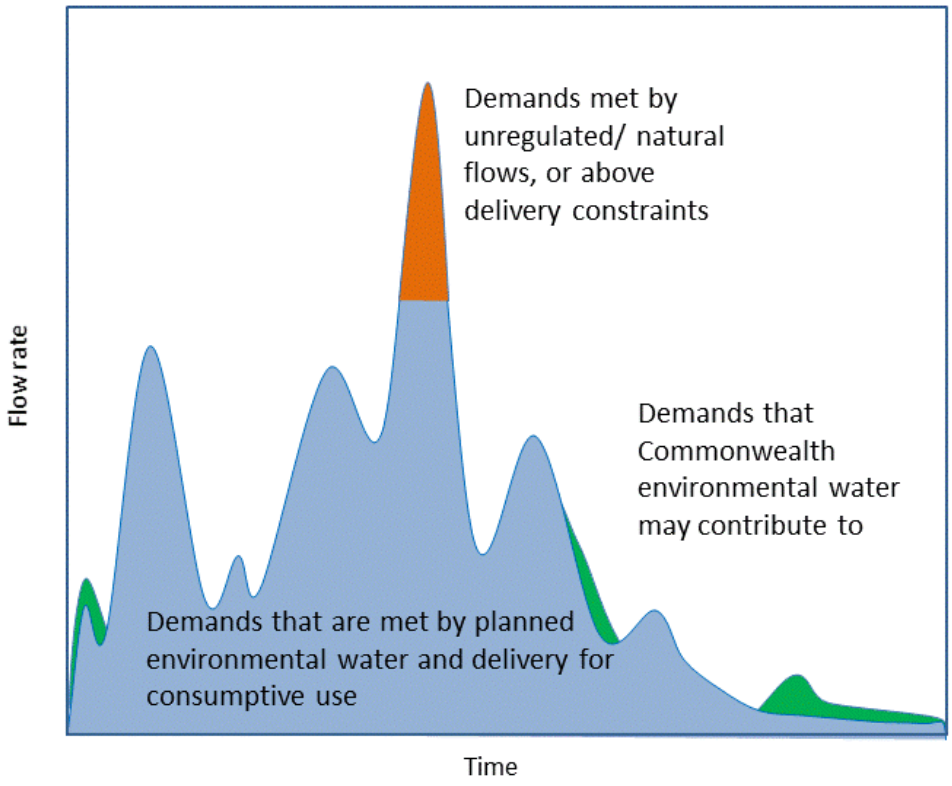
Table 1: Summary of objectives being targeted by environmental watering in the Namoi River Valley.

BASIN-WIDE OUTCOMES (Outcomes in red link to the Basin-wide Environmental Watering Strategy)	**ENVIRONMENTAL OBJECTIVES FOR NAMOI RIVER VALLEY ASSETS**		
	IN-CHANNEL ASSETS		**OFF-CHANNEL ASSETS**
	Lower Namoi River channel	**Peel River channel**	**Lower Namoi anabranch & floodplain wetland system**
VEGETATION	Maintain riparian and in-channel vegetation condition, growth and survival (extent) by providing in-channel freshes		Provide freshes to maintain the condition, growth and survival (extent) of native vegetation of the anabranch communities and wetland vegetation
WATERBIRDS	Provide drought refuge for waterbirds and support waterbird habitat		
FISH	Contribute to freshes to support reproduction and recruitment opportunities for native fish including silver perch, Murray cod and freshwater catfish Provide baseflows and freshes to support connectivity and movement, and maintain in-channel refuge and aquatic habitat for native fish, including silver perch, Murray cod and freshwater catfish		
MACROINVERTEBRATES	Support recruitment and maintain macroinvertebrate diversity		
OTHER VERTEBRATES	Support opportunities for the reproduction and recruitment of other native aquatic species, including frogs and turtles		
CONNECTIVITY	Support longitudinal connectivity, including with the Lower Namoi floodplain and Barwon-Darling system by providing baseflows and freshes	Support longitudinal connectivity along the river channel by providing baseflows and freshes	Support connectivity, particularly lateral between the river and floodplain, by contributing to freshes and bankfull flows
PROCESSES	Support key ecosystem functions within channel and on the floodplain, including the cycling of nutrients and wetting banks and benches		
WATER QUALITY	Maintain water quality within channels and pools		
RESILIENCE	Provide or maintain drought refuge habitat (particularly for fish)		

Information sourced from: MDBA (2012), MDBA (2014), Barma Water Resources et al. (2012), Department of the Environment (2014).

1.3. Environmental flow requirements

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



Commonwealth environmental water contribution unlikely:

- Flows above 4,500 ML/day at the Narrabri Creek gauge
- Flows above 1,100ML/day in the Peel River

Focus for environmental water contribution subject to seasonal conditions:

- Low to moderate in-channel flows in the Namoi and Peel rivers
- Moderate flows to the lower Namoi River that commence to fill wetlands and anabranches
- Extend/provide managed recession to higher flows
- Connection flows with the Barwon River

Demands met by other sources:

- Small to moderate in channel flows for irrigation and town water supplies
- Planned environmental water including high flows (>18,000 ML/day) that inundate broader floodplain areas

Figure 2: Scope of demands that Commonwealth environmental water may contribute to in the Namoi River Valley

Based on the above objectives and delivery constraints, specific watering requirements (flow magnitude, duration, timing and frequency) have been identified as being in scope for Commonwealth environmental water. These water requirements are described in Table 3. The priority for the use of Commonwealth environmental water is maintaining low flows in the catchment as these are required to maintain ecosystem health. As with the objectives, the environmental water requirements will continue to be reviewed and revised in response to new knowledge.

2. Portfolio management in 2019–20

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

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

2.1. Lessons from previous years

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

The Commonwealth Environmental Water Office works with the Murray–Darling Basin Authority, state agencies, research organisations, local groups and others, such as landholders, to collect monitoring information and evaluation results, to ensure we adaptively manage and change our practices where needed. This continual review of information and outcomes is helping to build knowledge about the best way to get positive outcomes on a larger scale, based on what works and what does not work.

Key lessons and findings from the 2017–18 and 2018–19 watering years and state agency monitoring results include:

- Providing a small flow to the lower Namoi River during dry conditions can be beneficial for water quality and native fish survival, by increasing water depth and dissolved oxygen levels in refuge pools.
- A pulse of 750 ML/day is more effective than 500 ML/day in wetting low level benches in the Peel River.
- Flows of 750 ML/day can also result in some fine sediment movement/scouring, however, flows over 1 000 ML/day may be required to effectively mobilise sediment and algae that has accumulated downstream of Chaffey Dam.
- The number of small freshes have been substantially reduced by river regulation downstream of Chaffey Dam. Therefore, providing environmental water may be important for supporting native fish that depend on these flows to maintain healthy condition, and to support dispersal and recruitment, which is needed to maintain native fish populations.

The outcomes from monitoring activities are used to inform portfolio management planning and adaptive management decision-making.

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

Dry conditions prevailed in the Namoi River Valley from 2013 to 2016 with below average rainfall and above average temperatures. The minimum flows required to maintain refuge pools were not adequately provided for over this time, particularly at sites at the lower end of the system. This is likely to have contributed to the decline in condition of environmental assets (such as the native fish community) in the Namoi River Valley.

Water availability improved in 2016 with increased rainfall, tributary, unregulated and consumptive flows starting the recovery of the environmental assets. Commonwealth environmental water releases in autumn 2017, along with flows from the Namoi River tributaries and the Peel River, supported further recovery of assets. These flows also contributed water to the Barwon River and may have provided opportunities for native fish to move between the Namoi and Barwon rivers.

Conditions began to dry again in 2017–18, with lowest on record rainfall and well above average maximum temperatures in parts of the catchment between July 2017 and April 2018. Commonwealth environmental water was delivered in autumn 2018 in the Namoi River following the delivery of irrigation flows to maintain baseflows to support native fish, particularly endangered silver perch. In the Peel, environmental water was delivered in autumn 2018 in conjunction with the Peel environmental contingency allowance, to improve in-stream productivity, and provide opportunities for native fish to move and access habitat.

