



**Submission on
Implementing the NSW
Floodplain Harvesting Policy
and Better Management of
Environmental Water -
Consultation papers**

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

The Centre for Ecosystem Science (CES), 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 provide a submission to the consultation papers for implementing the NSW Floodplain Harvesting Policy and Better Management of environmental water.

Current implementation and management policies proposed in these two consultation papers have major risks, inconsistencies and do not adequately reflect the inquiries and criticisms of water management in NSW, including the Matthews' report into NSW water management and compliance (Matthews, 2017), the Murray-Darling Basin Authority's compliance review (Murray-Darling Basin Authority, 2017) and the New South Wales Ombudsman's report (New South Wales Ombudsman, 2017).

The policies in the consultation papers also do not adequately reflect the current evidence base or needed investments and developments in use of technology for tracking water use. In particular, policies does not provide a strong evidence base for making decisions which impact on a range of policies and plans including the Murray-Darling Basin Plan, Sustainable Diversion Limits, Ramsar wetland management, and water management plans for the major valleys.

Policy decisions in relation to floodplain harvesting and management of environmental water 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.

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.

A. Implementation of Floodplain Harvesting Policy

In relation to comments on the implementation of the floodplain harvesting policy, this submission is structured to focus on the overall context for the policy and then each of the issues for consultation, followed by other issues which are not well covered in the consultation paper.

1. Overall 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).

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 implementation of the floodplain harvesting policy. Generally, the consultation paper inadequately identifies the already considerable costs of river regulation and floodplain harvesting on floodplain ecosystems. 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). Further the consultation generally poorly frames the issues around socio-economic impacts of the implementation of this policy on the environment or downstream users.

In addition, considerable volumes which are not accounted for are diverted from rivers in New South Wales with floodplain harvesting, particularly threatening good management of the Darling River basin and its tributary rivers (Murray-Darling Basin Authority, 2017). Little of this water has been included in Baseline Diversion Limits and was not included

adequately in hydrological modelling underpinning either the Basin Plan or the Northern Basin Review. This is reflected in significant differences in estimates. For example, only 210GL was included for the entire Murray-Darling Basin, including 17.7GL for the Gwydir River catchment and yet the estimated volume in the NSW Water Reform Action Plan is 600GL for the Gwydir alone.

Despite more than two decades of understanding of the challenges of floodplain harvesting, the data underpinning good decision-making (i.e. locations, functions and size of structures (levees, channels, storages)) remains poorly known. Such data are essential and combined with multiple lines of evidence in monitoring could provide a useful platform for effective floodplain harvesting policy. Currently this data platform is inadequate.

2. Rainfall runoff

The intent to capture all floodplain harvesting diversions within the licensing framework is supported but to do so can only be done when there is considerably more rigorous information collected. This evidence base is essential for long-term policy implementation and it is currently poor. Rainfall runoff is fundamentally important to incorporate into the implementation given that considerable amounts of rainfall also fall on floodplains. However it is important to recognize that this should not 'gift' an additional volume of water for extraction. There needs to be clear policy and management separation that recognizes floodplain harvesting works are designed primarily to divert overbank flows from rivers. Further it is important to clarify the relationship of the farm dams policy in relation to harvesting of 10% of flows and how this integrates with the current policy, particularly in relation to long-term impacts on downstream users and the environment. Until there is good baseline data on the locations, sizes and functions of structure in relation to floodplain harvesting, further policy development should not occur in this area.

Pros

It would be impossible to separate out works that are separately designed to harvest river or floodplain flows from those that are designed to harvest rainfall. For example local rainfall falling on the Gwydir River floodplain will naturally follow the hydraulic and channels that make these low-relief floodplains, the same channels that take river and overbank flows to downstream wetlands.

