Australian Government

Commonwealth Environmental Water Office

Commonwealth Environmental Water

Portfolio Management Plan

Namoi River Valley

2016–17

Front cover image credit: Namoi River west of Narrabri. Photo by Commonwealth Environmental Water Office

Back cover image credit: Tommy Swamp. Photo by Commonwealth Environmental Water Office

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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Commonwealth environmental water portfolio management planning

Commonwealth environmental water

The Commonwealth Environmental Water Holder is an independent statutory position established by the *Water Act 2007* to manage the Commonwealth environmental water holdings. The Commonwealth Environmental Water Holder leads and is supported by the Commonwealth Environmental Water Office (the Office), a division of the Australian Government Department of the Environment.

Under the *Water Act 2007*, Commonwealth environmental water must be managed to protect or restore environmental assets, so as to give effect to relevant international agreements. The *Water Act 2007* also requires that the Commonwealth Environmental Water Holder perform its functions and exercise its powers consistently with and in a manner that gives effect to the Basin Plan and that Commonwealth environmental water is managed in accordance with the Basin Plan's environmental watering plan.

Purpose of the document

This document sets out the plans for managing the Commonwealth environmental water portfolio in the Namoi River Valley for 2016–17. Efficient and effective management of Commonwealth environmental water requires the utilisation of all portfolio management options, including water delivery, carryover and trade. To support improved outcomes from water use over time, carryover provides the opportunity to optimise water use across water years and to improve water availability early in a water year, while trade provides further capacity to optimise use over the long-term as well as across catchments.

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 the Commonwealth environmental water portfolio, consistent with Basin Plan obligations including the expected outcomes in the Basin-wide environmental watering strategy and the Basin annual environmental watering priorities.

To learn more about the portfolio management planning approach see *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water 2016–17* (available at: http://www.environment.gov.au/water/cewo/publications).

Delivery partners

Commonwealth environmental water is managed in conjunction with and delivered by a range of partners. In the Namoi River Valley, our delivery partner is WaterNSW. Commonwealth environmental water planning and delivery in the Namoi River Valley is supported by advice from New South Wales Office of Environment and Heritage, Department of Primary Industries – Water, Department of Primary Industries – Fisheries, WaterNSW, Eco Logical Australia and North West Local Land Services.

This portfolio management plan has been developed in consultation with these partners.

Your input

The management of Commonwealth environmental water relies on considerable advice and assistance from local organisations, state governments and 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 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 (NSW), extending westwards of Nundle to Walgett. Rainfall in the upper catchment drives valley flows, with water for regulated delivery throughout the valley being stored in Split Rock and Keepit dams shown in Figure 1 on the following page. 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 downstream of Boggabri.

Environmental watering in the Namoi River 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 during prolonged low flow conditions.

In order to meet the Lower Namoi River in-channel fresh requirements regulated releases from Keepit Dam may need to be timed to coincide with unregulated inflows from the Mooki River and Cox's Creek. The environmental benefits from these flows may also extend downstream to the Barwon-Darling River. Consideration may also be given to augmenting modified river management practices implemented by river operators in response to low inflows, such as block releases of consumptive water orders. Where possible, environmental water will be managed to provide environmental benefit to multiple sites in order to maximise the efficiency and effectiveness of water delivery.

The Peel River contributes an average annual volume of approximately 280 000 megalitres (ML) into the Namoi system (Green et al. 2011) and as such constitutes the other key asset within the Namoi River Valley. Flows 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.

Held environmental water in the Peel River can be made available from Chaffey Dam in combination with downstream unregulated tributary inflows, or as a form of translucency release in response to storage inflows. Use of Commonwealth environmental water is not contingent on unregulated flows in the Peel River and can be delivered in conjunction with a stimulus flow managed by the NSW Department of Primary industries – Water (NSW DPI Water) under the planned environmental water provisions of the Water Sharing Plan.

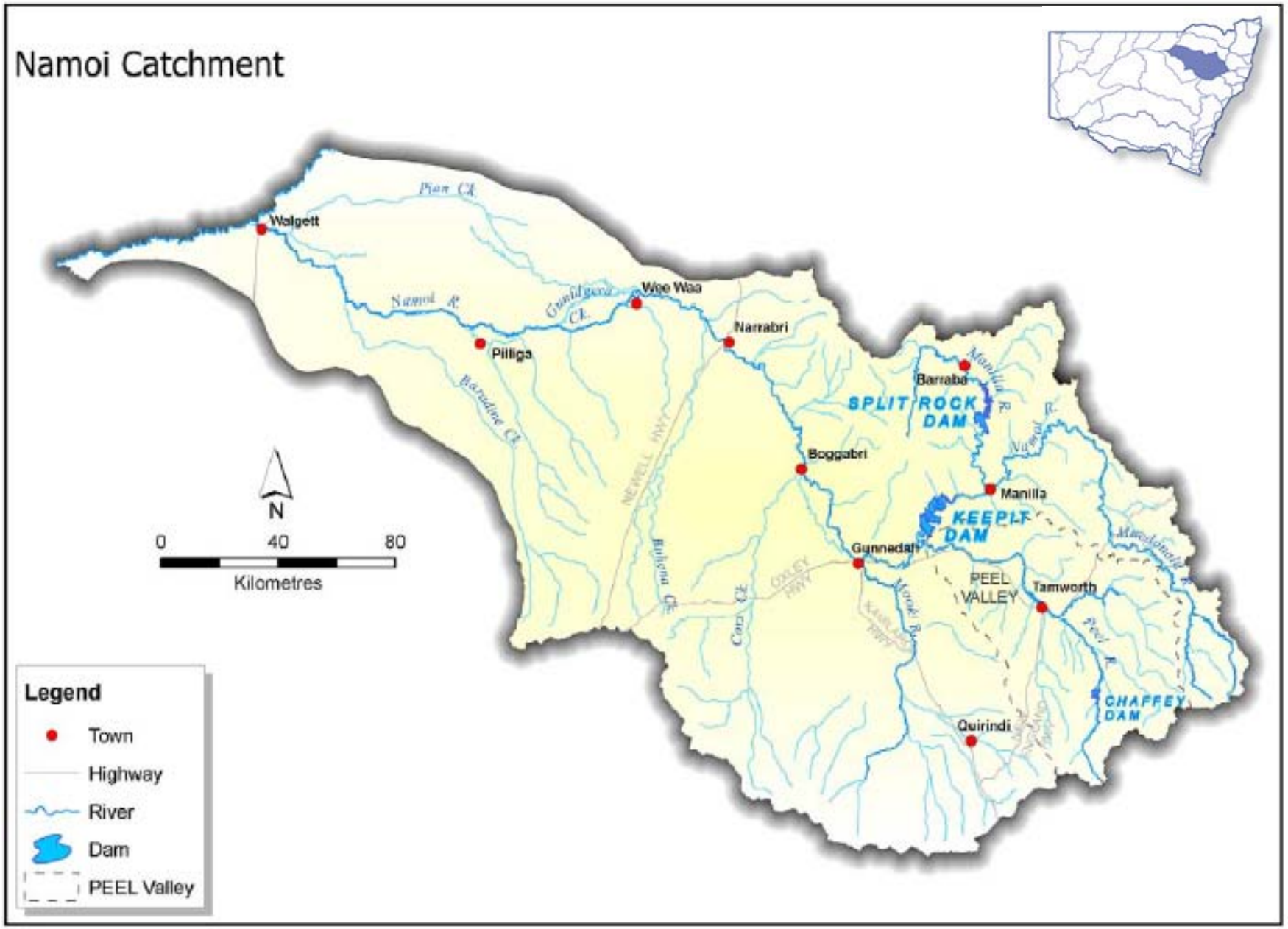

Figure 1: Map of the Namoi River Valley (Green et al. 2011).

