



**Submission on**  
***Inquiry into Floodplain***  
***Harvesting***  
**Select Committee on**  
**Floodplain Harvesting**  
**Legislative Council of NSW**

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## **1. Centre for Ecosystem Science, UNSW Sydney**

The Centre for Ecosystem Science, UNSW Sydney, supports instruments of government, including policies that improve effectiveness of natural resource management for all citizens of NSW, founded on a strong evidence base. Researchers in CES have established track records in the research and management of Australia's rivers and wetlands (<https://www.ecosystem.unsw.edu.au/>) and welcome the opportunity to comment on managing NSW Floodplain Harvesting.

CES cannot support the current approach to implementation of the NSW floodplain harvesting policy or the better management of environmental water without adequately addressing some of the significant gaps in understanding and knowledge which will threaten security of downstream users and also the environment and ensuring policies are adequate that address these problems. Recommendations are provided for consideration in a range of different areas.

## **2. Relevant background**

I was involved in government water policy and research when I worked for the NSW Government's environment agency for about 18 years. One of ongoing significant issues which was routinely discussed by Government Water CEOs, representing the following agencies, Water, Environment, Planning, Agriculture and Fisheries, was floodplain harvesting. For more than two decades, this was consistently acknowledged as a serious issue for the health and communities, requiring more understanding and data and accompanying policies. The public information base still appears limited in terms of location of floodplain structures and their potential effects on flow and flooding regimes.

## **3. Floodplain harvesting context**

It is important to underscore the importance of floodplains and their flows for the ecology of rivers. Much of the major sustainability problems affecting the rivers in New South Wales and particularly the Murray-Darling Basin are related to major ecological impacts on floodplains are caused by the regulation of rivers and developments on floodplains (Kingsford 2000, Steinfeld and Kingsford 2013, Kingsford et al. 2015, Thompson et al. 2017). These have affected the breeding of waterbirds (Leslie 2001, Arthur et al. 2012, Bino et al. 2014), vegetation health (Mac Nally et al. 2011, Bino et al. 2015, Catelotti et al. 2015), frogs (Ocock et al. 2014, Ocock et al. 2016), microbats (Blakey et al. 2017) and even woodland birds (Selwood et al. 2017). There have also been declines in inundation extent and frequency (Thomas et al. 2015). Most wetland areas (>80%) on rivers are floodplains in the Murray-Darling Basin (Kingsford et al. 2004).

Management of floodplain harvesting and river regulation can particularly exacerbate downstream impacts on Ramsar-listed wetlands which are already under considerable

pressure and are failing to meet government commitments to sustainability. Both the Macquarie Marshes (<http://www.environment.nsw.gov.au/research-and-publications/publications-search/macquarie-marshes-ramsar-site-response-strategy>) and the Gwydir wetlands (<http://www.environment.nsw.gov.au/topics/water/wetlands/internationally-significant-wetlands/gwydir-wetlands>) are subjects of Article 3.2 notifications to the Ramsar Bureau, acknowledging likelihood of significant human-mediated changes to ecological character.

These organisms and ecological processes rely on overbank flows where floodplain harvesting and its licensing is critical. Most of these areas are also privately owned, where landholders derive a benefit from the overland flooding (Nairn and Kingsford 2012). When such areas have reduced flooding, there can be considerable impacts on ecosystem services and social well-being and economic livelihoods (Fessey 2017, Hall 2017, Petersen 2017). These impacts are increasingly recognized within government decision-making (Murray-Darling Basin Authority 2016).

This overall context is critical for discussion about the management of floodplain harvesting. Reductions in river flows, particularly overbank flows, have caused many floodplains to contract in size and sustainability, exacerbated by developments on the floodplain to harvest or move water (Kingsford 2015). There is generally poor appreciation of the socio-economic impacts of floodplain harvesting on ecosystem services and river users downstream.

It is critical to understand the data challenges of floodplain harvesting, underpinning good decision-making (i.e. locations, functions and size of structures (levees, channels, storages)), which are increasingly known and need to be combined with other multiple lines of evidence and new techniques in monitoring to provide a useful platform for effective management of floodplain harvesting.