In 2018–19 very dry and hot conditions have continued in the Namoi River Valley, with the catchment experiencing the lowest inflows on record over the last 6 months, resulting in one of the worst drought sequences in history. In particular, summer was very hot and dry, with rainfall being well below average combined with highest on record temperatures over January and February. These conditions saw Keepit Dam being drawn down to <1 per cent of active capacity during summer, and cease to flow conditions through the majority of the lower Namoi River from Keepit to Walgett.

Environmental water was delivered in summer 2018, to help maintain waterholes in the lower Namoi River downstream of Wee Waa. This flow was designed to avoid damage and irretrievable loss, by improving water quality and helping native fish to survive drought conditions.

With extremely dry conditions continuing across the valley, significant rainfall will be required to replenish soil moisture, create runoff and improve inflows. Until conditions change, cease to flow conditions will continue in the lower Namoi River, and additional measures to conserve water in the Peel River may be implemented.

Water dependent species require further support in 2019–20 to ensure their survival, and the river system will need water to recover and build resilience over the coming years. However, the likelihood of environmental demands being met under ongoing drought conditions is significantly reduced.

Environmental water demands for environmental assets in the Namoi River Valley in 2019–20 are represented in Table 3 and summarised below:

Lower Namoi River channel

Very low flows: Critical environmental demand for water, in all sections between Keepit Dam and Walgett in 2019–20. Very low flows were not adequately met in 2018–19 in the Lower Namoi River downstream of Keepit, or in 2017–18 between Mollee and Walgett. Because these flows are ideally required annually, the desired frequency has already been exceeded and the demand for water is critical, to avoid damage and irretrievable loss.

Baseflows: Critical environmental demand for water in 2019–20, in the Lower Namoi River between Keepit Dam and Walgett. Baseflows have not been met in the Lower Namoi River for at least the last four years (except at Goangra, and partially at Walgett in 2016–17). These flows are required once in every 1–2 years to support native fish condition, with a maximum interval of two years for native fish recruitment. Therefore, the required frequency has been exceeded in the Lower Namoi, and the demand for water in 2019–20 is critical to avoid damage and increase the capacity to recover following the drought.

Small freshes: High to critical demand for water in 2019–20, depending on the target section in the Lower Namoi River. Between Keepit Dam and Mollee, small freshes have been met each year since at least 2015–16. However, in the lower sections between Mollee and Walgett, small freshes have not been achieved since 2016–17, except at Goangra in 2017–18. Baseflows are required annually for native fish dispersal and

condition, and 1 in 1–2 years for spawning. Therefore, the demand for water in 2019–20 has been assessed as high between Keepit Dam and Mollee, where baseflows were achieved more recently, and as critical downstream of Mollee to Walgett, where the required frequency has not been met.

Large freshes: High to critical demand for water in 2019–20, depending on target section in the Lower Namoi River. Large freshes were last met between Boggabri and Bugilbone in 2012–13, meaning the maximum interval for both spawning (4 years) and dispersal (2 years) flows have been exceeded in these sections. Therefore, the demand for water in 2019–20 has been assessed as critical. Downstream of Keepit Dam to Boggabri, and between Bugilbone and Walgett, the demand for water has been assessed as high–critical and high, respectively. Large freshes were last met in these sections in 2017–18 (downstream of Keepit Dam) or earlier, so require water in 2019–20. Large freshes are difficult to achieve with environmental water.

Bankfull and overbank flows: High to critical demand for water in 2019–20, depending on the target section in the Lower Namoi River. Bankfull and overbank flows were most recently met in the Lower Namoi River in 2016–17 in the section between Bugilbone and Walgett. In the Lower Namoi between Keepit Dam and Bugilbone, bankfull and overbank flows have not occurred since before 2012–13. These flows are required 1 in 2 years for fish spawning (maximum interval four years), and 1 in 3–5 years for fish dispersal and condition (maximum interval five years). Therefore, the required frequency for these flows have been exceeded in the Lower Namoi River, and the demand for water in 2019–20 is critical between Keepit Dam and Bugilbone, and high between Bugilbone and Walgett, where these flows have been achieved more recently. Bankfull and overbank flows are difficult to achieve with environmental water.

Peel River channel

Very low flows: High demand for water in the Peel River between Chaffey Dam and Carroll Gap in 2019–20. Very low flows have been met in every year in the Peel River since at least 2012–13. These flows are required annually, however, so the demand for water is high to avoid damage and irretreivable loss.

Baseflows: High to critical demand for water in the Peel River, depending on the target river section. Downstream of Chaffey Dam to Piallamore baseflows have been met in the last two years downstream of the dam, but not since 2016–17 at Piallamore. Baseflows are required 1 in 1–2 years, with a maximum interval of two years for native fish recruitment. Therefore, the demand for water has been assessed as high to critical in this section. Between Piallamore and Carroll Gap, baseflows have not been adequately achieved in more than seven years. Considering the required frequencies and that the maximum interval has been exceeded, the demand for water to provide baseflows downstream of Piallamore is critical. Provision of baseflows would help to avoid damage and build capacity for recovery following the drought.

Small freshes: Critical demand for water in 2019–20 in the Peel River to provide small freshes. Small freshes have not been fully met since 2016–17 between Chaffey Dam and Carroll Gap. In 2017–18 small flows were partially met, but there were no small freshes in 2018–19. These flows are ideally required annually for fish dispersal and condition, and 1 in 1–2 years for spawning. Therefore, the demand for water for small freshes in the Peel River in 2019–20 is critical, to avoid damage and build resilience in the system.

Large freshes: Critical demand for water in 2019–20 in the Peel River between Chaffey Dam and Carroll Gap. Large freshes have not been achieved in the Peel River since before 2012–13, although they were partially met in 2016–17 between Piallamore and Carroll Gap, when a suitable dispersal flow was achieved. The maximum intervals for both native fish dispersal and spawning flows have been exceeded, so the demand for water in 2019–20 for large freshes is critical. Large freshes are difficult to achieve with environmental water.

Bankfull and overbank flows: Critical demand for water in the Peel River in 2019–20. Bankfull and overbank flows have not been met in the Peel River between Chaffey Dam and Carroll Gap since before 2012–13. These flows are ideally required 1 in 2 years for native fish flow spawning, and the maximum intervals for both spawning and dispersal flows have been exceeded. Therefore, this demand has been assessed as critical, with water being required in 2019–20. Bankfull and overbank flows cannot be achieved with environmental water and required higher flow rates than can be released from the dam.

Barwon-Darling

There is a growing awareness of the importance of connecting flows across the northern Basin, to support habitat, water quality, native fish and other aquatic species in the Barwon-Darling and its tributary systems, including the Namoi River. Depending on flow conditions in the Barwon and Namoi rivers and weir drown-outs, native fish can move between these catchments, supporting native fish populations. Subject to

antecedent conditions, water availability, and urgency of environmental demands, opportunities to coordinate releases across multiple rivers in the northern Basin to meet broader environmental demands could be considered. The environmental demands in the Barwon-Darling are described in the *Commonwealth Environmental Water Portfolio Management Plan: Barwon-Darling 2019–2020*.

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

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

Rolling, multi-year priorities

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

- Support lateral and longitudinal connectivity along the river systems.

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

- Improve flow regimes and connectivity in northern Basin rivers to support native fish populations across local, regional and system scales.
- Support viable populations of threatened native fish, maximise opportunities for range expansion and establish new populations.

2.3. Water availability in 2019–20

Forecasts of Commonwealth water allocations

The volume of Commonwealth environmental water likely to be carried over in the Namoi River Valley for use in 2019–20 is estimated to be 0.6 GL.

Allocations against Commonwealth water entitlements in the Namoi River Valley are determined by state governments and will vary depending on inflows. The following forecasts in Table 2 are based on the best available information including State forecasts and historical inflow scenarios.

Table 2: Forecasts of Commonwealth water allocations (including carryover) in 2019–20 in the Namoi River Valley as at 31 May 2019.

