NSW GOVERNMENT

Natural Resources Commission

Final report

Review of the Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016

September 2024

Enquiries

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Acknowledgement of Country

The Natural Resources Commission acknowledges and pays its respects to the Aboriginal nations, communities, people and traditional owners, past and present and future, for whom these waterways are significant. The Commission recognises and acknowledges that Aboriginal people have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. We value and respect their knowledge in natural resource management, and the contributions of many generations, including Elders, to this understanding and connection.

Cover photo: James Maguire/DCCEEW

Suggested citation: Natural Resources Commission (2024) *Review of the Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016*.

Document No. D24/2775

ISBN: 978-1-923080-16-4

List of acronyms and abbreviations

The Act	the *Water Management Act 2000* (NSW)
ACCC	Australian Competition and Consumer Commission
ACT	Australian Capital Territory
AR	Amendment Recommendation
AWD	Available water determination
Basin Plan	*Murray-Darling Basin Plan 2012*
CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
Commission	the Natural Resources Commission
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Commonwealth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DPE-Water	Former NSW Department of Planning and Environment – Water, referred to in this report as the Water Group
DPI	Department of Primary Industries
DPIE	Former Department of Planning, Industry and Environment
DPIF	Department of Primary Industries – Fisheries
EWA	Environmental water allowance
EWR	Environmental watering requirements
GL	Gigalitre (unit of volume equivalent to one thousand million (1×10^9) litres
HEW	Held environmental water
ILUA	Indigenous Land Use Agreement
IQQM	Integrated Quantity and Quality Model
IVT	Inter valley trade
LALC	Local aboriginal land council
LGA	Local government area
LLS	Local Land Services

LT	Denotes a recommendation where the Commission views it may not be possible to fully meet the recommendation by Plan remake, and recommends an amendment provision is included to allow the recommendation to be fully implemented during the life of the Plan
LTAAEL	Long-term average annual extraction limit
LTIM	Long-term intervention monitoring
LTWP	Long-term water plan
MER	Monitoring, evaluation and reporting
MDBA	Murray-Darling Basin Authority
ML	Megalitre (unit of volume equivalent to one million (1×10^6) litres
MLDRIN	Murray Lower Darling Rivers Indigenous Nations
NARCliM	NSW and ACT Regional Climate Modelling Project
NRAR	The Natural Resources Access Regulator
NSW	New South Wales
The Plan	The *Water Sharing Plan for the Murrumbidgee Regulated River Water Sources 2016*
PFAS	Per- and polyfluoroalkyl substances
PPM	Pre-requisite policy measures
PSV	Provisional Storage Volume
R	Recommendation
The Regional Water Strategy	The Draft *Regional Water Strategy – Murrumbidgee*
the Regulation	*Water Management (General) Regulation 2018*
SDL	Sustainable diversion limit
SDLAM	Sustainable diversion limit adjustment mechanism
SES	State Emergency Services
SRES	Special Report Emissions Scenario
The Water Resource Plan	*Murrumbidgee Surface Water Resource Plan*

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Executive summary

The Natural Resources Commission (the Commission) has reviewed the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016* (the Plan) as required under Section 43A of the *Water Management Act 2000* (the Act).

The Commission has assessed the extent that provisions in the Plan have contributed to achieving environmental, social, cultural and economic outcomes, and identified where changes to provisions are warranted. The Plan is currently due for extension or replacement by 30 June 2026. Given the opportunities for improvement identified, it is recommended that the Plan be replaced.

The traditional owners of the Plan area are the Wiradjuri, Nari Nari, Barapa Barapa, Wemba Wemba, Yita Yita, Mutthi Mutthi, Wadi Wadi, Nyeri Nyeri, Ngunnawal/Ngunawal, Wolgalu and Ngarigu peoples. Each nation has strong cultural and spiritual connections with the rivers and wetlands of the Plan area.

The Murrumbidgee River is recognised as an iconic part of the landscape by the broader community. The Plan area forms part of the connected southern basin that acts as a major food bowl, with agriculture in the Murrumbidgee region generating more than $1.9 billion annually. The Plan area is home to large regional townships and key environmental assets, including 16 nationally significant wetlands and the second largest red gum forest in Australia.

Water diversions and regulation have fundamentally altered the flow regime of the river and impacted key environmental assets in the region. Climate change is projected to shift rainfall patterns and substantially impact on water availability for water users in the future. This will include more substantial reductions in available planned environmental water under climate change projections compared to licensed entitlement holders. The Draft *Regional Water Strategy – Murrumbidgee* has highlighted the potential risks to future water availability, making these risks clearer to water users. In this review, the Commission has sought to highlight the importance of commencing water management arrangements in the next decade under a shifting climate.

The review has also highlighted areas of improvement including:

- environmental water rules in the Plan and protections for environmental water
- changes to the allocations framework to improve equity and manage water availability where supply shortfalls occur
- modelling used in water management decision-making
- revision of the Long-Term Average Annual Extraction Limits (LTAAELs) to ensure these represent a sustainable level of extraction with greater transparency and use of actual extraction data in the assessment against extraction limits
- the Plan's outcomes for Aboriginal water users and communities.

Figure 1 provides a summary of the key opportunities to improve the Plan. The Commission has developed a detailed set of 29 recommendations (**Table 1**) to address these issues and improve the Plan. While all important to address, the Commission has assigned a priority rating to each recommendation based on an assessment of the contribution of the recommendation to ensuring Plan outcomes, its impact on the Plan's ability to meet the priorities of the Act and the potential consequences of the issue being addressed. The Commission has also considered the potential timing of the recommendation. The

Commission recognises that some recommendations will require more time than is available before the Plan must be remade. These have been considered as 'long-term' recommendations and it is recommended that amendment provisions are included in the Plan that allow them to be addressed during the life of the next Plan.

A significant number of changes were made to the Plan in conjunction with the water resource planning process. For this review, the Commission assessed the version of the Plan in place at the commencement of the review (dated 23 December 2022). The Commission found several amendments made during the term of the Plan that may materially impact the Plan's ability to achieve Plan outcomes. As such, the Commission recommends the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group (the Water Group) reinstate the previous Plan provisions unless it can demonstrate that equivalent outcomes can be achieved (**Table 2**).

The Commission identified several examples of good practice and positive outcomes, including coordinated delivery of the environmental water allowance (EWA) and held environmental water (HEW). Deliveries of the EWA occurred annually from 2016-2023 and were responsible for triggering waterbird breeding events and supporting native fish, turtles and frogs during periods of low flows. Stakeholders also indicated that intra-valley trade was operating effectively, evidenced by high levels of temporary allocation trade in the Plan area that appear to be supporting economic outcomes.

The Commission is also aware of a significant volume of work being undertaken by the Water Group to improve the monitoring, evaluating and reporting (MER) framework for the Plan. While some components of the MER framework have been finalised, other processes are still underway. Funding for the completion and implementation of the MER program will be critical to ensure Plan outcomes can be tracked. Tracking will provide opportunities for adaptive management and greater transparency for stakeholders where Plan changes are warranted.

Figure 1: Key areas to improve Plan performance

Overall finding on Plan replacement

The Commission identified that changes are required to Plan provisions to improve environmental, social, cultural and economic outcomes. It is recommended that the Plan be replaced to enable improvements to Plan provisions to occur.

Accounting for the impacts of climate change

Despite long-term water availability in the Plan area being projected to decrease due to climate change, the Plan's provisions and objectives for climate change adaptation are limited. Most critically, the Plan relies on historical datasets to make water management decisions, instead of incorporating climate change projections, which the Commission considers is not best practice. This approach does not use best available evidence and fails to appropriately convey future risks around future water availability to users, as well as how the Plan intends to manage these risks. It also drives a reliance on reactive management through Plan suspensions and Section 324 orders when climatic conditions do not align with historical datasets.

Ensuring sustainable extraction

The Plan lacks an LTAAEL that is based on an assessment of sustainability. While compliance assessment against extraction limits has recently commenced, indicating LTAAEL compliance in 2022 and 2023, improvements to the model used for LTAAEL compliance assessment are required to provide greater transparency around modelling assumptions, design, inputs and calibration. Independent review is also required to improve stakeholder confidence that outputs and water management policy derived from the model are reliable, and model limitations are clearly articulated. The migration of the Plan model to eWater Source provides an opportunity for the Water Group to integrate known model improvements in configuration, calibration and performance and should be expedited. The Commission supports moving towards use of actual extraction data within LTAAEL compliance assessment, recognising the substantial investment made by both individual licence holders and the NSW Government to transition to use of accurate metering equipment in the Plan area.

Developing a sustainable and robust allocation policy

The allocations process poses a risk to essential services and inverts the principles of the Act. Discretionary decision-making around AWDs does not align with the priorities of the Act. The Water Group's Corrective Action Plan for response to the Section 10 review indicates the Water Group intends to address this concern. Discretionary decisions also have limited oversight and transparency. Clause 71(2) of the Plan, which requires the river operator to manage the water system to supply water to meet priority needs during a repeat of the period of lowest accumulated inflows, does not reference environmental needs. The allocations process does not specifically address the impact of climate change, lacking the flexibility to respond to conditions outside of the historical record. This is has resulted in a reliance on reactive policy measures when conditions fall outside the historical average, including temporary water restrictions, the NSW *Extreme Events Policy*, or suspending the Plan in whole or in part. The lack of annual adjustment to irrigation infrastructure operator conveyance entitlement to adapt to changing conditions may result in excess allocation of priority conveyance water. Excess can then be carried over and is not required to be 'spilled' back into the shared consumptive pool, which may result in equity issues.

Strengthening environmental protections

The Plan area contains significant environmental assets. While some changes have been made to the Plan during the review period, the limitations of the Plan's environmental provisions indicate that the Plan still does not adequately prioritise the environment. Some provisions are largely not fit for purpose. While minimum daily flow rules have contributed towards the Plan's longitudinal connectivity objective, they are not adequate for meeting environmental outcomes. In particular, they do not mitigate stratification in the lower Murrumbidgee River and bypass key reaches of the Yanco Creek system when delivering flows to Billabong Creek at Darlot gauge.

Transparent flows, which are important for supporting low flows during dry conditions, are not adequately protected. Translucent releases intended to mimic natural variability have not been delivered as intended, are not effectively protected and cannot be effectively released with HEW. Further, environmental water deliveries are not treated equitably when delivering environmental water for off-channel outcomes.

Some provisions have achieved outcomes but could be further improved. While EWA deliveries have contributed to environmental outcomes, they are overly complex and not treated consistently with the priorities of the Act under channel sharing arrangements. Pre-requisite policy measures (PPMs) were recently implemented in the Plan area but can be improved to support efficient and effective environmental water deliveries.

Environmental water holdings have been important in addressing inadequacies in the Plan's environmental water provisions, but it is not appropriate to rely on environmental water holdings for managing issues within the scope of the Plan.

Restoring Aboriginal values and uses of water

The Commission has consistently heard from Aboriginal stakeholders that the Plan lacks an understanding of Aboriginal values and assets. Without an adequate understanding of these values, the Plan will continue to face barriers to achieving social, cultural and economic outcomes. Aboriginal communities have provided valuable insights for more than 20 years since the Act began. Despite this, values and uses of Aboriginal water remain underrepresented in the Plan. Prioritising the *NSW Aboriginal Water Strategy* is an important, currently undelivered, step in addressing some of these gaps. When the Plan can assign water to a social or cultural outcome, and protect water from market pressures, there will be an improved balance in the sharing of water, and better alignment with the values and needs of Aboriginal communities.