#### **4. Terms of reference**

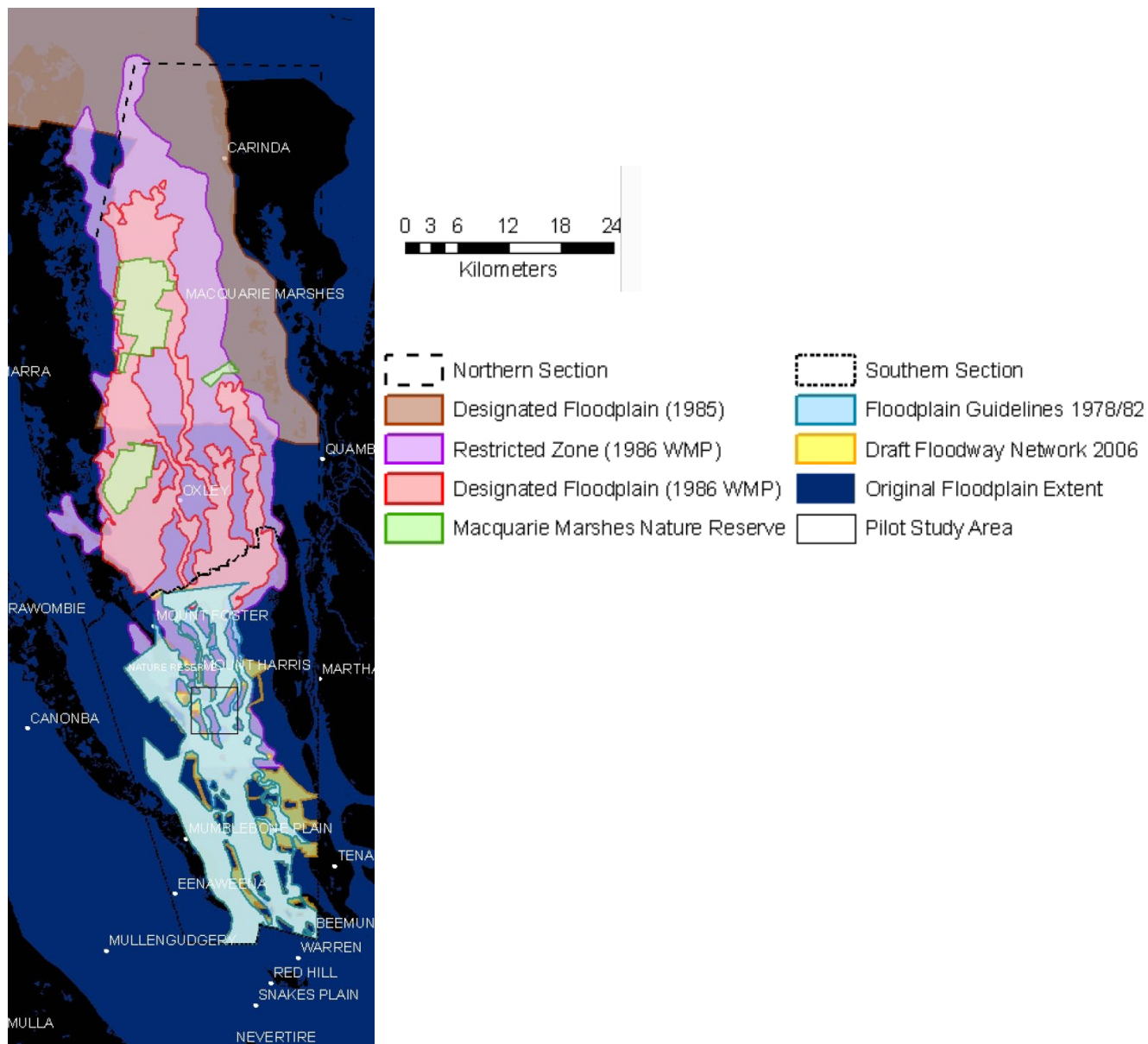
The structure of this submission follows the terms of reference including other related matters.

##### ***a. Legality of floodplain harvesting***

To date, floodplain harvesting in water management legislation and policy has been poorly developed, relative to other aspects of water management legislation. This means that when many, though not all, structures (works and extraction) were built and established there was little licence or regulation framework of the impacts that these structures would have on the rivers and the floodplain. Floodplains were largely omitted from water legislation because they were not defined as a 'watercourse' in NSW and Queensland legislation, where much of floodplain harvesting development has occurred.