Entitlement type	Forecasts of Commonwealth water allocations (including carryover) in 2019–20 (GL)					
	Very dry ← → Very wet					
	95 percentile	90 percentile	75 percentile	50 percentile	25 percentile	10 percentile
Upper Namoi general security	0.1	0.1	0.1	0.1	0.1	0.1
Lower Namoi general security	0.6	0.6	0.7	1.1	1.8	2.6
Peel River general security	0	0.2	0.5	1.0	1.2	1.2
Total – Namoi	**0.7**	**0.9**	**1.3**	**2.2**	**3.1**	**3.9**

Notes:
1. Forecasts for regulated catchments are given to the nearest whole GL except where the entitlement held by the Commonwealth is below 1 GL.
2. Allocation rate scenarios are based on long term average allocation rates.
3. Figures include a carryover account balance of 0.6 GL

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

Water resource availability scenarios

Commonwealth environmental water is managed with other water in the system and is not managed in isolation. When considering the available resources to meet environmental demands, it is necessary to also factor in the resources managed by other entities and available to contribute to environmental objectives. While there are currently no other sources of held environmental water in the Namoi River Valley, relevant water resources include planned environmental water (e.g. end of system flows and Peel environmental contingency allowance), unregulated flows, conveyance water and consumptive water. Further detail on the sources of water in the Namoi River Valley is provided in Attachment C.

By combining the forecasts of water held by the Commonwealth with streamflow forecasts, as well as taking into account operational considerations, water resource availability scenarios can be developed ranging from very low to very high. Based on available information very low to moderate resource availability scenarios are in scope for 2019–20.

Note that very low to moderate scenarios are only possible if conditions become wetter. Should conditions remain dry, no additional environmental water will be available for use in 2019–20. Furthermore, as of April 2019, more than 80 GL of inflows are estimated to be required into Keepit Dam before any increase in available allocations can be made in the Lower Namoi Valley.

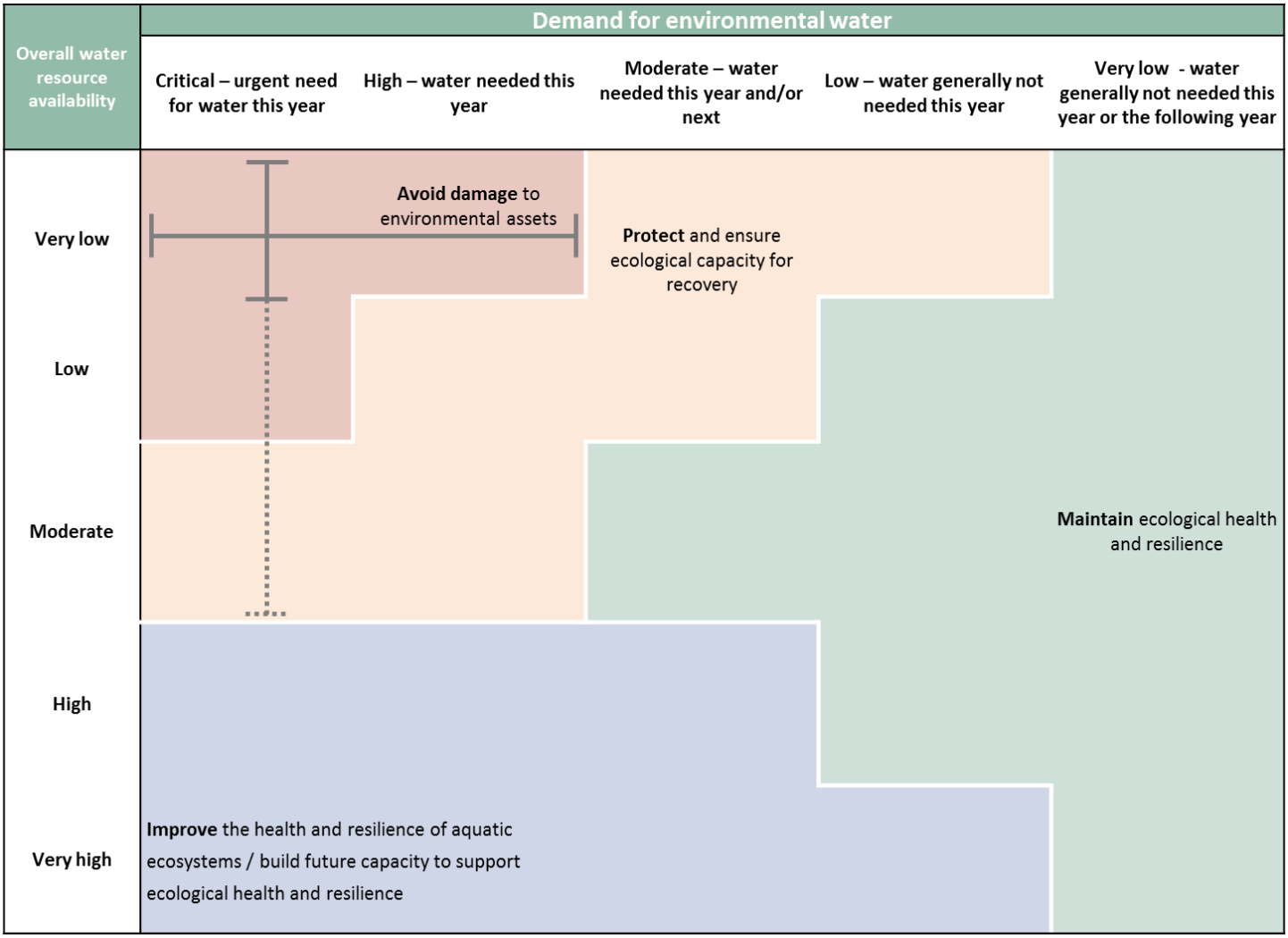
2.4. Overall purpose of managing environmental water based on supply and demand

Environmental water needs (demand) and water availability (supply) both influence the overall purpose of Commonwealth environmental water management. Under different combinations, the management purpose can range from 'avoiding damage' to the environment to 'improving' ecological health. This in turn informs the mix of portfolio management options that are suitable for maximising outcomes.

Figure 3 shows how current demands and forecasted supply are considered together.

The overall 'purpose' for managing the Commonwealth's water portfolio in the Namoi River Valley for 2019–20 is to avoid damage to the health and resilience of aquatic ecosystems in the Lower Namoi River, wetlands and anabranches, and the Peel River, subject to water availability.

Figure 3: Determining a broad purpose for portfolio management in the Namoi River Valley for 2019–20. Note: grey lines represent potential range in demand and water resource availability.



Further detail on how the overall purpose for portfolio management changes under different supply and demand scenarios is provided in *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water, 2019–20* (available at: http://www.environment.gov.au/water/cewo/publications).

2.5. Water Delivery in 2019–20

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

The priorities for the use of Commonwealth environmental water in the Namoi River Valley are to improve connectivity, support aquatic ecology, maintain habitat and refresh pools in the lower Namoi and Peel rivers.

Given the very low to moderate water resource availability scenarios in scope for 2019–20, options for the delivery of Commonwealth environmental water are:

- Lower Namoi River very low flows: In a very low to low resource availability scenario, supporting very low flows would be a high priority, to provide refuge habitat and avoid irretrievable loss, and maintain resilience (Action 1 – Appendix 3). Targeting very low flows in the sections between Mollee and Walgett may be the highest priority.

- Lower Namoi River baseflows: Under very low to moderate resource availability scenarios, contributing to baseflows would be a high priority, to improve water quality, provide connectivity and habitat, and to support native fish survival (all groups), recruitment (flow generalists and in-channel specialists) and

movement (small/medium bodied fish) (Action 2 – Appendix 3). Targeting baseflows in the section between Mollee and Bugilbone may be the highest priority.

- Lower Namoi River small freshes: Possible use under low to high water resource availability scenarios, depending on available environmental water and flows being delivered in conjunction with other water. Contributing to small freshes would provide connectivity, maintain pools, and support native fish movement and condition (all groups), and possible spawning of flow generalists and in-channel specialists (Action 3 – Appendix 3). The sections between Mollee and Walgett would be the highest priority to target freshes with environmental water.

- Peel River very low flows: In a very low to low resource availability scenario, supporting very low flows would be a high priority, to provide refuge habitat to avoid irretrievable loss, and maintain resilience (Action 6 – Appendix 3). Contributing to very low flows would also help to support native fish habitat.

- Peel River baseflows: Under very low to moderate resource availability scenarios, contributing to baseflows would be a high priority, to improve water quality, provide connectivity and habitat, and to support native fish survival (all groups) and recruitment (flow generalists and in-channel specialists) (Action 7 – Appendix 3). Targeting baseflows in the section between Piallamore and Carroll Gap may be a particularly high priority.

