Submission No 61

INQUIRY INTO FLOODPLAIN HARVESTING

Organisation: Wentworth Group of Concerned Scientists and Environmental Defenders Office

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WENTWORTH GROUP
OF CONCERNED SCIENTISTS

Environmental Defenders Office

SUBMISSION TO THE INQUIRY INTO THE *NSW GOVERNMENT'S MANAGEMENT OF FLOODPLAIN HARVESTING*
13 August 2021

The Wentworth Group of Concerned Scientists and the Environmental Defenders Office welcome the opportunity to provide a submission to the NSW Legislative Council's inquiry into the *NSW Government's management of floodplain harvesting*.

Established in 2002, the Wentworth Group is an independent group of Australian scientists, economists, lawyers and business people with a longstanding interest in the conservation of Australia's land, water and biodiversity. The Wentworth Group has built a national reputation for advising communities, businesses and governments of all political persuasions on national reforms for the long-term conservation and sustainable use of Australia's natural resources.

The Environmental Defenders Office (**EDO**) is the largest public-interest environmental law firm in the southern hemisphere. Its lawyers have decades of experience advising a diverse range of clients across Australia – including farmers, Aboriginal peoples, community groups and peak environment bodies – about all aspects of water law and policy. Our litigation and law reform work helps to give our many clients living in the Murray-Darling Basin (**MDB**) a legal voice and the ability to hold governments and others to account.

What is floodplain harvesting?

Floodplain harvesting is the capture and use of water flowing across a floodplain. This water is intercepted, diverted and captured by floodplain structures including engineered channels, levees and on-farm storages. Tens of thousands of kilometres of structures[1] have been built over more than 70 years of intensification in irrigation development in the MDB, harvesting large volumes of floodplain flows free of charge for irrigation and other purposes. Without floodplain harvesting, much of this water would have nourished floodplain and wetland habitats, contributed to clean water for downstream communities and ecosystems, or soaked into the ground to recharge aquifers.

Floodplains: the lungs of the river system

Water spreading periodically across vast shallow floodplains of northern NSW is vitally important for river health. Floodplains naturally purify water, enrich soil health, and provide natural flood and erosion control. Most of the water flowing across floodplains sustains floodplain eucalypt and other vegetation and aquatic communities, with considerable amounts either infiltrating into shallow groundwater aquifers where it contributes to regional water storage, or flowing back into rivers, contributing to water supply, wildlife health and water security in downstream river valleys.

Floodplain wetlands are among the most biodiverse ecosystems in the world[2]. Flows on floodplains underpin the health of freshwater species including migratory birds, other waterbirds, native fish, frogs and many flood dependent aquatic plants (e.g. river red gum). Internationally significant

[1] A study of structures in 2005 identified 2,320 km across the Macquarie floodplain mostly in the southern portion; cf. Steinfeld, C.M.M. and Kingsford, R.T. (2013), Disconnecting the Floodplain: Earthworks and Their Ecological Effect on a Dryland Floodplain in the Murray–Darling Basin, Australia. *River Research and Applications*, 29: 206-218. https://doi.org/10.1002/rra.1583

[2] Kingsford, R. T. (2015) Conservation of floodplain wetlands-out of sight, out of mind. *Aquatic Conservation: Marine and Freshwater Ecosystems* 25:727-732.

Ramsar wetlands also depend on these flows for survival[3,4]. Healthy floodplains support important recreational, tourism and fishing opportunities and enhance community wellbeing.

Impacts of floodplain harvesting

Structures on floodplains which harvest water and alter natural flow regimes have significant and cumulative effects on environmental and downstream values[5]. Evidence from Australia and internationally show that some floodplains have been almost entirely disconnected from their channel by floodplain levees altering natural flow regimes[6,7,8,9]. For example, large swathes of river red gums in the Macquarie valley have died because multiple disturbances including floodplain structures, river regulation, upstream water extractions and drought have fragmented or completely blocked inundation[10].

The *Biodiversity Conservation Act 2016* (NSW) recognises alteration of natural flow regimes on floodplains as a key threatening process that adversely affects threatened species and ecological communities. The Commonwealth Threatened Species Scientific Committee recognised that floodplain structures "reduced the frequency, amplitude, and duration of floods and increased the frequency of short-term water level fluctuations, disrupting connections between the river and the floodplain"[11]. According to the Sustainable Rivers Audit, river systems across northern NSW are in poor to very poor health due in large part to the effects of over-extraction of water from rivers and floodplains[12]. In summer 2018–19, major fish kills in the Darling River at Menindee were caused by hypoxia-inducing cyanobacterial blooms and low flows due to severe drought combined with excess upstream irrigation diversions, including floodplain harvesting.[13,14]

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[3] Rogers, K., and Ralph, T.J. (2010) *Floodplain Wetland Biota in the Murray-Darling Basin: Water and Habitat Requirements.* CSIRO Publishing, Melbourne.

