Managing resumption of flow

Proposed amendments to the Barwon-Darling unregulated water sharing plan to manage the resumption of flows

Why the proposed change

The first flow of water after a dry period has important social, cultural and environmental outcomes. This proposed rule reflects the need for the river to resume flowing and protects the first flows after an extended dry period.

The Barwon-Darling River is unregulated by large dams and the first flows after a dry period are particularly important. These first flows have cultural benefits to Aboriginal communities who have an association with the river. They are also important for local communities who rely on this water for human needs and for their stock. Local economies can be affected by the limited recreational and social opportunities during dry periods.

Low flow periods can stress aquatic biota that are surviving in refuges such as pools behind weirs and natural pools. These pools are often disconnected from each other during dry periods. Water quality in these pools degrades during no flow periods, typically putting the animals that rely on the river under significant stress. Protecting the first flow of water after a dry period will help maintain vital refuge pools for water dependent biota in dry times and may help to maintain water quality. Finally, by wetting the river channel with the first flows, we can help reduce water losses from any larger flows that follow.

The key aim of the resumption of flow rule is to protect the critical first flows after an extended low flow or dry period. The rule is triggered when a flow event occurs after a continuous period of dry or low flow conditions, and prevents water users from accessing the first flow for a period of time. Normal access conditions then apply after the flow has reached the required target flows, as shown in Figure 1.

The option to use a section 324 order under the *Water Management Act 2000* to prevent access to flows will continue into the future, when it is in the public interest to do so. However, the new resumption of flow rule will offer water users greater certainty about which flows will be protected. It will also reduce the frequency of use of section 324 orders, which tend to be applied at short notice.

Figure 1: Concept of resumption of flow rule

What changes are proposed to the water sharing plan

Currently the water sharing plan uses commence-to-pump (on a rising river) and cease-to-pump (on a falling river) thresholds as the main way to protect low flows. These thresholds don't directly provide for the first flows after an extended dry period to pass downstream without extraction and reach towns on the lower reaches of the river such as Wilcannia.

The resumption of flow rule will be applied in four rivers sections, measured at Walgett, Brewarrina, Bourke and Wilcannia. The general rule is as follows, detailed in the appendix and demonstrated in Figure 2:

- Access will be prohibited when the flow in that river section has been less than the flow equivalent of 200 ML/day at Wilcannia for greater than 90 days, even if the commence-to-pump thresholds have been met.
- Standard access conditions resume when a flow event is forecast to be received in that section and all downstream sections of at least the flow equivalent of 400 ML/day at Wilcannia for a minimum of 10 days, or if a total flow of 30,000 ML is forecast to pass Bourke since the commencement of the suspension.
- An operational forecast that considers conditions at the time will be used to decide if sufficient flow has occurred in an upper river section to meet the targeted 30,000 ML of accumulated volume at Bourke.
- If access is suspended in a river section, access in all sections upstream will also be suspended to ensure that flows that could contribute to the downstream section are protected.
- If access is reinstated (rule relaxed) in a lower river section due to a tributary inflow to that section, upper sections would remain suspended if they still meet the conditions to suspend access for that section.