Meeting the future needs of communities

A lack of clarity in gazettal orders is driving stakeholder concerns around the prioritisation given to local water utility licences, with the perception that regulated river (high security) access licences had greater certainty than utility licences. An assessment of shortfalls indicates that Jerilderie, Jugiong and Wanganella may experience water supply issues under a dry climate scenario. These risks may be exacerbated by planned river operation changes under the Yanco Creek Modernisation Project. While there are currently no town water supply safety risks from per- and polyfluoroalkyl substance (PFAS) contamination in Wagga Wagga, Riverina Water's entitlement should be reviewed to ensure it can respond to any PFAS migration issues.

Improving economic outcomes through trade

There has been substantial growth in water trading, which is a significant contributor to economic outcomes in the Plan area. Growth is largely in the southern connected system and between irrigated industries. Stakeholders are broadly supportive of trade arrangements, with only minor reforms required to ensure sufficient balances are available at the time of 71T water allocation trades. Several issues around Intervalley Trade (IVT) raised by the ACCC's review of Murray-Darling Basin water markets were also raised by stakeholders in this review, with opportunities in the Plan to remove constraints to IVT and revise administrative requirements and river operator rules.

Reducing the impact of flow constraints on environmental outcomes

Flow constraints are designed to protect landholders from low-level inundation but have also led to the decline of inundation-dependent ecosystems. As part of commitments under the Basin Plan, the NSW Government has developed the Reconnecting River Country Program to assess options for relaxing constraints to enable higher environmental flows and address adverse social and economic impacts, particularly to riparian landholders. If constraints are relaxed, Plan provisions will need to be amended to ensure this materially contributes to achieving environmental outcomes.

Aligning channel capacity sharing with the Act

When the river operator is unable to release enough water to meet all needs, it must share channel capacity based on the Plan's priority of extraction provisions. Amendments made in 2022 placed EWA water in the lowest priority category, to be shared with regulated river (general security) access licences. Providing the lowest priority for EWA releases potentially contradicts Section 5(3) of the Act, which prioritises water to protect the water source and its dependent ecosystems alongside basic landholder rights.

Mitigating flood risk through dam airspace provisions

Plan provisions around dam airspace operation rules prioritise water storage and supply needs, while potentially increasing the impacts of some uncontrolled floods by limiting the river operator's ability to mitigate flood impacts. These provisions should be changed, but given the complexity and risks involved in flood management, should be informed by an inter-agency review of legislative, regulatory and policy instruments related to infrastructure operations for flood management.

Table 1: Recommendations (R)

Priority 1	Priority 2	Priority 3

Note: Where the Commission views it may not be possible to fully meet the recommendation by Plan remake, we recommend an amendment provision is included to allow the recommendation to be fully implemented during the life of the Plan – these are denoted with (LT) in the recommendation table.

	Accounting for the impacts of climate change
R1 (LT)	To identify where Plan environmental rules may be at risk of failing to deliver on their required purpose under changing water availability, the Water Group should model impacts under the baseline scenario (historical climate scenario) and climate change scenarios. The Water Group should revise Plan provisions, where this is required, to maintain environmental outcomes.
R2	To ensure that the modelled representation of hydrological processes reflects any observed changes over time, the Water Group should undertake hydrological model validation and recalibrations at least once every five years.
R3 (LT)	In recognition of the potential future shifts in climatic conditions, the Water Group should incorporate climate change projections into decision making and shift away from the use of historical data as the sole basis for water management decisions.
R4	In relation to consideration of the Clause 72 review of the period of lowest accumulated inflows, the Water Group should: a) provide transparency on how climate change will be considered in redefining the lowest accumulated inflows b) revise Clause 72(2) to reflect that operations should be able to deliver higher priority needs based on projected climate and hydrologic conditions, rather than making decisions tied to the historical record c) following the Clause 72 review, notify licence holders of potential reductions in the long-term average annual extraction that may occur as a result of climate change impacts.
	Ensuring sustainable extraction
R5 (LT)	The Water Group should set a sustainable LTAAEL that: a) sets aside the water required to protect the water source and its dependent ecosystems b) enables the achievement of the Plan's environmental, social and cultural objectives c) establishes a limit framework that is responsive to the impacts of climate change d) is not reliant on the SDL to achieve the Plan's environmental outcomes.
R6	The Water Group should modify actions taken to address LTAAEL or SDL non-compliance by specifying that allocations for entitlements held by environmental water holders will not be reduced in 'make good' actions.
R7 (LT)	To improve quality and transparency of models used to represent the Plan LTAAEL, the Water Group should: a) action areas recognised as requiring model improvement b) use best available observed data for model development, assumptions and calibration c) transition from the Integrated Quantity and Quality Model (IQQM) to eWater Source, and using this opportunity to rebuild and recalibrate models and scenarios using best available information d) provide greater transparency of model revisions, inclusions, limitations and independent review.
R8	To improve transparency of the assessment of LTAAEL compliance reports, the Water Group should transition to use actual metered data to validate the LTAAEL compliance process.

R9 (LT)	To improve transparency of the assessment of LTAAEL compliance reports, the Water Group should: a) clarify whether models used in the LTAAEL assessment of compliance have been independently reviewed and deemed fit for purpose b) provide visibility of any revisions and inclusions to the scenario models used in the LTAAEL assessment of compliance c) provide disaggregated extraction information for each modelled scenario and identify where modelled extraction is set as a static value d) undertake annual independent reviews of the current conditions scenario to ensure it best represents current level of extraction.
	Developing a sustainable and robust allocation policy
R10	The Plan should include a provision that requires the Water Group to reconcile the Plan's lowest accumulated inflows against actual inflows and address any shortfall before issuing increased allocations.
R11	In addition to related items outlined in **Recommendation R4 and AR1**, the Water Group should: a) revise Clause 72(2) (Maintenance of water supply) to require the river operator to be able to firstly supply sufficient water to protect the water source and its dependent ecosystems during a repeat of the period of lowest accumulated inflows b) revise Clause 72(6) (review of lowest accumulated inflows) to include a requirement to not jeopardise critical environmental needs.
R12	To improve transparency, the Water Group should clarify decision-making related to the spilling of the IVT and the second-year reserve in the Plan.
R13 (LT)	To ensure ongoing equity and meet Plan conveyance requirements, the Water Group should: a) review the Plan's conveyance provisions for irrigation networks and, based on the materiality of potential impacts, determine whether changes are warranted to increase flexibility and ensure conveyance allocations best reflect conveyance needs b) review irrigation network excess conveyance spill arrangements and carryover provisions and, based on the materiality of potential impact, determine whether changes are warranted to ensure there is equitable sharing of excess conveyance allocations between irrigation networks and all other river water users.
	Strengthening environmental protections
R14	To align the Plan's minimum daily flow provisions with connectivity and water quality objectives and provide clarity in delivery of these flows, the Water Group should ensure that the replacement Plan: a) specifies that minimum daily flows at Balranald must be targeted, but that compliance be assessed within 25 percent variation (consistent with the Murrumbidgee Work Approval), and prescribe how the compliance test works b) requires monthly publication of targeted flows for the Murrumbidgee River downstream of Balranald Weir (410130) and the outcomes of the compliance test against targeted flows, including reasons for differences, to improve transparency and accountability c) provides for connectivity with the Murray to support movement and dispersal opportunities for aquatic biota d) maintains pool refugia and mitigates the risk of prolonged pool stratification in the lower Murrumbidgee River during periods of low flow, particularly when there are limited intervalley transfers to the Murray e) aligns minimum daily flow requirements for the Murrumbidgee River downstream of Balranald Weir (410130) with baseflow environmental flow requirements from the Murrumbidgee LTWP and require updates to these requirements when improved knowledge of destratifying flow requirements becomes available f) incorporates additional minimum daily flow rules for the five sites along the Yanco Creek system to achieve connectivity along the length of the system rather than bypassing river reaches when delivering flows to Darlot gauge (410134).

R15	The Water Group should modify the Plan's translucent flow rules to: a) simplify the rules and provide for flow variability and associated environmental benefits b) allow for HEW to be released on top of translucent flows without HEW accounts being debited for the translucent flow component c) provide for protection of translucent flows along the length of the Murrumbidgee Regulated River Water Source d) require a compliance / non-compliance test regarding non-delivery of translucency rules e) to improve clarity, require publication of plans for release of underdelivered translucent flows that are developed by the NSW Environmental Water Manager and approved by the Minister.
R16	To improve protection of environmental water, the Water Group should: a) determine how the categories of EWA and associated crediting and debiting rules can be simplified for accounting purposes and operability b) ensure that EWA water delivery is prioritised in channel sharing arrangements consistent with the Water Sharing Principles of the *Water Management Act 2000* c) ensure that the Plan's provisions for implementing the prerequisite policy measures (PPMs) provide for effective piggybacking of translucent flows and protect in channel supplementary flows (of held environmental water, including Lowbidgee supplementary water) intended to remain in channel for environmental outcomes d) ensure that the Plan and Murrumbidgee PPM Procedures Manual are clear about the circumstances where piggybacking can occur (i.e. unregulated flows) e) ensure that there is equity in the management and accounting of transmission losses with the use of HEW to avoid environmental licence holders wearing conveyance losses in contrast to other licence categories where losses are socialised across water users.
R17	The Water Group should revise transparency provisions to align with baseflow environmental water requirements (particularly for Tumut River downstream Blowering Dam) and ensure the replacement Plan effectively protects transparent releases from extraction along the length of the Murrumbidgee Regulated River Water Source to support fundamental ecosystem health.
	Restoring Aboriginal water rights, values and uses
R18	To support improved economic outcomes from the Plan, the Water Group should work with Aboriginal communities to: a) better understand cultural obligations and amend the purposes for which Aboriginal access licences may be granted by recognising traditional trade practices e.g., sale, exchange, gifting, and bartering of goods made from water provided under all categories of Aboriginal access licences b) explore further opportunities to enact all three sub-categories of Aboriginal access licence to support the Plan's Aboriginal cultural objectives c) revise trade dealing rules to remove restrictions on allocation trades (dealings) for all categories of Aboriginal access licences.
R19	To improve accountability against cultural objectives, the Water Group should ensure the Plan's objectives, corresponding provisions and performance indicators are co-designed with Aboriginal stakeholders, reflect Priority 2 of the *NSW Water Strategy* and continue to align with the *Water Management Act 2000*.
R20	To deliver better outcomes for Aboriginal peoples, the Water Group should: a) work with Aboriginal people to simplify the application process and provide stronger support for Aboriginal communities in accessing Aboriginal licence provisions b) remove the 2,150 ML cap on the total volume of the regulated river (high security) (Aboriginal cultural) access licence and remove 10 ML limit per licence application.
R21	To improve Aboriginal access licence uptake and use, the Water Group should ensure that the findings of the Developing Aboriginal Cultural Water Use Opportunities in the Murrumbidgee Valley project and the Cultural Watering Plan pilot are incorporated into the Plan.
R22	Consistent with mechanisms in place for environmental water (i.e., PPMs and active management), the Water Group should ensure: a) the Plan provides for protection within and between water sources (intervalley flows) including return flows, for all Aboriginal access licence categories. b) where required, constraints relaxation also applies to Aboriginal access licences.

