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**Connectivity Stakeholders Reference Group  
Comments on Discussion Paper Options and Other Issues**

**Introduction**

Inland Rivers Network (IRN) welcomed the opportunity to participate in the three meetings of the Connectivity Stakeholders Reference Group and contributes the following comments on the issues raised and options under consideration to improve the health of the Barwon-Darling/Baaka.

The key message for improvement in river health and rebuilding ecological resilience is to prevent prolonged, unnatural drought conditions before they reach crisis stage. This requires an overhaul of water management arrangements in the NSW Northern Basin tributaries and improved arrangements with Queensland tributary inflows as well as further improvements to water management within the Barwon-Darling/Baaka.

This submission outlines proposals for improvement in tributary inflows to reintroduce some natural pulses prior to and during prolonged dry events. It also provides comments on the options outlined in the discussion paper on critical dry condition triggers for s324 orders (Discussion Paper) and on options for updating the North-west Flow Plan.

The key message is to prevent the need for s324 orders by protecting natural pulses and medium to low flows from tributaries before critical dry conditions occur.

This will require a review of rules managing extraction through water access of supplementary flows, floodplain harvesting and tributary utilisation to meet water orders in regulated rivers.

The sustainable management of rivers systems and mitigation of risk of critical water shortages must be clearly linked in the decision-making process.

## **1. Draft Triggers for s324 order**

IRN considers that the proposed draft triggers for s324 orders intended to provide flows to the Barwon-Darling/Baaka and prevent critical ecological damage and provide critical human needs are not precautionary.

The proposed targets will fail to prevent further ecological damage to a river system that has already suffered ecological collapse.

They do not provide for the whole length of the river. The proposed triggers are when the river is already under stress and will do too little to reduce that stress. The proposal to restrict application of s324 orders then to lift them so that only a tiny target volume of water reaches Wilcannia (4000 ML), unless more is required by Menindee triggers, is quite unacceptable. An alternative approach is needed to limit stress on ecosystems caused by dams and water extraction more effectively. See below comments on Water Sharing Plan rules.

As noted on page 8 of the Discussion Paper “*The critical time for intervention is before water conditions reach a tipping point.*”

### **1.1 Critical conditions**

IRN is very concerned that the current proposal is for the Minister to wait until environmental conditions have become critical and are at a tipping point when a catastrophe is almost predictable, or until drought conditions have reached Drought Stage 4, before using s324. The proposal then fails to cover many of the situations in which protection of such flows as might naturally occur when there is heavy rain could prevent long-lasting environmental degradation. It does not recognise that the Barwon-Darling/Baaka ecosystems and associated cultural values are still in very poor health. We are pleased that the proposed s324 orders are to apply to all commercial water extraction including floodplain harvesting but alarmed that there is no clear plan to restrict floodplain harvesting sooner. In this context, we are concerned that this proposal to set rules to trigger and lift s324 orders is intended to deter future Ministers from using their discretion to provide stronger or earlier protection.

This proposal is to put critical human needs ahead of critical environmental needs rather than maintaining the priority set by the Water Management Act. Section 324 enables orders to protect water for environmental needs generally, as well as other needs. If it was initially used at an earlier stage in an attempt to prevent environmental conditions becoming critical then the river system and downstream communities would be at less risk. For example if other controls on floodplain harvesting and use of large pumps have not enabled large volumes and high flows to pass through the river system for over a specified period (1 year or whatever scientists recommend) a S324 order applying to floodplain harvesting and other high-volume users should be applied to protect the next lateral-connectivity event. If critical situations for either people or the environment are developing, s324 orders applying to all commercial use should then also be used.

### **1.2 Examples of critical environmental requirements**

- failure of short-lifecycle animals (e.g. many small fish species) to breed over a period long enough to put local populations and the food chain they support at serious risk;
- high salinity levels in extensive or unnatural localities

- lack of flow connections between natural pools for sufficiently long periods that populations of mature aquatic animals needed for future breeding are significantly reduced (e.g. die from lack of food, poor water quality or lack of water and/or inability to move to better locations). We note in relation to evaporation breaking large refuge pools into smaller ones that species survived for millennia in pools of natural sizes. So pools the size and depth of weir pools would not be required as large refuges if there were connecting flows of near-natural frequency

### **1.3 Cultural flows and values**

The Discussion Paper refers to a need to undertake further work to understand cultural needs in the context of an extended drought and first flush, however no estimates of water for native title rights and cultural water requirements are considered for the draft triggers.