- Peel River small freshes: High priority for use under low to high water resource availability scenarios, depending on available environmental water and flows being delivered in conjunction with other water. Contributing to small freshes would provide connectivity, maintain pools, and support native fish movement and condition (all groups), and possible spawning of flow generalists and in-channel specialists (Action 8 – Appendix 3).

Stakeholder Feedback

Feedback on the environmental demands was sought from the NSW OEH and DPI – Fisheries. New information had been developed by NSW DPI – Fisheries and as part of the draft Namoi Long Term Water Plan (NSW OEH), which was incorporated into this document. This included information about environmental watering requirements, such as flow rates, duration, timing and frequency of flows needed to support native fish. Feedback from NSW OEH and DPI – Fisheries included assessing the Namoi and Peel rivers in sections to determine environmental demand for water.

2.6. Trading water in 2019–20

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

Planning on water trade considers supply and demand within the catchment and across the Basin. As part of the planning process, the Commonwealth Environmental Water Office undertakes a Basin-wide analysis to identify opportunities to use allocation trade to better match differing demands across catchments. Consideration is given to the water available to meet both current and future environmental needs. Additionally these decisions are influenced by current climatic conditions, as well as implications of trade for commercial outcomes in communities.

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

No specific trade of water in the Namoi Valley has been identified for 2019–20. Trade opportunities will be reviewed in the valley throughout the water year and as conditions change. Further information will be provided to the market ahead of any trade of Commonwealth environmental water at: http://www.environment.gov.au/water/cewo/trade

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

2.7. Carrying over water for use in 2020–21

Carryover provisions vary across the Namoi River Valley.

- In the Lower Namoi unused water may be carried over, but the account limit is set at 150 per cent of the entitlement volume.
- In the Upper Namoi up to 50 per cent of the entitlement volume can be carried over, but the account limit is 100 per cent of the entitlement volume.
- In the Peel Valley there is no provision for carryover.

The volume of water carried over for use in 2020–21 will depend upon resource availability and demand throughout the year. As the 2019–20 water year progresses, a carryover target will be determined for the Namoi and Peel catchments, sufficient to meet early season requirements, subject to water availability. As documented in Table 3 below, potential demands in the lower Namoi and Peel rivers in 2020–21 include:

- Very low flows to refresh pools and to maintain refuge habitat and water quality, and support native fish survival.
- Baseflows to maintain habitat and water quality, increase connectivity, and support native fish survival and recruitment.
- Small freshes to increase connectivity, maintain pools and provide low level bank/bar wetting, and support native fish condition, movement and spawning.
- Large freshes to increase connectivity, access to habitat and ecosystem function, and support native fish condition, dispersal and spawning. (Note: unlikely to be possible to contribute to with environmental water in the Peel River, despite high demand).
- Bankfull and overbank flows to increase lateral and longitudinal connectivity, support riparian vegetation, increase access to habitat and ecosystem function, and support native fish spawning, dispersal and condition. (Note: unlikely to be possible to contribute to with environmental water in the Peel River, despite high demand).

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

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

2.8. Identifying Investment Opportunities

Under the *Water Act 2007*, the Commonwealth Environmental Water Holder has the flexibility to use the proceeds from the sale of water allocations to fund environmental activities in the Basin.

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

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

Table 3: Environmental demands, priority for watering in 2019–20 and outlook for coming year in the Namoi River Valley.

Environmental assets	Target values[1]	Indicative demand (for <u>all sources of water</u> in the system)[2]		Watering history[3]	2019–20		Implications for future demands
		Flow/Volume	Required frequency (maximum dry interval)	(from all sources of water)	Environmental demands for water	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2020–21 if watering occurred as planned in 2019–20
Lower Namoi River channel: • **Downstream Keepit Dam to Boggabri** • **Boggabri to Mollee** • **Mollee to Bugilbone** • **Bugilbone to Walgett** • Native fish habitat, dispersal and spawning • Instream aquatic ecosystems • Riparian vegetation • Threatened species e.g. silver perch, eel tailed catfish	Drought refuge habitat Water quality Fish maintenance and survival (all groups)	<u>Very low flows:</u> • 5–200 ML/day d/s Keepit Dam (min. 365 days) • 1–200 ML/day at Gunnedah (min. 365 days) • 1–150 ML/day at Boggabri (min. 356 days) • 1–200 ML/day at Mollee (min. 343 days) • 1–150 ML/day at Bugilbone (min. 336 days) • 1–25 ML/day at Goangra (min. 323 days)	Annually (can occur at any time of year)	Very low flows were last met in 2017–18 in the Namoi River between Keepit Dam and Mollee, and in 2016–17 between Mollee and Walgett. Very low flows were not adequately achieved in the Lower Namoi River in any section in 2018–19, with conditions becoming progressively drier and cease to flow conditions continuing for a number of months. Very low flows are required annually. Therefore, the demand for water in 2019–20 in the Lower Namoi River between Keepit and Walgett has been assessed as critical.	Critical	High priority for CEW under very low to low scenarios, subject to water availability. Would be met by other water in moderate to very high scenarios. The river between Mollee and Walgett may be a particularly important target for CEW.	High
	Water quality Habitat maintenance Connectivity Fish maintenance and survival (all groups) Fish recruitment (generalists + in-channel specialists) Fish movement (small/medium bodied)	<u>Baseflows:</u> • 200–500 ML/day d/s Keepit (min. 209 days for survival; 119 days for recruitment) • 200–600 ML/day at Gunnedah (min. 240 days for survival; 140 days for recruitment) • 150–300 ML/day at Boggabri (for a min. 274 days for survival; 154 days for recruitment) • 200–500 ML/day at Mollee (min. 267 days survival; 154 days recruitment) • 150–300 ML/day at Bugilbone (min. 277 days for survival; 158 days for recruitment) • 25–65 ML/day at Goangra (min. 335 days for survival; 195 days for recruitment) • 30–200 ML/day u/s of Walgett	1 in 1–2 years (Max interval 2 years for fish recruitment) (can occur at any time for native fish maintenance and survival, or Sept-Mar for native fish recruitment)	Baseflows have generally only been partially or not met in the Lower Namoi River over at least the past four years since 2015–16, except at Goangra, which was met in 2016–17. In 2018–19 baseflows are considered to have been met between Keepit Dam and Mollee based on significantly shorter durations identified for very dry years only. However, downstream of Mollee, baseflows were not met even based on those shorter dry year durations. Therefore, considering baseflow duration requirements at all other times, and that cease to flow conditions have persisted for a substantial time, baseflows have not been assessed as being met in 2018–19. The required frequency has been exceeded for both native fish survival and recruitment flows. Therefore, the demand for water in 2019–20 has been assessed as critical.	Critical	High priority for CEW under very low to moderate scenarios, subject to water availability. May be met by other water in high/very high scenarios. The river between Mollee and Walgett may be a particularly important target for CEW.	High
	Longitudinal connectivity Low level bank and bar wetting Pool maintenance Fish movement, productivity and condition Fish spawning (generalists + in-channel specialists)	<u>Small freshes:</u> • 500–1 400 ML/day d/s Keepit • 600–5 400 ML/day at Gunnedah • 350–3 600 ML/day at Boggabri • 500–6 000 ML/day at Mollee • 350–3 200 ML/day at Bugilbone • 65–1 000 ML/day at Goangra • 200–2 250 ML/day u/s of Walgett	Annually for fish dispersal and productivity/ condition (max interval 1 year); 1 in 1–2 years for fish spawning (max interval 2 years) (Ideally Oct–Apr for fish dispersal and condition/ productivity (but can occur any time) for a minimum of 10 days). Sept–Apr for fish spawning for a minimum of 14 days)	Small freshes have been met each year since at least 2015–16 in the Namoi River between Keepit Dam and Mollee. However, small freshes were last met between Mollee and Bugilbone, and at Walgett in 2016–17, and were not met in 2018–19. At Goangra, small freshes were last met in 2017–18, and partially met in 2018–19. Small freshes are ideally met each year, particularly for native fish dispersal and condition. In the lower sections the maximum interval for baseflows for native fish dispersal and condition have generally been exceeded. Therefore, water is required in 2019–20 and the demand has been assessed as high to critical.	High to Critical	High priority for CEW, particularly between Mollee and Walgett under low to high water resource scenarios, subject to water availability and being delivered in conjunction with other water. May be met by other water under a very high scenario.	High