	**Meeting the future needs of communities**
R23	To support the prioritisation of water for town water supply, the Water Group should ensure that any temporary water restrictions imposed on water taken for domestic purposes under access licences or basic landholder rights are clearly articulated in gazettal orders to avoid reductions in access that are inconsistent with the supply of water and prioritisation outlined in the Plan and Act.
R24	Where PFAS concentrations cannot be practically managed below Australian Drinking Water Guidelines, the Water Group should determine any requirement for additional surface water local water utility access licence entitlement required to service the Riverina Water network, with Plan updates to occur following assessment and implementation under the Act.
	**Improving economic outcomes through trade**
R25	To improve economic outcomes through trade, the Water Group should: a) include a provision that requires mandatory account reconciliation prior to approval of a water allocation trade (71T), to ensure sufficient account balance or avoid accounts going into a negative account balance b) consider the need to revise current constraints to IVT (71V), administrative requirements and river operator rules. Where required, the Water Group should update IVT Plan provisions that restrict 71V, and associated procedures documentation.
	**Reducing the impact of flow constraints on environmental outcomes**
R26	To improve environmental outcomes that can be achieved in the event of constraint relaxation, the Water Group should: a) include provisions that identify the flow rates or flow levels related to normal operations and where environmental flows are being released within relaxed constraint flow corridors b) ensure provisions promote the release of environmental flows and that the river operator cannot unreasonably refuse to deliver environmental flows up to the relaxed constraint flow levels.
	**Aligning channel capacity sharing with the Act**
R27	To align with priorities under the Act, the Water Group should revise Clause 74 of the Plan to specify that environmental water holders, EWA and other environmental releases hold channel capacity priority equivalent to basic landholder rights and above all other extractive users.
	**Mitigating flood risk through dam airspace provisions**
R28 (LT)	To address any Plan related flood risks, the Water Group should coordinate an inter-agency review of flood management and update the Plan with any necessary changes to relevant Plan provisions.

	Improving monitoring, evaluation and reporting
R29	As part of their ongoing MER process, the Water Group should: a) ensure that the Plan includes equity objectives and objectives that relate to economic values and water uses by Aboriginal people b) ensure that the Plan includes performance indicators related to • climate variability • cultural and amenity value of water • economic values and water uses by Aboriginal people c) broaden existing performance indicators related to economic outcomes and water quality parameters d) ensure that Plan provisions support the achievement of the Plan's objectives and performance indicators e) specify timely and transparent reporting requirements of the results of MER activities to support adaptive management f) establish appropriate governance arrangements and timeframes for adaptation and improvement.

Table 2: Recommendations on amendments made over the term of the Plan (AR)

General	
AR1	To maintain consistency with the requirements of the Act, the Water Group should remove the recently added Clause 72(7) that states: '*Any amendments made under subclause (6) cannot substantially alter the long-term average annual amount of water able to be extracted under water access licences*.'
AR2	To restore protection of Plan's outcomes, the Water Group should reinstate the following Plan provisions unless the Water Group can demonstrate equivalent outcomes can be achieved: a) Clause 41 in previous Plan – action to be taken on provisional storage volumes during a spill event is no longer specified, highlighting a broader issue regarding the lack of clarity on the approach for managing all water accounts during a spill event. The remade Plan should specify the priority of how spills are distributed for all relevant water accounts b) Clause 81 in previous Plan – mandatory conditions for abandoned, replaced or decommissioned water supply works. A lack of clarity around requirements for decommissioning of works approvals may have an impact on compliance assessments and any subsequent regulatory action.
AR3	To ensure the Plan can be amended to achieve outcomes, the Water Group should revert the following changes to amendment provisions in Part 12 of the Plan: a) removal of amendment provisions Clause 85 (1) in previous Plan for varying the LTAAEL after the surrender or cancellation of a water access licence b) removal of amendment provisions Clauses 85 (2-4) in previous Plan for varying determinations of conveyance requirements c) removal of amendment provision Clause 86 (2) in previous Plan for varying access to uncontrolled flow to compensate for changes to maximum carryover percentages d) removal of amendment provision Clauses 86 (3-4) in previous Plan for varying rules permitting access to supplementary flows e) inclusion of amendment provision Clause 93(1)(d) for the conversion of regulated river (high security) licences to upstream unregulated river water sources f) inclusion of amendment provision Clause 93(3) to amend the Plan to facilitate extractions reaching the long-term limits.
LTAAEL	
AR4	To restore protection of Plan's outcomes, the Water Group should reinstate the following Plan provisions unless the Water Group can demonstrate equivalent outcomes can be achieved:

	a) Clause 16 of previous plan – note estimating LTAAEL. While notes in the Plan do not form part of the Plan, stakeholders have called for inclusion to increase transparency b) Clause 30 of previous plan – note identifying model scenario number and estimation of the extraction limit, again supporting transparency c) Clause 54 of previous plan – removal of the requirement that '*…the [LTAAEL] model… must be set to represent as closely as possible…*' conditions and replacing with a note that the Department intends to update the model annually, removes legal obligations regarding model accuracy.
Environment	
AR5	To restore protection of Plan's outcomes, the Water Group should reinstate the following Plan provisions unless the Water Group can demonstrate equivalent outcomes can be achieved: a) Clause 32 – no longer specifies a requirement to deliver additional expected water use to the confluence with the Tumut River and may reduce environmental flow releases b) Clause 66 – the removal of the description of the EWA's purpose and its requirement to provide maximum environmental benefit 'to the maximum extent possible' may change the legal obligations for delivery of this water c) Clauses 60 and 61 – releases of Burrinjuck transparent and translucent flows '*throughout the year*' rather than as '*daily releases*'. Transparent and translucent flows to be released '*at a later date in accordance with a plan … approved by the Minister*' rather than '*the succeeding day(s)*'. Modifying the patterns that can be used to implement transparent and translucent flows may change the effectiveness of these environmental flows and their ability to mimic natural flow events.
Trade	
AR6	To restore protection of Plan's outcomes the Water Group should reinstate Clause 76(4) – removal of note identifying IVT limit on Murrumbidgee trade generates a lack of transparency for stakeholders unless the Water Group can demonstrate equivalent outcomes can be achieved under the current Plan.

1 Review background

1.1 Water sharing plans

Water sharing plans are statutory instruments under the Act. They prescribe how water is managed to support sustainable environmental, social, cultural and economic outcomes. They intend to provide certainty for water users regarding how available water will be shared over the life of the water sharing plan, which is typically 10 years unless extended.

The Plan commenced on 29 June 2016 and is due for extension or replacement by 30 June 2026. A suite of changes were made to the Plan in December 2022 in conjunction with the water resource planning process (**Chapter 2**).[1] The Commission has reviewed the Plan in place as at December 2022.

1.2 The Commission's role in reviewing water sharing plans

The Commission has a role under Section 43A of the Act to review water sharing plans within five years of expiry, and report to the Minister on:

- the extent that a plan's water sharing provisions have materially contributed to the achievement of, or failure to achieve, environmental, social and economic outcomes
- if changes to plan provisions are warranted.

The Commission may recommend extending or replacing plans depending on its review findings. Section 43A(3A) of the Act requires the Commission to consider some potential compensation requirements resulting from recommended plan changes.[2] Under the Act, compensation is payable by the state to access licence holders only in certain circumstances[3] where water allocations under a water sharing plan are reduced.

The Commission's review must consider the water management principles,[4] including the water sharing principles, when reviewing plans. The Act is clear that water sharing is not about balancing uses and values – it is about first providing for the environment and second recognising basic landholder rights above other uses. It specifies that the:

a) sharing of water from a water source must protect the water source and its dependent ecosystems, and

b) sharing of water from a water source must protect basic landholder rights, and

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1 The *Commonwealth Basin Plan 2012* requires the development of water resource plans. Water resource plans draw heavily on water sharing plans and provide a framework and rule set on which to manage water resources within the Murray Darling Basin.

2 If a Commission report recommends changes to a plan that will reduce water allocations in relation to which compensation might be payable under Section 87AA of the Act, the Commission is to state in the report if the purpose of the proposed changes is: (a) to restore water to the environment because of natural reductions in inflow to the relevant water source, including changes from climate change or drought or (b) to provide additional water to the environment because of more accurate scientific knowledge demonstrating the amount previously allocated to the environment is inadequate.

3 As set out in sections 87 and 87AA of the Act. Section 87 states that compensation applies for certain reductions in water allocations arising during the initial (10-year) period of a water sharing plan, only where amendments are not already contemplated in that plan. Section 87AA makes clear that compensation applies to amendments to the Plan after its 10-year term. In addition, the Minister has an overriding discretion under Section 87 (but not under Section 87AA) to determine if compensation should be paid and, if so, the amount of any such compensation and the manner and timing of any payments.

4 Section 5 of the Act.

c) sharing or extraction of water under any other right must not prejudice the principles set out in paragraphs (a) and (b).[5]

Further, the water management principles should be prioritised in the order that they are set out above.[6] Water sharing plans must be based on evidence to achieve these outcomes.

1.3 The Commission's review process

In reviewing the Plan, the Commission aims to contribute to improved and more transparent water management. The Commission evaluates the achievement of Plan environmental, social, cultural and economic outcomes by:

- evaluating key risks to Plan outcomes under current Plan provisions
- independently assessing Plan performance, and alignment with the objects, principles and priorities of the Act
- identifying areas where Plan provisions can be improved to better achieve outcomes
- identifying new evidence and good practices to improve Plan design and performance.

The Commission's full evaluation framework is published on its website.[7]

1.3.1 Evidence used to guide the review

The Commission's review is evidence-based, informed by a range of sources, including:

- **consultation** – targeted engagement with government agencies, community, Aboriginal and industry organisations
- **document review** – the Commission reviewed the Plan, its background document,[8] public reports and unpublished information from water management agencies. See **Chapter 1.3.2** for further details
- **technical advice** – consultants provided peer review
- **public submissions** – the Commission received 16 submissions. Non-confidential submissions are published on the Commission's website.[9] The Commission also reviewed stakeholder feedback made as part of the water resource planning process and the draft regional water strategy process through the 'What We Heard' documentation.

The Commission considers that some of the submissions made to the review were out of scope. Issues considered as out of scope are discussed further in **Appendix 1**.