It was clear from the information provided by DPIE Water in the first stakeholder consultation that the entire length of the Barwon-Darling/Baaka River had never experienced dry riverbed conditions in recorded history to the extent experienced in the 2017-2020 drought.

If the cultural, social and economic impact of those dry riverbed conditions to river communities downstream of Bourke during the 2017-20 drought was measured, the results were not provided to the stakeholder reference group.

The extent of the dry riverbed conditions that prevailed during the 2017/20 drought must be avoided, therefore the triggers proposed in this draft discussion paper must be significantly lifted along with other long-term solutions to improved water management

### **1.4 Cease to flow period of 120 days at Wilcannia**

This draft trigger for critical environmental needs is not adequate. The opportunity to prevent critical environmental conditions developing, and therefore the opportunity to prevent a catastrophe, may have been missed by the time the proposed rule is to apply, for example if the river has recently ceased to flow and most of what later turns out to be the only substantial flow event for 6 or 12 months was allowed to be extracted. Section 324 orders are needed to reduce the likelihood of the river reaching the 120-day maximum cease to flow period referred to, not only after that maximum has been exceeded. We do not consider that it is acceptable for that period to be exceeded when it is possible to prevent this because we note that the 120-day period proposed was based on 1990 to 2016 data. In that period dams and extraction greatly increased dry periods relative to the natural drying to which ecosystems are adapted<sup>1</sup>. DPIE's predictions of increased drought severity and reduced opportunities for getting flow into the Barwon-Darling/Baaka from its tributaries are sufficient basis for a much more precautionary approach.

We propose that a Section 324 Order to all commercial users should apply if either of three circumstances occur at Wilcannia:

- If the Darling/Baaka has ceased to flow or if it is otherwise likely to cease to flow, or
- If the flow at Wilcannia has been or is likely to otherwise be lower than 250 ML/day for over 90 days, or

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<sup>1</sup> Mallen-Cooper, M. and Zampatti, B. (2020) *Restoring the ecological integrity of a dryland river: Why low flows in the Barwon–Darling River must flow*. Ecological Management & Restoration VOL 21 NO 3

- If flow at Wilcannia has not exceeded 10,000 ML/day for over 12 months then protect whatever runoff events occur in its catchment that could produce a flow of over 5000 ML/day at Wilcannia until either a flow event exceeding 10,000 ML/day or events exceeding 5000 ML/day for at least 15 days have occurred.

We note that implementation of the revised North-west Flow Plan rules together with the recently revised Barwon-Darling WSP rules should limit the frequency of these situations occurring but will not always prevent them. Similarly, implementing these s324 triggers will keep Menindee Lakes above its trigger level for longer.

The scientific basis for the second rule is the work of Mallen-Cooper and Zampatti which explains the importance of maintaining sufficient flow to provide the lotic conditions with water movement required most of the time for the species and perennial ecosystem that characterise the Barwon-Darling/Baaka to survive. Their research determined that 250 ML/day is a critical flow rate at Wilcannia, below which lentic (lake-like still water) conditions tend to occur. We propose that the latter rule apply after 90 days to fit in with the resumption of flow rule in the Barwon-Darling/baaka WSP but consider 250ML/day is a more appropriate, scientifically based environmental trigger level.

The third rule is based on the importance of large in-channel flow pulses that inundate mid-high level in-channel surfaces and associated habitat for fish and invertebrate breeding, riparian vegetation health and to mediate nutrient transfer (Sheldon 2017 p17). At Wilcannia flows of around 10,000 ML/day are required to achieve this. Mallen-Cooper and Zampatti have shown that flows of this magnitude used to occur even in droughts: events of about 8-12,000 ML/day occurred with a frequency slightly less than once per year during two long extreme historical droughts. Flow events of this frequency in the two most recent droughts were reduced to less than 800 ML/day. When there has been no flow of this magnitude for a year the next one should be protected but there is no point waiting for the perfect event so protection of somewhat smaller events may be needed. The flow pulse should be of sufficient duration to provide multiple benefits. DPIE should use all relevant science as its basis for recommending minimum duration characteristics.