Environmental assets	Target values[1]	Indicative demand (for <u>all sources of water</u> in the system)[2]		Watering history[3]	2019–20		Implications for future demands
		Flow/Volume	Required frequency (maximum dry interval)	(from all sources of water)	Environmental demands for water	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2020–21 if watering occurred as planned in 2019–20
	Longitudinal connectivity Increase ecosystem function Bench and bank wetting Access to habitat Nutrient cycling Fish dispersal and productivity/condition (all groups) Fish spawning (flow specialists)	<u>Large freshes:</u> • 1 400–3 500 ML/day d/s Keepit • 5 400–32 700 ML/day at Gunnedah • 3 600–17 750 ML/day at Boggabri • 6 000–18 750 ML/day at Mollee • 3 200–9 900 ML/day at Bugilbone • 1 000–5 800 ML/day at Goangra • 2 250–8 500 ML/day u/s Walgett	1 in 1–2 years for fish dispersal and productivity/condition (max interval 2 years); 1 in 2–3 years for fish spawning (max interval 4 years) (Ideally July–Sept for fish dispersal and productivity/condition (but can occur any time) for a minimum of 5 days. Oct–Apr for flow specialists spawning for a minimum of 5 days.)	Large freshes were most recently met in the Lower Namoi River in 2017–18, downstream of Keepit Dam, but were not met for the required duration in 2018–19. Between Gunnedah and Boggabri, large freshes have not been adequately met since 2013–14, or longer. Large freshes were also last met between Boggabri and Bugilbone in 2012–13, and Bugilbone and Walgett in 2016–17. Large freshes are required in 2019–20, particularly for native fish dispersal and condition, which is required annually. The demand between Gunnedah and Bugilbone is particularly critical, because the maximum intervals for large flows have been exceeded.	High to Critical	Possible use of CEW only if there is an increase in available water under high to very high water resource availability scenarios. Would need to be delivered in conjunction with other flows.	High to Critical
	Lateral and longitudinal connectivity Riparian vegetation in low commence to flow anabranch channels Increase ecosystem function Nutrient cycling Access to habitat Fish spawning (floodplain specialists) Fish dispersal and productivity/condition (all groups)	<u>Bankfull and overbank flows:</u> • 3 500–6 150+ ML/day d/s Keepit • 32 700–40 000+ ML/day at Gunnedah • 17 750–22 000+ ML/day at Boggabri • 18 750–21 750+ ML/day at Mollee • 9 900–13 400+ ML/day at Bugilbone • 5 800–8 200+ ML/day at Goangra • 8 500–10 600+ ML/day u/s Walgett	1 in 2 years for fish spawning (max interval 4 years); 1 in 3–5 years for fish dispersal and productivity/condition (max interval 5 years) (Oct–Apr for fish spawning (floodplain specialists) for a minimum of 10 days. Ideally Sept–Feb for fish dispersal and productivity/ condition (but can occur any time) for a minimum of 5 days.)	Bankfull and overbank flows have not been met in the Lower Namoi River between Keepit Dam and in any year in the time assessed since 2012–13. The only time bankfull and overbank flows have been met in that time was between Bugilbone and Walgett in 2016–17. The maximum interval for these flows has been exceeded between Keepit Dam and Bugilbone for both spawning and dispersal/conditioning flows for native fish. Therefore, the demand has been assessed as critical for this river section. These flows are ideally required 1 in 2 years for native fish spawning, so are required in 2019–20 between Bugilbone and Walgett also (high demand).	High to Critical	Possible use of CEW only if water availability increases under a high water resource availability scenario. Under a high/very high resource scenario natural flow conditions may meet this demand. If required, environmental water may be able to contribute to meeting this demand if delivered in conjunction with other flows.	High to Critical
Peel River channel: • **downstream of Chaffey Dam to Piallamore** • **Piallamore to Carroll Gap** • Native fish habitat and spawning • Instream aquatic ecosystems • Riparian vegetation	Drought refuge habitat Water quality Fish maintenance and survival (all groups)	<u>Very low flows:</u> • 1–100 ML/day d/s Chaffey Dam, and at Piallamore and Carroll Gap Very low flows may occur at any time.	Annually	Very low flows have been met in the Peel River downstream of Chaffey Dam to Carroll Gap in every year since at least 2012–13, with flows being maintained above the minimum of 1 ML/day. Because very low flows are required annually, the demand for water in 2019–20 has been assessed as high.	High	High priority for CEW under very low and low water resource scenarios, subject to water availability. May be met by other water under moderate to very high scenarios.	HIgh
	Water quality Habitat maintenance Connectivity Fish maintenance and survival (all groups) Fish recruitment (generalists + in-channel specialists)	<u>Baseflows:</u> • 100–250 ML/day d/s Chaffey Dam and at Piallamore • 100–300 ML/day at Carroll Gap	1 in 1–2 years (Max interval 2 years for fish recruitment) (May occur at any time for native fish maintenance and survival, or Sept–Mar for native fish recruitment.)	Baseflows downstream of Chaffey Dam on the Peel River have been met in the last two years. However, baseflows at Piallamore were last sufficiently met in 2016–17, and at Carroll Gap more than seven years ago (partially met in 2012–13 and 2016–17). These flows are required once in every 1–2 years, with a maximum interval of 2 years for native fish recruitment. Therefore, the demand for water in 2019–20 has been assessed as High to Critical (high for d/s Chaffey; critical for Piallamore and Carroll Gap).	High to Critical	High priority for CEW (particularly to Piallamore and Carroll Gap) under very low to moderate water resource scenarios, subject to water availability. May be met by other water under high to very high scenarios.	HIgh
	Longitudinal connectivity	<u>Small freshes:</u>	Annually for fish dispersal and productivity/ condition (max interval 1 year);	Small freshes were last met in the Peel River between Chaffey Dam and Carroll Gap in 2016–17. Since then, small freshes were	Critical	High priority for CEW in conjunction with other	High

Environmental assets	Target values[1]	Indicative demand (for <u>all sources of water</u> in the system)[2]		Watering history[3]	2019–20		Implications for future demands
		Flow/Volume	Required frequency (maximum dry interval)	(from all sources of water)	Environmental demands for water	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2020–21 if watering occurred as planned in 2019–20
	Low level bank and bar wetting Pool maintenance Fish movement, productivity and condition Fish spawning (generalists + in-channel specialists)	• 250–900 ML/day d/s Chaffey Dam • 250–1 350 ML/day at Piallamore • 300–3 900 ML/day at Carroll Gap	1 in 1–2 years for fish spawning (max interval 2 years) (Ideally Oct–Apr for fish dispersal and condition/productivity (but can occur any time) for a minimum of 10 days. Sept–Apr for fish spawning for a minimum of 14 days)	partially met in 2017–18, and not met in 2018–19. These flows are required annually for native fish dispersal and condition, and the maximum interval has been exceeded in this section. Therefore, this demand for water in 2019–20 has been assessed as critical.		water under low to high scenarios. Would be met by other water under a very high scenario.	
	Longitudinal connectivity Increase ecosystem function Bench and bank wetting Access to habitat Nutrient cycling Fish dispersal and productivity/condition (all groups) Fish spawning (flow specialists)	<u>Large freshes:</u> • 900–2 900 ML/day d/s Chaffey Dam • 1 350–5 150 ML/day at Piallamore • 3 900–13 500 ML/day at Carroll Gap	1 in 1–2 years for fish dispersal and productivity/condition (max interval 2 years); 1 in 2–3 years for fish spawning (max interval 4 years) (Ideally July–Sept for fish dispersal and productivity/ condition (but can occur any time) for a minimum of 5 days).	Large freshes have not been achieved in the Peel River between Chaffey Dam and Piallamore in the period assessed since 2012–13. During that time, large freshes have only been partially met for a dispersal flow in 2016–17 at Carroll Gap, and have otherwise not been met. Large freshes are ideally required every 1–2 years for native fish dispersal and once in every 2–3 years for spawning. The maximum intervals for both flows have been exceeded in this section. Therefore, the demand for water in 2019–20 has been assessed as critical.	Critical	Commonwealth environmental water unlikely to contribute to this demand because of insufficient water and system constraints.	Critical
	Lateral and longitudinal connectivity Riparian vegetation in low commence to flow anabranch channels Increase ecosystem function Nutrient cycling Access to habitat Fish spawning (floodplain specialists) Fish dispersal and productivity/condition (all groups)	<u>Bankfull and overbank flows:</u> • 2 900–6 400+ ML/day d/s Chaffey Dam • 5 150–13 400+ ML/day at Piallamore • 13 500–40 000+ ML/day at Carroll Gap	1 in 2 years for fish spawning (max interval 4 years); 1 in 3–5 years for fish dispersal and productivity/ condition (max interval 5 years) (Oct–Apr for fish spawning (floodplain specialists) for a minimum of 10 days. Ideally Sept–Feb for fish dispersal and productivity/ condition (but can occur any time) for a minimum of 5 days.)	Bankfull and overbank flows have not been met in the Peel River between Chaffey Dam and Carroll Gap during the period assessed since 2012–13. These flows are ideally required 1 in 2 years for native fish flow spawning, and the maximum intervals for both spawning and dispersal flows have been exceeded. Therefore, this demand has been assessed as critical, with water being required in 2019–20.	Critical	Commonwealth environmental water unlikely to contribute to this demand because of insufficient water and system constraints.	Critical