[4] Roberts, J., and Marston, F. (2011) *Water Regime for Wetland and Floodplain Plants: A Source Book for the Murray–Darling Basin*. National Water Commission, Canberra. Available at: https://www.researchgate.net/publication/268421798_Water_regime_for_Wetland_and_floodplain_plants_A_source_book_for_the_Murray-Darling_basin

[5] Kingsford, R. T. (2015) Conservation of floodplain wetlands-out of sight, out of mind. *Aquatic Conservation: Marine and Freshwater Ecosystems* 25:727-732.

[6] Leyer I. (2004) Effects of dykes on plant species composition in a large low-land river floodplain. *River Research and Applications* 20: 813–827, DOI: 10.1002/rra.795.

[7] Kesel RH. (2003) Human modifications to the sediment regime of the Lower Mississippi River flood plain. *Geomorphology* 56(3–4): 325–334, DOI:10.1016/S0169-555X(03)00159-4.

[8] Galat DL, Fredrickson LH, Humburg DD, Bataille KJ, Bodie JR, Dohrenwend J, Gelwicks GT, Havel JE, Helmers DL, Hooker JB, Jones JR, Knowlton MF, Kubisiak J, Mazoureck J, McColpin AC, Renken RB, Semlitsch RD. (1998) Flooding to restore connectivity of regulated, large-river wetlands. *Bioscience* 48: 721–733, DOI: 10.2307/1313335.

[9] Kingsford RT, Thomas RF. 2002. Use of satellite image analysis to track wetland loss on the Murrumbidgee River floodplain in arid Australia, 1975–1998. *Water Science and Technology* 45(1): 45–53.

[10] Steinfeld, C.M.M. and Kingsford, R.T. (2013), Disconnecting the Floodplain: Earthworks and Their Ecological Effect on a Dryland Floodplain in the Murray–Darling Basin, Australia. *River Research and Applications*, 29: 206-218. https://doi.org/10.1002/rra.1583.

[11] Advice regarding structures in the Macquarie Marshes, page 19. Available at: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/93-committee-advice.pdf

[12] Murray-Darling Basin Authority (2012) *Sustainable Rivers Audit 2: The ecological health of rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*. Summary. Canberra. Available at: https://www.mdba.gov.au/sites/default/files/pubs/SRA2-SUMMARY-FINAL_0.pdf

[13] AAS (2019) *Investigation of the causes of mass fish kills in the Menindee region of NSW over the summer of 2018–2019.* Australian Academy of Sciences, Canberra. Available at: https://www.science.org.au/supporting-science/science-policy-and-sector-analysis/reports-and-publications/fish-kills-report

[14] Vertessy, R., Barma, D., Baumgartner, L., Mitrovic, S., Sheldon, F. and Bond, N. (2019). *Independent assessment of the 2018–19 fish deaths in the lower Darling.* Australian Government, Canberra. Available at:

Floodplain management plans[15] in NSW identify a range of direct and indirect impacts associated with flood works. Flood works can impact public and private property by re-directing flood flows onto adjacent land, increasing flood velocity leading to erosion and scour, and increasing local flood levels leading to disruption to property access and loss of crops and infrastructure. Flood works can also lead to disconnection of floodplain habitats from their water supply in rivers, diversion of flood flows away from ecological assets, decline in nesting and refuge habitat, restricted native fish passage, reduction in groundwater recharge and a decline in the condition or viability of species.

Significance to Aboriginal nations

Floodplains are of great significance to Aboriginal peoples. Floodplains and their interconnected lagoons, wetlands, swamps and waterways have fostered totemic species, language, songlines, creation stories, men's and women's business, and law and culture in these sacred places over thousands of years. They support human health, recreational fishing, spiritual and cultural wellbeing as well as providing important social and economic opportunities for Aboriginal communities. These values are recognised in the overarching principles of the *Water Management Act 2000* (NSW) (**WM Act**) (specifically s 5.2 (e) and (f)) which state that geographical and other features of Aboriginal significance and other features of major cultural, heritage or spiritual significance should be protected.