### **1.5 Triggers for other Barwon-Darling/Baaka locations**

The current proposed draft trigger at Wilcannia does not consider condition and flows in the Barwon. We note that the possibility of a target at Bourke is being considered. Targets for Brewarrina, Walgett and Collarenebri are also needed because they are above some tributary inflows that may reach Wilcannia and improve conditions there such that s324 is not triggered, but do nothing to prevent critical conditions occurring in these upper reaches. Each river reach between tributaries must have its own targets. A cease to flow of any duration at these locations should trigger an s324 order for the river and tributaries upstream. Flows dropping below the flow rate at which the relevant river reach tends to become lentic should be a second trigger at each location (possibly 250 ML/day for Walgett<sup>2</sup> but different rates might be applicable at the other 4 locations, calculated by the appropriate scientific technique). The duration of flows below the trigger level before s324 applies should be based on a scientific assessment of the ecosystem's needs. A third trigger to protect the next large fresh if there has been none of that magnitude for over 12 months should also be established for each location.

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<sup>2</sup> Mallen-Cooper and Zampatti 2020 page 221

Timing of tributary inflows along the length of the Barwon-Darling must be factored in along with travel times for flows, notably when the riverbed and banks are dry and the thirsty environment takes in part of its share. While it was found in 2020 that flows take 50 days to reach Wilcannia from Mungindi, many earlier flows in drought situations should also be assessed and a precautionary approach applied.

### **1.6 Duration and lifting of these s324 orders**

Whole events including tails should be protected to minimise risks to riverbanks, to biota adapted to gradual recessions, and the water left in large pools being of poor quality. This applies to both the larger and smaller flow events.

The lifting of S324 orders should not occur on the basis of a tiny-size fits all rule set years in advance. Any indication of when an order will be lifted should be accompanied by a statement that the Minister will consider, before deciding when to lift the order,

- results of on-ground monitoring of the river's current condition,
- what flows have actually reached the sections of river where ecosystems or human needs for quality water are at risk and how much more water will arrive, and
- scientific advice on the effectiveness of the particular flows protected in satisfactorily improving its condition and before deciding when to lift the order.

The proposal to lift an order when just 4000 ML for Wilcannia is woefully inadequate, suggesting that the Government gives a disgracefully low priority to people and ecosystems below Bourke, and ignores scientific recommendations. Sheldon<sup>3</sup> identified the need for a flow above the natural 80<sup>th</sup> percentile for 25 days at least once per year (about 360 ML/day at Wilcannia). Small flow pulses “inundate low-level in-channel surfaces and associated habitat – important for maintenance of fish and invertebrate populations”. Sheldon drew attention to the risk that small fish species with a life span of less than 3 years are very important in this river's ecosystem. Several of these species require small flow pulses to reproduce successfully and grow into adults: these species are therefore vulnerable to local extinction if small flow pulses of sufficient duration do not occur. Some species may spawn in response to flows in spring while others prefer November to March flows but flows of less than 20 days may mean very few hatchlings survive. Flows at other times may assist growth. Therefore, if part of the river ceases to flow, or if flows are reduced from lotic to lentic conditions for long enough to trigger a S324 order, the next opportunity to protect a flow that achieves the 80<sup>th</sup> percentile for a minimum of 25 days should be taken by not lifting the order until that flow is assured.

For the Wilcannia river reach, that means aiming for over 361 ML/day for 25 days as a minimum. 400 ML/day for at least 25 days would be a safer target given the difficulties of ensuring sufficient flow arrives there. It should be expected that a longer period of flow protection might be needed in the later stages of a severe drought.

### **1.7 Menindee Lakes fall below 195 GL capacity**

Travel times for flows must be factored in before Menindee Lakes reach a low capacity level.