5 Section 5(3) of the Act.
6 Section 9(1) of the Act.
7 Natural Resources Commission (2022) *Review approach*
8 Murrumbidgee Regulated River Management Committee (2004) *Murrumbidgee Water Sharing Plan: Background document, Part A*, unpublished.
9 Natural Resources Commission (n.d.) *Water sharing plan reviews*

1.3.2 Relevant regional plans, policies, programs and agreements

In reviewing the Plan, the project team considered the following plans, policies and agreements in accordance with Section 43A(4)(b) of the Act:

- the *NSW Water Strategy*
- the Draft *Regional Water Strategy – Murrumbidgee* (the Draft *Regional Water Strategy*)
- the *Basin Plan* and Murray Darling Basin Agreement, as these affect issues analysed as part of the review
- the *Murrumbidgee Surface Water Resource Plan* (the Water Resource Plan) and other accompanying documentation, such as the Murrumbidgee LTWP
- programs that form part of the suite of projects under the Sustainable Diversion Limits Adjustment Mechanism (SDLAM), as these affect the Murrumbidgee system
- the *Aboriginal Water Strategy*, noting that the Commission did not review it but received an update on program intent and progress from the Water Group[10] The draft strategy and action plan was released in July 2024 for public exhibition following the completion of the NRC's analysis for this Plan review.
- various NSW Government water management policies as these impact water management in the Murrumbidgee regulated system, including water allocation methodology[11] and the *Extreme Events Policy*.[12]

[10] In this report, the Water Group has been used to refer to the equivalent group within DPE-Water, DPIE-Water and the current DCCEEW.
[11] DPE (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*
[12] DPE (2023) *Extreme Events Policy*

2 Plan amendments

In 2023, the Commission audited the Plan version effective from 6 July 2018.[13] In undertaking the Plan review, as detailed in this report, the Commission assessed the Plan version dated 23 December 2022 (the version in force when the review commenced) but also considered amendments that have been made over the life of the Plan and whether they have increased the likelihood of achieving outcomes.

The 23 December 2022 version of the Plan was substantially redrafted and amended, in part to comply with Water Resource Plan requirements.[14] The changes made at that time were the most substantial revisions of the Plan since its introduction in 2003. The Commission notes that at the time of review, the water resource plan for Murrumbidgee surface waters was still being reviewed by the Murray-Darling Basin Authority (MDBA) and was yet to be accredited by the Commonwealth Minister. The Water Resource Plan has since been accredited and commenced 29 February 2024 under the Commonwealth *Water Act* 2007.[15]

The Commission notes that a number of plans covering multiple water sources have been amended to include a provision that states: "*Any amendments made* [in relation to a review of the lowest accumulated inflows] *... cannot substantially alter the long-term average annual amount of water able to be extracted under water access licences*."[16] The Commission considers this provision to be inconsistent with the Act's principles in that it effectively limits the ability to provide for environmental and basic landholder rights water if it would reduce licenced extraction. The Act clearly prioritises environmental and basic landholder rights over licenced extraction. Therefore, the Commission recommends that this provision is removed.

The Commission has found several amendments that may materially impact the Plan's ability to achieve Plan outcomes and therefore should be reconsidered (**Section 2.1**).

13 Natural Resources Commission (2023) *Audit of the implementation of the Lachlan, Murrumbidgee and NSW Murray and Lower Darling regulated rivers water sharing plans*

14 The Basin Plan requires that state and territory governments develop water resource plans, which specify how state-based water management, including water sharing plans, comply with Basin Plan requirements. The MDBA assesses water resource plans against requirements listed in Chapter 10 of the Basin Plan. These assessments usually lead to additional changes being required to the water resource plan, which usually includes changes to the water sharing plan. After the MDBA's review the water resource plan can be presented to the Commonwealth Minister for accreditation.

15 MDBA (2024) *Murrumbidgee water resource plan*

16 For example, Clause 72(7) in the Plan, discussed in Chapter 6: Allocations.

2.1 Plan amendment recommendations

General	
AR1	To maintain consistency with the requirements of the Act, the Water Group should remove the recently added Clause 72(7) that states: '*Any amendments made under subclause (6) cannot substantially alter the long-term average annual amount of water able to be extracted under water access licences.*'
AR2	To restore protection of Plan's outcomes, the Water Group should reinstate the following Plan provisions unless the Water Group can demonstrate equivalent outcomes can be achieved: a) Clause 41 in previous Plan – action to be taken on provisional storage volumes during a spill event is no longer specified, highlighting a broader issue regarding the lack of clarity on the approach for managing all water accounts during a spill event. The remade Plan should specify the priority of how spills are distributed for all relevant water accounts b) Clause 81 in previous Plan – mandatory conditions for abandoned, replaced or decommissioned water supply works. A lack of clarity around requirements for decommissioning of works approvals may have an impact on compliance assessments and any subsequent regulatory action.
AR3	To ensure the Plan can be amended to achieve outcomes, the Water Group should revert the following changes to amendment provisions in Part 12 of the Plan: a) removal of amendment provisions Clause 85 (1) in previous Plan for varying the LTAAEL after the surrender or cancellation of a water access licence b) removal of amendment provisions Clauses 85 (2-4) in previous Plan for varying determinations of conveyance requirements c) removal of amendment provision Clause 86 (2) in previous Plan for varying access to uncontrolled flow to compensate for changes to maximum carryover percentages d) removal of amendment provision Clauses 86 (3-4) in previous Plan for varying rules permitting access to supplementary flows e) inclusion of amendment provision Clause 93(1)(d) for the conversion of regulated river (high security) licences to upstream unregulated river water sources f) inclusion of amendment provision Clause 93(3) to amend the Plan to facilitate extractions reaching the long-term limits.
LTAAEL	
AR4	To restore protection of Plan's outcomes, the Water Group should reinstate the following Plan provisions unless the Water Group can demonstrate equivalent outcomes can be achieved:

	a) Clause 16 of previous plan – note estimating LTAAEL. While notes in the Plan do not form part of the Plan, stakeholders have called for inclusion to increase transparency b) Clause 30 of previous plan – note identifying model scenario number and estimation of the extraction limit, again supporting transparency c) Clause 54 of previous plan – removal of the requirement that '*…the [LTAAEL] model… must be set to represent as closely as possible…*' conditions and replacing with a note that the Department intends to update the model annually, removes legal obligations regarding model accuracy.
Environment	
AR5	To restore protection of Plan's outcomes, the Water Group should reinstate the following Plan provisions unless the Water Group can demonstrate equivalent outcomes can be achieved: a) Clause 32 – no longer specifies a requirement to deliver additional expected water use to the confluence with the Tumut River and may reduce environmental flow releases b) Clause 66 – the removal of the description of the EWA's purpose and its requirement to provide maximum environmental benefit 'to the maximum extent possible' may change the legal obligations for delivery of this water c) Clauses 60 and 61 – releases of Burrinjuck transparent and translucent flows '*throughout the year*' rather than as '*daily releases*'. Transparent and translucent flows to be released '*at a later date in accordance with a plan … approved by the Minister*' rather than '*the succeeding day(s)*'. Modifying the patterns that can be used to implement transparent and translucent flows may change the effectiveness of these environmental flows and their ability to mimic natural flow events.
Trade	
AR6	To restore protection of Plan's outcomes the Water Group should reinstate Clause 76(4) – removal of note identifying IVT limit on Murrumbidgee trade generates a lack of transparency for stakeholders unless the Water Group can demonstrate equivalent outcomes can be achieved under the current Plan.

3 About the Plan area

The Plan area is defined as the area between the banks of the Murrumbidgee River, from Burrinjuck Dam and Blowering Dam downstream to the confluence of the Murray River, as well as the Yanco Creek system (**Figure 2**).[17]

The traditional owners of the Plan area are the Wiradjuri, Nari Nari, Barapa Barapa, Wemba Wemba, Yita Yita, Mutthi Mutthi, Wadi Wadi, Nyeri Nyeri, Ngunnawal/Ngunawal, Wolgalu and Ngarigu peoples.[18] Each nation has strong cultural and spiritual connections with the rivers and wetlands of the Plan area. Water-dependent sites of deep significance to Aboriginal peoples in the Murrumbidgee catchment include Coolamatong (Lambie Gorge), Wiradjuri Reserve and Gobba Beach, Koonadan, Dippo ceremonial ground, the Toogimbie Indigenous Protected Area and Gayini Nimmie-Caira.[19]

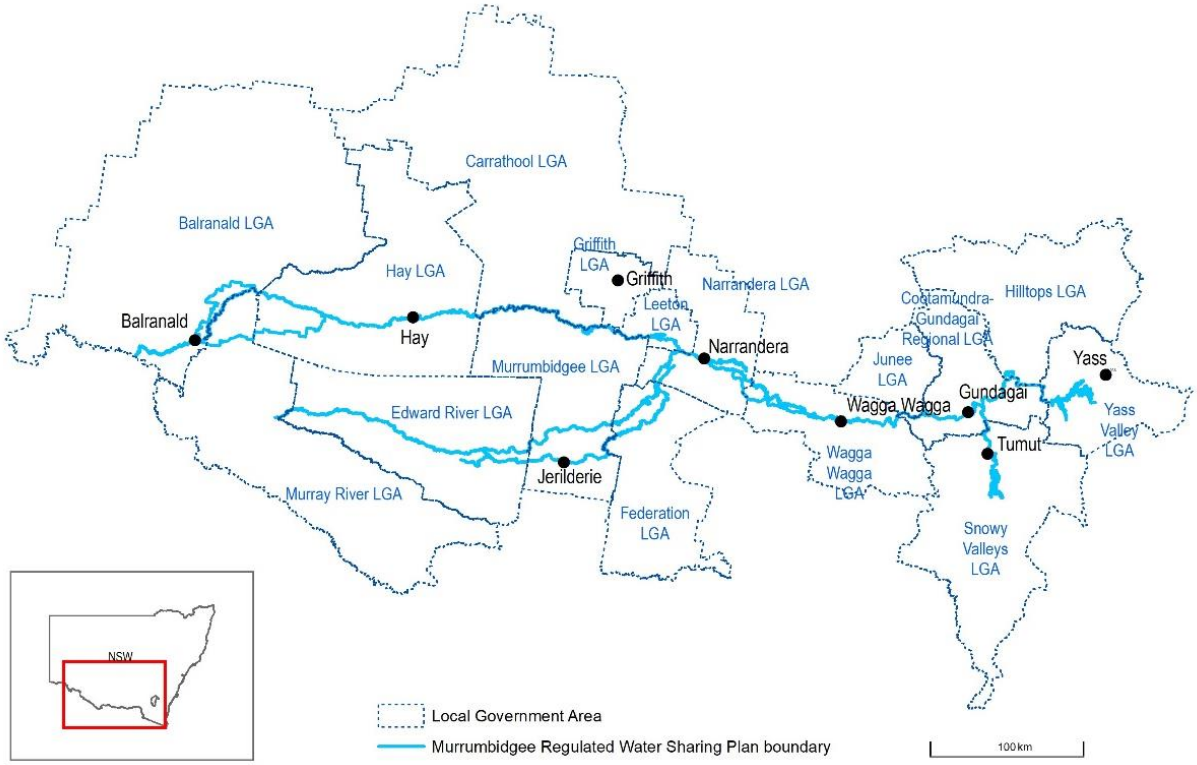

Figure 2: The Plan area, including local government areas (LGAs)

The Plan has two main water storages – Burrinjuck Dam and Blowering Dam – with a combined operating capacity of 2,656 gigalitres (GL).[20] The dams receive inflows from the catchment and from the Snowy Mountains Scheme. Downstream tributaries, including Goobarragandra River and Jugiong, Muttama, Adelong, Tarcutta, Kyeamba and Billabong creeks, contribute on average around 21 percent of inflows (750 GL).[21] The Murrumbidgee River downstream of Blowering and Burrinjuck dams is highly regulated, with eight major weirs that regulate flows to towns, the main irrigation areas, environmental assets, and

17 Appendix 2 of the Plan.
18 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee*
19 *Ibid.*
20 *Ibid.*
21 *Ibid.*

effluent streams.[22] The Murrumbidgee River has several physical and operational constraints that limit the volumes of water that can be delivered along the system. These constraints have an impact on environmental outcomes that can be achieved with overbank flows (see **Chapters 7** and **11**).

