

# Barwon-Darling: low flow environmental watering impediments and opportunities

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The Department acknowledges the traditional owners of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

## Executive Summary

NSW is now developing Water Resource Plans for accreditation under the Basin Plan, which provides an opportunity for new arrangements to be considered. In this context, the Commonwealth Environmental Water Holder (CEWH) is seeking independent advice on the impediments to achieving low flow environmental outcomes in the Barwon-Darling, and potential options to protect environmental water under the Water Resource Plan being developed by NSW.

The water sharing plan for the Barwon-Darling unregulated and alluvial water sources 2012 (the Water Sharing Plan) largely carries forward the pre-existing water management arrangements, but does contain some new elements, the most important of which was the loss of A Class pump rate limits through the unbundling of licences and commencement of licence dealings that allow relatively unrestricted connection of licences and Works Approvals.

The Water Sharing Plan also provides for other new elements to be introduced, including Total and Individual Daily Extraction Limits (TDELs, and IDELs) that may provide an avenue for achieving event-based environmental outcomes.

The CEWH has identified a number of environmental low flow indicators that are generally in the range of 350 – 700 ML/day at various locations<sup>1</sup>, with one indicator at Bourke requiring 1,500 ML/day for a period of 14 days.

The key impediments to achieving event-based environmental flow outcomes generally are:

- the nature of unregulated licences makes water recovery less useful than regulated systems (incl. shepherding),
- upstream flow constraints in regulated tributaries, and
- the degree of take permitted during low flow periods under the Water Sharing Plan – particularly by A Class licences.

These various impediments to achieving environmental flow targets have combined to limit the outcomes that can be achieved by the Basin Plan. However, for environmental outcomes at low flows, there is still an opportunity to use the limited capacity to deliver planned and held environmental water from the upstream regulated tributaries – the Border, Gwydir, and Namoi in particular. If environmental water can be delivered from the regulated Namoi and Gwydir tributaries at rates that are below the existing B Class Commence-To-Pump (CTP) thresholds, it is possible to provide additional low flows to the Barwon-Darling that can meet some of the low flow targets identified for Walgett, and possibly Brewarrina.

Environmental flow events in the Gwydir Valley over recent years have demonstrated that reasonable flow rates can be delivered to the Barwon-Darling River, when channel capacity is available and there is cooperation from local water managers.

To achieve more of the identified low flow targets primarily requires dealing with the significant risk posed by the significant take of water by A Class licences, and take by B Class licences in the upper sections between Mungindi and Walgett, and the relaxation of existing operational channel capacity constraints in the lower sections of the regulated tributaries. Where such relaxation of flow constraints can provide further environmental outcomes, and landholder support can be achieved, there may be potential to improve the flow rates that can be achieved in the Barwon-Darling River.

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<sup>1</sup> Sheldon, F. 2017, Characterising the ecological effects of changes in the 'low-flow hydrology' of the Barwon-Darling River, Report to the Commonwealth Environmental Water Holder.

It is noted that market-based mechanisms may be useful in mitigating the risk of licensed take, and that the Individual Daily Extraction Limits (IDELs) foreshadowed in the Water Sharing Plan provide additional options. However, the IDELs foreshadowed in the draft water sharing plan took into account pump capacity that was authorised (but not installed), and are significantly higher than the likely installed pump capacity for A Class licences prior to the making of the Water Sharing Plan in 2012.

There is one prospective option for statutory change that could be pursued via the Water Resource Plan development process to address the risk of A and B Class access to low flows. Where a flow event is effectively composed entirely of flows from the release of water for environmental licences, or rules based environmental accounts, in the upstream regulated tributaries, the water sharing plan could contain provisions that prevent A, B, and C Class pumping. In this circumstance, it is relatively straightforward to argue that such a rule would not have any impact to consumptive water users on the Barwon-Darling when compared to pre-Basin Plan arrangements.

The most prospective options for statutory changes to improve low flow outcomes in the Barwon-Darling system that could be pursued as part of the NSW Water Resource Plan development process are:

- protection within the Water Sharing Plan (as the key component of the Water Resource Plan for the Barwon-Darling) for flow events that have arisen as a result of the release of held environmental water / ECA in the regulated tributary systems.
- formal recognition that supplementary access should be withheld whenever the flows have arisen as a result of the release of held environmental water / ECA in the regulated tributary systems,
- where useful for protecting environmental flows, it is logical to pursue the changes provided for in the final water sharing plan, such as IDELs/TDELs, but at rates more closely matched with the installed pump capacity for that class at the time the Water Sharing Plan was originally made (2012).

# Introduction

## Context

Modelling undertaken during the development of the Basin Plan suggested that the Basin Plan could not achieve many of the identified flow indicators for environmental outcomes, in large part due to the difficulty in achieving event based outcomes through the purchase of unregulated licences, and the challenges in coordinating flow management across the upstream tributaries that often have limited operational connectivity to the Barwon-Darling system.

In recognition that further work could improve the design of the Basin Plan, a Northern Basin Review was undertaken by the MDBA, primarily focussed on the Barwon-Darling and Condamine-Balonne systems. The return of drought conditions across much of the northern basin following the making of the Basin Plan has further renewed the focus on the Barwon-Darling river system, and the impacts of water take on the low flow regime.

If implemented in its current form, the Review will further clarify the water recovery targets and the potential for environmental outcomes. The Northern Basin Review process also resulted in a proposal for revised hydrologic flow indicators and water recovery targets, and also the development of a “toolkit” of potential measures that may be more acceptable, and potentially more effective, than water recovery at providing environmental outcomes for the Barwon-Darling.