The Wentworth Group does have an Aboriginal Member but does not and cannot speak for all Aboriginal peoples in the northern Basin. Nevertheless, we recognise that it is iniquitous that Aboriginal peoples have been profoundly disadvantaged by multiple waves of water dispossession and water reform across the MDB. This has culminated in Aboriginal peoples of NSW's MDB holding only 0.2% of issued water entitlements.[16] The NSW Government's proposal to create floodplain harvesting licences and transfer all but one of these to non-Indigenous interests would exacerbate this injustice. This is clearly unacceptable, particularly as the extent and impacts of Aboriginal water dispossession in the MDB are well documented and can only be reversed with meaningful, co-designed policy that seeks to redistribute water to Aboriginal nations. We note that failure to take such steps (including in relation to the licensing of floodplain harvesting) would be inconsistent with the National Commitment to Closing the Gap, which the Premier of NSW signed in July 2020. To that end, the NSW Parliament should consult Aboriginal nations in the Basin as to how their entitlements to water can be significantly increased to meet their cultural, social, environmental and economic needs.

Floodplain harvesting is unmeasured, unmetered and unsustainable

Floodplain harvesting in NSW is currently an unmeasured, unlicensed and poorly regulated activity. The NSW Government estimates that floodplain harvesting accounts for between 15 to 35 percent of the overall surface water extraction in the northern Basin[17], although there has been little monitoring or measurement in practice. In most valleys in northern NSW, the amount of water extracted by floodplain harvesting has grown to exceed long-term extraction limits[18] and has

https://www.mdba.gov.au/sites/default/files/pubs/Final-Report-Independent-Panel-fish-deaths-lower%20Darling_4.pdf

[15] For example, Floodplain Management Plan for the Macquarie Valley Floodplain 2018 https://www.industry.nsw.gov.au/__data/assets/pdf_file/0006/166524/draft-FMP-for-the-Macquarie-Valley-Floodplain-2018.pdf

[16] Hartwig, L., Jackson, S. and Osborne, N. (2020) Trends in Aboriginal water ownership in New South Wales, Australia: the continuities between colonial and neoliberal forms of dispossession. *Land Use Policy*, 99: article no. 104869. https://doi.org/10.1016/j.landusepol.2020.104869

[17] NSW Department of Planning, Industry and Environment (2020) *Floodplain harvesting measurement policy*, PUB20/5, available at: https://www.industry.nsw.gov.au/__data/assets/pdf_file/0005/317093/floodplain-harvesting-measurement-policy.pdf

[18] For growth in use in each valley see section 4.2 in NSW Department of Planning, Industry and Environment (2020) *Floodplain harvesting entitlements for the regulated river system: Model Scenarios reports*.

contributed to the declining health of rivers and their floodplains. This compromises flow connectivity and water quality along rivers and across floodplains and threatens the health of the northern MDB and its communities, including Aboriginal Nations.

The NSW Government has committed to implementing its Floodplain Harvesting Policy (**FPH Policy**) which would involve licensing floodplain harvesting on 'designated floodplains' in five northern Basin catchments.

Floodplain harvesting regulation is long overdue

A licencing framework is needed to rein in the growth of floodplain harvesting diversions[19] that have occurred since implementation of the 1993/94 valley-wide Cap on diversions. The licencing framework must ensure that overall take is within Cap and the Basin Plan's Sustainable Diversion Limits (**SDLs**). Issuing licences and developing the regulatory regime under the WM Act form the basis of the proposed framework to manage this form of take.

Summary of issues and recommendations

We have four main concerns related to implementation of the FPH policy that must be addressed if floodplain harvesting in NSW is to comply with State and Commonwealth legislation including water sharing principles, extraction limits, environmental water requirements under the Basin Plan and support water management objectives. These apply to floodplain harvesting in both regulated and unregulated systems.

1) Widespread lack of trust in the modelled estimates of extraction limits because of limited data and inability to verify model outcomes including levels of take;
2) Higher priority water for environmental and community needs will not be protected under the proposed FPH policy;
3) Many floodplain structures will continue to intercept floodplain flows even when extraction is not permitted; and
4) There is insufficient evidence to demonstrate that the policy will deliver legally mandated environmental and other downstream outcomes.