From Burrinjuck and Blowering dams to Darlington Point, the mid-Murrumbidgee consists of extensive alluvial plains with a few major tributaries and several anabranches. Downstream of Narrandera, the Yanco Creek system links the Murrumbidgee and Murray rivers through 800 kilometres of interconnected waterways, including Colombo Creek, Billabong Creek and Forest Creek.[23] The lower reaches of the Murrumbidgee expand into a broad floodplain and a complex area of effluent channels, wetlands and swamps known as the 'Lowbidgee'.[24] As identified in **Figure 2** the Plan area is bounded by the creek and river channels, with many of the wetlands and billabongs falling within the boundaries of the Murrumbidgee unregulated system. Flows delivered by the Murrumbidgee regulated system are important for the Murrumbidgee unregulated system.[25]

The Murrumbidgee region is part of the broader 'southern connected basin', linked hydrologically and through water management arrangements to the Murray River and, by extension, to Victoria and South Australia.[26]

The regulated Murrumbidgee River and its tributaries and anabranches, including Billabong Creek, Yanco Creek, Colombo Creek and their tributaries, are listed as part of the Lower Murray River aquatic ecological community.[27] All native fish and other aquatic biota within this endangered ecological community are given endangered status.

The Murrumbidgee region is home to 16 nationally significant wetlands, including the Lowbidgee and mid-Murrumbidgee wetlands, and the Ramsar-listed Tuckerbil and Fivebough swamps (**Figure 3**). Tuckerbil and Fivebough swamps are of international importance because of the presence, abundance and diversity of waterbirds, including migratory shorebirds and threatened species,[28] such as the Australasian bittern (*Botaurus poiciloptilus*), Australian painted snipe (*Rostratula australis*) and freckled duck (*Stictonetta naevosa*).[29] The mid-Murrumbidgee wetlands rarely dry out and provide important drought refugia. The Lowbidgee floodplain supports waterbird breeding and the second-largest red gum forest in Australia.[30]

The vast Lower Murrumbidgee River floodplain, covering about 200,000 hectares, includes some of the largest lignum wetlands in NSW. It is an important bird breeding site, particularly for royal spoonbill (*Platalea regia*), great egret (*Ardea alba*), straw-necked ibis (*Threskiornis spinicollis*), Australian white ibis (*Threskiornis moluccus*) and glossy ibis (*Plegadis falcinellus*).[31]

These regions provide critical habitat for a range of water-dependent animals, including internationally listed migratory waterbirds and a range of threatened species, including the southern bell frog (*Litoria raniformis*), trout cod (*Maccullochella macquariensis*), Murray cod

22 *Ibid.*
23 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee*
24 *Ibid.*
25 Natural Resources Commission (2023) *Review of the Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources 2012 – Final Report*
26 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee*
27 DPI (2007) *Prime fact: Lower Murray River aquatic ecological Community*
28 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee*
29 DPIE (2020) *Murrumbidgee Long Term Water Plan Part A: Murrumbidgee catchment*
30 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee*
31 CEWO (2017) *Restoring and protecting the Murrumbidgee River 2017-18 snapshot*

(*Maccullochella peelii*), silver perch (*Bidyanus bidyanus*), eel-tailed catfish (*Tandanus tandanus*), fishing bat (*Myotis macropus*), and blue-billed ducks (*Oxyura australis*).[32]

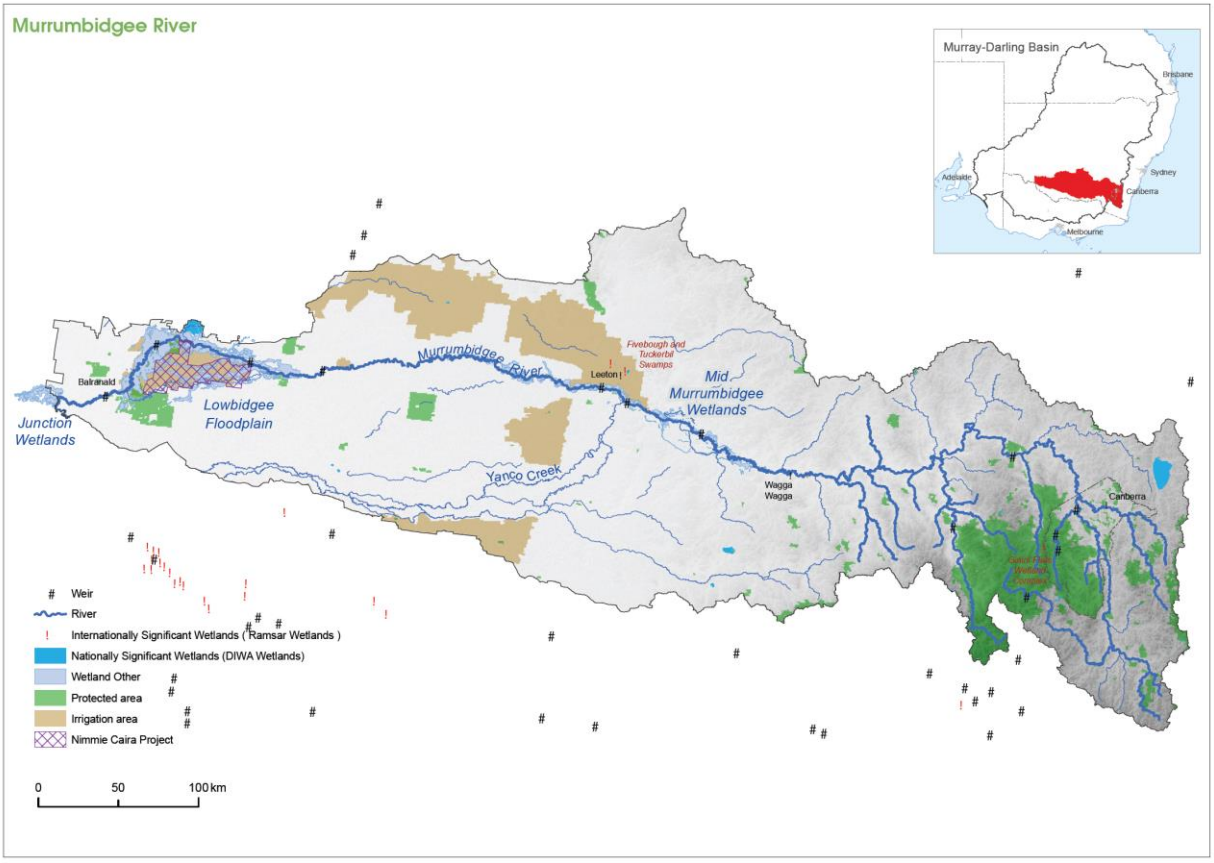

Figure 3: Location of environmental assets in the Murrumbidgee region[33]

The development of water resources and the extensive regulation of the river system have altered flow regimes and impacted key environmental assets in the region. For example, around 58 percent of the original wetland area of the Lowbidgee floodplain has been lost and the remaining wetlands are substantially degraded (see **Chapter 7**).[34]

The Plan area has a range of water-dependent towns including Wagga Wagga (NSW's largest inland city) and the regional centre of Griffith, as well as the smaller towns of Balranald, Coolamon, Coleambally, Darlington Point, Gundagai, Hay, Jerilderie, Jugiong, Junee, Leeton, Moulamein, Narrandera, Tumut and Yanco.[35]

In 2021, the total population for LGAs in the Plan area was 138,369, including Wagga Wagga Shire (65,835), Griffith Shire (27,063), Leeton Shire (11,302) and Cootamundra-Gundagai Regional Shire (11,141).[36] The total population is expected to grow to 153,046 by 2041, including growth above the NSW average in Lockhart and Coolamon shires (1.5 percent and 1.33 percent respectively).[37] Growth is also expected in the large regional centres of both Griffith (0.78 percent) and Wagga Wagga (0.54 percent), placing additional demand on town water needs and future local utilities.[38]

32 Commonwealth of Australia (2022) *Commonwealth Environmental Water Office Water Management Plan 2022-2023: Chapters 1 to 2*
33 CEWO (2017) *Restoring and Protecting the Murrumbidgee River 2017-2018 Snapshot*
34 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee*
35 Appendix 2 of the Plan.
36 NSW Government (2023) *NSW Projections Explorer*
37 *Ibid.*
38 *Ibid.*

Urban water supply, provided under water access licences issued across the plans, is critical for local populations. Towns below Burrinjuck Dam rely on regulated river supply and groundwater. Water delivery to the end of the Murrumbidgee and Yanco systems takes around 20 and 28 days respectively.[39] Delivering water for critical human needs and other water uses along the entire length of the Murrumbidgee River will remain a challenge during dry periods (see **Chapter 4** and **Chapter 9**).[40]

The proportion of Aboriginal and Torres Strait Islander peoples in all LGAs in the Plan area is above the regional state average (2.9 percent) and has risen since 2016. The largest proportion of Aboriginal and Torres Strait Islander populations is located in the Narrandera Shire (12.7 precent), followed by Junee Shire (9.2 percent) and Murrumbidgee Shire (8.6 percent).[41] In both Cootamundra-Gundagai and Coolamon shires, the percentage of Aboriginal and Torres Strait Island peoples doubled between 2011-2022 (to 6.4 percent and 5.6 percent of the town population respectively). The Plan covers 11 Local Aboriginal Land Council (LALC) areas, with one registered Indigenous Land Use Agreement (ILUA) in the Tumut Brungle LALC area. There is no native title determination across the Plan area (see **Chapter 8**).

In the southern basin, approximately 53 percent of water in the Murrumbidgee catchment is diverted annually by water users.[42] Water is diverted for irrigated agriculture, urban water supply, stock and domestic purposes, hydro-electricity generation and mining.[43] Waterways in the region also provide amenity and recreation values,[44] as well as underpinning tourism industries valued at $500 million annually.[45]

Agriculture is the key industry across the Murrumbidgee region, generating more than $1.9 billion annually.[46] In 2020-2021, cereal production was the largest land use by land area (825,000 hectares), and by gross value ($872 million) followed closely by livestock ($822 million).[47] Irrigated agriculture is a significant contributor to local economies. The Murrumbidgee is one of the larger irrigation areas in the Murray-Darling Basin, with 22 percent of surface water diversions used for this purpose.[48]

Irrigated crops include rice, cotton, soybeans, corn, wheat, oats, barley, pasture, citrus, stone fruit and wine grapes.[49] Cotton and rice are typically the largest water users in the Murrumbidgee region, although the total volume of water applied each year varies with water availability.[50] Pasture crop water use also fluctuates, whereas for fruit and grapes water use is relatively stable. Recent growth in permanent almond plantings with year-round water demand, and the expansion of cotton, which competes with other annual crops for water in the region, are changing patterns of water use and demand in the Plan area.