More recently, a number of inquiries have been announced into water management and compliance activities in the Barwon-Darling during the recent record low flow period from 2012 to 2016, and there has been increased pressure upon NSW to improve existing water management arrangements.

NSW is now developing Water Resource Plans for accreditation under the Basin Plan, which provides an opportunity for new arrangements to be considered.

In this context, the CEWH is seeking independent advice on the impediments to achieving low flow environmental outcomes in the Barwon-Darling, and potential options to protect environmental water under the Water Resource Plan being developed by NSW.

This report forms the final stage of a three stage collaborative project by the CEWH to characterise the ecological effects of changes in the Barwon-Darling’s low flows, and develop approaches to improve environmental outcomes during low flows.

## The Task

This report considers the impact that current water management arrangements have on achieving environmental outcomes under low flow conditions, and potential options to address those impacts. This includes:

- Identify ecological opportunities lost from the legal take of Commonwealth environmental water within and between the four river sections<sup>2</sup>. The analysis will consider tributary inflows, which comprised Commonwealth environmental water (including water re-allocated at an upstream tributary accounting point).
- Identify any potential challenges to meeting the environmental outcomes associated with the low flow hydrology that are set out in the basin-wide environmental watering strategy.

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<sup>2</sup> As defined in clause 6 of the water sharing plan for the Barwon-Darling unregulated and alluvial water sources 2012.

- describe how any negative ecological impacts associated with the extraction of low flows could be ameliorated by enacting clauses 51 and 52 Total and Individual Daily Extraction Limits on licences drawing on Appendix 3 of the 2012 draft Water Sharing Plan and/or Clause 84 rules for shepherding of environmental water (IDELs calculated in 2012 to be used in this analysis unless otherwise agreed).
- Identify other opportunities to protect environmental water under the Water Resource Plan currently being developed that are consistent with water resource plan requirements set out in the Basin Plan with consideration of potential third party impacts (positive and negative).

# Background to current water management arrangements

## Environmental Flow Rules (1997 – 2001)

In the mid 1990s, NSW commenced a program to develop environmental flow rules, as well as continuing with the over-arching reform process towards more secure water rights and broader trading opportunities. A key element of the reform process was the formation of local consultative groups, known as River Management Committees, and one was created for the Barwon-Darling system.

The environmental flows process led to the creation of water management rules that are referred to in Basin Plan terminology as Planned Environmental Water, and had the overall effect of reducing long-term average diversions in each valley. These rules were later formalised in statutory water sharing plans. For the Barwon-Darling these rules were essentially an agreement to lift the Commence To Pump (CTP) thresholds for water access licences. The original CTPs were set very low (e.g. visible flow) when licences were originally issued, but were reformed into the A/B/C Class system in the late 1980s to protect town water supplies and stock and domestic access. The higher CTP thresholds proposed by the River Management Committee process, and eventually implemented in 2000/01 were based on the desire to protect flows in the 50<sup>th</sup> – 60<sup>th</sup> percentile flow range (NOW 2012<sup>i</sup>), and it is these increased the CTPs that were formalised in the later water sharing plan (2012)<sup>3</sup>.

## The Cap Management Strategy (2007)

It was well recognised that development had continued beyond the 1993/94 levels, and that long-term diversions were likely to be in excess of the 1993/94 Cap on diversions. The results from the Barwon-Darling IQQM being developed by the NSW government confirmed that this was the case, and the local River Management Committee was asked to develop a strategy to bring diversions back within Cap. Whilst the new CTP thresholds were estimated to reduce long-term diversions by 4%, this was insufficient to counteract the increases in irrigation development.

Given the continuing irrigation development occurring on the Barwon-Darling, the NSW government imposed “no further development” conditions on all irrigation licences in January 2001. However, the difficulty in accepting a significant reduction in water availability meant that the River Management Committee process was unlikely to be able to agree on an approach to maintain Cap.

In the face of growing pressure from the Murray-Darling Basin Ministerial Council to bring diversions in the Barwon-Darling back within the 1993/94 Cap, the NSW government made a proposal in 2006 to restructure licences from the existing 530 GL of Annual Volumetric Limit (also known as “quotas”) to 173 GL of Cap share. (revised to 189 GL in 2011 following model upgrade/recalibration). This proposal was enshrined in a Heads of Agreement between water users and the NSW government in 2006, with the following key elements:

- the restructure of licences:
  - convert 530 GL of Annual Volumetric Limit to 173 GL of Cap shares using a differential to favour active use,
  - manage extractions to Cap by only allocating 173 GL to water accounts each year,
  - introduce continuous accounting and unlimited carryover of account water,
- an independent Integrated Quantity Quality Model (IQQM) review,

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<sup>3</sup> All CTPs are set out in Table A at Cl.45 of the water sharing plan for the Barwon-Darling unregulated and alluvial water sources.



- use the recently installed metering upgrades (MACE meters) to update the independently reviewed IQQM model's Cap scenario (this was expected to remove up to 20% under registering of water use and, through an appropriately re-calibrated IQQM that represented the more accurate diversions, result in a large volume of Cap shares),
- the NSW government would introduce interim trade arrangements, and concessional conversions (e.g. B Class to A Class, C Class to B Class) to allow individuals to maintain their current level of diversions, and
- remove the "no further development" conditions on irrigation licences.