Without licensing works that also capture local rainfall, there will be long-term impacts on downstream users and environments. The take could also be increased in a catchment, further contributing to challenges in terms of adjusting sustainable diversion limits. There would also be considerable challenges in measuring the amount of local rainfall that might be diverted in these systems, as opposed to river flows. Even for

systems, high up in the catchment, there is a need to measure the take of water because it will affect viability of downstream users as well as the environment.

Further, including all floodplain harvesting within the licensing framework would be consistent with the intent of the NSW Floodplain Harvesting Policy (http://www.water.nsw.gov.au/data/assets/pdf_file/0012/548499/floodplain_harvesting_policy.pdf). It would also provide more effective management of floodplain diversions and improved protection of environmental flows and reliability to downstream users.

It is not clear from the consultation paper, what compensable rights that protect access to both overland and rainfall runoff refers to. There are no clear compensable rights to landholders who have had their overland flows removed as a result of river regulation, including diversions upstream (Fessey, 2017; Hall, 2017; Petersen, 2017).

The benefits are also clearly outlined in the consultation paper in terms of rigorous compliance and enforcement regime, equity of treatment and no increase in the amounts already capped. The benefits identified for Option 2 (not including rainfall-runoff in the licensing) are not clearly benefits. They more reflect a poorly developed management and administrative system. Note the comment above about IPART and the value of licensing. To argue that option 2 is an improvement of floodplain diversions, ignores the fact that option 1 is better. The second benefit point for option 2 should not have been included.

Further the argument that there is less risk of pollution is also disingenuous. This is primarily a management issue and should not be included as a benefit. As a result of including rainfall-runoff into the licensing framework then there should be an approach of not allowing contaminated water to reenter the environment, as long as this doesn't open up an opportunity to divert more water from the river.

Cons

Increased measurement and access to water is critical and it would be an advantage to have IPART further consider this aspect. As identified above, it is not possible to easily separate the difference between rainfall-runoff and flows in the river and floodplain and so this should be an advantage to capture this part of the water cycle in the determinations. It may be possible to apply a lower price threshold for rainfall-runoff but its current absence from the accounting equation represents a problem. It is not clear why there is an increased risk of diffuse pollution.

Recommendation

Rainfall-runoff needs to be licenced but before doing this, it essential for the following steps to be completed:

- A statewide historical audit that establishes current and past establishment of floodplain harvesting works (levees, channels and storages) and their relative capacity to divert floodplain water in relation to major government policy.
- Identification of volumes diverted by those floodplain works for each part of every floodplain in NSW, in relation to changes in capacity over time.
- Inclusion of volumes of water in Basin Diversions Limits, the Basin Plan and updating modelling outputs.
- Clarification of access to 10% of run-off on farm and interaction with flood flows on floodplains.
- Assessment of the volume of water separated from rainfall input for floodplain harvesting earthworks to determine the potential volume harvested. Rainfall data and remote sensing imagery could be used to estimate this volume and the local importance of large rainfall events on the floodplains of the rivers of NSW.

3. Monitoring of floodplain harvesting

Floodplains are incredibly complex systems with channels, wetlands and dependent vegetation. It is not sufficient to rely on only a few measures of monitoring. The problem of floodplain harvesting and potential for diverting water has been known for decades but has not been addressed adequately. The proposed staged approach is not clear in providing direction on what needs to be measured and which organization or individuals will be responsible for such monitoring. In particular, it is not clear how this might integrate with regulation and compliance around legislation.

The proposed staged approach does not adequately outline the role of an independent regulator charged with collecting data independent of users for monitoring floodplain harvesting. There are useable technologies (e.g. remote sensing measurement of water and evapotranspiration of crops and storages) which provide an opportunity for regulation, based on a good evidence base. There is a clear opportunity to use independent reporting and lines of evidence as well as some of the other critical aspects of water management in NSW to adequately design system that monitor floodplain harvesting.

The comments below (recommendations and response) are directed at each of the suggested parts of the staged approach.