Rainfall in the Murrumbidgee River catchment is typically winter dominant. However, analysis of long-term average rainfall trends highlights a shift to increasing rainfall during

39 Appendix 2 of the Plan.
40 *Ibid*.
41 ABS (2023) *Data by region (map) – LGAs*
42 MDBA (2022) *Murrumbidgee catchment*
43 *Ibid*.
44 DPIE (2018) *Murrumbidgee surface water resource plan area description: Appendix A, p 10*
45 Murrumbidgee Regulated River Management Committee (2004) *Murrumbidgee Water Sharing Plan: Background document, Part A*, unpublished.
46 *Ibid*.
47 ABARES (2021) *ABARES commodities 2021 by LGA*
48 DPIE (2018) *Murrumbidgee surface water resource plan area description: Appendix A, p 10*
49 *Ibid*.
50 In 2018, 535,937 ML of water was applied to cotton crops, compared to 126,925 in 2020. For rice crops, in 2017 532,299 ML was applied, compared to 46,833 ML in 2020. See DAFF (2021) *Murray-Darling Basin water market catchment dataset*

autumn.[51] The average annual rainfall of the Murrumbidgee River catchment is 533 millimetres, ranging from 1,500 millimetres in the alpine areas to 400 millimetres in the riverine floodplains.[52] During the Plan period, the Plan area was significantly affected by drought, recording some of the region's lowest inflows during the 2018-19 and 2019-20 water years, with impacts to communities and water users.[53]

The region has experienced several major flood events, notably in 2010, 2012, 2016, 2020 and 2022. The smaller but longer-duration October 2016 flood also caused hypoxic blackwater events in the lower Murrumbidgee.[54] Historically, major floods have occurred between July and October, when dam levels are typically already high. The wet and dry cycles seen over the last 120 years are considered fairly normal when compared against the long-term records and are an important characteristic of the Murrumbidgee region.[55]

Over the last 20 years, there has been a shift in the climate in the southern connected basin, with an increase in temperatures.[56] The future climate in the Murrumbidgee could be more variable, with changes in rainfall patterns, a decrease in overall annual rainfall and higher evapotranspiration.[57] The Murrumbidgee region could also experience higher minimum and maximum temperatures, more hot days, less cold nights, decreased snowfall and snowmelt and more severe fire conditions. This will likely change the volume of water available across the Plan area (see **Chapter 4**).[58]

51 Muhury, N., Ayele, G.T., Balcha, S.K., Jemberie, M. A., and Teferi, E. (2023) 'Basin Runoff Responses to Climate Change Using a Rainfall-Runoff Hydrological Model in Southeast Australia', *Atmosphere*, 14, 306.
52 *Ibid.*
53 DPIE (n.d.) *Drought stages and measures implemented during the 2017-20 drought*
54 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee*
55 *Ibid.*
56 *Ibid.*
57 *Ibid.*
58 *Ibid.*

4 Accounting for the impacts of climate change

Long-term water availability in the Plan area is projected to decrease as a result of climate change.[59] The Plan's provisions and objectives for adapting to climate change are limited, including how to prepare for or respond to the predicted impacts of climate change and improve system resilience. The Plan relies on historical datasets to make water management decisions, which the Commission considers is not best practice. Current approaches to manage water in the Plan:

- do not use best available evidence to guide decision making in water management
- do not convey risks of future water availability to water users, and how these risks are to be addressed and managed by the Plan
- rely on historical datasets to make water management decisions, rather than building in climate change projections to better understand shifts in future water availability
- rely on Plan suspensions and Section 324 orders where water management based on historical datasets proves to be inappropriate, based on climatic conditions. While there will always be a need for adaptive action, plans and decision-making should better reflect future climate change projections, recognising that such an approach will provide for improved transparency of changes in seasonal water reliability for water users.

The revised Plan should better consider climate change given the projected changes in rainfall patterns and associated reduced runoff, temperature increases and higher rates of evapotranspiration.[60] Plan revisions should:

- ensure the Plan can achieve its desired outcomes given the projected changes to water availability informed by climate and hydrological modelling
- consider how water will be managed and shared equitably among all users, including the environment, as levels of water availability change with continuing or growing demand on water resources
- provide transparency and certainty for water users on how water will be managed under a future with reduced water availability.

59 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*; Speer, M.S., Leslie, L.M., MacNamara, S. and Hartigan, J. (2021) 'From the 1990s climate change has decreased cool season catchment precipitation reducing river heights in Australia's southern Murray-Darling Basin', *Scientific Reports*, 11(16136); Muhury, N., Ayele, G.T., Balcha, S.K., Jemberie, M.A. and Teferi, E. (2023) 'Basin Runoff Responses to Climate Change Using a Rainfall-Runoff Hydrological Model in Southeast Australia', *Atmosphere 2023*, 14(306).

60 *Ibid*.

4.1 Historic climatic conditions in the Plan area

The topography of the Murrumbidgee region results in large spatial variations in climatic conditions, ranging from the alpine climate of the Snowy Mountains in the east, to temperate conditions in the central parts, and semi-arid conditions further west.[61]

Rainfall in winter and spring, and additional spring snowmelt in elevated areas of the east, are critically important for inflows into the region's main storages. Rainfall in the Murrumbidgee region varies from year to year with observed historical records showing distinct dry and wet cycles, some spanning 10-20 years.[62]

Over the last 20 years, there has been a shift in the climate in the southern connected basin, with a trend of decreasing rainfall in autumn and early winter and an increase in temperatures.[63] The Millennium Drought (2001-2009) remains the most severe drought for the Murrumbidgee Valley.[64] However, inflows in to Burrinjuck Dam for the 24-month period from February 2018 to January 2020 were the lowest on record, 17 percent less than the worst recorded period in 2008-2010.[65] The 2017-2020 drought took place against the backdrop of rising temperatures, increasing evaporation and record low root-zone soil moisture.[66]

The highest rainfall records for the regulated Murrumbidgee primarily occurred from the late 1940s to the early 1990s, a time of significant expansion in irrigated agriculture, as well as the wet period of 2010-2012.[67] Rainfall for the 18 months to October 2022 was recorded to be very much above average across much of the Murrumbidgee region,[68] arising from a succession of three consecutive La Niña periods.[69] Above average rainfall and dam inflows increased the region's storages to above 90 percent, and led to spills of Burrinjuck and Blowering dams in mid-2021.[70]

4.2 Climate change modelling projects changed rainfall patterns and water availability in the Plan area

4.2.1 Projected impacts to the climate in the Plan area

As part of the Draft *Regional Water Strategy*, the Water Team undertook a significant work program to build an understanding of the projected impacts of climate change in the Plan area, and the potential impacts to valley storages and water availability. The climate change modelling looked at three plausible climate scenarios and their respective implications for regional water resources: historical climate (approximately 130 years), long-term historical climate (10,000 years generated stochastically from 500 years of reconstructed paleoclimate data) and dry future climate (20 years of climate model

61 DPE (2022) *Draft Regional Water Strategy – Murrumbidgee*; Muhury, N., Ayele, G.T., Balcha, S.K., Jemberie, M.A. and Teferi, E. (2023) 'Basin Runoff Responses to Climate Change Using a Rainfall-Runoff Hydrological Model in Southeast Australia', *Atmosphere 2023*, 14(306).
62 DPE (2022) *Draft Regional Water Strategy – Murrumbidgee*
63 *Ibid.*
64 DPIE (2021) *Murrumbidgee Valley snapshot – 2017 2020 Drought*
65 *Ibid.*
66 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*
67 *Ibid.*
68 Bureau of Meteorology (n.d.) *Recent and historical rainfall maps – provided for specified time period*
69 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*
70 DPIE (2021) *Water Allocation Statement – Water availability and allocation update, Murrumbidgee Valley*; ABC Riverina (2021) *SES 'alert but not alarmed' as Murrumbidgee River runs high*

projections downscaled under the NSW and ACT Regional Climate Modelling Project (NARCliM 1.0 project)[71] (see **Box 1**).[72]

As part of the Draft *Regional Water Strategy*, the Water Group also developed an interconnected model for the southern connected system, allowing for feedback loops between the Murray, Murrumbidgee and Snowy models as part of the climate scenario modelling.[73] As noted in **Section 5.4**, the source model used for the Draft *Regional Water Strategy* is not currently being used for LTAAEL assessment of compliance or policy decision-making processes.

The dry future climate scenario is the only scenario to include climate change modelling. The other two scenarios use historical datasets. The Commission does not support the use of historical climate data as the only means to project and develop water management strategies under a changing climate in the Plan area in future years (see **Section 4.3**). The Commission has presented the results of the Water Group-assessed climate scenarios where this information is available.

Where data was unavailable across the suite of climate scenarios, the Commission has clarified whether data from scientific publications was used. There are several climate models and climate scenarios being used to project climate change impacts, many of which can be extrapolated to the Plan area and have been published in scientific literature. The Commission has not sought to identify the 'best' climate change projection as part of the review, recognising that across the international scientific community there is no consensus on a single set of 'best' models, scenarios or techniques.

Assessing impacts on water availability using the historic, paleoclimatic and dry future climate scenarios[74] represents a strong approach to build an understanding of potential climate change impacts. This is due to its ability to highlight potential risks to future water availability according to the 'baseline' using the historic climate scenarios and climate change using the dry future climate scenario.

By 2079, under the dry future climate scenario, catchments in the regulated river sections of the Murrumbidgee region could experience:

- changing rainfall patterns – with decreases in average winter and spring rainfall of around 20 percent and an increase in late summer rainfall of over 30 percent
- higher evapotranspiration - annual average evapotranspiration could increase by up to 4 percent.[75]

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71 NARCliM 1.0 uses four global climate models, that are regionally downscaled using three regional climate models. All regional climate model simulations were performed at 10-kilometre resolution over Southeast Australia, embedded within the 50-kilometre resolution domain of the CORDEX Australasia region. Simulations were run for three 20-year periods: the recent past (1990–2009), near future (2020–2039) and far future (2060–2079) using the SRES A2 scenario. Taken from: Nishant, N., Evans, J.P., Di Virgilio, G., Downes, S.M., Ji, F., Kevin K. W. Cheung, K.K.W., Tam, E., Miller, J., Beyer, K., and Riley, M. (2021) 'Introducing NARCliM1.5: Evaluating the Performance of Regional Climate Projections for Southeast Australia for 1950–2100, *Earth's Future*, 9, e2020EF001833.

72 Limitations and assumptions identified by the climate change modelling undertaken as part of the draft regional water strategies include: the uncertainty in the climate and hydrological modelling, which means that trends identified cannot be used as firm predictions; and that hydrological models used cannot reliably assess flood impacts and do not represent groundwater resources. Further limitations of the models used are outlined in DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*

73 DPE (2022) *Southern basin regional water strategy modelling - Factsheet*

74 This approach was undertaken by the Water Group through the regional water strategies.

75 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*

Box 1: Background on the climate scenarios developed for the Draft *Regional Water Strategy*[76]

Climate datasets and hydrological modelling developed for the Draft *Regional Water Strategy* program provide an updated understanding of the climate variability in the Murrumbidgee region beyond the recorded historical data.[77] The three climate scenarios used for this purpose include the historical climate scenario, long-term historical climate scenario and the dry future climate scenario.