This significant restructure of water licences, by definition, restricts long-term diversions to Cap levels – that is, over the 110 years or so of IQQM simulations. However, the new licences were established with water in their accounts equivalent to 300% of the Cap share, and the old Annual Volumetric Limits were still retained as an annual limit to diversions.

This led to continuing debits under the 1993/94 Cap process and, in 2010, the NSW government restricted annual use to the annual Cap share for several years, until recalibration of the IQQM resulted in reduced Cap debits. These additional restrictions were deeply unpopular with water users and became a key issue during the consultation process for the water sharing plan.

## The Water Sharing Plan (2012)

Water sharing plans are a statutory instrument made under the NSW Water Management Act 2000, and are made for a period of 10 years. The Barwon-Darling "combination" (surface and groundwater) plan was made in October 2012, just prior to the making of the Basin Plan, and followed a typical development and consultation period of approximately 18 months.

This Plan largely carries forward the previous water management arrangements, including: the total volume of entitlements as restructured in 2007, the long-term extraction limit (the 1993/94 Cap), the A/B/C system of flow classes and associated commence/cease-to-pump limits, and licensed pump capacities.

### New elements of the Plan

- The commencement of the Plan was accompanied by the cancellation of existing licences under the old Water Act 1912, and the creation of new Unregulated River Access Licences under the Water Management Act 2000, which effectively "unbundled" licences from land.
  - The new licences do not include any specification of purpose of use or maximum pump capacities for any class of licence, as was the case previously of licences under the Water Act 1912. Instead, new Works Approvals were issued independently of the water access Licences, based on the existing authorised pump capacities, and users are able to link access licences to Works Approvals. This has allowed users with works approvals for larger pumps (generally B and C class users) to link their own A Class licences or purchase and link other A Class licences with those pumps.
- 1993/94 Cap provisions:
  - generally small volumes of "concessional" conversions from one Flow Class to a higher priority Flow Class (e.g. B Class to A Class) to allow individuals to regain the estimated level of access prior to the restructuring of licences in 2007<sup>4</sup>.

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<sup>4</sup> Concessional conversions were permitted shortly after the plan commenced, and must be undertaken within five years of the commencement of the Plan.

- if the Murray-Darling Basin Ministerial Council declares the Barwon-Darling sub valley to be in breach of Cap, the Minister may announce a rolling three year diversion limit for individual licences of 300% of the licensed entitlement,
- an annual diversion limit for individual licences equivalent to 300% of the licensed entitlement (now formally termed the “share component”) to replace the previous Annual Volumetric Limit.
- discontinuation of “notwithstanding” clauses that provided the Minister discretion to allow access to water other than under the conditions stated on a licence, and inclusion of specific provisions representing prior practice, including:
  - Survival watering – Class A water access licences may apply for access when flows are in the No/Low Flow Class, dependent on location of the licence,
  - Imminent flows access – Class A and B water access licences may apply for access when flows are expected to exceed the bottom of that Class within three weeks (A Class), or two weeks (B Class), subject to a number of specific provisions.
- Trade of licensed entitlement (share components) and water allocations is formally made available<sup>5</sup>, subject to limits specified in the Plan for each of the four major reaches of the Barwon-Darling River. A number of additional provisions were added, including:
  - the NSW Government may introduce Individual Total Daily Extraction Limits (IDELs), and Total Daily Extraction Limits (TDELs, which are equivalent to the sum of the initially issued IDELs in a river section),
  - provision is made for trade between River Reaches beyond the specified limits for share components, subject to issuing of Individual Daily Extraction Limits (IDELs)<sup>6</sup>.

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<sup>5</sup> Transfers of licensed entitlement was previously only undertaken administratively at the discretion of the Minister.

<sup>6</sup> No IDELs have been issued to date.

## Hydrologic flow indicators for low flow environmental outcomes

Through the development of the Basin Plan, and the subsequent Northern Basin Review, the Murray-Darling Basin Authority has developed a range of environmental flow indicators at various sites along the Barwon-Darling River. These indicators generally relate to moderate to high flows that are beyond the capacity of environmental water managers to influence in a significant way. However, the CEWH has been developing requirements for base flows and small in-channel freshes that are more likely to be influenced by use of their portfolio of environmental water entitlements.

Drawing on previous work, a collation of identified flow thresholds that are environmentally important has been prepared for the CEWH<sup>7</sup>, with the low flow thresholds summarised in Table 1 below. Many studies have indicated the importance of the 80<sup>th</sup> percentile flows (i.e a flow rate that is exceeded 80% of the time) and, as noted previously, flows below these rates were intended to be protected from large-scale irrigation extraction.

**Table 1: Ecologically relevant flow thresholds (ML/day) for different gauged sites within the Barwon-Darling river system.**

Flow Band	Flow Description	Gauge Station – Discharge ML/day				
		Walgett	Brewarrina	Bourke	Louth	Wilcannia
Low Flows (Figure 6)	Riparian Flows – minimum flows for reaches to remain connected (Interim Northwest Unregulated Flow Plan, 1992)	700	550	390	280	150
Small In-channel Flow Pulse	Critical discharge (ML/day) required to suppress persistent stratification and <i>Anabaena circinalis</i> growth in the Barwon-Darling River (from Mitrovic et al. 2010)		510	450		350
	80 <sup>th</sup> percentile flows required to inundate low-level in-channel surfaces and associated habitat – important for maintenance of fish and invertebrate populations and water quality mediation (from Thoms et al. 1996)	250		500	1,200	400
	Flows that enhance spawning in low-flow spawning specialist fish, such as olive perchlet (endangered) and other small bodies fish (see Humphries and Walker 2013).	500		500	350	

The CEWH have developed a number of flow indicators for the Barwon-Darling as part of the 2017/18 XXXXX, and those that relate to low flows are summarised in below.