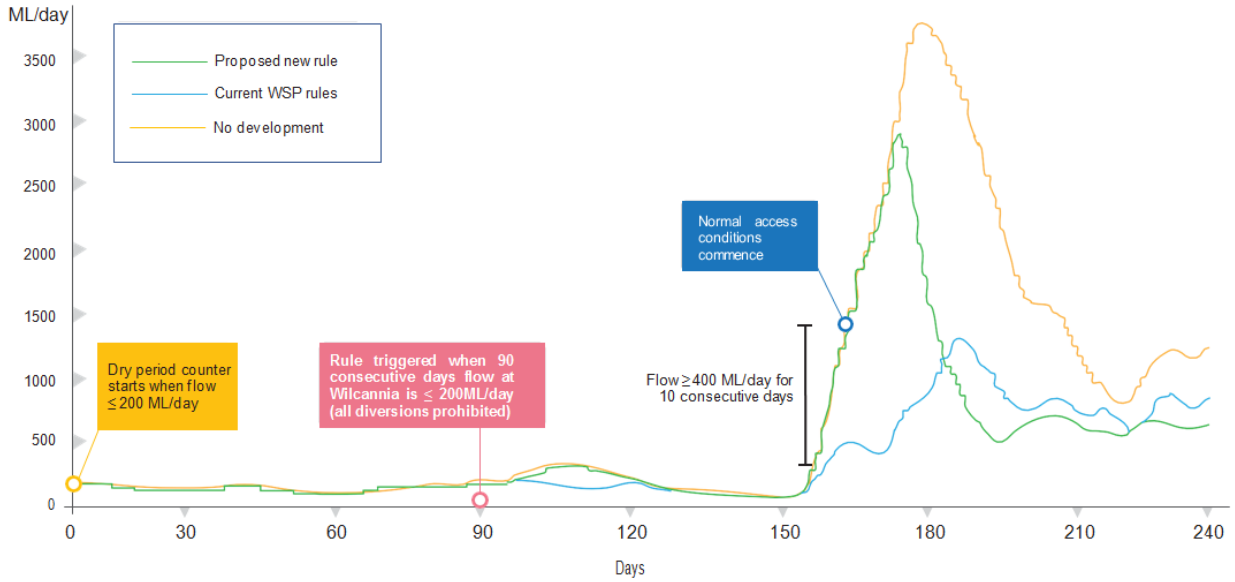

Figure 2: Example of flow with the resumption of flow rule at Wilcannia

This example compares the resumption of flow rule at Wilcannia with the current water sharing plan rules and no development modelled flows. In this simulation, a small pulse was protected between 90 and 120 days, as was the rising of the river after 150 days. The rule was relaxed and normal access conditions resumed at approximately 160 days, which is after the flow had been above 400ML/day for 10 continuous days. The simulation shows that the resumption of flow rule does as it is intended and protects the first flows after a dry period, when compared to the current water sharing plan rules (approximately between 160 to 170 days). After the resumption of flow rule is relaxed, normal access conditions are allowed and flows subsequently decrease. Under the current water sharing plan rules, water extraction reduces the initial rising of the river and a smaller peak occurs after 180 days.

What it means for licence holders

Our modelling of the package of proposed rule amendments (including the multi-sectional resumption of flow rule and the distribution of individual daily extraction limits) changes the access to the long-term average diversion volume as follows: A class -0.7%, B class -0.1% and C class -1.6%, with a total diversion of -0.5%.

An independent analysis of the cost of the resumption of flow rule in terms of changed irrigated production gives an estimated cost over the next 10 years of $774,000 for the whole water source, in terms of present day costs (based on a resumption of flow rule only for Wilcannia). The calculation of the economic cost to irrigators was based on the modelled volume of water diversions restricted by the rule, multiplied by the calculated gross margin per ML for irrigated cotton based on 2019 figures. These monetary costs experienced by the irrigation industry can also be presented as equivalent hectares not cultivated (368 ha) and the percentage change in hectares under production (-0.3%), over the entire10 year time period.

These estimates do not factor in the current and historical practice of restricting access through temporary water restriction orders (section 324 orders) in dry periods to meet critical water requirements. If these restrictions were included in the economic modelling, the nett costs would be significantly less.

Table 1 shows results of modelling the package of proposed plan rule amendments, had the resumption of flow rule been in place over the historical 119 year flow record. It shows the number of times that the rule would have been activated and the number of these events that would have been protected by temporary water restriction orders, based on current and historical practice by the NSW Government. The resumption of flow rule will replace a large portion of the temporary water restrictions expected in the future.

Table 1: Activation of resumption of flow rule compared to temporary water restrictions

Location	Number of times resumption of flow rule activated	Number of times a temporary water restriction would have applied	Number of additional water restrictions due to resumption of flow rule
Walgett	26	20	6
Brewarrina	26	19	7
Bourke	22	16	6
Wilcannia	18	14	4

The benefits of the resumption of flow rule

Ecological modelling indicated that the resumption to flow rule had to be designed carefully, so that improvements gained by protecting the initial smaller flows do not create significant additional extraction pressure on the subsequent larger flow events. This rule was designed to have the most potential to improve watering of the environment at very low flows without compromising the environmental benefits of higher flows.

Protecting the first flows after a dry period also provides important social and cultural benefits to the communities of the Barwon-Darling region. These include mental and general wellbeing from simply viewing the flowing river, and being able to engage in recreational activities such as swimming, boating and fishing. Societal, recreational and local economic improvements were considered qualitatively when designing the proposed resumption of flow rule.

Natural Resources Commission recommendation

The final report by the Natural Resources Commission into the Barwon-Darling Water Sharing Plan recommends that the flow values used in the design of the resumption of flow rule align with the Environmental Water Requirements of the Barwon-Darling Long Term Water Plan (LTWP).

We will further evaluate the proposed resumption of flow rule before the 2023 remake of the Water Sharing Plan, and revise rules as necessary to achieve Plan objectives.