Note: Flow releases in the lower Namoi and Peel rivers are constrained by the outlet capacity of Keepit Dam (4 000 ML/d) and Chaffey Dam (1 100 ML/d), respectively.

Carryover potential	The volume of Commonwealth environmental water likely to be carried over in the Namoi River Valley for use in 2019–20 is estimated to be 0.6 GL	A low proportion of available allocations in the Namoi expected to be carried into 2020–21 There are no carryover provisions in the Peel.
Trade potential	No specific commercial trade of water has been identified for 2019–20. Trade opportunities will be reviewed in the valley throughout the water year and as conditions change	Potential to trade will depend on environmental demands, resource availability and market conditions.

References

1. Sourced from information provided by NSW Department of Primary Industries (2018)
2. Sourced from information provided by NSW Department of Primary Industries (2018) and NSW Office of Environment and Heritage (2019)
3. All watering history sourced from data from the following gauges (WaterNSW 2019):
   - 419007: Namoi at d/s Keepit Dam
   - 419001: Namoi at Gunnedah
   - 419012: Namoi River at Boggabri
   - 419039: Namoi at Mollee
   - 419021: Namoi River at Bugilbone
   - 419026: Namoi at Goangra
   - 419091: Upstream Walgett
   - 419045: Peel River d/s Chaffey Dam
   - 419015: Peel at Piallamore
   - 419006: Peel at Carroll Gap

Key - potential watering in 2019–20

High priority for Commonwealth environmental watering (likely to receive water even under low water resource availability)

Secondary priority for Commonwealth environmental watering (watering to occur only if natural trigger is met, or under moderate – high water resource availability); or water demand likely to be met via other means

Low priority for Commonwealth environmental watering (under high – very high water resource availability)

Unable to provide Commonwealth water due to constraints

Key - environmental demands

critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage

high demand for water i.e. needed in that particular year

moderate demand for water i.e. water needed that particular year and/or next

low demand for water i.e. water generally not needed that particular year

very low demand for water i.e. water generally not needed that particular year or the following year

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

3. Next steps

3.1. From planning to decision making

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

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

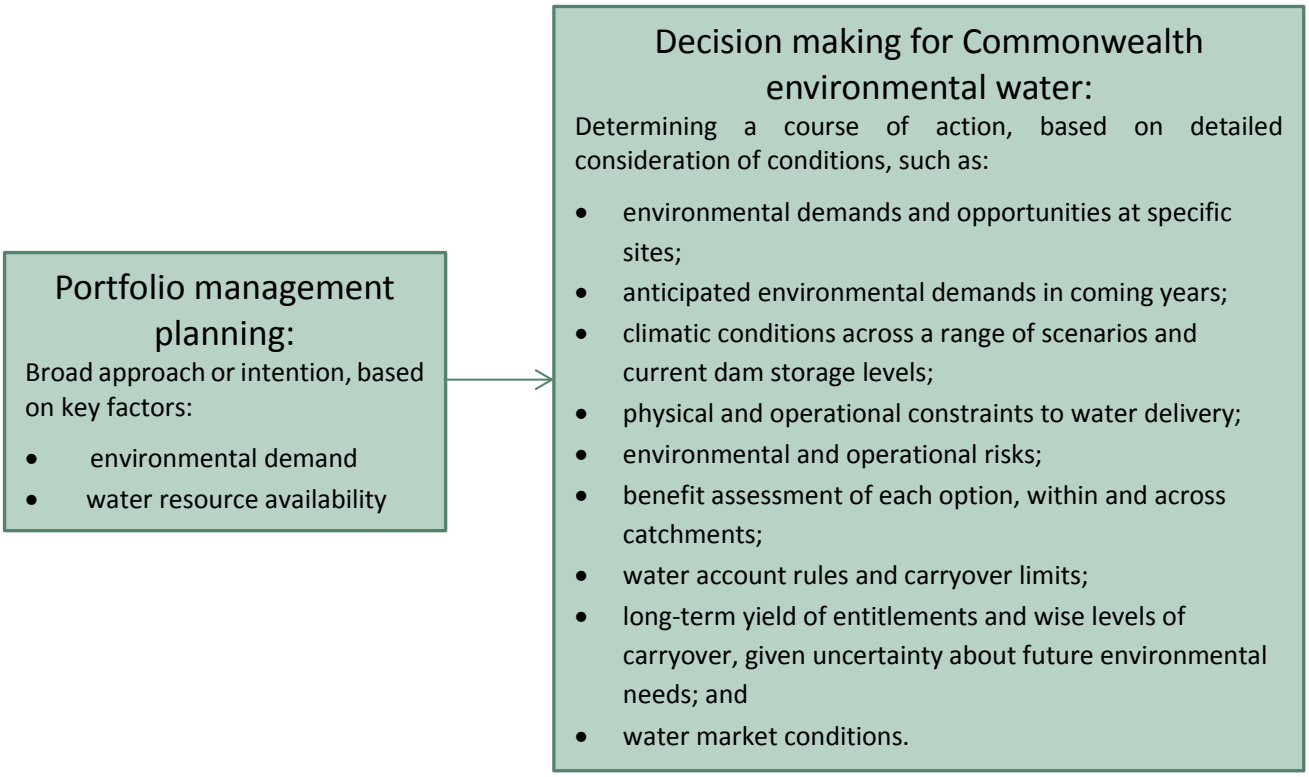


Figure 4: Planning and decision making for Commonwealth environmental water use

3.2. Monitoring

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

Information on the Commonwealth Environmental Water Office's monitoring activities is available at http://www.environment.gov.au/water/cewo/monitoring. Monitoring information is also provided by state governments.

In the Namoi and Peel rivers, NSW state government agencies undertake some ecological monitoring activities that may provide information on the outcomes of environmental water, including:

- Long-term monitoring in the Namoi and Peel rivers as part of Basin Plan Environmental Outcomes Monitoring, undertaken by DPI – Fisheries

- Use of an acoustic array installed to monitor the movement of tagged fish on the Namoi River downstream of Gunidgera Weir. This project is being undertaken by DOI – Water and DPI – Fisheries.

3.3. Further information

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

or the sites below:

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

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

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

RIVER FLOWS AND CONNECTIVITY

- Baseflows are at least 60 per cent of the natural level.
- Contributing to a 10 per cent overall increase in flows in the Barwon-Darling.
- A 10–20 per cent increase in the frequency of freshes and bankfull flows.