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<sup>3</sup> Sheldon, F. (October 2017). Characterising the ecological effects of changes in the ‘low-flow hydrology’ of the Barwon-Darling River. Advice to the Commonwealth Environmental Water Holder Office. Australian Rivers Institute, Griffith University. page 37

If there is a 55 GL level of unusable dead storage in Menindee Lakes, this trigger level needs to be reconsidered in regard to the flushing flow releases to the lower Baaka-Darling.

250 GL is a more appropriate lower level for Menindee Lakes. The proposed reconfiguration of the lakes under the Murray-Darling Basin SDL Adjustment Mechanism must also be factored into water levels to meet connectivity requirements through the entire river system.

### **1.8 Northern valley and/or Barwon-Darling in critical stage 4 drought**

This draft trigger is more to do with critical human needs. Ecological needs must be provided greater access to a variety of flow rates to prevent critical conditions being reached at the beginning of a prolonged drought.

## **2. Flushing flow release in lower Baaka-Darling**

The proposed draft triggers for flushing flows in the lower Baaka-Darling are at a critical stage for freshwater ecology and need to be improved. Flushing flows must occur before fish are gasping for oxygen. Stress levels for different freshwater species must be better understood and prevented.

While stratification of pools can be normal in Summer with high day time temperatures, these normally remix during cooler nights. Prolonged stratification of large pools needs appropriate size flows and duration to remix before fauna are stressed.

### **2.1 stratification of refuge pools**

The larger the refuge pool, the more flow is needed to provide mixing, flushing and reoxygenation.

### **2.2 dissolved oxygen levels**

< 5mg/L and falling – too late

Flow times for releases to reach critical refuge pools must be considered. The period of time between flows and the relationship between pool stratification, algal presence and depleted oxygen requires action before the proposed dissolved oxygen levels are occurring.

### **2.3 blue-green algae levels**

> 4mm<sup>3</sup>/L and rising – too late

Flow times for releases to reach critical refuge pools must be considered. The period of time between flows and the relationship between pool stratification, depleted oxygen and presence of blue-green algae blooms requires action before the proposed blue-green algae levels are occurring. Blue-green algae can reach red alert levels very quickly with high temperatures and high evaporation rates.

### **3. North-west Flow Plan**

Meeting #3 of the Connectivity Stakeholder Reference Group focussed on the North-west Flow Plan and included options for consideration.

IRN considers the targets in the North-west Flow Plan were developed with good scientific evidence and with some small improvements are still the best set of flow triggers to improve the connectivity and health of the Barwon-Darling/Baaka Rivers.

It is essential that tributary flows are protected to flow into the Barwon-Darling/Baaka before critical ecological threat occurs.

#### **3.1 Options presented in Connectivity SRG meeting #3**

We note that the Alluvium Review Report of the North-west Flow Plan has not yet been released. We also note that some of the implementation barriers eg flow forecasts, are now available. The issue of fish migration and habitat protection is still an important flow issue, along with other freshwater species.

##### **3.1.1 Riparian Target**

IRN considers that the existing targets, while they may be no longer necessary to provide basic rights, are still important to prevent the Barwon-Darling/Baaka from reaching critical dry conditions because when implemented they protect inflows from all regulated tributaries, providing connectivity.

Presentations to Reference Group incorrectly stated that flows below 10,000 ML per day in the Border Rivers are protected from supplementary access. Only part of the rule was referred to. That part limits access by licensees upstream of Goondiwindi for the benefit of those with enormous pumps and storages downstream. The second part allows taking of flows down to 1550ML/2days (775ML/day) at Kanowna and the Weir River combined.

If part of the Barwon-Darling at any of the NW Flow Plan target locations is starting to dry up and rainfall produces substantial inflows to one or more of the tributaries sufficient should be protected to meet the target. This was how the Plan worked in the 1990s.

We support Option 1 but request that the targets for Bourke, Louth and Wilcannia be raised to above the natural 80<sup>th</sup> percentile to restore these low flows, provide small flow pulses and reduce salinity issues. We suggest at least 500 ML/day at Bourke which is the flow rate found to enable spawning there by Olive Perchlet (a threatened fish)<sup>4</sup>; 450ML/day at Louth and 400 ML/day at Wilcannia – the same Wilcannia target level as we propose for protection before s324 orders are lifted.