Have your say

We seek your comments on the proposed amendments to the Barwon-Darling unregulated water sharing plan.

Make a submission

Use our online form or send an email to make a submission. All submissions will be considered when finalising the plan. **Submissions close at 5 pm on Tuesday 29 October 2019.**

More information

The draft amended *Water Sharing Plan for the Barwon-Darling Unregulated River Water Source 2012* is available from https://www.industry.nsw.gov.au/barwon-darling-wrp

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Appendix

Multi – sectional resumption of flow rule characteristics

The application of the rule varies based on the minimum flow that triggers the rule to come into place in each river section, and the number of continuous days that the flow has been below that trigger value. For each section, these values are equivalent to 200 ML/d and 90 days at Wilcannia. The details of this rule are shown in Tables 2 and 3 below.

To remove the suspension of access, a flow of 400 ML/day must pass Wilcannia for 10 consecutive days, or the forecast total flow passing Bourke during the event must exceed 30,000 ML. The criteria can also be relaxed due to tributary inflows into the lower river sections, which is the reason for the multi-sectional rule design. The relaxing triggers for river sections 1, 2 and 3 are equivalent to those of Wilcannia. The relaxation triggers are shown in Table 4 below.

Table 2: River section characteristics of multi-sectional resumption of flow rule

Variable	Characteristic	Explanation[1]
Trigger condition – minimum flow	< 326 ML/day at Walgett	Bottom of base flow at Walgett
	< 468 ML/day at Brewarrina	Bottom of base flow at Brewarrina
	< 450 ML/day at Bourke	Bottom of base flow at Bourke
	< 200 ML/day at Wilcannia	Bottom of base flow at Wilcannia
Trigger condition – interflow frequency	150 days	Model equivalent of 90 days at Wilcannia
	150 days	Model equivalent of 90 days at Wilcannia
	120 days	Model equivalent of 90 days at Wilcannia
	90 days	High risk length of no flow for Wilcannia Town Water Supply is 120 – 150 days[2]
Relaxing condition – flow magnitude for 10 days	706 ML/day at Walgett	Top of base flow at Walgett
	1008 ML/day at Brewarrina	Top of base flow at Brewarrina
	972 ML/day at Bourke	Top of base flow at Bourke
	400 ML/day at Wilcannia	Top of base flow at Wilcannia
Relaxing condition – total flow at Bourke	30,000 ML forecast total flow past Bourke since the start of the suspension	Size of event likely to provide longitudinal connectivity from Bourke to Wilcannia is 20 GL[2]. Volume of 30 GL increases likelihood of event connecting to end of system (Lake Wetherell).

[1] This was the base flow information available at the time of rule development; more recent estimates are now available. The rule may be reviewed during evaluation of the water sharing plan as appropriate to consider these new values.
[2] Murray-Darling Basin Authority (2018), *Ecological needs of low flows in the Barwon-Darling; Technical Report*. Published by the Murray-Darling Basin Authority.

Table 3: Description of activation triggers for Barwon-Darling resumption of flow rule

	Criteria set at Section 1 (Walgett)	**Criteria set at Section 2** (Brewarrina)	**Criteria set at Section 3** (Bourke)	**Criteria set at Section 4** (Wilcannia)
Section 1 restriction is activated if:	If Section 1 flow has been below 326 ML/d for 150 days OR	If Section 2 flow has been below 468 ML/d for 150 days OR	If Section 3 flow has been below 450 ML/d for 120 days OR	If Section 4 flow has been below 200 ML/d for 90 days
Section 2 restriction is activated if:		If Section 2 flow has been below 468 ML/d for 150 days OR	If Section 3 flow has been below 450 ML/d for 120 days OR	If Section 4 flow has been below 200 ML/d for 90 days
Section 3 restriction is activated if:			If Section 3 flow has been below 450 ML/d for 120 days OR	If Section 4 flow has been below 200 ML/d for 90 days
Section 4 restriction is activated if:				If Section 4 flow has been below 200 ML/d for 90 days

River sections:

Section 1 = Mungindi to Walgett

Section 2 = Walgett to Brewarrina

Section 3 = Brewarrina to Bourke

Section 4 = Bourke to Wilcannia

Table 4: Description of relaxation triggers for Barwon-Darling resumption of flow rule