In light of these concerns, we suggest that the Committee recommend that the following protections are incorporated into the licencing framework:

1) improve confidence in, and implement rigorous estimates of, long-term extraction limits by improving models, the modelling process and using multiple lines of evidence;
2) implement flow triggers and other rules to protect high priority flows from being extracted on floodplains, namely basic landholder rights and flows required to protect water sources and dependent ecosystems (as required under s 5(3) of the WM Act);
3) ensure floodplain structures do not alter natural flood flows at times when extraction is not permitted; and
4) issue only temporary licences until there is clear evidence that extractions are within limits and that legally mandated environmental and other downstream outcomes are being achieved.

[19] E.g. in the Border Rivers and Gwydir. NSW Department of Planning, Industry and Environment (2020): NSW *Border Rivers: Floodplain harvesting in water sharing plans: Report to assist community consultation*, INT20/86681.

Key issues and recommendations

Issue 1: Widespread lack of trust in the modelled estimates of extraction limits because of limited data and inability to verify model outcomes including levels of take.

State and Commonwealth water legislation requires that all forms of take within a valley are within long-term extraction limits. These limits include the MDB Cap[20] (**Cap**) on water extractions reflecting development and management conditions at 30 June 1994, the NSW Water Sharing Plan Limit[21] (**Plan Limit**) reflecting development and management conditions at the early 2000's and the Basin Plan's SDLs[22] representing a 2,137 GL[23] reduction in extractions compared to development and management conditions at mid-2009. These are jointly referred to as **extraction limits**. Compliance with these extraction limits generally applies to all forms of take, of which floodplain harvesting is a component part.

Extraction limits are estimated by complex hydrological models developed by the NSW Government as a single volume representing all forms of take for each valley. The models are underpinned by thousands of decisions which cannot be verified by the public. Their code and simulated time series are not available for public scrutiny. Given the lack of public access to these models, the only way to have confidence in the model output is to have confidence in the modelling process. This means confidence in the input data, model development, model testing, sensitivity analysis, independent review, accreditation and annual evaluation. However, the independent review undertaken as part of the FPH policy reported a number of modelling shortfalls and suggested improvements which have not been incorporated into the final modelling. These include recommendations to cross-verify estimated volumes, improve rainfall-runoff estimates, incorporate return flows, assess model uncertainty, incorporate access rules and provide reasons for changing floodplain harvesting volume estimates over time[24].

We have identified considerable uncertainties in the modelling process which raise doubts about the accuracy of the model estimates of the floodplain harvesting entitlement volumes and proposed extraction limits. The main sources of uncertainties include:

1. **Model errors** including those reported in the model build documentation. For example in the Border Rivers, over the 8-14 year validation period, low flow volumes were overestimated by 10-30%, and there was a ±7% error in medium flows and a ±2% error in high flows, resulting in an overall model error of -10% to +16% for river flows.[25] Yet there is no requirement for modelled river flows to be annually validated against actual river flows, nor is there a requirement for recalibration or corrections to account for these errors. Evaluation and error correction are needed to demonstrate that the model accurately simulates real-world river flows each year to ensure the compliance framework is robust. Without this evaluation, and given the tendency for models to overestimate flows, the environment and downstream communities could bear risks associated with model errors[26];

[20] Schedule E of *Water Act 2007* (Cth)
[21] Defined in NSW Water Sharing Plans.
[22] Defined in the *Water Act 2007* (Cth) and described for each valley in Schedule 2 of the *Basin Plan 2012* (Cth)
[23] https://www.mdba.gov.au/basin-plan/sustainable-diversion-limits/current-diversion-limits-basin
[24] Weber, T., and Claydon, G., (2019) *Independent Review of NSW Floodplain Harvesting Policy Implementation*, Final Report, Alluvium, available at: https://www.industry.nsw.gov.au/__data/assets/pdf_file/0004/272146/Final-floodplain-harvesting-independent-review.pdf
[25] DPIE-W (2021), *Building the river system model for the Border Rivers Valley regulated river system*, Report, PUB20/885, Sydney.
[26] Wentworth Group of Concerned Scientists (2020) *Assessment of river flows in the Murray-Darling Basin: Observed versus expected flows under the Basin Plan 2012-2019*, Sydney.