Resumption of flow rules should be extended at all locations to at least 25 days for the reasons given for s324 orders.

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<sup>4</sup> Sheldon (2017) p17

### 3.1.2 Algal Target

IRN supports a combination of Option 1 & Option 2

The existing algal suppression rule is about protecting flow before the river gets into a bad condition in case this is the last good flow.

The rule needs improvement because it does not require protection from 3 months before October if rule will not be satisfied by flows already going down the river.

Option 2 rule, while having some improved benefits, appears to only protect flows after the river is in a poor condition.

Needs to be occur in Spring & Summer not just autumn or all year round. Natural flows during this period need to be protected.

### 3.1.3 Fish Passage Target

IRN supports a combination of Option 1 & Option 2 so that there is a duration target at Bourke as well as at Brewarrina. Also, if the 15,000 ML flow cannot be achieved at Bourke then there is at least the possibility of 10,000 ML flow for 5 days between September and February.

The addition of spawning, as well as migration targets is supported. Habitat inundation and other important functions can be provided with the same events. Consideration should be given to achieving gradual recession after the specified period of high flows to maximise ecological benefits (e.g. reduce risk that fish will be suddenly stranded in temporarily inundated habitats).

Similar targets must also extend to other structures upstream, eg at Presbury, Mogil Mogil and Collarenebri on the Barwon. Detailed data and recommendations by NSW Department of Primary Industries<sup>5</sup> are available and should be implemented.

A report on the frequency and success of the North-west Flow Plan fish passage target would be useful to further consideration of this important flow rule.

## 3.2 Water Sharing Plan rules

### 3.2.1 Border Rivers Regulated WSP

The 2021 WSP for Border Rivers Regulated Water Source includes the targets of the North-west Flow Plan to inform supplementary licence access to uncontrolled flows. (Schedule 1)

This is to be reviewed by an independent expert panel to advise on amendments to the flow targets by 1 July 2023. IRN emphasises the comments made in this submission regarding improvements to those flow targets.

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<sup>5</sup> NSW Department of Primary Industries (April 2020) Mapping the Barwon River - Mungindi to Walgett: Aquatic Habitat Mapping to Inform Water Management. Report prepared for the Commonwealth Environmental Water Office



The Border Rivers are recognised to supply 18.5% of the long-term annual average flows to the Barwon-Darling/Baaka.<sup>6</sup>

The contribution of medium flows from the Border Rivers must be given a higher priority.

The current end-of-system flow rule of 100 ML/d at Mungindi between 1 September and 31 March is grossly inadequate to provide improved connectivity.

Rules to manage floodplain harvesting interception of medium flows and protection of uncontrolled flows critical to improving connectivity must be adopted. This must be recognised as a means of preventing the Barwon-Darling/Baaka reaching prolonged, unnatural dry periods, and ensuring that the important wetland and anabranch systems along the Barwon and the full length of the Darling/Baaka can perform their important ecological functions and provide cultural benefits.

### 3.2.2 Gwydir Regulated WSP

The 2019 WSP for Gwydir River Regulated Water Source includes the targets of the North-west Flow Plan to inform supplementary licence access to uncontrolled flows in the Mehi River, Carole Creek and downstream. (Schedule 1)

The Gwydir River is recognised to supply 6.3% of the long-term annual average flows to the Barwon-Darling/Baaka.<sup>7</sup>

There is no end-of-system flow rule. However, the Gwydir has been successfully used to provide critical connectivity flows using Held Environmental Water during the 2017 – 2020 worst drought on record for the Barwon-Darling/Baaka.

Improved protection of flows in the Gwydir streams that connect directly downstream, ie Mehi River, Moomin Creek and Carole/Gil Gil Creek, need to be considered.

Rules to manage floodplain harvesting interception of medium flows and protection of uncontrolled flows critical to improving connectivity throughout the Gwydir system must be adopted. This must be recognised as a means of preventing the Barwon-Darling/Baaka reaching prolonged, unnatural dry periods.