At various times, the NSW Government designated a few floodplains and produced guidelines to maintain flows through floodplains and downstream and restrict development that would affect the environment and downstream users. But there was limited government commitment to compliance to maintain these areas for rivers to flow unimpeded through these areas. There is also limited public information on the shifting baselines in relation to the management of floodplain development and subsequent harvesting.

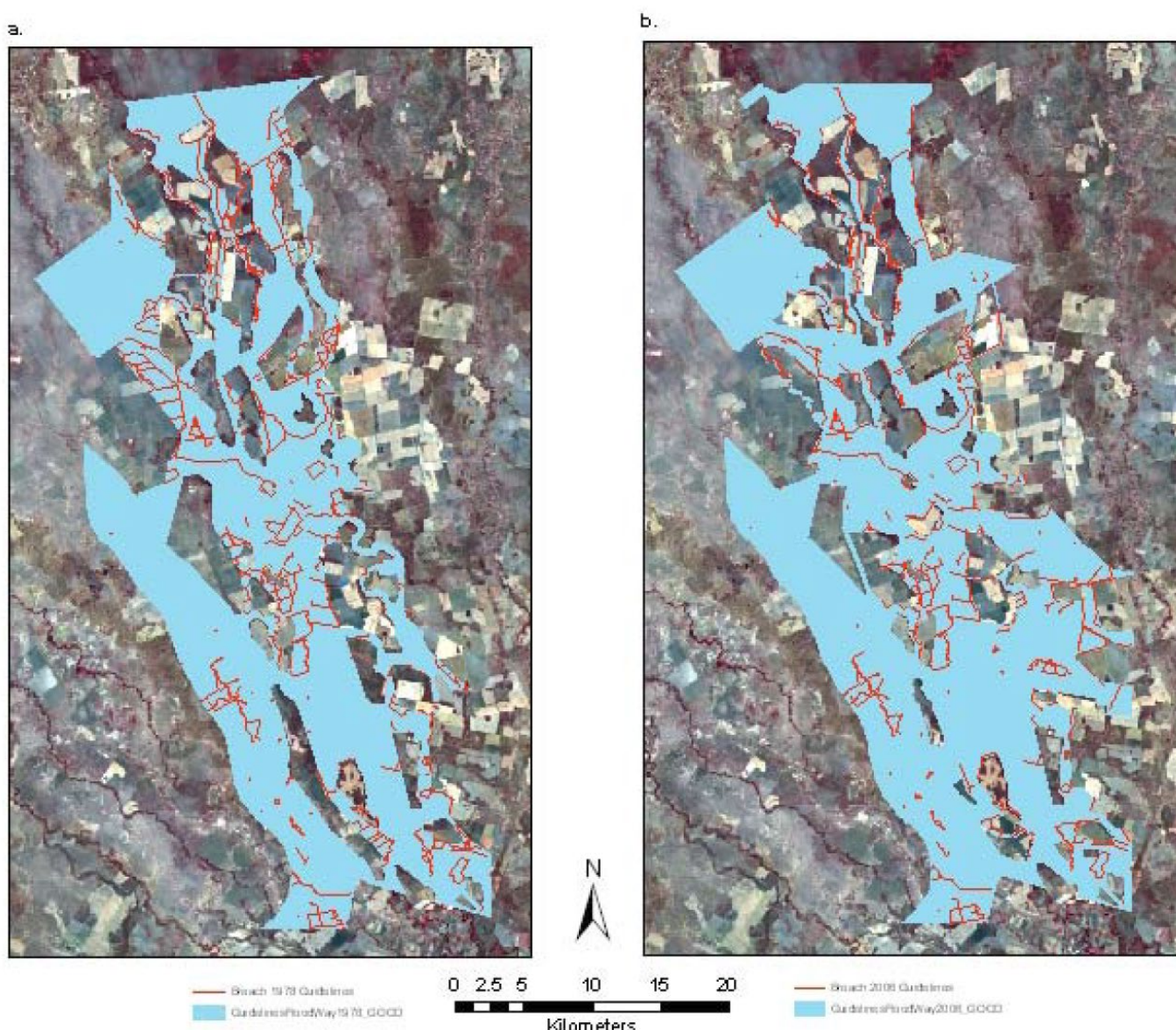
The only explicit public analysis of this issue was through an investigation for the Macquarie River floodplain (Fig. 1), completed in 2008 (Steinfeld and Kingsford 2008). The main results and conclusions are reproduced here, which demonstrate a shifting of baselines between 1978 and 2006. Changes since 2006 to this government policy framework were not analysed. In 1985, in recognition of the importance of the Macquarie Marshes, the NSW Government designated the northern part of the Macquarie River floodplain as a designated floodplain (Millington 1985) (see Fig. 1). In 1982, the Government water agency developed guidelines for development of the Macquarie floodplain from Narromine to Oxley (Southern Section) (Water Resources Commission 1982). These guidelines were meant to identify areas where floods could progress unimpeded through designated pathways or floodways for efficient flow transmission, allowing for agricultural development of the floodplain outside the floodways. No floodplain harvesting works should have been built in these floodways but the guidelines were not enforced or regulated.