2. **Limited input data** including lack of historically measured floodplain harvesting take and incomplete information on floodplain structures in 1994[27]. Given that there has been no historical measurement of extractions, other evidence such as satellite imagery, remote sensing, farm surveys and site inspections had to be used to derive extraction estimates. However, these are an incomplete representation of extractions which can undermine the accuracy of the model outputs;
3. **Model deficiencies** including failing to represent water returning from the floodplain into the river ('**return flows**'). This meant that the models were unable to adequately simulate environmental and downstream impacts of licence settings;
4. **No sensitivity analysis** to enable an understanding of the impacts of climate change and the sensitivity of the modelled results to changes in rainfall, evaporation, soil moisture and other hydrological process; and
5. **Limited expert reviews** including limited scope and transparency of the independent peer review of the model compared to previous expert review processes. The independent reviewer focused on the model reports rather than the model itself, and the full independent model review reports for each valley were not published. In addition, the model has not been approved by the Murray-Darling Basin Authority which is a Cap requirement in the *Water Act 2007* (Cth).

The WM Act was enacted over 20 years ago and models were then, and remain, one of the most important water management tools in the MDB and beyond. Given this effluxion of time and the crucial role that models play in sharing water, it is not unreasonable to expect NSW to have developed fit-for-purpose tools capable of ensuring compliance with overarching legal obligations. This is particularly true given the impacts of climate change on water availability in large parts of south-eastern Australia. It is in light of these observations that we make the following recommendations.

Recommendation 1: Improve confidence in, and implement rigorous estimates of, long-term extraction limits by improving models, the modelling process and using multiple lines of evidence.

a. Annually validate models used for compliance against actual river flows and account for model error transparently, either through model recalibration or bias correction, when determining the total extraction limits for that year.
b. Meter or otherwise measure all floodplain take using best available technology.
c. Update models based on metered and measured floodplain take and use multiple lines of evidence to review and adjust floodplain harvesting licence volumes.
d. Incorporate return flows into the models to evaluate whether the FPH policy will achieve environmental water requirements and whether downstream flows will satisfy higher priority needs.
e. Use best available climate change projections and sensitivity analysis to evaluate the impact of climate change on entitlement reliability, downstream outcomes and environmental impacts. Re-evaluate the Environmentally Sustainable Level of Take (**ESLT**) based on this data and adjust the SDLs and floodplain harvesting entitlement volumes to align with the improved ESLT estimate.
f. Direct an expert panel coordinated by the NSW Natural Resources Commission to undertake a thorough independent review of floodplain harvesting models to ensure that model settings, including assumptions and parameters, are fit-for-purpose, that licence and accounting rules for each valley are demonstrably within extraction limits and that water

[27] Slattery and Johnson (2021) *Floodplain water harvesting in the northern New South Wales Murray-Darling Basin*. Slattery and Johnson Pty Ltd., Canberra. Available at: https://irnnsw.files.wordpress.com/2021/02/21022-fph-final-report.pdf

sharing principles are being met. The panel should report all findings and publish modelled output data for each scenario.

Issue 2: Higher priority water for environmental and community needs will not be protected under the proposed FPH policy.

The proposed framework does not guarantee that higher priority water needs, including flows which contribute to first flushes and connectivity along the Barwon-Darling/Barka River, will be protected from floodplain harvesting at all times. This is inconsistent with ss 5(3) and 9(1) of the WM Act which require water to be prioritised for the water source and its dependent ecosystem and basic landholder rights before other forms of take (**'priority of use'**).

Without rules to protect higher priority needs on an event basis, floodwaters needed to support river health and communities may be harvested. This could pose a significant risk to water supply for people and stock, water quality, environmental health and cultural values within each valley and in downstream connected valleys. These risks will be amplified under climate change. Specifically, and according to NSW Government's latest climate modelling documented in the Regional Water Strategies[28], river inflows are expected to decrease by over 60%[29] in some valleys over the next few decades, while drought is likely to be more frequent and of greater duration.

Long-term extraction limits are inadequate for preventing high priority flows from being extracted by floodplain harvesting because they do not provide the flexibility needed to manage take on an event basis in response to changing water requirements, or during periods of reduced water availability due to drought and climate change. Extraction limits set out in the legislation are historic limits that are not founded on best-available scientific evidence. That is, they do not represent an environmentally sustainable level of take[30,31] which is capable of achieving legislated environmental and downstream outcomes.