1.2. Environmental objectives and outcomes in the Namoi River Valley

The long-term environmental objectives and expected outcomes for the Murray-Darling Basin are described in the Basin Plan's environmental watering plan and the Basin-wide environmental watering strategy. The Basin-wide environmental watering strategy includes quantified environmental outcomes at both a Basin-scale and for each catchment—outcomes relevant for the Namoi River Valley are described 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. Prior to the development of long-term watering plans, the 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 programmes, the outcomes being targeted by environmental watering in the Namoi River Valley are summarised in Table 1 below. The objectives and targeted outcomes 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 outcomes being targeted by environmental watering in the Namoi River Valley.

BASIN-WIDE OUTCOMES (Outcomes in red link to the Basin-wide Environmental Watering Strategy)	**EXPECTED OUTCOMES FOR LOWER NAMOI 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)		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	Support reproduction and recruitment opportunities for native fish Support connectivity and movement, and maintain in-channel refuge and aquatic habitat for native fish		
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	Support longitudinal connectivity along the river channel	Support connectivity, particularly lateral between the river and floodplain
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 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 flows 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 actions may contribute to particular opportunities, such as using infrastructure to deliver water to individual wetlands that would otherwise not be possible due to constraints. Also, 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 delivery constraints are described in Attachment B.

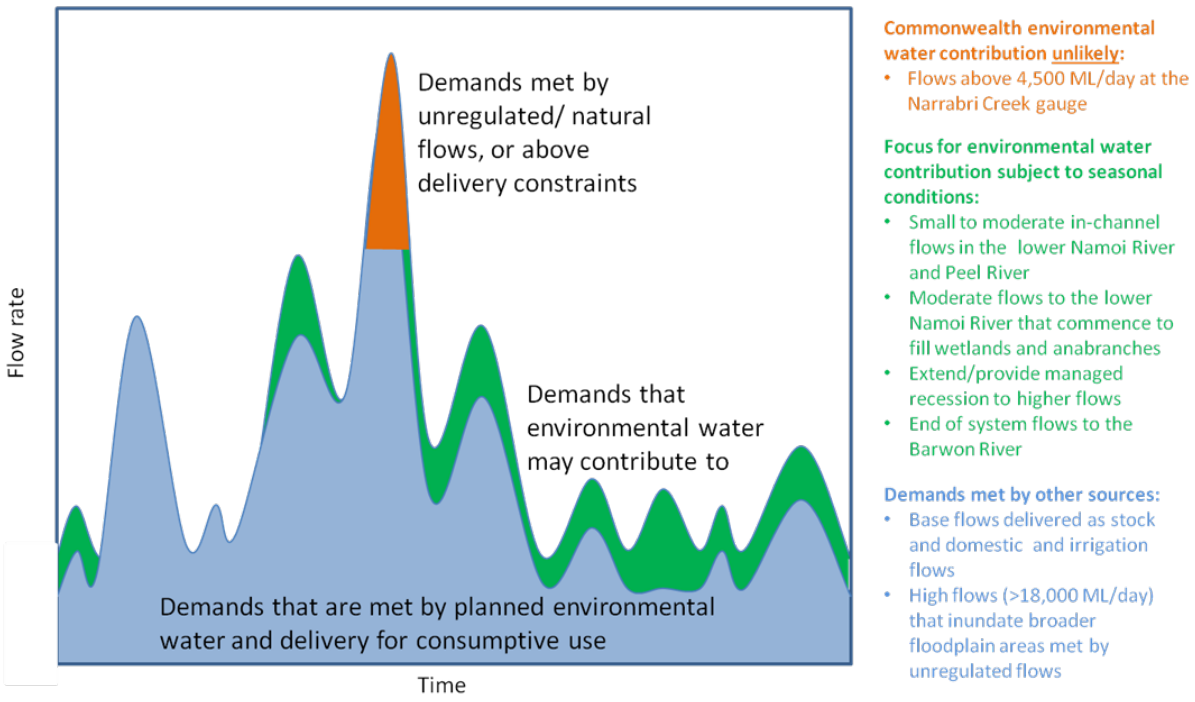

Figure 2: Scope of demands that environmental water may contribute to in the Namoi River Valley.

Based on the above outcomes sought and delivery constraints, specific watering requirements (flow magnitude, duration, timing and frequency) have been identified as being in scope for Commonwealth environmental water. These water requirements are described in Table 3. As with the objectives and targeted outcomes, the environmental water requirements will continue to be reviewed and revised in response to new knowledge.

1.4. Monitoring and adaptive management

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

2. Portfolio management in 2016–17

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 outcomes and watering requirements, watering history and asset condition watering) 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. Antecedent and current catchment conditions and the demand for environmental water in 2016–17

Generally hot and dry conditions have prevailed in the Namoi catchment since 2012–13, with below average to lowest on record rainfall since March 2012, and above average to very much above average maximum temperatures across the region. As a result of ongoing dry conditions, since August 2014, WaterNSW delivered water through block releases (WaterNSW 2014). Dry conditions have led to decreasing storage levels and a lack of natural flows to be supplemented with the delivery of environmental water in 2013–14, 2014–15 and 2015–16. If conditions continue to dry, water dependent species will require support to ensure their survival, and the river system will need watering to maintain resilience over the coming years.

Environmental water demands for environmental assets in the Namoi River Valley in 2016–17 are represented in Table 3 and summarised below:

- **Lower Namoi River channel**: High to Critical demand. As a result of dry conditions in the catchment, target flows have not been fully met over the past four years. Demands identified in the Lower Namoi River require flows between 1 in 1–2 years and 1 in 3 years. Consequently there is a critical demand for water to provide drought refuge and a high demand for water to maintain habitat, support native fish dispersal and resilience, and maintain connectivity within the river channel.
- **Wetlands/anabranches**: Moderate to High demand. As a result of dry conditions in the catchment, target flows have not been fully met in the wetlands and anabranches of the Lower Namoi system in the last four years. Water is required to meet the demands identified 1 in 4–5 years, and may be required in the next 1–2 years to provide off channel habitat, and to support native fish and riparian vegetation in low commence to flow anabranches.
- **Peel River channel**: High demand. There is a high demand for baseflows and freshes in the Peel River as they have not been fully met in the past three years. In particular, there is an environmental demand for a pulsed baseflow (~500 ML/day) and continuous minimum baseflow (greater than 3 ML/day) from Chaffey Dam.

Environmental water holdings in the Namoi are insufficient to meet all of the environmental water demands in the Namoi.

Murray-Darling Basin 2016–17 environmental watering priorities

In contributing to these demands, the Commonwealth Environmental Water Office will also be aiming to contribute to the following 2016–17 Basin annual environmental watering priorities relevant for the Namoi River Valley:

- Support viable populations of threatened native fish species by protecting drought refuges and maintaining instream habitats
- Contribute to the long-term recovery of silver perch by imporving the viability of existing populations and enhancing conditions for recruitment and dispersal to suitable habitats
- In moderate conditions, contribute to the long-term recovery of threatened species, (including silver perch), through range expansion and the establishment of new populations

2.2. Water availability in 2016–17

Forecasts of Commonwealth water allocations

The volume of Commonwealth environmental water likely to be carried over in the Namoi River Valley for use in 2016–17 is estimated to be 6.2 GL.