**Figure 1** (reproduced from (Steinfeld and Kingsford 2008)). The original Macquarie River floodplain (blue) was produced by amalgamating hydrological, geomorphological and vegetation map layers with the following administrative areas: designated floodplain (Millington 1985), Macquarie Marshes Nature Reserve, restricted zone (1996 Water Management Plan), designated floodplain (1986 Water Management Plan), floodplain guidelines 1978/82 (Water Resources Commission 1982) and draft floodway guidelines (Department of Natural Resources 2006) are overlaid.



There were 101 km of levees, 368 km of channels and 16 off-river storages built within the precluded area defined by government guidelines (1978/82), which were supposed to be free of any earthworks, (Water Resources Commission 1982). Revised guidelines were then developed in 2006 by the NSW Government (Department of Natural Resources 2006). This 2006 floodway network still included 88 km of levees, 338 km of channels, 8 off rivers storages and 84 tanks, within the area supposed to be free of these earthworks (Fig. 2). And in relation to the original guidelines, the new 2006 floodway network excluded 13 km of levees, 30 km of channels and 8 off-river storages. These were now 'outside' the policy framework for affecting flows. It was not clear how these areas were excluded although there were discussions between the government water agency and stakeholders.



**Figure 2** (reproduced from (Steinfeld and Kingsford 2008)). (a.) Earthworks (red lines, 101 km of levees and 368 km of channels) within the 1978/82 floodplain guidelines (blue shaded areas) (Water Resources Commission 1982), and (b.) earthworks (red lines, 88 km of levees and 338 km of channels) in the 2006 draft floodway network (blue shaded area) (Department of Natural Resources 2006).

The NSW Healthy Floodplains Project was designed to identify the size and location of all floodplain structures on floodplains. It was understood that this project would assess legality as well as identifying structures which may be legal but still impede floodwaters from moving downstream. The floodplain earthworks in the Macquarie River still do not seem to be available publicly.

**Recommendation 1.** The NSW Government continually improve maps of the distribution of floodplain earthworks (storages, channels and levees) that are publicly available and identify the risk to floodplain and downstream ecosystems from the interception of water.

**Recommendation 2.** Illegal earthworks should be removed.

**Recommendation 3.** Earthworks that substantially impede and intercept flows required for downstream communities be removed by government investment focused on restoration of rivers.

**b. Water regulations published on 30 April 2021**

The NSW Government gazette regulations on 30<sup>th</sup> April 2021 but they were disallowed by the Legislative Council (6<sup>th</sup> May 2021). The proposed regulations, and the policy and compliance frameworks, and the hydrological modelling supporting licensing have considerable uncertainties. Further it is not clear how such a licencing framework would inform the Commonwealth Government's proposed approach for revising Basin Diversion Limits (BDLs) and Sustainable Diversion Limits (SDLs). There is a need for transparency in relation to the assumptions in the modelling so that these can be examined.

**Recommendation 3.** There is a need to provide sufficient confidence to the public in relation to recommendations in this submission related to estimates of floodplain harvesting volumes for licences and their management, before there is access to implementation of the floodplain harvesting regulations, given there is considerable evidence of long-term unsustainability of rivers.