- **A minimum requirement for water users to measure storage volume through gauge boards and calibrated storage curves to account for floodplain harvesting during the first three years of implementation**

Recommendation: It is not clear how a regulator will be able to adequately ensure the rigour and veracity of these data. More than a decade ago, the NSW Government put forward a draft policy to apply to floodplain harvesting which was never implemented but would potentially equip governments with the necessary information for ensuring that there is transparency and auditing opportunities available for necessary regulation. Floodplain harvesting could be measured where appropriate by installing a ‘second-lift’ pump which would meter the amount of water taken from a channel and stored. This may require some work in relation to the volume of water pumped from the river but would give an opportunity for the system to integrate with current licensing management. For harvesting which simply directs water into a storage, other methods (e.g. remote sensing) would be more effective and available.

- **Identifying alternative measurement approaches during the first two years of implementation**

Recommendation: Governments have generally ‘vaguely’ provided such direction on alternative measurement techniques for more than a decade. It is important to specify explicitly the types of measurement techniques already available. These include use of remote sensing, LiDAR for determining the path of water flows and storage volumes. This would add another independent source of information that complements metering. These methods should be mentioned here so that stakeholders already are aware of the direction of government. In particular, there is currently a call for new water technology to assist the NSW Government <https://www.industry.nsw.gov.au/water-reform/water-pilot-technology-program> which will be critical to the future. It is important that this complex area progress and implement the most state of the art technology to assist with water access.

- **Evaluating the performance of the minimum requirement against the policy objectives after the first two years of implementation**

Recommendation: This is fundamentally important but there needs to be more clarity about where this is going to occur. A staged approach would benefit from a plan in relation to which parts of NSW this implementation will occur. Also it is not clear exactly how such a performance will be evaluated. It clearly needs to articulate how such a performance will occur in terms of tracking volumes of water diverted using floodplain harvesting licences and how this meets the objectives of policy, including obligations to downstream users and environmental assets.

- **A revised minimum requirement implemented (if required) after the third year of implementation**

Response: It is not clear what this means and how it differs to the stage above. Similar criticisms apply to this stage as provided above.

4. Proposed approach to account management rules for floodplain harvesting

There remains a key issue related to understanding levels of development on floodplains that allow for harvesting and what volume of water can be extracted during different flooding periods. These data are critical for achieving the Baseline Diversion limit and the

harvesting component of the Baseline Diversion Limit as well as managing future growth in development.

There are key data requirements and opportunities for using technology to understand, manage and regulate floodplain harvesting. In addition, there is no clear mechanism for preventing growth in floodplain harvesting from construction or modification of floodplain works.

Recommendations

- In particular, it is critical to measure the volume of water taken from the floodplain. This could be done by using 'second-lift' pumps into on-farm storages, combined with remote sensing of storage volumes and water use by crops.
- Associated with measuring volume, there is a need to identify all structures that intercept or affect downstream flows on the floodplain. These should be assessed for their impacts on flow and capability of harvesting floodwaters.
- There needs to be a growth in use strategy for manage increased diversions resulting from changing floodplain harvesting structures. This should also incorporate potential impacts of increased numbers of farm dams and also the potential for forest plantations to reduce run-off into rivers.
- Baseline Diversion Limits in the Base Plan should include accurate estimates of floodplain harvesting volumes for each of the river valleys.
- All floodplain harvesting works need to be licenced and metered. The NSW Water Reform Action Plan needs to have a 'no metre' 'no pump' rule as recommended by the Matthew's report (Matthews, 2017).
- A 500% allocation should not be permitted, given this applies to no other licence and this maximized the impact on floodplains and their dependent ecological communities and downstream users during flood times. It is during these periods that river and wetland ecosystems are most productive and provide for sustainability of river systems.
- Finally, it is important to ensure that tools for measuring and accounting for floodplain harvesting provide data over time and can be implemented across all floodplains transparently and in real time.