<sup>7</sup> Sheldon, F. 2017, Characterising the ecological effects of changes in the ‘low-flow hydrology’ of the Barwon-Darling River, Report to the Commonwealth Environmental Water Holder.

**Table 2: Flow indicators for base flows and small in-channel pulses in the Barwon–Darling system.**

<b>Magnitude (ML/d)</b>	<b>Basis of magnitude</b>	<b>Duration</b>	<b>Basis of duration</b>	<b>Timing</b>	<b>Basis of timing</b>	<b>Freq. range</b>	<b>Basis of frequency</b>
500 (Walgett gauge)	<ul style="list-style-type: none"> <li>Maintenance of native fish populations and ecosystem functions including provision or replenishment of drought refuge, particularly across the 500 large refuge pools located between Walgett and Bourke and improve water quality along the upper Darling</li> <li>reduce the frequency and duration of no-flow periods in the upper Darling</li> </ul>	7 -14 consecutive days	Breaking prolonged no-flow periods across the upper Darling River and provide opportunities for fish movement between refuges	Aug - May	Provide multiple opportunities outside the two coldest months, as well as contribute to water quality and refuge benefits during the warmer months	3 - 5 times a year in an average of 8-9 years out of 10	Provide multiple opportunities for fish movement between refuge pools during drier than average years
500 (Bourke gauge)	<ul style="list-style-type: none"> <li>Maintenance of native fish populations and ecosystem functions including provision or replenishment of drought refuge, particularly across the 500 large refuge pools located between Walgett and Bourke and improve water quality along the upper Darling</li> <li>reduce the frequency and duration of no-flow periods in the upper – mid Darling</li> </ul>	7 -14 consecutive days	Breaking prolonged no-flow periods across the upper and mid Darling River and provide opportunities for fish movement between refuges	Aug - May	Provide multiple opportunities outside the two coldest months, as well as contribute to water quality and refuge benefits during the warmer months	2 – 3 times a year in an average of 8-9 years out of 10	Provide multiple opportunities for fish movement between refuge pools during drier than average years

350 (Louth gauge)	<ul style="list-style-type: none"> <li>Maintenance of native fish populations and ecosystem functions including provision or replenishment of drought refuge, particularly across the 500 large refuge pools located between Walgett and Bourke and improve water quality along the upper Darling</li> <li>reduce the frequency and duration of no-flow periods in the mid Darling</li> </ul>	7 consecutive days	Breaking prolonged no-flow periods across the mid Darling River and provide opportunities for fish movement between refuges	Aug - May	Provide multiple opportunities outside the two coldest months, as well as contribute to water quality and refuge benefits during the warmer months	2 - 3 times a year in an average of 8-9 years out of 10	Provide multiple opportunities for fish movement between refuge pools during drier than average years
500 with a minimum peak of 1,500 (Bourke gauge)	<ul style="list-style-type: none"> <li>Enhance conditions for fish spawning, recruitment and dispersal</li> <li>Replenish and enhance water quality in the 500 waterholes located between Bourke and Wilcannia</li> <li>Enhance the inundation frequency of 30 - 40% (180 – 240) of benches located in the lower sections of channel and outside of weir pools between Walgett and Wilcannia</li> <li>Enhance fish access to the 30% (or around 8,000) of snags located in the lower sections of channel and outside of weir pools between Walgett and</li> </ul>	500 ML/d for 50 consecutive days and peak of 1,500 ML/d for 14 consecutive days	<p>The 14 day duration of the higher flow at Bourke will provide sufficient time for egg development and hatching for most native fish species.</p> <p>The lower flow of 500 ML/d would provide opportunities for fish movement between refuges, and enhance recruitment and dispersal outcomes for native fish within sections of the Barwon-Darling</p>	Minimum of 1 flow event between Sept - April	To maximise their effectiveness of spawning flows in the Barwon-Darling system, and enhance the resulting recruitment and dispersal stages for native fish	Average of 7 to 8 years out of 10 (with at least 1 event)	To provide regular pulses required to complete important life-cycle stages for shorter-lived fish, (life cycles for these types of fish generally last between 2 and 4 years), and maximise outcomes from spawning events that result from larger flow events

	Wilcannia						
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## Impediments to achieving environmental watering outcomes

### Unregulated Licence Rights

One of the key impediments in unregulated river systems to achieving environmental outcomes through the purchase of water entitlements is the nature of unregulated licences themselves. In general, most states in the Murray-Darling Basin have defined unregulated licences in simple opportunistic terms by providing a right to take water whenever natural flows permit, often with a requirement for a minimum flow threshold to be achieved prior to pumping.

Management oversight is also generally minimal in unregulated areas, as there is typically a large number of licences spread over a large area that take relatively small volumes.

The effect of structuring licences this way is that, if water is not taken by a particular licence, the next licence downstream is free to take that water. The result is that, while the purchase of a licence may stop the previous consumptive use from occurring, there is no mechanism to protect the flows that would have been taken from similarly being taken by the next licence downstream. Given this basic arrangement, it is possible that the purchase of any particular licence could result in little more than improving the access to water by downstream water users.