**c. Licensing, regulation, metering and monitoring of floodplain harvesting to meet sustainable levels and the objectives of the Water Management Act 2000 and the Murray-Darling Basin Plan**

- i. *Licensing.* The NSW Government is significantly improve the licensing framework for floodplain harvesting. This involves licensing works and volumetric capacity. However, the NSW Government is currently focusing on five river valleys in the northern Murray-Darling Basin but floodplain harvesting also occurs in other river valleys. It is also confined only to 'designated floodplains'. This is not sufficient.

The calculation of the volumes for floodplain harvesting licences is of concern,



given the considerable uncertainty about how much water was diverted at the time of the setting of the Murray-Darling Basin Cap (1994 levels of development). Water volumes licensed for many regulated rivers were over allocated initially, with considerably more water allocated than was available in many rivers in the Darling River catchments. This mistake should not be repeated, given the current poor ecological state of many of the rivers in the Darling River and its catchments.

Water harvesting licences should not be tradeable. The amount of water that can be diverted during floodplain harvesting varies considerably along the length of a river and depends on the actual location of the works. These reflect river flooding patterns (e.g. location of levees, other banks, channels and storages). Trading a volume of water upstream or downstream is likely to have unintended consequences. There will be the impacts of new earthworks on floodplains, fragmenting floodplain habitat and affecting water volumes and flow downstream. Floodplain harvesting take may increase for example, if a floodplain harvesting licence was moved upstream, as well as impacting on the hydraulic movement of flows across the floodplain, affecting ecosystem and downstream users.

**Recommendation 4.** All floodplain harvesting should be licensed throughout NSW not just on the five designated floodplains, using the NSW Government framework, but they should not be tradeable and the quantities of water that are specified need to reflect the level of extraction at 1993/ 1994 levels.

**Recommendation 5.** To ensure there is continuity, temporary licences should be issued, allowing for a range of other issues to be resolved to achieve sustainability.

- ii. *Regulation.* There should be sufficient regulation in place to ensure that licensing, compliance and monitoring can occur to ensure that floodplain licensing is managed to sustainable levels of development. There is a need for essential resources for effective regulation and compliance.

**Recommendation 6.** Regulations, particularly event based management and flow triggers, should be established to ensure that the proposed NSW Government's licensing framework can be adequately implemented and there is sustainability for downstream users and the environment.

- iii. *Metering.* All floodplain harvesting works need to be licenced and metered. The NSW Water Reform Action Plan needs to have a 'no meter, no pump' rule as recommended by the Matthew's report (Matthews 2017). This includes diversions of flows from the floodplain, capture of flows down creeks and

rainfall capture. This can be done using meters on pumps into storages (part of the NSW policy, ie point of intake). However, flows could still be diverted to bypass these storages if timed for when a particular crop requires water. There is a need to measure this volume which could be possible by estimating water use by crops or monitoring with Sentinel satellite imagery.

**Recommendation 7.** All floodplain harvesting volumes should be metered and measured including flows that enter and bypass storages.

- iv. *Monitoring.* All floodplain harvesting should be monitored with clear compliance checks. This includes tracking the filling of storages during floods and the use of water on crops, as well as metering. Satellite imagery, particularly Sentinel-2 and drones could be used to ensure compliance, identifying potential hot spots of concern. There needs to be event based monitoring of floodplain harvesting using aerial photography, metering and satellite imagery and tracking each flow based event at the valley level. Such information is essential to adequately address this key issue and provide independent data and improve the modelling.

**Recommendation 8.** All floodplain harvesting should be monitored in real time, using all available technology, including meters, satellite imagery and drones.

#### **d. Other related matters**

In relation to other related matters, there are a range of issues that I would like to raise.

- i. *Rainfall runoff*

All floodplain harvesting diversions should be captured within the licensing framework including rainfall-runoff, given this water would have flowed into rivers and floodplains. This should be included in the licencing framework, including where there are distributary creek systems that flow across floodplains and where water can be intercepted. This volume also needs to be consistent with the Murray-Darling Basin Cap and the volume of water diverted at each location at 1993/1994 levels of development.

**Recommendation 9.** Rainfall runoff needs to be measured, metered and reported as part of the extraction limits, even if not within the licencing framework.