5. Other issues

Clear definition of structures and floodplain harvesting in to the sequence of floodplain harvesting policy by governments including the Murray-Darling Basin Cap and Murray-Darling Basin Plan

Recommendations

- a. There needs to be a clear definition that defines all structures, capable of harvesting floodplain flows for compliance. This should include levees, channels and storages.
- b. There needs to be a sequential 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 should then be examined in relation to significant government policies related to floodplain harvesting including the Murray-Darling Basin Cap and the Basin Plan but also include guidelines by government for floodplain developments.
- c. 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 environmental water.

Regulation and compliance issues

Resources are critical for effective monitoring and regulation. There are few officers and little information on the distribution and effects of floodplain structures.

Recommendations

- a. There is a need for sufficient financial and human resources for adequate compliance and transparent reporting.
- b. These resources need to also be provided in real time, allowing for rigorous compliance and regulation of flow events, particularly if environmental flows are managed through event based methods. Such analyses should include multiple lines of evidence.
- c. 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.

Volumetric management

It is not easy identifying how much water is diverted. Identification of the size and volumes of storages provides the most obvious and reliable index but not all water may be diverted into storage, storages can be refilled and emptied during floods and water is lost to evaporation.

The 'volume' or 'history of use' for establishment of the floodplain harvesting licence 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. This is complicated further as the location of a structure on the floodplain and its frequency of inundation will determine how much water it can divert. This will need to be considered in providing the volumetric licences for works.

Recommendations

- a. Volumetric assessments of the take of floodplain harvesting, based on multiple lines of evidence are essential. The NSW Government should develop rigorous remote sensing techniques and implementation of metering to ensure the 'no take' 'no pump' implementation occurs. This needs occur valley by valley.
- b. The total floodplain harvesting share component which is essentially based on modelled estimates needs to be updated based on historical information and real time information on volumes diverted.
- c. These resources need to also be provided in real time, allowing for rigorous compliance and regulation of flow events, particularly if environmental flows are managed through event based methods. Such analyses should include multiple lines of evidence.

Floodplain guidelines

Previous governments have established floodplain guidelines in which no structures were to be built and flow could be unimpeded (e.g. Macquarie). Floodplains now have a number of structures built within the 'no development' floodways that affect the flow of the river and allow for floodplain harvesting. The draft policy is silent on this previous policy framework. Some reference needs to be given to this previous policy and how the Government will address development within the guidelines.

Assessment of floodplain works

It is not clear how assessment for licencing will be carried out and if assessment will not only investigate hydrological effects but also investigate potential impacts on ecosystems and biota and cultural resources. The role of the EP&A Act in the assessment is also not clear. There needs to be a NSW audit of all floodplain works on rivers, including levees, channels and storage volumes.

Hydrological models

Management of the diversion limits for river valleys relies on modelling changes to flows at different nodes on each river. It is critical that each valley reexamine the data used to set diversion limits, given that poor quality of data on floodplain harvesting and in anticipation of more rigorous and accountable data (see above).

B. Better Management of Environmental Water

In relation to comments on the better management of environmental water, this submission focuses on planned environmental water and held environmental water in relation to regulated and unregulated rivers.

1. Planned environmental water

Planned environmental water includes water used to deliver extractive water but should also include dam spills and unregulated flow water. Planned environmental water is also highly dependent on adequate specification and management of licensed water through transparent regulation which also ensures no illegal theft of water. In addition, there is evidence that planned environmental water is reduced more than extractive forms of water, including held environmental water, under increased effects of climate change (Young *et al.*, 2011).