VEGETATION

- Maintain the current extent of forest and woodland vegetation and non woody vegetation.
- No decline in the condition of black box, river red gum and coolibah.
- Improved recruitment of trees within black box and river red gum communities

Vegetation extent

Area of river red gum (ha)	Area of black box (ha)	Area of coolibah (ha)	Shrublands	Non–woody water dependent vegetation
6 100	800	4 200		Closely fringing or occurring within the Namoi River

WATERBIRDS

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

FISH

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

Key fish species for the Namoi River Valley include:

Species	Specific outcomes	In-scope for C'th water in the Namoi River Valley?
Freshwater catfish (*Tandanus tandanus*)	Expand the core range of at least 3–5 existing populations (Candidate sites include Namoi and Peel River)	Yes
Golden perch (*Macquaria ambigua*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Murray cod (*Maccullochella peelii*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Olive perchlet (*Ambassis agassizii*)	Establish or improve the core range of 2–5 additional populations (Candidate sites include Namoi River)	Possibly (Once widespread. Current extent unknown in Namoi)
River blackfish (*Gadopsis marmoratus*)	Establish or improve the core range of 2–4 additional populations (candidate sites include Namoi River)	Yes
Silver perch (*Bidyanus bidyanus)*	Expand the core range of at least 2 existing populations (Candidate sites include Namoi River)	Yes (Current extent unknown in Namoi. Stocking of 50 000 fingerlings each year in 2016 and 2017 and around 3,000 in 2018. Anecdotal evidence of silver perch between Narrabri and Gunnedah, near Keepit Dam and in the Peel River)
Southern purple-spotted gudgeon (*Mogurnda adspersa*)	Establish or improve the core range of 2–5 additional populations – (priority catchments include Namoi)	Possibly (Once widespread. Current extent in Namoi unknown. Some stocking has occurred)

Important Basin environmental assets for native fish in the Namoi River Valley

Environmental asset	Key movement corridors	High Biodiversity	Site of other Significance	Key site of hydrodynamic diversity	Threatened species	Dry period / drought refuge	In-scope for C'th e-water
Lower Namoi River (Keepit Dam to Walgett)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peel River downstream of Chaffey Dam		Yes		Yes	Yes	Yes	Yes
Upper Namoi River upstream of Keepit Dam		Yes		Yes	Yes		Yes

Attachment B – Operational details for watering

Operational considerations in the Namoi River Valley catchment

The delivery of environmental water in the Namoi River Valley is currently constrained by the release capacities from storages, channel capacities, and system constraints.

Watering actions will be developed in consideration of the following constraints:

- Keepit Dam storage capacity of 425 510 ML and outlet capacity of 4 000 ML/day (WaterNSW 2017)
- Chaffey Dam storage capacity of 102 868 ML and outlet capacity of 1 100 ML/day (WaterNSW 2016)
- Minor flood level of 39 900 ML/day at Narrabri
- Minor flood level of 13 400 ML/day at Bugilbone (downstream of Duncan's Junction)
- The need to notify the community if deliveries from Chaffey Dam will exceed 500 ML/day.
- The Lower Namoi entitlement has a maximum use in a single year of 125 per cent of entitlement (subject to the account balance) and 300 per cent of entitlement over three consecutive years.

In the Namoi River, Commonwealth environmental water could potentially be coordinated with unregulated flow events to deliver freshes and appropriate flow recessions during wetter times.

During periods of low water availability in storage, river operators may implement drought management strategies such as delivering water in block releases and upstream accounting points. Rules and thresholds that provide some water to the environment by limiting supplementary access or providing end-of-system flows vary depending on volumes in storage or allocations in general security accounts. This may reduce water left instream and increase periods of cease to flow. In the instance of a low inflow scenario, Commonwealth environmental water may be used in conjunction with other flows to provide low flow variability and maintain water quality and drought refuge.

In the Peel River, Commonwealth environmental water deliveries could be coordinated with a NSW environmental contingency allowance flow or other flows to deliver a fresh flow. Under a low flow scenario, Commonwealth environmental water could provide low flow variability for baseflows delivered from Chaffey Dam or translucency flows in response to dam inflows. The Peel allocation cannot be carried over and unused water is forfeited.

Operational considerations such as delivery methods, opportunities, constraints and risks will differ depending on the inflow scenario and are summarised in Table 4 on the following page. These considerations will be assessed throughout the year as decisions to make water available for use are made and implemented. This includes refining the ecological objectives, assessing operational feasibility and potential risks and the ongoing monitoring of the seasonal outlook and river conditions.

Potential watering actions under different levels of water resource availability

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

Table 4: Summary of potential watering actions for the Namoi River Valley

Broad Asset	Indicative demand (refer to Table 3 for flow rates)	Applicable level(s) of resource availability				
		Very Low	**Low**	**Moderate**	**High**	**Very High**
Lower Namoi River channel (Keepit to Walgett)	Very low flows: various flow rates Very low flows may occur at any time	*1. Very low flows:* contribute to minimum flows during dry periods to provide refuge habitat and maintain resilience.				
	Baseflows: various flow rates Baseflows may occur at any time for native fish maintenance and survival, or Sept–Mar for native fish recruitment.	*2. Baseflows:* contribute to baseflows to improve water quality, provide connectivity and habitat, and support native fish survival (all groups), fish recruitment (flow generalists and in-channel specialists) and movement (small/medium bodied).				
	Small freshes: various flow rates Ideally Oct–Apr for fish dispersal and condition/ productivity (but can occur any time) for a minimum of 10 days. Sept–Apr for fish spawning for a minimum of 14 days		*3. Small freshes:* contribute to small freshes (in conjunction with other water) to provide connectivity, pool maintenance, and support native fish movement and condition (all groups), and spawning of flow generalists and in-channel specialists.			
	Large freshes: various flow rates Ideally July–Sept for fish dispersal and productivity/condition (but can occur any time) for a minimum of 5 days. Oct–Apr for flow specialists spawning for a minimum of 5 days.				*4. Large freshes:* contribute to large freshes (in conjunction with other water) to provide connectivity, wet banks and benches, and support native fish movement and condition (all groups), and spawning of flow specialists.	
	Bankfull and overbank flows: various flow rates Oct–Apr for fish spawning (floodplain specialists) for a minimum of 10 days. Ideally Sept–Feb for fish dispersal and productivity/condition (but can occur any time) for a minimum of 5 days.					*5. Bankfull and overbank flows:* contribute to bankfull and overbank flows (in conjunction with other water) to increase connectivity, and support native fish spawning (floodplain

<table>
<tr><th rowspan="2">Broad Asset</th><th rowspan="2">Indicative demand
(refer to Table 3 for flow rates)</th><th colspan="5">Applicable level(s) of resource availability</th></tr>
<tr><th>Very Low</th><th>Low</th><th>Moderate</th><th>High</th><th>Very High</th></tr>
<tr><td></td><td></td><td colspan="4"></td><td>specialists), and dispersal and condition (all groups).</td></tr>
<tr><td rowspan="3">Peel River channel</td><td>Very low flows:
1–100 ML/day d/s Chaffey Dam, and at Piallamore and Carroll Gap
Very low flows may occur at any time.</td><td colspan="2">6. Very low flows: contribute to minimum flows during dry periods to provide refuge habitat and maintain resilience.</td><td colspan="3"></td></tr>
<tr><td>Baseflows: various flow rates
May occur at any time for native fish maintenance and survival, or Sept–Mar for native fish recruitment.</td><td colspan="3">7. Baseflows: contribute to baseflows to improve water quality, provide connectivity and habitat, and support native fish survival (all groups) and fish recruitment (flow generalists and in-channel specialists).</td><td colspan="2"></td></tr>
<tr><td>Small freshes: various flow rates
Ideally Oct–Apr for fish dispersal and condition/productivity (but can occur any time) for a minimum of 10 days.
Sept–Apr for fish spawning for a minimum of 14 days</td><td></td><td colspan="3">8. Small freshes: contribute to small freshes (in conjunction with other water) to provide connectivity, pool maintenance, native fish movement and condition (all groups), and spawning of flow generalists and in-channel specialists.</td><td></td></tr>
</table>

Potential watering actions – standard operating arrangements

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

Watering Action 1: Lower Namoi River very low flows

Watering action: Contribute to minimum flows in the Lower Namoi River during dry periods to provide refuge habitat and maintain resilience.

Standard operational considerations:

- Environmental water could be delivered from Keepit Dam, or Gunidgera weir, as in-channel flows, and managed within standard water delivery arrangements.
- The delivery rate will depend on antecedent conditions and available water, and may be delivered by supplementing other water sources.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.