The **historical climate scenario** is based on approximately 130 years of recorded daily rainfall, temperature and evaporation data for 1889–2020. The scenario is useful to build an understanding of how the Plan responds under a repeat of recorded climate conditions.[78]

The **long-term historical climate scenario** is derived stochastically from historical daily climate data and reconstructed paleo climatic information. For example:

- 500 years' worth of climatic patterns detected in paleo records such as tree rings, river sediments, cave deposits and ice cores. These data show that longer and deeper droughts have occurred prior to observed climate data as well as stronger wet periods, compared with the instrumental record
- records and scientific understanding about major climate drivers for the southern Murray–Darling Basin, including the Inter-Decadal Pacific Oscillation Index.

This scenario is useful to help understand how regional water resources would respond under a repeat of the extremes of droughts and wet periods that are possible in the historical record, based on the long-term past.[79]

The **dry future climate scenario** uses regionally downscaled, un-bias corrected, global climate model data from the NARCliM 1.0 project.[80] NARCliM 1.0 uses the 2010 Intergovernmental Panel on Climate Change Special Report Emissions Scenario (SRES) A2.[81] This scenario equates to approximately a 2.2 degree increase in average global temperature by 2079 (relative to 1980-1999). SRES A2 represented the most likely future scenario at the time of NARCliM 1.0 development, based on global emissions trajectory, and rate of population growth, economic growth and technological change.[82] The dry future climate scenario supports an understanding of how a drying climate would impact regional water resources and performance of options identified for regional water strategies.

This projection is consistent with other scientific literature of modelled impacts in the Plan area that show a decreasing rainfall trend across the Murrumbidgee region.[83] It is also

76 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*
77 *Ibid.*
78 *Ibid.*
79 *Ibid.*
80 *Ibid.*
81 The Commission is aware that there have been updates to improve performance of NARCliM 1.0 to provide a continuous simulation as opposed to three simulations across 20 year periods, and to incorporate more than one emissions scenario SRES A2. This update is available as NARCliM 1.5. Further details on NARCliM 1.5 performance are available at Nishant, N., Evans, J.P., Di Virgilio, G., Downes, S.M., Ji, F., Kevin K. W. Cheung, K.K.W., Tam, E., Miller, J., Beyer, K., and Riley, M. (2021) 'Introducing NARCliM1.5: Evaluating the Performance of Regional Climate Projections for Southeast Australia for 1950–2100, *Earth's Future*, 9, e2020EF001833. Information regarding water availability utilising NARCliM 1.5 was not available at the time of this review; AdaptNSW (n.d.) *Climate Projections used on AdaptNSW*
82 The SRES A2 has been identified as business as usual according to Nishant, N., Evans, J.P., Di Virgilio, G., Downes, S.M., Ji, F., Kevin K. W. Cheung, K.K.W., Tam, E., Miller, J., Beyer, K., and Riley, M. (2021) 'Introducing NARCliM1.5: Evaluating the Performance of Regional Climate Projections for Southeast Australia for 1950–2100, *Earth's Future*, 9, e2020EF001833; AdaptNSW (n.d.) *Climate Projections used on AdaptNSW*
83 Muhury, N., Ayele, G.T., Balcha, S.K., Jemberie, M.A. and Teferi, E. (2023) 'Basin Runoff Responses to Climate Change Using a Rainfall-Runoff Hydrological Model in Southeast Australia', *Atmosphere 2023*, 14(306).

consistent with analysis of observed trends that have identified a statistically significant decrease in autumn rainfall, contributing to decreased runoff in the catchment area.[84] This observed change in rainfall patterns and reductions in runoff has already contributed to a reduction in the average flow height of the Murrumbidgee river.[85] Changes in rainfall and evapotranspiration could affect irrigation, town water and environmental water demands, availability of soil moisture under cropping, as well as instream delivery losses.[86]

The implications of the dry future climate scenario compared to the historic scenarios in the Plan area is that, by 2079, catchments in the regulated river sections of the Murrumbidgee region could experience:

- reduced mean annual river flows at both Balranald and Gundagai – the scale of reductions are more substantial for the dry future climate scenario when compared to the long-term historical scenario. Reductions under the dry future climate scenario are also more substantial at Balranald (44 percent) at the end of the river system, compared with the reduction experienced at Gundagai (33 percent) on the upstream reaches of the regulated system[87]
- lower inflows to storage dams – including substantial reductions to seasonal inflows to both Burrinjuck and Blowering dams, compared to the historical and long-term historical scenarios,[88] and an overall lower minimum inflow sequence in the dry future climate scenario than either the historical climate or long-term historical climate scenarios[89]
- a reduction in water availability for water entitlement holders – general security entitlement at the end of the average water year would reach 100 percent allocation approximately 6 percent of the time under the dry future climate scenario (compared to 40 percent under historical and long-term historical scenarios),[90] and high security entitlement would exceed 95 percent allocation 80 percent of the time under the dry future and historical climate scenario, and 95 percent of the time under the long-term historical climate scenarios[91]
- risks to town water supply – modelling has identified that Jerilderie, Jugiong and Wanganella may face water supply issues under a dry future climate scenario (see **Chapter 9**).

The detailed assessment of impacts to annual river flows, storage dams and water availability across the three climate scenarios is provided in **Appendix 2**.

While the modelling work undertaken by the Department Water Group through the Draft *Regional Water Strategy* provides projections beyond the scope of the Plan's ten-year term, it represents a substantial step forward. It provides some transparency to stakeholders regarding potential risks to future water availability, particularly highlighting:

- the 'baseline' or the historical climate scenario, where water availability is assessed using historical data

84 Speer, M.S., Leslie, L.M., MacNamara, S. and Hartigan, J. (2021) 'From the 1990s climate change has decreased cool season catchment precipitation reducing river heights in Australia's southern Murray-Darling Basin', *Scientific Reports*, 11(16136).
85 *Ibid.*
86 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*
87 *Ibid.*
88 *Ibid.*
89 *Ibid.*
90 *Ibid.*
91 *Ibid.*

- the most likely future SRES climate scenario or dry future climate scenario, where water availability is severely affected based on climate change projections.

While the current projections describe the water availability challenges to 2079, the Commission has sought to highlight the importance of commencing management under a shifting climate in the next decade of the Plan (see **Section 4.3**).

Providing information on the potential hydrological impacts, based on the range from the three climate scenarios, allows water users to assess risks based on their reliance on river flows for basic landholder rights, and water access licence allocations. While the Draft *Regional Water Strategy* provided transparency for licence holders regarding potential risk to water allocations under the dry future climate scenario, it did not identify the risks to delivery of planned environmental water.

Assessing potential environmental impacts is an important gap that requires clarification to ensure that the Plan can effectively achieve environmental outcomes under a future with reduced water availability.[92] The Commission understands that entitlement holders are better protected from the risk of climate change under water sharing plans, with larger risks of reduced water availability borne by planned environmental water, including water remaining in the system after water has been taken pursuant to basic landholder rights and access licences.[93]

As such, the Commission considers it necessary to also model the impacts of the scenarios on the volumes of planned environmental water to identify where risks are exposed to water delivery, and as a result the environmental outcomes that can be achieved by the Plan. This will expose the risks to planned environmental water, and potentially identify the need for changes in management approaches or where Plan provisions may need to be revised to mitigate impacts to the environmental assets in the Plan.[94]

Recommendation R1 (LT) – Priority 1

To identify where Plan environmental rules may be at risk of failing to deliver on their required purpose under changing water availability, the Water Group should model impacts under the baseline scenario (historical climate scenario) and climate change scenarios. The Water Group should revise Plan provisions, where this is required, to maintain environmental outcomes.

92 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*; Muhury, N., Ayele, G.T., Balcha, S.K., Jemberie, M.A. and Teferi, E. (2023) 'Basin Runoff Responses to Climate Change Using a Rainfall-Runoff Hydrological Model in Southeast Australia', *Atmosphere 2023*, 14(306).

93 Young W.J., Bond, N., Brookes, J., Gawne, B. and Jones, G.J. (2011*). Science Review of the Estimation of and Environmentally Sustainable Level of Take for the Murray-Darling Basin*. A report to the MDBA from the CSIRO Water for a Healthy Country Flagship.

94 The Commission recognises that the Basin Plan scenario modelling was determined by simulating a reduction in consumptive water use and making an equivalent volume of water available for environmental use within the water sharing, water management rules and constraints prescribed under baseline conditions. Taken from MDBA (2012) *Hydrologic modelling to inform the proposed Basin Plan – methods and results*. Climate change impacts on planned environmental water may as such impact the effectiveness of any water recovery and the environmental outcomes that can be achieved through held environmental water. This has been highlighted by the Commonwealth Environmental Water Holder (CEWH) '*Water resource plan requirements under the Basin Plan (Section 10.26) stipulate that water resource plans must be consistent with the environmental watering plan and the Basin-wide environmental watering strategy. Any reduction of planned environmental water undermines the foundation of the Basin Plan and would require greater volumes of held environmental water to be recovered to meet the minimum set environmental objectives*' (taken from CEWH (2017) *Inquiry into the management, governance and use of environmental water*, Submission 7).

4.3 Use of only historic data to inform water management is no longer best practice

Historically, water management decisions were made based on the best available observed climate and hydrological records. In the Plan area, hydrological models are calibrated and validated on historical data, thereby building into these models fixed representation of climate and hydrological processes. The Water Group advised that it uses the historic record when reviewing any Plan changes or water management decisions.

The use of historical data to underpin future water management relies on the assumption of 'stationarity', i.e. '*that natural systems will continue to fluctuate with an unchanging envelope of variability*'.[95] However, improved understanding of climate and hydrological sciences, including climate change impacts, calls in to question the assumption of stationarity, as it is now known that changes to climate and hydrological relationships occur that modify the envelope of variability in ways not seen in the historic record.

These changes can impact, among other things, average and extreme rates of precipitation, evapotranspiration, rainfall-runoff relationships, and system losses during water delivery and changes to patterns of water delivery.[96] Limitations of the assumption of stationarity point towards the need for historical data to be considered in conjunction with climate change projections, to reflect and account for changes to climate non-stationary processes. This is particularly important where climate projections indicate water availability will shift beyond the historically predicted pattern of variability.

Hydrological systems can undergo abrupt shifts in their dynamics due to non-stationary tipping points. This means that hydrological models that have been calibrated and validated using historical data may not adequately simulate the flow volumes and runoff characteristics of climate events outside those that they have been tested on. Regular hydrological model evaluations and recalibrations are required to ensure the representation of hydrological relationships continue to be appropriate, i.e. based on up-to-date data.

For example, the runoff decline during the Millennium drought was unprecedented in the instrumental historical record.[97] The reduction in runoff was caused not only by lower annual rainfall but also by changes in other climate characteristics[98] and dominant hydrological processes.[99] The challenges of managing the system under such a scenario is demonstrated in the Plan being suspended from 10 November 2006[100] to 19 August 2011.[101] The Commission notes that the Plan was not suspended during the review period.[102]

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95 Milly, P., Betancourt, J., Falkenmark, M., Hirsch, R.M., Kundzewicz, Z.W., Lettenmaier, D.P., and Stouffer, R.J., (2008) 'Stationarity Is Dead: Whither Water Management?', *Science*, 319(573-574).

96 *Ibid*.