Recommendations

- There should be no reduction in planned environmental water, as agreed under the Murray-Darling Basin Plan for each river system in NSW.
- There should be clear and explicit water management policies that ensure an equitable impact of projected and current climate change reducing reliability of river flows is across all types of water including extractive licences (high, general and supplementary licences, floodplain licences), held environmental water and planned environmental water.
- Modelling of environmental flow water needs to be transparent, clearly showing that modelling recognizes where licenced water is delivered. Current modelling inadequately treats environmental flow volumes as if they are extractive licences.
- Interpretation of the reliability clause (section 6.14 Basin Plan) should not be 'interpreted' or 'modelled' to reduce planned environmental water.
- Planned environmental water needs to be protected between river valleys. To do this, there should be clear commitments in water resource plans, real time management of water access and reflected in the implementation of the Basin Plan.
- Multiple lines of evidence need to be used for regulation and transparent reporting of access to planned environmental water, including modelling, satellite imagery, metering and water use by crops.

2. Held environmental water

Held environmental water is managed as a right, similar to other forms of extractive use but for environmental outcomes. Currently there are some major challenges in the delivery and management of held environmental water. The following recommendations are made for improvement.

Recommendations

- Held environmental flows should be protected throughout the Murray-Darling Basin. This requires that it be protected when it move between connected river valleys and not be pooled into available water. Environmental flows are simply destined for one location as during extraction for irrigation, environmental flows serve a function all along the river system, ensuring longitudinal connectivity.
- Modelling of environmental flow water needs to transparent, clearly showing that modelling recognizes where licenced water is delivered. Current modelling inadequately treats environmental flow volumes as if they are from the locations of the original extractive licences.
- There needs to be improved management of environmental flows to ensure that channel capacity constraints or delivery options are not driven by current practices which primarily favour delivery of flows for irrigation on town water supplies.
- There needs to be clear separation in the accounting of held environmental water, separate from planned environmental water.
- Metering of pumps needs to clearly demonstrate that held environmental water is not pumped for extractive irrigation use.
- Multiple lines of evidence need to be used for regulation and transparent reporting of access to planned environmental water, including modelling, satellite imagery, metering and water use by crops.
- There is a need to develop agreements with landholders where appropriate which allows for natural flooding to occur in the way that it previously did before river regulation. This may require the negotiation of flood easements.

3. Regulated rivers

Regulated rivers are primarily rivers regulated by large government storages in the catchment. This provides for volumes of high and general security licences as well as supplementary flow licences.

Recommendations

- ‘No meter’ and ‘no pump’ rules need to be implemented for all types of extracted water (high and general security, supplementary and floodplain harvesting).
- An audit of floodplain works needs to be completed, along with rigorous assessment of diversion of water. In particular, environmental flows across the floodplain need to be protected. Where they are potentially diverted by channels or floodplain harvesting works, there needs to be restoration of the floodplain to ensure that the environmental flows are able to deliver environmental outcomes and not be diverted for other purposes.
- All other recommendations for planned and held environmental water, outlined above, need to be implemented.
- Multiple lines of evidence (metering, modelling (different types), crop water use, satellite image analyses) need to be used to determine extractive use and ensure protection of held and planned environmental water in regulated rivers.

4. Unregulated rivers

Unregulated rivers usually have limited government build storages in the upper catchment with most extractive use through direct pumping from the rivers into on-farm storages.

Recommendations

- Environmental flow water needs to be protected in unregulated rivers through event based management which can adjust commence to pump rules to ensure that water is 'shepherded' down the system.
- Environmental flow water needs to be allowed to flow and be protected as it moves between river valleys (e.g. Macquarie River into the Barwon-Darling River).
- A statewide audit of floodplain works needs to be completed, along with rigorous assessment of diversion of water. In particular, environmental flows across the floodplain need to be protected. Where they are potentially diverted by channels or floodplain harvesting works, there needs to be restoration of the floodplain to ensure that the environmental flows are able to deliver environmental outcomes and not be diverted for other purposes.
- 'No meter' and 'no pump' rules need to be implemented for all types of extracted water (high and general security, supplementary and floodplain harvesting).
- Recommendations above for planned and held environmental water need to be implemented.
- Multiple lines of evidence (metering, modelling (different types), crop water use, satellite image analyses) need to be used to determine extractive use and ensure protection of held and planned environmental water in regulated rivers.

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