	Criteria set at Section 1 (Walgett)	**Criteria set at Section 2** (Brewarrina)	**Criteria set at Section 3** (Bourke)	**Criteria set at Section 4** (Wilcannia)
Section 1 restriction is relaxed:	If Section 1 is forecasted to have a flow of greater than 706 ML/d for 10 days at Walgett OR The cumulative flow past Walgett is forecast to cause a cumulative flow past Bourke greater than 30 GL AND	If Section 2 is forecasted to have a flow of 1008 ML/d for 10 days at Brewarrina OR The cumulative flow past Brewarrina is forecast to cause a cumulative flow past Bourke greater than 30 GL AND	If Section 3 is forecasted to have a flow of 972 ML/d for 10 days at Bourke OR The cumulative flow past Bourke is forecast to be greater than 30 GL AND	If Section 4 is forecasted to have: • a flow of 400 ML/d at Wilcannia for 10 days OR • a cumulative flow past Bourke (since start of restriction) greater than 30 GL
Section 2 restriction is relaxed:		If Section 2 is forecasted to have a flow of 1008 ML/d for 10 days at Brewarrina OR The cumulative flow past Brewarrina is forecast to cause a cumulative flow past Bourke greater than 30 GL AND	If Section 3 is forecasted to have a flow of 972 ML/d for 10 days at Bourke OR The cumulative flow past Bourke is forecast to be greater than 30 GL AND	If Section 4 is forecasted to have: • a flow of 400 ML/d at Wilcannia for 10 days OR • a cumulative flow past Bourke (since start of restriction) greater than 30 GL
Section 3 restriction is relaxed:			If Section 3 is forecasted to have a flow of 972 ML/d for 10 days at Bourke. OR The cumulative flow past Bourke is forecast to be greater than 30 GL AND	If Section 4 is forecasted to have: • a flow of 400 ML/d at Wilcannia for 10 days OR • a cumulative flow past Bourke (since start of restriction) greater than 30 GL
Section 4 restriction is relaxed:				If Section 4 is forecasted to have: • a flow of 400 ML/d at Wilcannia for 10 days OR • a cumulative flow past Bourke (since start of restriction) greater than 30 GL

Summary of considerations when developing the rule

Table 5 summarises the issues that were considered when developing the rule and the performance of the rule in addressing these issues.

Table 5: Assessment criteria of proposed resumption of flow rule for the Barwon-Darling

Criteria	Feature	Value	Performance
Hydrology	Interflow duration (at Wilcannia)	90 days	High risk length of no flow for Wilcannia Town Water Supply is 120 – 150 days.[3]
	Commencement trigger (at Wilcannia)	200 ML/day	Maintains flows below the base flow for longer than a CtF trigger.
	Section 324 comparison	no. of expected and additional events (Wilcannia)	At Wilcannia, the expected number of events due to the resumption of flow rule is 18 over the entire flow record (119 years), of which 14 would be covered by s324 under current and historical practice i.e. 4 additional events with access suspended over modelled historical record.
	Total flow forecast at Bourke	30,000 ML	Size of event likely to provide longitudinal connectivity from Bourke to Wilcannia is 20 GL[1]. Volume of 30 GL increases likelihood of event connecting to end of system (Lake Wetherell).
Long term ecological assessment	Preferred options, in order B16, A14, A15	A14 is 2nd choice	Provides potential to improve ecological outcomes at low flow without compromising other flow categories: • Minimise loss of weir and refuge pools as important habitat, • Maintain water quality of weir and refuge pools.
Economic analysis	Cost impact of A14	-$774,000 (NPV for 10yrs)	Equivalent to 368 hectares per year of lost cultivation or reduction in the average hectares planted of 0.3%, incremental to the base case.
Water Quality	Salinity dilution	400 ML/day	Flow will lower EC while flow occurs along the water source.
	Salinity flush	30,000 ML forecast at Bourke	Flow will provide a reasonable sized flush along the water source.
	Thermal de-stratification	400 ML/day	Flow required for destratification of the weir pool at Wilcannia is 200 ML/day, and 450 ML/day at Bourke.[4]

[3] Murray-Darling Basin Authority (2018), *Ecological needs of low flows in the Barwon-Darling; Technical Report*. Published by the Murray-Darling Basin Authority.
[4] Mitrovic, S.M., Oliver, R.L., Rees, C., Bowling, L.C., and R.T. Buckney (2003), Critical flow velocities for the growth and dominance of *Anabaena circinalis* in some turbid freshwater rivers, *Freshwater Biology*, **48**, 164-174.

	Thermal de-stratification & Blue Green Algae (BGA)	10 days of flow (before rule is relaxed)	Will provide protection from BGA during the 10 day period of the event (and subsequent 4 days until thermal stratification re-establishes after cease to flow).[2]