However, as a result of the restructuring of licences in 2007, each licence now has an individual share of the 1993/94 Cap, and also the Plan Limit from the commencement of the water sharing plan in 2012. This means that, by purchasing a licence you are also purchasing some of the Plan Limit, meaning that (if the water is not traded to any other licence holders) the consumptive diversions will reduce by that amount in the long-term. Whilst this may still be of little value in any particular event, the individualising of the Cap/Plan Limit in the Barwon-Darling does provide some benefit compared to the purchase of unregulated licences elsewhere, subject to appropriate compliance with normal licence conditions being enforced.

### Upstream flow constraints

Physical flow constraints on regulated flows from upstream tributary systems make it difficult to use held environmental water (licences) to deliver significant volumes of water to the Barwon-Darling. However, there is capability to deliver lower flows from regulated tributaries to the Barwon-Darling:

- Each of the Border, Gwydir, and Namoi Rivers is able to provide around 500 – 800 ML/day, subject to sharing of channel capacity with other water users, or any drought management actions (e.g. block releases from storages).
- With agreement to cover increased losses, slightly higher flows can be provided, possibly up to 800-1,000 ML/day, with the same caveats as above regarding channel capacity and drought management, and dependent on impacts to riparian landholders.



## Opportunities lost from legal take

Legal take of water within the Barwon-Darling system affects low to moderate flows to the greatest extent, with increasingly higher flows being too large to be affected by diversions in the Barwon-Darling alone.

Pumping by Local Water Utility, and domestic and stock licences from very low flows and pools is generally at very low rates, and has generally been considered to be negligible for environmental flow purposes in the past.

A more significant issue to low flow protection within the Barwon-Darling is the pumping by approximately 10 GL of A Class entitlement, which can take place down to reasonably low flows of between 100 and 500 ML/day, depending on the particular river reach.

Up to 2012, the A Class licences were only licensed to have small pumps, in line with the original licensed purposes of these entitlements, and to manage their impact on low flows. As part of the commencement of the Water Sharing Plan in 2012 the old Water Act 1912 licences were replaced with several Water Access Licences under the Water Management Act 2000, one for each class of access on the pre-existing licence. The new Water Access Licences were “unbundled” from land, and separate Works Approvals were issued for any location-based elements of the old licence, such as authorised pump installations. The new state-wide licensing system allows licence holders to link licences with works approvals that they own, or with the approval of the owner.

This was a state-wide approach intended to implement COAG agreed water reforms, such as facilitation of trade. However, the side-effect of the reform was to allow A Class licences to be linked to Works Approvals for much larger pump installations that were previously intended for B and C Class entitlement.

The impact of increased A Class take of water may be exacerbated by the replacement of the former Annual Volumetric Limits with an annual limit of 300% of Cap share, as this provides a more generous annual limit for those water users who were more highly developed (who received Cap shares that were in excess of 1/3<sup>rd</sup> of the old Annual Volumetric Limits), and conversely a less generous limit for those licences with a low history of use in 2007 and therefore received less Cap share compared to the old Annual Volumetric Limit. In any case, additional annual limit (above 300%) is automatically traded into a licence whenever additional account water is traded in from another licence.

## Opportunities to achieve environmental watering outcomes – low flow regime

### Low flow delivery from regulated tributaries

As noted in previous sections, there is capacity to deliver planned and held environmental water from the upstream regulated tributaries – the Border, Gwydir, and Namoi in particular. The existing Commence-To-Pump (CTP) thresholds protect lower flows, and held environmental water in regulated tributaries can be used to provide additional low flows to the Barwon-Darling up to the B Class CTP flows, and probably a little more.

These CTP thresholds protect lower flows:

- almost completely for flows varying from (around): 200 ML/day (Mungindi) to 600 ML/day (Walgett) to 400 ML/day (Bourke) to 200 ML/day (Wilcannia), and
- from large volume extraction (i.e. B and C Class access) for flows varying from (around): 200 ML/day (Mungindi) to 800 ML/day (Walgett/Boorooma) to 1,200 ML/day (Bourke) to 850 ML/day (Wilcannia).

The B Class CTPs form an upper limit to the useful protection of low flows, as there is a significant volume of entitlement issued and these licences have pumps that are large enough to divert a significant proportion of flows. In this context, it is worth noting the following in regard to B Class CTPs.

- The B Class CTPs in the sections between Mungindi and Collarenebri vary between 230 – 500 ML/day, which are the lowest of all reaches. This limits the value of flow contributions from the Border Rivers.
- The B Class CTPs in the section between Collarenebri and Walgett are set at 500 ML/day (Collarenebri) and 430 ML/day (Walgett), which limits the value of flow contributions from the Gwydir Valley.
- Below Walgett the CTPs are around 800 ML/day or above, making flow contributions from the Namoi Valley more valuable for meeting the higher of the low-flow hydrologic indicators.

Under normal conditions, each of the three regulated tributaries above is able to provide sufficient flow to reach B Class CTPs, subject to potential channel capacity constraints in the Border and Gwydir valleys if consumptive demands are high. However, in drier periods when low flow contributions to the Barwon-Darling are more likely to be needed, these regulated tributaries may also be operating under various restrictions, such as block releases and/or reduced extent of regulated flows. These restrictions may place limits on the channel capacity available for environmental releases, the timing of flow contributions to the Barwon-Darling, or require environmental water managers to cover any additional transmission losses incurred in making such flow contributions. These restrictions on the ability to provide environmental flows from the regulated tributaries are likely to become more significant for those low flow targets that have a significant duration, such as the last indicator described in Table 2, which extends for 50 days.