Allocations against Commonwealth water entitlements in the Namoi River Valley are determined by the NSW government and will vary depending on inflows and the criteria in the Namoi Water Sharing Plan. 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 2016–17 in the Namoi River Valley as at 30 April 2016.

Entitlement type	Forecasts of Commonwealth water allocations (including carryover) in 2016–17 (GL)					
	Very dry ←					→ Very wet
	95 percentile	90 percentile	75 percentile	50 percentile	25 percentile	10 percentile
Upper Namoi general security	0.05	0.1	0.1	0.1	0.1	0.1
Lower Namoi general security	6.2	6.2	7.2	10.4	14.7	14.7
Peel River general security	0	0.2	0.6	0.9	1.3	1.3
Total – Namoi	**6.3**	**6.5**	**7.9**	**11.4**	**16.1**	**16.1**

Notes:
1. Forecasts for regulated catchments are given to the nearest whole gigalitre except where the entitlement held by the Commonwealth is below 1 GL.
2. Allocation rate scenarios are based on long term average allocation rates.

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

Water resource availability scenarios

Commonwealth environmental water is not managed in isolation. When considering the available resource to meet environmental demands, it is necessary to also factor in the water resources managed by other entities and available to contribute to environmental outcomes. 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), 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 very high resource availability scenarios are in scope for 2016–17, however, moderate to very high resource availability is only possible if conditions become wet. This resource availability scenario takes into account the significant storage deficit in the Lower Namoi that is required be made up to meet essential needs prior to any new allocation announcements being made. As at 28 April 2016 inflows of 50 to 60 GL are required before block releases can recommence and 140 GL of inflows are required before the storage deficit will have been met and water orders can be managed on a demand and supply basis rather than through bulk deliveries[1].

[1] Under normal operations water ordered by users is supplied against the individual requirements outlined in the water order (demand and supply basis). Under dry conditions water orders are programmed for a set period and supplied as part of a bulk delivery.

The resource availability for the start of the 2016–17 water year is very low. If no allocations are received in 2016–17 the Commonwealth will hold the majority of account water in the Lower Namoi, with dam levels very low (WaterNSW 2016b). There have been no general security allocations in the Lower Namoi regulated water source since September 2013 (NSW Government 2016b).

2.3. 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 available for maximising outcomes. Figure 3 below 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 2016–17 is to **avoid damage** and **protect** assets in the Lower Namoi River channel, wetlands and anabranches, and the Peel River to ensure ecological capacity for recovery. If water availability becomes high to very high, there may be scope to **improve** the health and resilience of aquatic ecosystems in the Namoi River Valley.

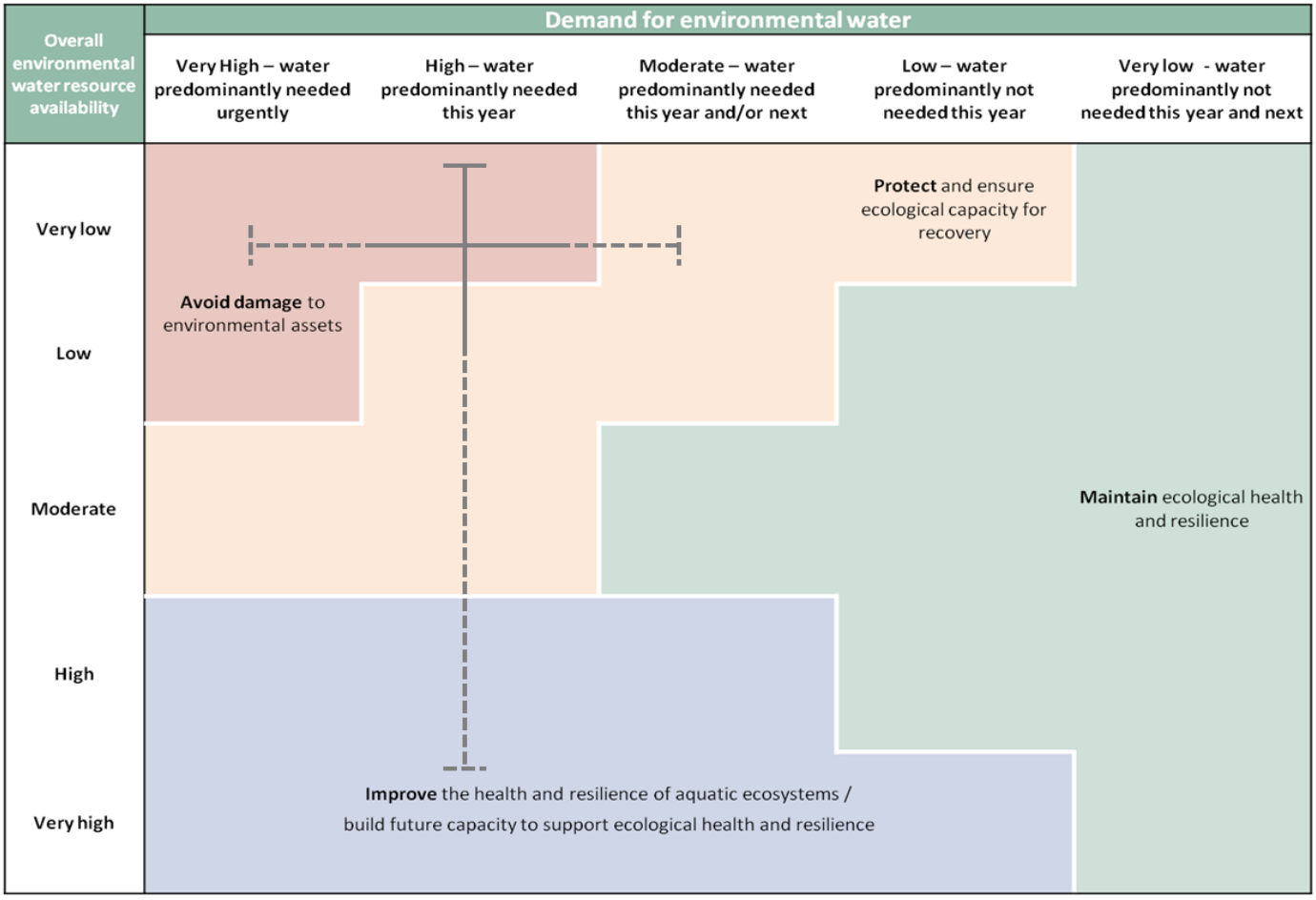

Figure 3: Determining a broad purpose for portfolio management in the Namoi River Valley for 2016–17. Note: grey lines represent the likely range in demand and resource availability for the 2016-17 water year.

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 2016–17* (available at: http://www.environment.gov.au/water/cewo/publications).

2.4. Water Delivery in 2016–17

Consistent with the demands and purpose described above, the Office is considering supplying environmental water to the following watering actions for 2016–17 (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 catchment are to improve connectivity, support aquatic ecology and replenish refuge pools in the Lower Namoi.