There has been over a decade's-worth of scientific evidence on the use of flow triggers to manage river systems[32]. Flow triggers are already in place in a number of NSW valleys including through water sharing plans[33] such as the cease and commence to pump requirements, the 'resumption of flow' rule[34] in the Barwon-Darling/Barka River and largely unimplemented flow management plans.[35] The Productivity Commission[36], the NSW Natural Resources Commission[37] and the Commonwealth

[28] Available at: https://www.industry.nsw.gov.au/water/plans-programs/regional-water-strategies
[29] E.g. Border Rivers by 45%, Macquarie by 62%, Gwydir by 66%, Namoi by 50%, Barwon-Darling/Barka by 60%.
[30] Young WJ, Bond N, Brookes J, Gawne B and Jones GJ (2011) *Science Review of the estimation of an environmentally sustainable level of take for the Murray–Darling Basin*. A report to the Murray–Darling Basin Authority from the CSIRO Water for a Healthy Country Flagship, 36pp.
[31] South Australia (2019) *Murray-Darling Basin Royal Commission Report*, available at https://www.environment.sa.gov.au/files/sharedassets/public/river_murray/basin_plan/murray-darling-basin-royal-commission-report.pdf
[32] For example, Thoms, M.C, and Sheldon, F. (2002) An ecosystem approach for determining environmental water allocations in Australian dryland river systems: the role of geomorphology, *Geomorphology*, 47(2–4), pp.153-168. https://doi.org/10.1016/S0169-555X(02)00085-5
[33] For example s 12(m) in the Water Sharing Plan for the NSW Border Rivers Regulated River Water Source 2009.
[34] NSW Department of Planning, Industry and Environment (2019) *Barwon-Darling Watercourse Water Resource Plan, Managing resumption of flow*, PUB19/434, available at: https://www.industry.nsw.gov.au/__data/assets/pdf_file/0016/274102/resumption-of-flow-rule-barwon-darling-wsp.pdf
[35] For example the Interim Unregulated Flow Management Plan for the North West, noting that these are not legally binding.
[36] Productivity Commission (2021) *National Water Reform 2020*, Draft Report, Canberra.
[37] Natural Resources Commission (2019) *Review of the Water Sharing Plan for the Barwon-Darling Unregulated and Alluvial Water Sources 2012: Final report*, NSW Government, Sydney.

Environmental Water Office[38] have all recommended expanding upon the current use of flow triggers.

Flow triggers which span a range of flow conditions provide clear benefits for managing water because they:

1) provide a direct transparent mechanism to protect priority needs during specific flow events given whereas the proposed policy settings (e.g. 100% vs 500% carryover, volumes, trade rules, long-term modelling averages, allocation and accounting framework, etc.) are not capable of ensuring this outcome;
2) remove the uncertainty and discretion related to temporary water restrictions as they can be agreed in advance;
3) allow the public to evaluate achievement in a transparent way through real-time data of flows at river gauges;
4) allow for event management which is increasingly important for unpredictable issues (e.g. fish kills); and
5) Allow for genuine adaptive management, including adjustments to reductions in inflows due to climate change, which is a stated objective of the Basin Plan.[39]

Finally, held environmental water purchased by taxpayers is not adequately protected from floodplain harvesting under the proposed policy. This undermines the Basin Plan reforms and may reduce the overall volume of water that is available to achieve environmental outcomes. Rules are needed to protect held environmental water from extraction so that it can be protected for the public good and managed to 'piggyback' on natural flows and create overbank watering events.

Recommendation 2: Implement flow triggers and other rules to protect high priority flows from being extracted on floodplains, namely basic landholder rights and flows required to protect water sources and dependent ecosystems (as required under s 5(3) of the WM Act).

a. Clearly defined and enforceable access rules based on flow triggers must be applied to both floodplain harvesting and supplementary licenses to enable event-based management of these lowest priority forms of take. These must include within-valley and downstream flow triggers, based on minimum flows needed to maintain or improve outcomes for environmental, cultural and basic landholder requirements under a range of flow conditions and as per water sharing principles. We recommend Environmental Water Requirements (**EWRs**)[40] as the basis for flow triggers needed to maintain or improve environmental outcomes. Additional flow triggers need to be developed for stock and domestic and cultural needs. Table 1 identifies interim environmental flow triggers to be in place before temporary floodplain harvesting licences are issued followed by a set of final triggers reflecting basic landholder rights and cultural needs. For each event, floodplain harvesting take should only be permitted if the active triggers are met, or forecast to be met. Flow triggers should be active when the recurrence frequencies have been exceeded or are forecast to be exceeded, based on recent flow conditions and best available scientific knowledge of environmental thresholds. Flow triggers should be reviewed regularly to ensure they achieve expected outcomes.