Where flows are sourced from more than one regulated tributary, and the two contributions are intended to combine to achieve a flow target in the Barwon-Darling, which

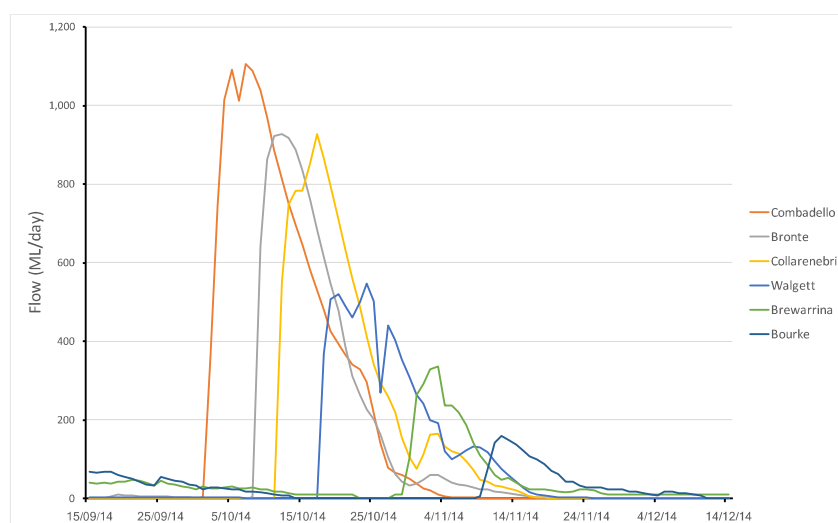
would likely be needed if flow targets in excess of around 500 ML/day at Bourke are to be considered, allowance will need to be made for the practical difficulties in timing the two releases to overlap. The apparent travel time of flows can vary significantly with antecedent conditions, and it would be difficult for river operators to accurately predict this effect – particularly if there have not recently been any other flows to travel down to, and along, the Barwon-Darling to inform such judgements. This is likely to mean that releases from each tributary might need to be sustained for a longer period to ensure overlap of the two events does occur in the Barwon-Darling River.

These potential restrictions would need to be considered in more detail to assess their significance, but the results of environmental releases such as those from the Gwydir in 2014 (see box below) appear promising.

### 2014 Gwydir Releases

The 2014 Gwydir releases for the CEWH were made down the Mehi at around 1,100 ML/day, which is just above the normal channel capacity of around 1,000 - 1,100 ML/day, as the CEWH agreed to order the water at the Mehi offtake (hence incurring all downstream losses). This achieved a peak end of system flow into the Barwon-Darling near Collarenebri of around 800 ML/day. Important elements of this event were:

- avoiding take by water users along the Mehi by choosing a period where there were no significant water orders (freeing up channel capacity),
- agreement by Water NSW to divert flows into the Mehi slightly higher than nominal channel capacity (together with some level of acceptance from riparian landholders of the resulting (very low level) inundation), and
- no announcement of supplementary access to flows downstream of the order point, which had the effect of avoiding opportunistic access from Supplementary Water Access Licences downstream of Combadello).



The final flow indicator described in Table 2 includes a peak flow at Bourke of 1,500 ML/day, which is likely to be difficult to achieve without some level of relaxation of operational flow constraints in the lower parts of the regulated tributaries, contributions from multiple valleys, and protection of flows above the B Class CTPs. Such an event would also require a considerable volume of held environmental water for a stand-alone event that may be beyond the CEWH's holdings – particularly in the Namoi and Border Rivers.

However, it may be more practical to extend the recession from a naturally occurring event as sought by this flow indicator.

As previously noted, A Class licences in the Barwon-Darling have the potential to take significant volumes of water under low flow conditions. If the risk of extraction by A Class licences could be managed, the CTPs could allow held environmental water and account-based planned environmental water in upstream regulated tributaries to provide flows around 600-800 ML/day at Bourke.

The various classes of licence, including A Class are distributed along all sections of the Barwon-Darling<sup>8</sup> and generally across a large number of licence holders. However, the greatest concentration of A Class licences is in the Culgoa – Bourke section, with the largest single holder of A Class licence holding around 4 GL of A Class shares.

### Options to address the risk posed by A Class take:

#### Individual daily Extraction Limits (IDELs)

One option is to re-introduce limits to the extraction rates for particular classes of licence (particularly A Class), potentially through the making of the Individual Daily Extraction Limits (IDELs) foreshadowed in the Water Sharing Plan.

To the extent that IDELs were able to represent the previous maximum pumping rates of around 5 ML/day, they would greatly diminish the risk to environmental flows, and low flows generally, from A Class access to low flows.

However, it is worth noting that IDELs proposed in the draft Water Sharing Plan were largely based on authorised pump capacities, and this is significantly higher than the installed pump capacities as at 2001, although there may not be much change in the installed pump capacity since that time.

As at 2001, when the “no further development” condition was placed on Barwon-Darling irrigation licences, it was estimated that there was approximately 230 ML/day of installed/active pump capacity for A Class<sup>9</sup>. However, under the IDELs envisaged in the draft WSP the total pump capacity was increased to approximately 620 ML/day, based on:

- authorised but uninstalled pump capacities, and
- the greater of:
  - the average (observed) pumping rate, and

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<sup>8</sup> Distribution is shown in Attachment B

<sup>9</sup> Estimate made by Peter Terrill in 2004.

- the agreed (manufacturer specifications) pump capacities for installed/active pumps).