Options for the delivery of Commonwealth environmental water are:

- Lower Namoi River drought refuge – In very low resource availability the purpose of the action is to avoid damage/protect, with the environmental demand very high. Refreshing refuge pools is a priority in supporting the survival of native fish including silver perch.

- Habitat maintenance, fish dispersal and resilience. The purpose of the action is to avoid damage/protect with the environmental demand very high. This option is dependent on additional flows and may be delivered in conjunction with a block release.

- Lower Namoi connectivity, fish spawning and movement. The purpose of the action is to avoid damage/protect with the environmental demand high. This action requires an increase in water availability, a natural flow event and the appropriate conditions (water temperature, flow rates and season).

Stakeholder feedback

Feedback on the proposed actions was sought from New South Wales Office of Environment and Heritage, Department of Primary Industries – Water, Fisheries, WaterNSW, Eco Logical Australia and North West Local Land Services. There was agreement on the environmental watering demands and the feasibility of the proposed watering actions. If dry conditions continue the preferred option is to provide an environmental flow to refresh refuges in conjunction with a consumptive water delivery, given the high system losses under dry conditions. This environmental flow would help to refresh refuge pools, support the native fish demonstration reach and the newly released silver perch (50 000 fingerlings). Feedback from the Namoi-Peel Customer Service Committee suggested that the environmental demand in the Peel was lower than was in the planning document because of almost continuous flows to the Namoi River and the release in 2013 of 1 600 ML of planned environmental water. This feedback has been incorporated into the plan.

2.5. Trading water in 2016–17

Planning for 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 (see *Commonwealth Environmental Water Portfolio Management: Basin-wide analysis 2016–17* available at: http://www.environment.gov.au/water/cewo/publications).

The Commonwealth Environmental Water Office is investigating the potential for purchases to augment water for the environment in a number of catchments in the northern Murray-Darling Basin to meet high environmental water demands (particularly in the Macquarie Marshes, Lower Balonne/Narran Lakes and Border Rivers). Further information will be provided to the market ahead of any trade of Commonwealth environmental water at: http://www.environment.gov.au/water/cewo/trade/current-trading-actions.

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-dec2014.

2.6. Carrying over water for use in 2017–18

The volume of water carried over for use in 2017–18 will depend upon resource availability and demand throughout the year. Commonwealth environmental water in the Namoi River Valley may be carried over to 2017–18 if it is not needed for drought refuge or cannot be delivered in 2016–17 due to limited conveyance water.

There are limits on the amount of water held in accounts and different carryover provisions across the 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 percent of the entitlement volume.
- In the Peel Valley there is no provision for carryover.

As documented in Table 3 below, potential demands in 2017–18 include:

- Lower Namoi River channel: Demand for water to provide drought refuge and to maintain habitat, support native fish dispersal and resilience, and maintain connectivity within the river channel.
- Wetlands/anabranches: Demand for water to provide off channel habitat, and to support native fish and riparian vegetation in low commence to flow anabranches.
- Peel River channel: Demand for baseflows and freshes in the Peel River.

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.

Table 3a: Environmental demands, potential watering in 2016–17 and outlook for coming years in the Namoi River Valley – VERY LOW / LOW WATER RESOURCE AVAILABILITY IN 2016–17

Environmental assets	*Physical and process assets*	Indicative demand (for <u>all sources of water</u> in the system)	Required frequency (maximum dry interval)	Watering history (from all sources of water) [4]				2016–17			Implications for future demands		
				2012–13 (drying)	2013–14 (dry)	2014–15 (dry)	2015–16 (dry)	Predominant urgency of environmental demand for water	Purpose under <u>very low</u> / <u>low</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016–17	2018–19 Range of likely demand	
Lower Namoi River channel [1]	Drought refuge habitat Habitat maintenance Fish dispersal and resilience	Small flows (minimum flows and baseflows): • 8 ML/day at Boggabri and 13 ML/day at Wee Waa • 72 ML/day at Boggabri and 105 ML/day at Wee Waa (Dec–June) • 215 ML/day at Boggabri and 260 ML/day at Wee Waa (July–Nov)	1 in 1–2 years	Minimum flows met Baseflows below targets Target at Wee Waa not met	Minimum flows not met Baseflows below targets.	Minimum flows not met Baseflows below targets	Minimum flows not met. Cease to flow periods at Boggabri. Baseflows below targets (block releases used to deliver water)	Critical Minimum flows not fully met for last three years. Baseflow demands not been fully met in last four years.	**Avoid damage / Protect**	A high potential for watering in 2016–17 to provide drought refuge if maximum cease to flow triggers are met and/or water quality issues identified. Minimum flows and baseflow requirements may not be met.	High	Moderate to High	Met in 2017–18
												Critical	Not met in 2017–18
	Longitudinal connectivity Low level bank and bar wetting: Pool maintenance Fish movement, habitat access, spawning and recruitment	Medium flows: • 500 ML/day at Bugilbone for 75 days (min. 25 consecutive days) preferably in late spring/summer and late winter	1 in 2–3 years	Minimum 25 consecutive days not met	Not met	Not met	Not met Height above 500 ML for 2 days at Bugilbone	High Demands have not been fully met in the last four years.	**Protect**	Environmental water could contribute to meeting this demand for the minimum of 25 days if delivered in conjunction with other water.	Moderate to High	Low	Met in 2017–18
												High	Not met in 2017–18
	Fish spawning, recruitment, dispersal and condition Increase ecosystem function Bench and bank wetting: Access to habitat Nutrient cycling	Large flows: • 1 800 ML/day at Bugilbone for 60 days (min. 6 consecutive days) preferably in late spring/summer and late winter • 1 400–2 870 ML/day at Boggabri and 1 500–3 150 ML/day at Wee Waa in Sept–Dec for min. 7 days	1 in 3–5 years	1 800 ML/day flow met for min. 6 consecutive days Min. target met at Boggabri but target not met at Wee Waa	1 800 ML/day flow not met Target met at Boggabri, but not met at Wee Waa	Not met	Not met	Moderate to High Demands have not been fully met in the last four years.	**Protect**	Insufficient water under a low water availability scenario to contribute to this demand.	High	Low	Met in 2017–18
												Critical	Not met in 2017–18
Wetlands / Anabranches [2]	Riparian vegetation in low commence to flow anabranch channels Fish movement and off channel habitat Fish breeding and recruitment	Commence to fill wetlands preferably in late spring/summer and winter over 45 days (min. 7 consecutive days): • 4 000–4 500 ML/day at Bugilbone • Greater than 4 600 ML/day at Boggabri (for Barbers Lagoon) • Greater than 3 300 ML/day at Duncan's gauge	1 in 2–5 years (varies between native fish species)	Target at Bugilbone only met for min. 7 consecutive days (in winter) Other targets not met	Not met	Not met	Not met	Moderate to High Demands have not been fully met in the last four years.	**Protect**	Insufficient water under a low water availability scenario to contribute to this demand.	High	Low	Met in 2017–18
												Critical	Not met in 2017–18