[38] Commonwealth Environmental Water Holder (2019) *Submission: Barwon-Darling Watercourse Water Resource Plan*, Canberra, available at: https://www.environment.gov.au/system/files/pages/dca287c3-73bd-4ec1-a3b1-c29dd5cf95f9/files/cewh-submission-barwon-darling-wrp.pdf

[39] *Basin Plan 2012* (Cth), s. 5.02(1)(b).

[40] EWRs have been identified for each valley's Long Term Water Plan available at: https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans

b. Implement active management rules in all river reaches containing held environmental water, including rules to ensure held environmental water is reaccredited as water moves between water sharing plan areas.

Table 1: Suggested flow triggers subject to operational constraints and review.

	Interim triggers	**Final triggers**
Objectives	*Within-valley requirements* 1. Provide human water needs, basic landholder rights and ensure connectivity along the length of rivers within each valley. 2. Maintain or improve the health of floodplain habitats in the Border, Gwydir, Namoi and Macquarie valleys. *Downstream requirements* 3. Provide connectivity along the length of the Barwon-Darling for native fish migration, riparian watering, water quality, stock and domestic and cultural requirements. 4. Secure water supply in Menindee Lakes for the lakes and high priority needs in the Lower Darling at all times.	Must satisfy the priorities identified in ss 5(2) and 5(3) of the WM Act within each valley and in downstream valleys. This includes: 1. Maintain or improve environmental outcomes, as consistent with outcomes of the Long Term Environmental Watering Plans. 2. Provide basic landholder rights. 3. Secure flow regimes for Native Title requirements and Aboriginal cultural values including geographical and other features of cultural, heritage and spiritual significance.
Suggested triggers	1. Large fresh and bankfull in Barwon-Darling River at Bourke. 2. At least small fresh at Wilcannia and Louth in lower Barwon-Darling River. 3. Sufficient storage and inflow into Menindee Lakes. 4. Overbank, bankfull, large fresh and baseflows in the Border, Gwydir, Namoi and Macquarie valleys.	1. Environmental water requirements which meet the objectives/standard of the Long Term Water Plans. 2. Basic landholder rights as determined by DPIE-W. 3. Cultural and spiritual water requirements, as defined by Aboriginal peoples within each valley.
Location	Border, Gwydir, Namoi, Macquarie, and Barwon-Darling valleys	Border, Gwydir, Namoi, Macquarie, and Barwon-Darling valleys

Issue 3: Many floodplain structures will continue to intercept floodplain flows even when extraction is not permitted.

Despite NSW Government programs and funding for healthy floodplains over more than a decade, many floodplain structures continue to alter natural flow regimes on floodplains and reduce flow connectivity. Some lawful structures may also be impacting property and ecosystems on floodplains and in the surrounding area. We have the following concerns related to how floodplain structures are considered under the FPH policy:

1) lawful structures will continue to passively capture flood water even when extractions are not permitted impacting the flow of water across floodplains and reducing flow connectivity;

2) unlawful structures will continue to impact the flow of water across floodplains and reduce flow connectivity and there is no publicly available information regarding how or when these structures will be brought into compliance;

3) Some structures will continue to pose high risks to property and floodplain environments and have not been evaluated in terms of their impact on downstream flows and environmental outcomes. These include lawful floodplain harvesting structures and some

structures which fall outside of the FPH policy (including structures outside of designated floodways and structures 'that do not facilitate the collection, extraction or impoundment of water flowing across floodplains'[41]); and

4) Some lawful structures that fall outside of the FPH policy (including roads, railways) will continue to reduce the volume of water available to the environment and downstream communities and will remain unmetered and unmeasured.

Finally, there should be no trade of annual allocations or licenced entitlements for floodplain harvesting. Trade has the potential to concentrate floodplain harvesting licences around sensitive environmental areas including Ramsar listed wetlands, which would decrease critical flows to ecosystems and impact environmental outcomes. Trade could also concentrate licences in areas with higher frequency of access to floodplain water. The combined effect could increase the overall volume of take, resulting in compliance actions including allocation reductions being applied to all floodplain harvesting licences.