This generous definition undermines the usefulness of IDELs for managing extraction from low flows, and may require further purchase of such rights for the environment to mitigate the impacts of A Class access.

#### Strategic Purchase

The original purpose of A Class licences for horticulture, and small scale cropping of high value (e.g. fodder crops) is becoming less relevant, and corporate owners of A Class licences who are engaged in broad-acre cropping (i.e. cotton) might be more amenable to a strategic buy out, agreements, or other market-based measures.

A large proportion of A Class licences may still be inactive, and may not need to be considered initially. Approximately two thirds of A Class licences were considered to be inactive in 2001, when the “no further development” conditions were announced by the NSW government. The conditions were lifted in 2007 with the introduction of the Cap Management Strategy, but recent history following the millennium drought, and the recent historic dry inflow period to Menindee Lakes, appears to be one of concentration of ownership rather than renewed development.

#### Agreements to protect environmental flows

Where a flow event is effectively composed entirely of flows from the release of water for environmental licences, or rules based environmental accounts, there could be an opportunity to seek agreement from water users to abstain from pumping. In this sense, an “agreement” could be to include such a rule in the water sharing plan as part of the Water Resource Plan development process, or to enter into a legal agreement directly with the Commonwealth Environmental Water Holder.

In the circumstance where an event was effectively composed entirely of water released from environmental accounts upstream, it is relatively straightforward to argue that such a rule would not have any long-term impact to consumptive water users on the Barwon-Darling. If environmental releases are mixed with “other flows” (unregulated tributary inflows, and normal operational flows from regulated tributaries), there is still a principle to be argued that, if such “other flows” flows would not have reached the relevant CTP levels, then water users would not have had access.

If environmental releases are mixed with other flows that would normally be accessible to licence holders, such an agreement would be difficult to achieve.

If there was any significant proportion of “other flows” in an event, the question as to whether the event would have exceeded the relevant CTP levels would need to be addressed. There would need to be a rigorous assessment methodology applied to satisfy concerns from licence holders, and would probably need to be weighted in favour of consumptive users to the extent that there was any doubt.

This approach has the added benefit of:

- allowing flow contributions from the Border Rivers that would otherwise likely be diminished as a result of the low B Class CTP thresholds in the river reaches below Mungindi, and

- improving the prospects of achieving higher flows at Bourke.

One potential issue for such a proposal is that, given the lengthy travel times involved from the tributary storages to Bourke, there is potential for rainfall and inflows to occur during the event, complicating the composition of the flows. If the rainfall and subsequent event was significant, then it may be the case that the intended flow target will be met anyway, even if protection from take was removed the environmental flows.

There may also be other alternatives that could be investigated for managing the occurrence of small local inflows that might occur, such as an assessment of water that would normally have been available for pumping made conservatively in favour of water users to the extent that there is any uncertainty in the assessment, or even a make-up supply to any affected users by extending the releases.

#### Other market-based measures or agreements

There are a number of actions to purchase rights or compensate licence holders that can be considered, in addition to the more straightforward strategic purchase of shares, such as entering into agreements with licence holders not to pump for a discrete period of time. These are likely to be cumbersome to put in place, less administratively efficient to manage, and more difficult to enforce.

Alternatively, a new dealing could be proposed to allow conversion of A Class to B Class. However, developing appropriate conversion factors and consideration of the impacts to other B Class water users would need to be undertaken.

Should IDELs be issued, presumably with appropriate dealings to provide an ability to trade them, there would obviously be another option to improve the protection of low flows via the market.

However, given recent concerns about compliance arrangements, these options may not be prospective in the near-term for environmental water managers.

### Shepherding of water from the CEWH's Barwon-Darling licences

Shepherding has been investigated as a potential mechanism for protecting environmental flows and, conceptually at least, could provide protection for environmental water, either from licences recovered in the Barwon-Darling, or from tributary inflows arising from environmental releases.

However, technically, it is very difficult to track/apportion environmental water as it flows from reach to reach, which is also proving to be one of the issues associated with Prerequisite Policy Measures (PPMs) for regulated river systems.

The 2012 NSW/Commonwealth shepherding proposal did not provide event-based protection, and primarily served as a process to identify/tag a proportion of the inflows to Menindee as environmental water. In other words, it is a mechanism for regaining ownership/recognition of environmental water at Menindee that could be used when flows along the Barwon-Darling from other sources were already sufficient to satisfy consumptive demand. However, implementing and pursuing this "long-term" shepherding proposal may still be important to environmental outcomes in the southern basin, and have important

synergies with the proposed reconfiguration of Menindee Lakes as part of the SDL adjustment process.

Keeping the option open for shepherding is worthwhile, as it may be possible to develop a robust event-based approach at some future point, particularly for generating greater utility from the CEWH's Barwon-Darling licences, and to provide protection for higher flow rates.

### Environmental flows above B Class CTP Limits

If flows are required along the Barwon-Darling that are substantially in excess of 800 - 1,000 ML/day, a number of issues would need to be addressed:

- The current CTP thresholds would be inadequate,
  - Changing B Class CTPs is likely to have demonstrable effects on long-term diversions, and is unlikely to be supported by NSW.
- The introduction of IDELs may not prevent significant access by B Class licence holders, but it may provide a ready mechanism for market-based measures.
- Direct releases from storage would need to be made at rates that produced increasing inundation of low-lying floodplain in the lower reaches of the regulated tributaries, and this would need to be assessed.
  - This may be a desired part of the environmental watering regime for the regulated tributaries.
  - There is potential for landholders to see such events as beneficial, and this has been the case for landholders in the lower reaches of the Murrumbidgee and Lower Darling during the constraints relaxation process,
  - However, such flows may still require that something similar to the current process for relaxation of physical flow constraints to be applied to these new areas (i.e. funding may be required).
- Either in conjunction with shepherding, or as an approach for the tributary valleys, it may be useful for the CEWH to hold a larger volume of supplementary access entitlements, rather than general security licences, to increase the volume of larger natural flow events reaching the Barwon-Darling River.