Environmental assets	*Physical and process assets*	Indicative demand (for <u>all sources of water</u> in the system)	Required frequency (maximum dry interval)	Watering history (from all sources of water) [4]				2016–17			Implications for future demands		
				2012–13 (drying)	2013–14 (dry)	2014–15 (dry)	2015–16 (dry)	Predominant urgency of environmental demand for water	Purpose under <u>very low</u> / <u>low</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016–17	2018–19 Range of likely demand	Met in 2017–18 / Not met in 2017–18
Peel River channel [3]	Habitat Water quality Fish resilience, movement, spawning and recruitment Connectivity Wet low level-benches and point bars	Baseflows: • Minimum variable low baseflow greater than 3 ML/day) from Chaffey Dam • Pulsed baseflows (~500 ML/day) from Chaffey Dam	Annually	Min. baseflows met	Min. baseflows met	Min. baseflows met	Min. Baseflows not met	High Min baseflows not fully met in 2015–16 Pulsed baseflow requirements have not been met in the last two years.	**Avoid damage /** Protect	Environmental water could contribute to providing minimum baseflow variability if required triggers are met for cease to flow duration and water quality issues.	High	Moderate	
												High	
				Pulsed baseflows met for only 4 days in July 2012	Pulsed baseflows met for 1 day in August 2013	Pulsed baseflows not met	Pulsed baseflows not met			Insufficient water under a very low water availability scenario to contribute to this demand.	Critical	Critical	
												Moderate	
	Connectivity Water quality Fish spawning, recruitment, movement and condition	Fresh flow (1 000–4 000 ML/day) to provide connectivity and wet medium-level benches, point bars and riparian zone	2–3 years Average return interval	Flows greater than 1 000 ML/day over 3 days in July 2012	Not met	Not met	Not met	High Demand has not been met in last three years.	Protect	Insufficient water under a very low water availability scenario to contribute to this demand.	Critical	Low	
												Critical	
Carryover potential										Low proportion of Lower Namoi allocations carried into 2016–17. *NOTE: No carryover provisions in the Peel Valley.*	Low to high proportion of allocations may be carried over to 2017–18, but will depend upon resource availability and demands.	Level of carryover will depend on environmental demands and resource availability.	
Trade potential	Potential for purchases to augment water for the environment in a number of catchments in the northern Murray-Darling Basin to meet high environmental water demands (particularly in the Macquarie Marshes, Lower Balonne/Narran Lakes and Border Rivers). Further information will be provided to the market ahead of any trade of Commonwealth environmental water.												

1. Sourced from information provided by Green et al (2011), MDBA (2012), and previous environmental watering, with advice from NSW DPI Fisheries (Tony Townsend, pers. comm.)
2. Sourced from information provided by Green et al (2011), MDBA (2012) and Foster (1999), with advice from NSW DPI Fisheries (Tony Townsend, pers. comm.)
3. Sourced from Barma Water Resources et al. (2012), with advice from NSW DPI Fisheries (Tony Townsend, pers. comm.)
4. All watering history sourced from data from the following gauges (WaterNSW 2016d):
   - 419021: Namoi River at Bugilbone
   - 419012: Namoi River at Boggabri
   - 419059: Namoi River d/s Gunidgera Weir (Wee Waa)
   - 419094: Namoi River d/s Duncan's Junction
   - 419045: Peel River d/s Chaffey Dam

Key - events in previous years

- means demand was met by Commonwealth environmental water or any other source
- means demand was partially met by Commonwealth environmental water or any other source (may be used to indicate infrastructure assisted delivery)
- means water not provided (or not required)

Note that not all demands require water every year; drying phases are important for floodplains and temporary wetlands or streams

Key - potential watering in 2016-17

- means a high priority for Commonwealth environmental watering (full or partial contribution, and subject to seasonal and operational considerations)
- means a secondary priority for Commonwealth environmental watering, likely to be met via other means (other water holders, or natural flows)
- means a low priority for Commonwealth environmental watering

Key - urgency of environmental demands

- means critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage
- means high demand for water i.e. needed in that particular year
- means moderate demand for water i.e. water needed that particular year and/or next
- means low demand for water i.e. water generally not needed that particular year
- means 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

Table 3b: Environmental demands, potential watering in 2016–17 and outlook for coming years in the Namoi River Valley - **MODERATE WATER RESOURCE AVAILABILITY IN 2016–17**

Environmental assets	*Physical and process assets*	Indicative demand (for all sources of water in the system)	Required frequency (maximum dry interval)	Watering history (from all sources of water) [4]				2016–17			Implications for future demands		
				2012–13	2013–14	2014–15	2015–16	Predominant urgency of environmental demand for water	Purpose under moderate resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016–17	2018–19 Range of likely demand	
				(drying)	(dry)	(dry)	(dry)						Met in 2017–18
													Not met in 2017–18
Lower Namoi River channel [1]	Drought refuge habitat Habitat maintenance Fish dispersal and resilience	Small flows (minimum flows and baseflows): • 8 ML/day at Boggabri and 13 ML/day at Wee Waa • 72 ML/day at Boggabri and 105 ML/day at Wee Waa (Dec–June) • 215 ML/day at Boggabri and 260 ML/day at Wee Waa (July–Nov)	1 in 1–2 years	Minimum flows met Baseflows below targets . target at Wee Waa not met	Minimum flows not met Baseflows below targets.	Minimum flows not met Baseflows below targets	Minimum flows not met. Cease to flow periods at Boggabri. Baseflows below targets (block releases used to deliver water)	Critical Minimum flows not fully met for last three years. Baseflow demands not been fully met in last four years.	**Avoid damage / Protect**	Low Potential for contribution under moderate resource scenario as requirements should be met by natural flow conditions. Contributing to medium sized flows would also meet this demand	Moderate	Moderate	
												High	
	Longitudinal connectivity Low level bank and bar wetting: Pool maintenance Fish movement, habitat access, spawning and recruitment	Medium flows: • 500 ML/day at Bugilbone for 75 days (min. 25 consecutive days) preferably in late spring/summer and late winter	1 in 2–3 years	Minimum 25 consecutive days not met	Not met	Not met	Not met Height above 500 ML for 2 days at Bugilbone	High Demands have generally not been fully met in the last four years.	**Protect**	Environmental water may be able to contribute to meeting this demand in 2016–17, depending on available water and if delivered in conjunction with other flows	Low to Moderate	Low	
												Moderate	
	Fish spawning, recruitment, dispersal and condition (linked to nutrient cycling Increase ecosystem function Bench and bank wetting: Access to habitat Nutrient cycling	Large flows: • 1 800 ML/day at Bugilbone for 60 days (min. 6 consecutive days) preferably in late spring/summer and late winter • 1 400–2 870 ML/day at Boggabri and 1 500–3 150 ML/day at Wee Waa in Sept–Dec for min. 7 days	1 in 3–5 years	1 800 ML/day flow met for min. 6 consecutive days Min. target met at Boggabri but target not met at Wee Waa	1 800 ML/day flow not met Target met at Boggabri, but not met at Wee Waa	Not met	Not met	Moderate Demands have not been fully met in the last four years.	**Protect**	Environmental water may be able to contribute to meeting this demand in conjunction with other flows, at least for the minimum number of days, depending on available water	Moderate to High	Low	
												Moderate to High	
Wetlands / Anabranches [2]	Riparian vegetation in low commence to flow anabranch channels Fish movement and off channel habitat Fish breeding and recruitment	Commence to fill wetlands preferably in late spring/summer and winter over 45 days (min. 7 consecutive days): • 4 000–4 500 ML/day at Bugilbone • Greater than 4 600 ML/day at Boggabri (for Barbers Lagoon) • Greater than 3 300 ML/day at Duncan's gauge	1 in 2–5 years (varies between native fish species)	Target at Bugilbone only met for min. 7 consecutive days (in winter) Other targets not met	Not met	Not met	Not met	Moderate Demands have not been fully met in the last four years.	**Protect**	Insufficient water under a moderate water availability scenario to contribute to this demand.	High	Low	
												Critical	