Typical extent: This action could contribute flows to the Lower Namoi River downstream of Keepit Dam to Walgett. The actual extent achieved will depend on antecedent conditions and available water. Consideration could also be given to delivering low baseflows in the Manilla River downstream of Split Rock Dam to maintain critical refuge during extreme dry conditions (using General Security entitlements held in the Upper Namoi River).

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH and DPI – Fisheries) before implementing this action. Approval would need to be sought to link Commonwealth entitlements to a Works Approval for Split Rock Dam if delivery of water to the Manilla River was to proceed.

Watering Action 2: Lower Namoi River baseflows

Watering action: Contribute to baseflows in the Lower Namoi River to improve water quality, provide connectivity and habitat, and support native fish survival (all groups) and fish recruitment (flow generalists and in-channel specialists).

Standard operational considerations:

- Environmental water could be delivered from Keepit Dam, or Gunidgera weir, as in-channel flows, or sourced from tributary flows as appropriate, and managed within standard water delivery arrangements.
- The delivery rate will depend on antecedent conditions and available water, and may be delivered by supplementing other water sources.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.

Typical extent: This action could contribute flows to the Lower Namoi River downstream of Keepit Dam to Walgett. The actual extent achieved will depend on antecedent conditions and water availability.

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH and DPI – Fisheries) before implementing this action.

Watering Action 3: Lower Namoi River small freshes

Watering action: contribute to small freshes (in conjunction with other water) to provide connectivity, pool maintenance, and support native fish movement and condition (all groups), and spawning of flow generalists and in-channel specialists.

The timing and duration of this action is important for achieving outcomes for target native fish species.

Standard operational considerations:

- Environmental water could be delivered from Keepit Dam, or Gunidgera weir, as in-channel flows, or sourced from tributary flows as appropriate, and managed within standard water delivery arrangements.
- The flow limit for this action is generally 4 500 ML/day at Narrabri Creek (noting that the minor flood level at Bugilbone is 13 400 ML/day).
- This action could be delivered by supplementing other river flows, with preference given to supplementing natural flows rather than regulated releases.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.

Typical extent: This action could contribute flows to the Lower Namoi River downstream of Keepit Dam to Walgett, with the potential to increase connection with the Barwon River.

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH, DOI – Water and DPI – Fisheries) before implementing this action.

Watering Action 4: Lower Namoi River large freshes

Watering action: contribute to large freshes (in conjunction with other water) to provide connectivity, wet banks and benches, and support native fish movement and condition (all groups), and spawning of flow specialists.

The timing and duration of this action is important for achieving outcomes for target native fish species.

Standard operational considerations:

- Environmental water could be delivered from Keepit Dam, or Gunidgera weir, as in-channel flows, or sourced from tributary flows as appropriate, and managed within standard water delivery arrangements.
- The flow limit for this action is generally 4 500 ML/day at Narrabri Creek (noting that the minor flood level at Bugilbone is 13 400 ML/day).
- Keepit Dam outlet capacity (4 000 ML/day) may constrain the ability to meet large fresh flow rates in some sections of the river with regulated releases alone.
- This action would be delivered by supplementing other river flows, with preference given to supplementing natural flows rather than regulated releases. Consideration may be given to augmenting regulated releases to increase peak flows, or to provide a secondary flow peak, and to provide a more natural recession.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.

Typical extent: This action could contribute flows to the Lower Namoi River downstream of Keepit Dam to Walgett, with the potential to increase connection with the Barwon River.

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH and DPI – Fisheries) before implementing this action.

Watering Action 5: Lower Namoi River bankfull and overbank flows

Watering action: contribute to bankfull and overbank flows (in conjunction with other water) to increase connectivity, and support native fish spawning (floodplain specialists), and dispersal and condition (all groups).

Standard operational considerations:

- Target flow rates in most sections of the river are difficult to achieve with environmental water.
- Environmental water could be delivered from Keepit Dam, or Gunidgera weir, as in-channel flows or sourced from tributary flows as appropriate. There is a possibility of providing water via pumps or instream as part of standard water delivery arrangements.
- Catchment conditions and water availability.
- Environmental water may be used to slow and extend the flow recession following an unregulated flow event of an appropriate size to maintain inundation in anabranch habitats.
- Environmental water delivery may also be considered to add to an unregulated event to deliver a secondary flow peak that allows reconnection of anabranch habitat for native fish outcomes.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.
- The risk of third party inundation impacts by contributing to overbank flows would need to be considered.

Typical extent: This watering action would contribute flows to increase lateral and longitudinal connectivity in the Lower Namoi River, including with low commence to flow anabranches, and potentially with the Barwon River.

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH and DPI – Fisheries) and relevant landholders before implementing this action.

Watering Action 6: Peel River very low flows

Watering action: contribute to minimum flows during dry periods to provide refuge habitat and maintain resilience.

Standard operational considerations:

- Water could be delivered to the Peel River from Chaffey Dam as in-channel flows, and managed within standard water delivery arrangements.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.
- The actual flow rate will be determined based on antecedent conditions and flows through the season.

Typical extent: This action will contribute flows to the Peel River between Chaffey Dam (and potentially the Namoi River depending on conditions and volume delivered).

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH and DPI – Fisheries) before implementing this action.

Watering Action 7: Peel River baseflows

Watering action: contribute to baseflows to improve water quality, provide connectivity and habitat, and support native fish survival (all groups) and fish recruitment (flow generalists and in-channel specialists).

Standard operational considerations:

- Water could be delivered to the Peel River from Chaffey Dam as in-channel flows, and managed within standard water delivery arrangements.
- Water could be delivered in conjunction with other water, including the environmental contingency allowance.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.
- Flows will be delivered to achieve a minimum depth of 0.3 m (ideal minimum of 10 days).
- The actual flow rate will be determined based on antecedent conditions and flows through the season.

Typical extent: This action will contribute flows to the Peel River between Chaffey Dam (and potentially the Namoi River depending on conditions and volume delivered).

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH and DPI – Fisheries) before implementing this action.

Watering Action 8: Peel River small freshes

Watering action: contribute to small freshes (in conjunction with other water) to provide connectivity, pool maintenance, native fish movement and condition (all groups), and spawning of flow generalists and in-channel specialists.

Standard operational considerations:

- Chaffey Dam outlet capacity (1 100 ML/day) and potential inundation impacts constrain ability to achieve target flow rates over 1 000 ML/day.
- Water could be delivered in conjunction with other in-stream freshes or water sources, such as tributary flows or the environmental contingency allowance.
- Water orders will be developed in conjunction with WaterNSW to ensure operational feasiblity and the achievement of environmental objectives.
- The actual flow rate will be determined based on antecedent conditions and flows through the season.

Typical extent: This action will contribute flows to the Peel River between Chaffey Dam and the Namoi River.

Approvals: Consult with NSW agencies (WaterNSW, NSW OEH and DPI – Fisheries), Local Land Services, peak irrigation bodies and landholders before implementing this action. WaterNSW to provide notification for flows over 500 ML/day.

Attachment C – Long-term water availability

Commonwealth environmental water holdings

The Commonwealth holds the following entitlements in the Namoi River Valley:

- General Security – Upper Namoi
- General Security – Lower Namoi
- General Security – Peel

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

Other sources of environmental water

There are currently no other sources of held environmental water in the Namoi River Valley.

Planned environmental water

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

The Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated Water Sources (NSW Government 2016) provides for planned environmental water and stock and domestic (replenishment flows) releases. Water deliveries to meet irrigation orders may provide baseflows in some sections of the Namoi River. Planned environmental water includes limiting the long-term average extraction levels to a percentage of average flow, limiting supplementary access to a percentage of flow at certain times of the year and providing minimum end of system flows. Thresholds in the Water Sharing Plan that provide for supplementary access change depending on volume water allocations in General Security accounts. When storages fall below certain levels, rules that provide for end-of-system flow requirements do not need to be implemented. This may result in less planned environmental water during dry times. Supplementing other water releases with Commonwealth environmental water may increase the potential for environmental objectives to be achieved and assist with delivery efficiency.

The Peel Water Sharing Plan (Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources, NSW Government 2010) includes a 5 000 ML environmental contingency allowance. The Commonwealth Environmental Water Office has been working with the NSW Government to coordinate environmental water releases in the Peel River.