- ii. *Audit of structures*

There needs to be a clear definition that defines all structures, capable of harvesting floodplain flows for compliance. This should include roads, levees,

channels and storages. There needs to be a temporal analyses, using available historic data (aerial photography, satellite imagery) of the development of structures capable of floodplain harvesting, including levees, channels and storages. In particular, this audit should be valley by valley and identify timing, location and size of each structure.

Each structure should then be examined in relation to the licensing framework and government policies related to floodplain harvesting including the Murray-Darling Basin Cap and the Basin Plan. All floodplain harvesting structures capable of diverting planned or held environmental water need to be examined to first determine when they were built in relation to major government policies (see above) and then develop mitigation options for reducing the impacts of these floodplain harvesting structures on the diversion of floodwater including environmental water.

**Recommendation 10.** There should be an audit of all structures and their risks in relation to impact on downstream flows, affecting ecosystems downstream.

*iii. Volumetric estimates, hydrological modelling and Basin Diversion Limit (BDL)*

The management of rivers and restricting diversions to Murray-Darling Basin Cap levels is achieved by using a model and updating the model with new information. An important element is how such data is used to manage and inform the modelling resulting in changes to access to flows if diversions exceed a Basin Diversion Limit and requirements of the floodplain where this water floods, including servicing users on the extremities of floodplains. Currently these relationships are not transparent or clear in relation to what data is currently used to make decisions about basin diversion limits.

There is the challenge of data input and assumptions in the calculation of floodplain harvesting. For example, a range of estimates have been variously derived for measuring floodplain harvesting and storages in the Gwydir River. In 2010, there was an estimate of 146,000 ML/yr, with estimated storage capacity of 429,000 ML, recognizing that previous estimates were 97,000-114,000 ML/yr with 351,000 ML of storage (Sinclair Knight Merz CSIRO and Bureau of Rural Sciences 2010). Subsequently, the Murray-Darling Basin Authority compared different estimates across river valleys (Murray-Darling Basin Authority 2011). In relation to the Gwydir, it identified the NSW water sharing plan used an estimate of 80,000 ML/yr for floodplain harvesting. However, in the Basin Plan model for the Murray-Darling Basin, the Murray-Darling Basin Authority used an estimate of 17,700 ML/yr for floodplain harvesting in the Gwydir River, a reduction of 62,300 ML/yr or only 22% of the original estimate, and this was “based on irrigator surveys” (Murray-Darling Basin Authority 2011). Most recently, the NSW Government estimated that Cap take was 103,600 ML/yr and that there are currently 523,000 ML of storage in the Gwydir River, compared to the Cap (plan limit) of 291,100 ML (NSW Department of Planning Industry and

Environment 2021). At the Murray-Darling Basin scale, the Murray-Darling Basin Authority in its calculation of Basin Baseline Diversion Limits in 2012 estimated that floodplain harvesting only accounted for 210,000 ML/yr for the entire Murray-Darling Basin, including only 17,700 ML/yr for the Gwydir (<https://www.mdba.gov.au/sites/default/files/pubs/baseline-diversion-limit-estimates-as-included-in-basin-plan-schedule-3-2012%E2%80%93surface-water.pdf>).

These differences matter. The disparity between estimates erodes public confidence and rigour. These are also the type of estimates that are being used to determine the diversion limits for a river valley and could be used to identify the volume of water to be provided to irrigators in their floodplain licences. It underlines the importance of transparency and the need for good information for water resources, a public resource, before they are provided to users.

These estimates are further complicated by the drying climate. The relatively simple approach of using the 'volume' or 'history of use' for establishment of the floodplain harvesting licences will be critical and needs to take account of a drying river environment, as this policy will probably favour extraction over the environment. If not, there is likely to be further overallocation of the water resource by establishing a volume for floodplain diversions.

**Recommendation 11.** There should be improved transparency in the reporting of floodplain harvesting (diversions, storages and hydraulics) and the relationships with Murray-Darling Basin plan and modelling.

**Recommendation 12.** There need to be a protection of flows on floodplains by implementing flow triggers that permit floodplain harvesting only when thresholds of flow at downstream points on each river, which allow for progression of flows, are achieved.

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