Environmental assets	*Physical and process assets*	Indicative demand (for <u>all sources of water</u> in the system)	Required frequency (maximum dry interval)	Watering history (from all sources of water) [4]				2016–17			Implications for future demands		
				2012–13	2013–14	2014–15	2015–16	Predominant urgency of environmental demand for water	Purpose under <u>moderate</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016–17	2018–19 Range of likely demand	
				(drying)	(dry)	(dry)	(dry)					Met in 2017–18	Not met in 2017–18
Peel River channel [3]	Habitat Water quality Fish resilience, movement, spawning and recruitment Connectivity Wet low level-benches and point bars	Baseflows: • Minimum variable low baseflow greater than 3 ML/day) from Chaffey Dam • Pulsed baseflow (~500 ML/day) from Chaffey Dam	Annually	Min. baseflows met	Min. baseflows met	Min. baseflows met	Min. baseflows not met	High Min baseflows not fully met in 2015–16 Pulsed baseflow requirements have not been met in the last two years.	**Avoid damage / Protect**	Minimum baseflows would be met by other water under a wet scenario.	Moderate	Moderate	High
				Pulsed baseflows met for only 4 days in July 2012	Pulsed baseflows met for 1 day in August 2013	Pulsed baseflows not met	Pulsed baseflows not met			Environmental water could contribute to pulsed baseflow releases from Chaffey Dam	Moderate	Low	High
	Connectivity Water quality Fish spawning, recruitment, movement and condition	Fresh flow (1 000–4 000 ML/day) to provide connectivity and wet medium-level benches, point bars and riparian zone	2–3 years Average return interval	Flows greater than 1 000 ML/day over 3 days in July 2012	Not met	Not met	Not Met	High Demand has not been met in last three years.	**Protect**	Insufficient water under a moderate water availability scenario to contribute to this demand.	Critical	Low	Critical
									Carryover potential	Low to moderate proportion of allocations carried into 2016–17. *NOTE: No carryover provisions in the Peel Valley.*	Low to moderate proportion of allocations may be carried over to 2017–18, but will depend upon resource availability and demands.	Level of carryover will depend on environmental demands and resource availability.	
									Trade potential	Potential for purchases to augment water for the environment in a number of catchments in the northern Murray-Darling Basin to meet high environmental water demands (particularly in the Macquarie Marshes, Lower Balonne/Narran Lakes and Border Rivers). Further information will be provided to the market ahead of any trade of Commonwealth environmental water.		

See references at Table 3a

Key - events in previous years

- means demand was met by Commonwealth environmental water or any other source
- means demand was partially met by Commonwealth environmental water or any other source (may be used to indicate infrastructure assisted delivery)
- means water not provided (or not required)

Note that not all demands require water every year; drying phases are important for floodplains and temporary wetlands or streams

Key - potential watering in 2016-17

- means a high priority for Commonwealth environmental watering (full or partial contribution, and subject to seasonal and operational considerations)
- means a secondary priority for Commonwealth environmental watering, likely to be met via other means (other water holders, or natural flows)
- means a low priority for Commonwealth environmental watering

Key - urgency of environmental demands

- means critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage
- means high demand for water i.e. needed in that particular year
- means moderate demand for water i.e. water needed that particular year and/or next
- means low demand for water i.e. water generally not needed that particular year
- means 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

Table 3c: Environmental demands, potential watering in 2016–17 and outlook for coming years in the Namoi River Valley –**HIGH/VERY HIGH WATER RESOURCE AVAILABILITY IN 2016–17**

Environmental assets	*Physical and process assets*	Indicative demand (for all sources of water in the system)	Required frequency (maximum dry interval)	Watering history (from all sources of water) [4]				2016–17			Implications for future demands		
				2012–13 (drying)	2013–14 (dry)	2014–15 (dry)	2015–16	Predominant urgency of environmental demand for water	Purpose under high / very high resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016–17	2018–19 Range of likely demand	Met in 2017–18 / Not met in 2017–18
Lower Namoi River channel [1]	Drought refuge habitat Habitat maintenance Fish dispersal and resilience	Small flows (minimum flows and baseflows): • 8 ML/day at Boggabri and 13 ML/day at Wee Waa • 72 ML/day at Boggabri and 105 ML/day at Wee Waa (Dec–June) • 215 ML/day at Boggabri and 260 ML/day at Wee Waa (July–Nov)	1 in 1–2 years	Minimum flows met Baseflows below targets. Target at Wee Waa not met	Minimum flows not met Baseflows below targets	Minimum flows not met Baseflows below targets	Minimum flows not met. Cease to flow periods at Boggabri. Baseflows below targets (block releases used to deliver water)	Critical Minimum flows not fully met for last three years. Baseflow demands not been fully met in last four years.	Improve	Low Potential for contribution under high resource scenario as requirements should be met by natural flow conditions. Contributing to medium sized flows would also meet this demand	Moderate	Moderate	
												Moderate to High	
	Longitudinal connectivity Low level bank and bar wetting: Pool maintenance Fish movement, habitat access, spawning and recruitment	Medium flows: • 500 ML/day at Bugilbone for 75 days (min. 25 consecutive days) preferably in late spring/summer and late winter	1 in 2–3 years	Minimum 25 consecutive days not met	Not met	Not met	Not met Height above 500 ML for 2 days at Bugilbone	High Demands have generally not been fully met in the last three years.	Improve	Environmental water could contribute to meeting this demand	Low	Very Low	
												Low	
	Fish spawning, recruitment, dispersal and condition (linked to nutrient cycling Increase ecosystem function Bench and bank wetting: Access to habitat Nutrient cycling	Large flows: • 1 800 ML/day at Bugilbone for 60 days (min. 6 consecutive days) preferably in late spring/summer and late winter • 1 400–2 870 ML/day at Boggabri and 1 500–3 150 ML/day at Wee Waa in Sept–Dec for min. 7 days	1 in 3–5 years	1 800 ML/day flow met for min. 6 consecutive days Min. target met at Boggabri but target not met at Wee Waa	1 800 ML/day flow not met target met at Boggabri, but not met at Wee Waa	Not met	Not met	Moderate Demands have generally not been fully met in the last three years.	Improve	Environmental water could contribute to meeting this demand in conjunction with other flows	Low	Very Low	
												Low	
Wetlands / Anabranches [2]	Riparian vegetation in low commence to flow anabranch channels Fish movement and off channel habitat Fish breeding and recruitment	Commence to fill wetlands preferably in late spring/summer and winter over 45 days (min. 7 consecutive days): • 4 000–4 500 ML/day at Bugilbone • Greater than 4 600 ML/day at Boggabri (for Barbers Lagoon) • Greater than 3 300 ML/day at Duncan's gauge	1 in 2–5 years (varies between native fish species)	Target at Bugilbone only met for min. 7 consecutive days (in winter) Other targets not met	Not met	Not met	Not met	Moderate Demands have not been fully met in the last three years.	Improve	Environmental water could contribute to meeting this demand in conjunction with other flows.	Low	Very Low	
												Low	