### 3.2.3 Namoi Regulated WSP

The 2020 WSP for the Upper and Lower Namoi Regulated Water Source includes the targets of the North-west Flow Plan to inform supplementary licence access to uncontrolled flows. (Schedule 1)

The Namoi River is recognised to supply 23.5% of the long-term annual average flows to the Barwon-Darling/Baaka.<sup>8</sup>

The contribution of medium flows from the Namoi River must be given a higher priority.

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<sup>6</sup> MDBA 2011

<sup>7</sup> Ibid

<sup>8</sup> Ibid

The minimum flow rules for end-of-system flow at Walgett are highly inadequate and need to be reviewed.

Rules to manage floodplain harvesting interception of medium flows and protection of uncontrolled flows critical to improving connectivity must be adopted. This must be recognised as a means of preventing the Barwon-Darling/Baaka reaching prolonged, unnatural dry periods.

#### 3.2.4 Macquarie Regulated WSP

There is no reference to the North-west Flow Plan targets in the 2020 WSP for the Macquarie-Cudgegong Regulated River Water Source.

The Macquarie River is recognised to supply 20.8% of the long-term annual average flows to the Barwon-Darling/Baaka.<sup>9</sup> End-of-system flow rules must be established in the Macquarie.

Rules to manage floodplain harvesting interception of medium flows and protection of uncontrolled flows critical to improving connectivity must be adopted. This must be recognised as a means of preventing the Barwon-Darling/Baaka reaching prolonged, unnatural dry periods.

### 3.3 Access to Tributary Utilisation Flows

The operational management practice of supplying water orders from tributary inflows must be closely examined. This operation, by WaterNSW, does not recognise rules set to manage supplementary licence access to uncontrolled flows.

The volume of water extracted from NSW Northern Basin Rivers through Tributary Utilisation announcements is a critical piece of information that has been undertaken to be provided to the Connectivity Stakeholder Reference Group.

In the interest of transparency in river management and water extraction, this information must be publicly released and considered in any reviews of targets and inflows into the Barwon-Darling/Baaka. This additional use of natural flows into regulated river systems must be analysed and better understood.

## 4. Base flow for ecological and human health

The provision of a variable base flow of up to 500 ML/d from tributary inflows should be protected in the Barwon-Darling to ensure that freshwater ecosystems and dependent species are not pushed to tipping point limits of resilience. An annual base flow of 500 ML/d has been calculated to be 182,500 ML. This is a very small proportion of water extractions from NSW Northern Basin tributaries and could be managed through translucency rules in water sharing plans.

The implementation of this improved river management would help to prevent prolonged critical stage drought conditions in the Barwon-darling/Baaka and reduce the need for s 324 orders.

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<sup>9</sup> MDBA 2011

## **5. Extraction in NSW Northern Basin tributaries**

The combined storages in the NSW Northern Basin tributaries capture 4,409,500 ML. The proposed 500ML/d base flow for the Barwon-Darling is only 4% of the total storage capacity.

This does not account for extraction under supplementary licences, floodplain harvesting and tributary utilisation access.

Natural flow triggers are essential for meeting ecological needs in rivers, wetlands and floodplains. While the purchase of water licences to meet some environmental needs and decrease extraction levels are useful, the held environmental licences are constrained under water sharing plan rules and cannot provide the same level of support for environmental requirements as planned environmental water and natural event triggers.

Rules in water sharing plans to allow for small translucent flows to be protected throughout regulated and unregulated river reaches, to allow for more natural flows to reach the full length of the Barwon-Darling/Baaka would help restore the ecological character and fish populations.

Pulse flows during dry times are critical to ensure that unnatural prolonged critical drought conditions never occur again.

## **6. Western Weirs**

The construction of larger weirs on the Barwon-Darling/Barkaa eg at Walgett and Wilcannia will have an impact on the size and duration of flows needed to meet targets the full length of the river system to Menindee Lakes.

Setting a target just for Wilcannia has had major consequences in the past. The 2018 ‘flushing flow’ left poor quality water in Wilcannia weir for over 12 months. Any flushing flows must pass through weir pools until better water quality is available. Salinity is a major water quality issue that must also be managed effectively for human and ecological health.