Recommendation 3: Ensure floodplain structures do not alter natural flood flows at times when extraction is not permitted.

a. Only structures that can demonstrate the ability to let water pass through without capturing, spreading or substantially slowing floodwaters, when required and where legally permissible and practical, should be granted floodplain harvesting licences and works approvals. This should apply to all floodplain harvesting structures including surge areas, temporary storages, artificial channels and levees. The ability of structures to act transparently should be regularly audited for compliance purposes.

b. Access licences and works approvals must not be granted to structures that were unlawfully constructed within the designated floodway zone. Funding should be in place for compliance and remediation to ensure unlawful structures are removed and floodplain flows restored within an agreed time period. The legal status of all structures and progress of removing unlawful structures should be published regularly in an aggregate form for each zone and valley.

c. Evaluate and undertake remediation work on lawful structures and structures outside of the FPH policy which significantly impact floodplain flows to mitigate major environmental and downstream community impacts.

d. NSW must account for the volume for all water impeded, diverted or spread by structures on floodplains which are not metered or measured under the proposed framework as interceptions that contributes toward Basin Plan extraction limits.

e. Trade of allocations and entitlements should not be permitted due to the potential for environmental harm, growth in extractions or impacts on connectivity. If entitlement trade is permitted, all trades must trigger a review to identify any impacts (e.g. hydrological, environment assets, property etc.), potential changes in volumes diverted, and orders for remediation or decommission of structures.

Issue 4: There is insufficient evidence to demonstrate that the policy will deliver legally mandated environmental and other downstream outcomes.

Conferring permanent floodplain harvesting licences is a once-off event which will, as NSW is proposing, lock in compensable property rights to an expected volume of long-term extractions. Substantial community concerns related to floodplain harvesting, including those addressed in this submission, could be acknowledged by issuing temporary access licences with specific conditions

[41] NSW Department of Industry (2018) *NSW Floodplain Harvesting Policy*, Sydney, PUB18/393, available at: https://www.industry.nsw.gov.au/__data/assets/pdf_file/0017/143441/NSW-Floodplain-harvesting-policy.pdf

that must be met before permanent licences can be issued. Issuing licences on a temporary, non-compensable basis provides an opportunity to evaluate the licencing framework in practice to ensure it meets public expectations and policy objectives.

The NSW Parliament should also have the opportunity to consider the full suite of regulatory reforms before making a decision regarding specific legislative amendments related to floodplain harvesting. This includes all proposed amendments to water sharing plans, water resource plans, access licence conditions and any other legislative or regulatory amendments in relation to floodplain harvesting before or at the time of gazetting regulations for the issuing of permanent entitlements. Previously, only a subset of amendments were presented to Parliament which excluded critical components such as water sharing plan amendments and access licence conditions.

Recommendation 4: Issue only temporary licences until there is clear evidence that extractions are within limits and that legally mandated environmental and other downstream outcomes are being achieved.

a. Temporary, non-compensable licences should be issued for a trial period (e.g. 10 years) only after conditions in Table 2 have been satisfied. During the trial period mandatory reviews of extraction levels should occur after every major floodplain harvesting event. Entitlement volumes and the regulatory framework should be reviewed and modified based on updated data and modelling to ensure that any permanent licences that are issued deliver expected outcomes. Permanent access licence should only be issued after conditions in Table 1 and 2 have been satisfied. Failure to meet these conditions should result in the access licence and works approval being cancelled.

   Table 2: Conditions for issuing temporary and permanent access licence and works approvals.

Licence	Recommendations that need to be in place before issuing licences
Temporary licences	1a. Annual model validation and error correction 1b. Metering or measurement of all floodplain harvesting 2a. Interim flow triggers from Table 1 2b. Active management to protect environmental water 3a. Floodplain structures can act transparently 3e. Trade restrictions 4b. Comprehensive legislative package
Permanent licences	1c. Models and entitlements updated based on metered or measured data 1d. Return flows incorporated into models 1e. Climate change impacts assessed and licenced take to be reduced in line with updated estimate of ESLT 1f. Independent model review by expert panel 2a. Final flow triggers from Table 1 3b. Unlawful structures removed 3c. Structures which pose high risk remediated 3d. All floodplain interceptions accounted for under take limits

b. The comprehensive legislative package containing draft regulations, WSPs, WRPs, licence conditions and any other legislative amendments should be presented to Parliament before the issuing of any entitlement.

Wentworth Group of Concerned Scientists

Wentworth Group is an independent group of scientists and professionals, working to secure the long-term health of Australia's land, water and biodiversity.

Environmental Defenders Office (EDO)

EDO is a community legal centre specialising in public interest environmental law. EDO represents and collaborates with several Indigenous clients in relation to freshwater issues across Australia including in the Murray-Darling Basin.