Environmental assets	*Physical and process assets*	Indicative demand (for <u>all sources of water</u> in the system)	Required frequency (maximum dry interval)	Watering history (from all sources of water) [4]				2016–17			Implications for future demands		
				2012–13	2013–14	2014–15	2015–16	Predominant urgency of environmental demand for water	Purpose under <u>high</u> / <u>very high</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016–17	2018–19 Range of likely demand	Met in 2017–18 / Not met in 2017–18
				(drying)	(dry)	(dry)							
Peel River channel [3]	Habitat Water quality Fish resilience, movement, spawning and recruitment Connectivity Wet low level-benches and point bars	Baseflows: • Minimum variable low baseflow greater than 3 ML/day) from Chaffey Dam • Pulsed baseflow (~500 ML/day) from Chaffey Dam	Annually	Min. baseflows met	Min. baseflows met	Min. baseflows met	Min. baseflows not met	High Min baseflows not fully met in 2015–16 Pulsed baseflow requirements have not been met in the last two years.	**Improve**	Minimum baseflows would be met by other water under a wet scenario.	Moderate	Moderate	Moderate
				Pulsed baseflows met for only 4 days in July 2012	Pulsed baseflows met for 1 day in August 2013	Pulsed baseflows not met	Pulsed baseflows not met			Environmental water could contribute to pulsed baseflow releases from Chaffey Dam	Moderate	Low	Low
												High	High
	Connectivity Water quality Fish spawning, recruitment, movement and condition	Fresh flow (1 000–4 000 ML/day) to provide connectivity and wet medium-level benches, point bars and riparian zone	2–3 years Average return interval	Flows greater than 1 000 ML/day over 3 days in July 2012	Not met	Not met	Not met	High Demand has not been met in last three years.	**Improve**	Environmental water could contribute to this demand if allocations become available and if delivered in conjunction with other water.	Low	Very Low	Very Low
												Low	Low
									Carryover potential	Due to small holdings, low to moderate proportion of allocations carried into 2016–17. *NOTE: No carryover provisions in the Peel Valley.*	Low to moderate proportion of allocations may be carried over to 2017–18, but will depend upon resource availability and demands.	Level of carryover will depend on environmental demands and resource availability.	
									Trade potential	Potential for purchases to augment water for the environment in a number of catchments in the northern Murray-Darling Basin to meet high environmental water demands (particularly in the Macquarie Marshes, Lower Balonne/Narran Lakes and Border Rivers). Further information will be provided to the market ahead of any trade of Commonwealth environmental water.			

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- means low demand for water i.e. water generally not needed that particular year
- means 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 below, planning allows the 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.

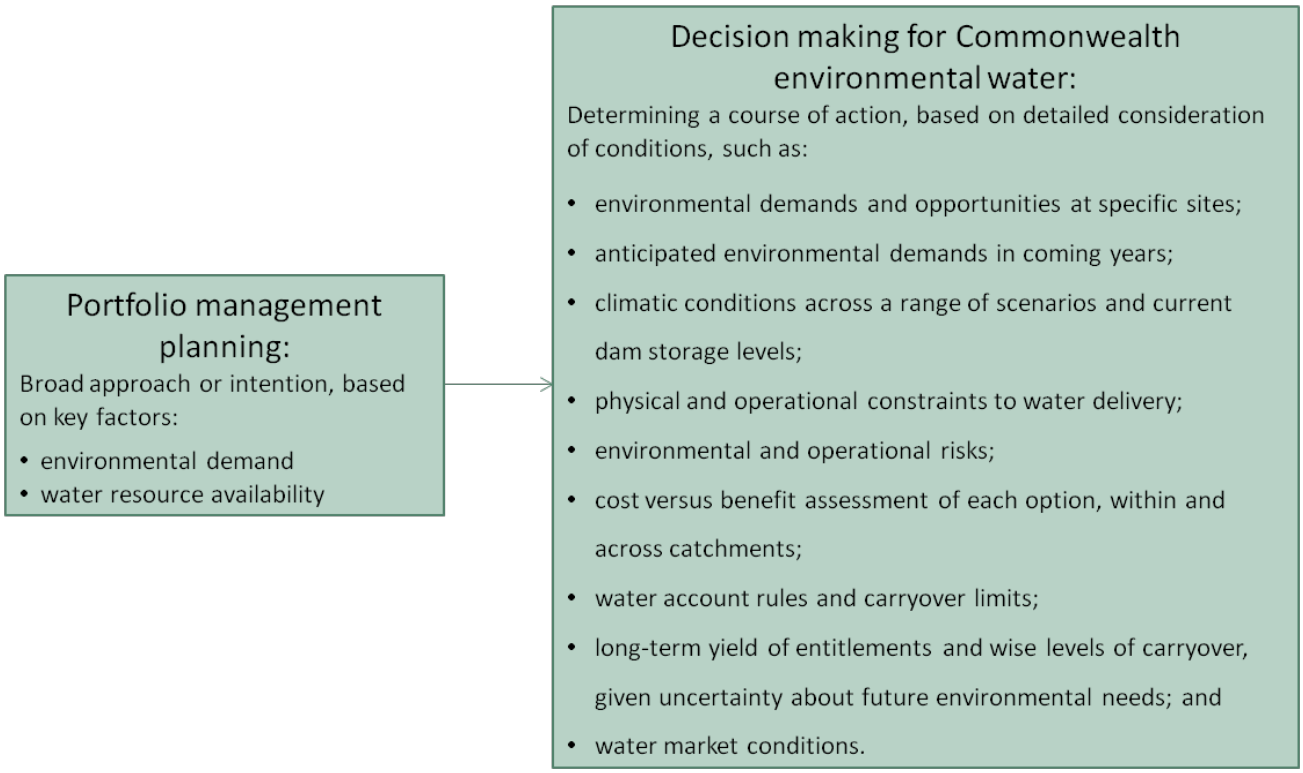

Figure 4: Planning and decision making for Commonwealth environmental water use

3.2. Further information

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

- 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: *Discussion Paper – Trade of Commonwealth Environmental Water* and *Commonwealth Environmental Water Trading Framework:* 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 catchment 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 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 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 in 2016)
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
Namoi (Gunnedah to Walgett)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peel River downstream of Chaffey Dam		Yes		Yes	Yes	Yes	Yes
Namoi River upstream of Keepit Dam		Yes		Yes	Yes		No

Attachment B – Library of watering actions

Operational considerations in the Namoi River Valley

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 2016b)
- Chaffey Dam storage capacity of 102 868 ML and outlet capacity of 1 100 ML/day (WaterNSW 2016a)
- 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)

In the Namoi River, Commonwealth environmental water will be carefully coordinated with unregulated flow events to deliver freshes and appropriate flow recessions. 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.