### The Northern Basin Review (NBR) Toolkit

During the Murray-Darling Basin Authority's NBR process, there was recognition of other proposals that may improve environmental outcomes in the Barwon-Darling and the Condamine-Balonne Rivers, but were outside of the statutory Basin Plan process.

In summary, at least four of the six shortlisted options have potential to improve low-flow outcomes in the Barwon-Darling, three of which have been discussed above (shepherding, targeted recovery, and coordinated delivery), and the fourth being event-based mechanisms.

Adoption of the NBR toolkit would commit states to (re)looking at a number of options useful for protection of low flows to the extent agreed in an Intergovernmental Memorandum of Understanding. If such an agreement is reached in the near future, it would provide further impetus to the CEWHs efforts to provide low-flow watering events

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along the Barwon-Darling River, and also any proposals to facilitate such activities via the Water Resource Plan that is currently under development.



## Legislative or statutory changes

Any changes to management rules or licence conditions that are likely to be considered through the Water Resource Plan process, will require demonstration that they will not affect long-term average diversions, or that impacts are addressed. NSW is also likely to consider the potential for any increase in the administrative burden for management of the Barwon-Darling that might arise.

Conversely, where there are demonstrated or likely benefits for other stakeholders, or previous commitments have been made (or implied), this would add weight to any proposals for regulatory change.

With these issues in mind, the most prospective options would appear to be:

- protection within the Water Sharing Plan (as the key component of the Water Resource Plan for the Barwon-Darling) for flow events that have arisen as a result of the release of held environmental water / ECA in the regulated tributary systems.
- formal recognition that supplementary access should be withheld whenever the flows have arisen as a result of the release of held environmental water / ECA in the regulated tributary systems,
- where useful for protecting environmental flows, it is logical to pursue the changes provided for in the final water sharing plan, such as IDELs/TDELs, but at rates more closely matched with the installed pump capacity for that class at the time the Water Sharing Plan was originally made (2012).

In making such proposals, it would be beneficial to establish whether the likely benefits from the low-flow events contemplated in Table 1 and Table 2 provide tangible benefits to water users for domestic and stock access if such flows can improve water quality and suppress algal blooms. Similarly, there may also be recreational benefits to local communities, and benefits for aboriginal cultural values.

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## Attachment A – Geographic distribution of licences.

Barwon Darling Unregulated River Water Source Multiple Water Access Licenses linked to Works Approvals & DP numbers DPI water Register, current at April 2016				
	A ML	B ML	C ML	
Total entitlements	9,856	131,393	47,422	
CEWH entitlements	73	12,006	12,498	
<b>Consumptive entitlements</b>	<b>9,783</b>	<b>119,387</b>	<b>34,924</b>	
Entitlements with common Works approvals, combined approvals or DP numbers	4,601	79,980	34,733	
% of consumptive pool	47.03%	66.99%	99.45%	
<b>Entitlement share by reach</b>				
Mungindi to Boomi River Confluence	20	7,528	1	
Boomi River Confluence to US Mogil Mogil Weir Pool	38	2,044	-	
DS Mogil Mogil to Collarenebri	247	1,466	-	
Collarenebri to US Walgett Weir Pool	460	8,280	-	
Walgett Weir Pool	250	3,645	-	
DS Walgett to Boorooma	213	5,935	1,072	
Boorooma to Brewarrina	667	13,411	32,168	
Brewarrina to Culgoa River Junction	381	13,628	3	
Culgoa River Junction to Bourke	6,048	48,546	1,677	
Bourke to Louth	889	10,875	2	
Louth to Tilpa	49	1,438	-	
Tilpa to Wilcannia	521	1,519	-	
Wilcannia to US Lake Wetherell	-	1,072	-	
Total	9,783	119,387	34,924	
Control check	-	-	-	
<b>% of entitlement share with common Works approvals or DP numbers by reach</b>				
	No. combined holdings	%	%	%
Mungindi to Boomi River Confluence	-	0.00%	0.00%	0.00%
Boomi River Confluence to US Mogil Mogil Weir Pool	-	0.00%	0.00%	0.00%
DS Mogil Mogil to Collarenebri	-	0.00%	0.00%	0.00%
Collarenebri to US Walgett Weir Pool	1	8.91%	17.54%	0.00%
Walgett Weir Pool	1	54.40%	33.77%	0.00%
DS Walgett to Boorooma	1	42.25%	68.41%	82.84%
Boorooma to Brewarrina	1	27.14%	94.68%	100.00%
Brewarrina to Culgoa River Junction	1	38.85%	83.97%	0.00%
Culgoa River Junction to Bourke	2	66.22%	98.17%	100.00%
Bourke to Louth	-	0.00%	0.00%	0.00%
Louth to Tilpa	-	0.00%	100.00%	0.00%
Tilpa to Wilcannia	-	0.00%	0.00%	0.00%
Wilcannia to US Lake Wetherell	-	0.00%	0.00%	0.00%