If dam levels improve Commonwealth environmental water deliveries could be coordinated with a NSW stimulus flow in the Peel River 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 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. 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 or 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

<table>
<tr><th rowspan="2">Broad Asset</th><th rowspan="2">Indicative demand</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 rowspan="3">Lower Namoi River channel</td><td rowspan="2">Small flows (minimum flows and baseflows):
8 ML/day at Boggabri and 13 ML/day at Wee Waa
72 ML/day at Boggabri and 105 ML/day at Wee Waa (Dec–June)
215 ML/day at Boggabri and 260 ML/day at Wee Waa (July–Nov)</td><td>1. Minimum baseflows: contribute to minimum flows during dry periods to provide refuge habitat and maintain resilience.</td><td colspan="3"></td></tr>
<tr><td colspan="2">2. High and low season baseflows: contribute to baseflows to refresh and maintain pools as refuge, manage water quality, and provide hydrological connectivity, allowing fish movement and building population resilience.</td><td colspan="2"></td></tr>
<tr><td>Medium flows:
500 ML/day at Bugilbone for 75 days (min. 25 consecutive days) preferably in late spring/summer and late winter</td><td></td><td colspan="2">3. Providing hydrological connectivity: contribute flows (freshes) to supplement river flows to inundate low level structures and provide longitudinal connectivity and access to habitat for native fish, which would also achieve movement, spawning and possible recruitment in some species.</td><td></td></tr>
<tr><td>Large flows:
1 800 ML/day at Bugilbone for 60 days (min. 6 consecutive days) preferably in late spring/summer and late winter
1 400–2 870 ML/day at Boggabri and 1 500–3 150 ML/day at Wee Waa in Sept–Dec for</td><td colspan="2"></td><td colspan="3">4. Managed flow recessions: contribute flows (freshes) to extend the duration and recession of unregulated flows to provide instream habitat, support native fish (movement, spawning, recruitment and condition), and maintain ecosystem function and longitudinal connectivity.</td></tr>
</table>

	min. 7 days			
Wetlands / Anabranches	Commence to fill wetlands preferably in late spring/summer and late winter over 45 days (min. 7 consecutive days): • 4 000–4 500 ML/day at Bugilbone • Greater than 4 600 ML/day at Boggabri (for Barbers Lagoon) • Greater than 3 300 ML/day at Duncan's gauge		*5. Connectivity with anabranches:* contribute flows to supplement natural unregulated freshes to connect the river with low commence to flow anabranches, provide off channel habitat, support riparian vegetation, and support fish movement, spawning, recruitment and condition.	
Peel River channel	Baseflows: • Minimum variable low baseflow (greater than 3 ML/day) from Chaffey Dam • Pulsed baseflow (~500 ML/day) from Chaffey Dam	*6. Variable baseflows:* Contribute to a variable baseflow, likely during or after a period of low flows, to provide refuge habitat, maintain resilience, provide hydrological connectivity, and maintain water quality, as well as fish movement and population resilience.		
	Fresh flow (1 000–4 000 ML/day)		*7. In-channel freshes:* Contribute to freshes in conjunction with other flows to provide habitat, support ecological processes, maintain riparian vegetation, and support fish movement, spawning, recruitment and condition	

Note: Under certain resource availabilities, options may not be pursued for a variety of reasons including that environmental demand may be met by unregulated flows and that constraints and/or risks may limit the ability to deliver environmental water.

Potential watering actions – standard operating arrangements

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

Action 1. Lower Namoi River minimum baseflows

Watering action: Contribute to minimum flows (including low flow variability) in the Lower Namoi River during dry periods to provide refuge habitat and maintain resilience. This action would contribute to maintaining flows and preventing a no flow situation.

Standard operational considerations:

- Environmental water would be delivered from Keepit Dam as in-channel flows, and will be 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).
- 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 Bugilbone. The actual extent achieved will depend on antecedent conditions and availabile 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, 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.

Action 2. Lower Namoi River high/low season baseflows

Watering action: Contribute to baseflows in the Lower Namoi River to refresh and maintain pools as refuge, manage water quality, and provide hydrological connectivity, allowing fish movement and building population resilience.

Standard operational considerations:

- Environmental water would be delivered from Keepit Dam as in-channel flows, and will be 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).
- The delivery rate will depend on season and antecedent conditions, and could 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 Bugilbone. The actual extent achieved will depend on antecedent conditions and water availability.

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

Action 3. Providing hydrological connectivity

Watering action: Contribute flows (freshes) to supplement river flows to inundate low level structures and provide longitudinal connectivity and access to habitat for native fish, which would also achieve movement, spawning and possible recruitment in some species.

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

Standard operational considerations:

- Environmental water would be delivered from Keepit Dam as in-channel flows, and will be 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, with the potential to coordinate releases to augment end of system flows to the Barwon-Darling system.

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

Action 4. Managed flow recessions in the Lower Namoi River

Watering action: Contribute flows (freshes) to extend the duration and recession of unregulated flows or water deliveries to provide instream habitat, support native fish support native fish (movement, spawning, recruitment and condition), and maintain ecosystem function and longitudinal connectivity.

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

Standard operational considerations:

- Environmental water would be delivered from Keepit Dam as in-channel flows, and will be 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 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, with the potential to coordinate releases to meet end of system flow requirements in the Barwon-Darling system.

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

Action 5. Connectivity with wetlands/anabranches in the Lower Namoi

Watering action: Contribute flows to supplement natural unregulated freshes or other water to connect the Namoi River with low commence to flow anabranches, provide off channel habitat, support riparian vegetation, and support fish movement, spawning, recruitment and condition.

Standard operational considerations:

- Environmental water would be delivered from Keepit Dam as in-channel flows, and will be managed within standard water delivery arrangements.
- This action would be delivered in conjunction with a natural unregulated flow event (likely in the order of 2 000–4 000 ML/day.
- 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 may 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.

Typical extent: This watering action would contribute flows to low commence to flow anabranch channels in the Lower Namoi River system. Providing a reconnection flow is important for native fish outcomes.

Approvals: Consult with NSW agencies (WaterNSW, OEH and DPI Fisheries), Local Land Services, peak irrigation bodies and landholders before implementing this action.

Action 6. Variable baseflows in the Peel River

Watering action: Contribute to a variable baseflow in the Peel River, likely during or after a period of low flows. This will provide refuge habitat, maintain resilience, provide hydrological connectivity, and maintain water quality, as well as fish movement and population resilience.

Standard operational considerations:

- Water will be delivered to the Peel River from Chaffey Dam as in-channel flows, and will be 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 the Namoi River.

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

Action 7. In-channel freshes in the Peel River

Watering action: Contribute to freshes to the Peel River, in conjunction with other flows to provide habitat, support ecological proceses, maintain riparian vegetation, and support fish movement, spawning, recruitment and condition.

Standard operational considerations:

- Water will be delivered in conjunction with other in-stream freshes or water sources, such as tributary flows or a Water Sharing Plan stimulus flow. Stimulus flows only occur from Chaffey Dam when certain storage conditions are met. In the absence of a stimulus flow, releases of environmental water will be timed to take advantage of tributary inflows or other water delivery/transfers.

- Water will be delivered to the Peel River from Chaffey Dam as in-channel flows, and will be 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 the Namoi River.

Approvals: Consult with NSW agencies (WaterNSW, OEH and DPI Fisheries), Local Land Services, peak irrigation bodies and landholders before implementing this action.

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 http://www.environment.gov.au/water/cewo/about/water-holdings 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 2016a) 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. This end of system flows can be suspended if dam levels drop below a set volume. Due to the current dry conditions these end of system flows are currently not being provided. 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 (NSW Government 2010) has provision for a stimulus flow of 1 600 ML to be released from Chaffey Dam under certain conditions. A 5 000 ML environmental contingency allowance has been created with the recent increase in the capacity of Chaffey Dam to just over 100 000 ML. How this environmental contingency allowance will be managed is still being determined by the NSW Government.

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