97 Chiew, F.H.S., Potter, N.J., Vaze, J. *et al*. 'Observed hydrologic non-stationarity in far south-eastern Australia: implications for modelling and prediction', *Stoch Environ Res Risk Assess,* 28(3-15); Potter, N.J., Chiew, F.H.S. and Frost, A.J. (2010) 'An assessment of the severity of recent reductions in rainfall and runoff in the Murray–Darling Basin', *Journal of Hydrology*, 381(1-2), pp. 52-64.

98 Lack of any high rainfall years, change in rainfall seasonality and higher temperatures.

99 Reduced surface–groundwater connection and farm dams intercepting proportionally more water during dry periods; Chiew, F.H.S., Potter, N.J., Vaze, J. *et al*. 'Observed hydrologic non-stationarity in far south-eastern Australia: implications for modelling and prediction', *Stoch Environ Res Risk Assess,* 28(3-15).

100 *Government Gazette 137, Friday 10 November 2006*

101 *Government Gazette 90, Friday 16 September 2011*

102 The Tinderbox Drought (2017-2020) led to the Plan area being declared to be in 'Stage 2 – emerging drought' from 15 May 2019 (see DPI (2019) *Murrumbidgee Regulated River Water Source Water allocation update 15 May 2019*) to 1 August 2019 (see DPI (2019) *Murrumbidgee Regulated River Water Source Water allocation update 1 August 2019*). During this time licence holders had full access to water carried over from the previous year (see DPI (2019) *Murrumbidgee Regulated River Water Source Water allocation*

The use of historical data to predict future water availability in the Plan highlights large differentials when compared with trends in water availability under the long-term historical scenario and dry future climate scenario.[103] For example, mean average annual flows at Gundagai and Balranald, and cumulative inflows for Burrinjuck and Blowering dams are both lower in the long-term historical and dry future climate scenarios compared to the historical climate scenario.[104] This points towards the potential to overestimate water availability where hydrological models only use the historical dataset. This may increase the need for Plan suspensions or temporary water restrictions, where inflows in the Plan area fall outside the range identified in the historical record (see **Section 6.3**).

It is no longer best practice to use historical data as the sole basis for projections of future water availability. There is consensus from a range of climate change models that the Murrumbidgee will experience reduced runoff, changed rainfall patterns and increased evapotranspiration (see **Section 4.2**). Where these changed climatic conditions occur, and are unprecedented against the historical dataset, there may be a greater need for use of Plan mechanisms that do not provide longer-term signals on water availability, such as Section 324 orders or Plan suspensions. This is despite these events not being unprecedented but expected to occur under climate change.

The Water Group should update approaches to water management decision-making, such as water allocations, to factor in current climate change projections, including evidence of climate and hydrologic non-stationarities.[105] The Commission notes that this is consistent with the *NSW Water Strategy*, which under Priority 4 seeks to undertake water resource management using '*the most up-to-date understanding of climate, including climate change and associated risks to water resources. This understanding is reflected in strategic planning and supports water management decisions*'.[106]

The Commission acknowledges that it is a substantial shift for the Water Group to move towards an approach that incorporates both historical data and climate change projections in water management decision-making, and that there are complexities in such an approach. As such, the Commission has not sought to identify the best path forward, recognising the challenges in implementation. However, using different operating rules for different conditions, i.e. rules that can be implemented under predicted wet versus predicted dry climatic conditions, may be warranted.

The Water Group has advised that it will be commencing several projects to consider how climate change and climate change variability is integrated within the water sharing plan framework. This includes commitments made under the Clause 72 review, which seeks to revise the minimum inflows and the minimum volume of water to be set aside in storages to meet planned environmental water, basic landholder rights and critical human needs including town water supply. At the time of this review, these initiatives had not been commenced by the Water Group.

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update 1 July 2019) but general security access licences did not receive new allocations. The Plan area remained in 'Stage 1 – normal conditions' for the remainder of the drought until 17 May 2021 (see DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 17 May 2021*).

103 As highlighted through the climate change scenario modelling work undertaken for the Regional Water Strategies.

104 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*

105 Chiew, F.H.S., Potter, N.J., Vaze, J. *et al*. (2014) 'Observed hydrologic non-stationarity in far south-eastern Australia: implications for modelling and prediction', *Stoch Environ Res Risk Assess*, 28(3-15); Milly, P., Betancourt, J., Falkenmark, M., Hirsch, R.M., Kundzewicz, Z.W., Lettenmaier, D.P., and Stouffer, R.J., (2008) 'Stationarity Is Dead: Whither Water Management?', *Science*, 319, pp. 573-574; DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*

106 DPIE (2021) *NSW Water Strategy*

Recommendation R2 – Priority 1
To ensure that the modelled representation of hydrological processes reflects any observed changes over time, the Water Group should undertake hydrological model validation and recalibrations at least once every five years.
Recommendation R3 (LT) – Priority 1
In recognition of the potential future shifts in climatic conditions, the Water Group should incorporate climate change projections into decision making and shift away from the use of historical data as the sole basis for water management decisions.

4.4 Plan provisions for climate change adaptation are limited

The Plan's provisions and objectives for climate change adaptation are limited, including how to prepare or respond to predicted impacts and improve resiliency for water users and the environment. Current Plan provisions that potentially allow for consideration of climate change include a review of the lowest accumulated inflows used for the AWD process. Shortcomings of the Plan include use of historical data in water management decisions, and a lack of climate change objectives to track the performance of the Plan. The Commission has raised a requirement for the Plan to identify climate change objectives and corresponding strategies and performance indicators as part of its discussion of monitoring and evaluation (see **Chapter 14**).

Clause 72 of the Plan commits to a review of the lowest accumulated inflows by 30 June 2026.[107] Lowest accumulated inflows form a critical component of the allocations process and how water is shared by water users within the system (**Chapter 6**). The inclusion of Clause 72 in the Plan recognises that the use of the historical dataset to define the lowest accumulated inflows in the Plan is no longer best practice. However, it is not clear how the review will factor in climate change projections, or the improved understanding of changes to water availability.[108] Further, until the review referred to in Clause 72 of the Plan occurs,[109] there will be no adjustment to current water management arrangements.

Clause 72(7) of the Plan specifies that any changes made as a consequence of the review, '*cannot substantially alter the long-term average annual amount of water able to be extracted under water access licences*'. The Commission does not support this subclause, which is in direct contrast to best available evidence of future water availability in the Plan area. Current evidence points towards a need to manage water under a future of reduced water availability. The Commission considers that this subclause is inconsistent with the principles of the Act and may therefore not be valid (see **Chapter 6**). Further, Section 59 of the Act gives the Minister full discretion for how to determine AWDs. Clause 72(7) would appear to 'fetter' the Minister's discretion, which may also make the clause invalid.

The Commission recommends that as part of the Clause 72 review, the Water Group revise Clause 72(2), which restricts the operator to managing '*the water supply system in such a way that water would be able to be supplied during a repeat of the period of lowest*

107 Clause 72 of *Amendment Order 2022* of the Plan.
108 An improved understanding was developed as part of the Regional Water Strategies and via the broader scientific literature.
109 Clause 72 of *Amendment Order 2022* of the Plan commits to a review of the lowest accumulated inflows by 30 June 2026.

accumulated inflows'.[110] Given this Plan provision is intended to ensure supply to high priority licence categories, including town water supply, best practice decision-making should be integrated into system operation. The Commission would support the revision of this Plan provision to allow the operator to manage the water supply system under expected climate and hydrologic conditions, rather than being restricted to the historical record.

The NSW Government's *Extreme Events Policy*[111] and *Incident Response Guide*[112] outline how water allocations will be prioritised in periods of drought or unacceptable water quality. The Commission recognises that this policy and guide represented a substantial improvement on previous arrangements, with no prior transparency on how water is prioritised during periods of water scarcity. However, the Commission considers that, in its current form, it acts as a reactive policy for individual events to account for climate variability, not projections of climatic conditions that may occur as a result of climate change.[113]

The Commission considers that the historically unprecedented events that have been managed using the *Extreme Events Policy*, Plan suspensions and Section 324 orders are expected to occur with greater frequency in future years if the management approach is not changed. While there will always be a need for adaptive management, and tools to allow decision-makers to manage the prevailing climatic conditions, the use of historical datasets to make decisions may result in the more frequent triggering of these water management mechanisms. This approach does not provide the certainty for water users that was intended under the water sharing plan framework. The Plan provisions should enable the management of projected reductions in water availability due to climate change, with decision-making using historical datasets and climate change projections to provide transparency to water users of seasonal water availability.

The long-term extraction limit recognises the effect of climatic variability on the availability of water, in accordance with Section 20(2)(c) of the Act. However, it uses the historical climate dataset in its determination.[114] While LTAAEL Plan rules account for environmental Plan rule requirements, these rules must be based on environmental needs. The shortcomings of some of the current environmental Plan rules are outlined in **Chapter 7**. Additionally, the LTAAEL should factor in the full suite of climate scenarios and recognise that the future climate is uncertain and further work is required to mitigate against a changing climate. This should be part of an adaptive management approach. The Plan maintains the water above the LTAAEL is identified as planned environmental water for the environment. However, if the LTAAEL is based on extraction from a period with greater water availability than is likely in the future, there is a risk that less water will be available for the environment (see **Section 4.3** and **Chapter 6**).

The Commission recognises that the Plan sits within the broader scope of the Basin Plan, where long-term average sustainable diversion limits took into consideration an assessment of the environmentally sustainable level of take.[115] The environmentally sustainable level of take was informed by detailed hydrological modelling.[116] However, the

110 As identified in **Section 6.3.1**, minimum inflows are defined by flow information held by the Water Group prior to 1 July 2004 and as such remove the impact of new record lowest accumulated inflows that occurred during the Millenium (2008-2010) and Tinderbox droughts (2018-2020).
111 NSW DPE (2023) *Extreme Events Policy*
112 DPIE (2020) *Murrumbidgee Surface Water Resource Plan Incident Response Guide – Schedule G*
113 NSW DPE (2023) *Extreme Events Policy*
114 Part 6, Division 2 (5) Note 2 of the Plan.
115 MDBA (2011) *The proposed 'environmentally sustainable level of take' for surface water of the Murray-Darling Basin: Method and outcomes*
116 MDBA (2019) *Climate change and Murray-Darling Basin Plan, MDBA Discussion Paper*

legislated sustainable diversion limits were not based on scientific determinations of environmental needs[117] and do not achieve the majority of the hydrological targets required to represent a 'sustainable level of take.'[118] In addition, climate change was not accounted for in the sustainable diversion limits.

The Basin Plan's strategy to address reduced water availability includes adapting to future changes through regular monitoring and review, for example:

- the 2026 Basin Plan review needing to have regard to climate change risk management
- regular review of the environmental watering priorities (annually) and environmental watering strategy (at least five-yearly), which may be updated at any time
- the 2026 review of the Basin Plan including an evaluation criteria for protection of water-dependent ecosystems including resilience to climate change.[119]

The Commission considers that it is best practice to manage water availability using best available information, including incorporating climate change projections and historical datasets in water management decision making. Building this into the Plan will provide transparency for water users.

Recommendation R4 – Priority 2

Refer to **Recommendation R2** and **AR1**

In relation to consideration of the Clause 72 review of the period of lowest accumulated inflows, the Water Group should:

a) provide transparency on how climate change will be considered in redefining the lowest accumulated inflows

b) revise Clause 72(2) to reflect that operations should be able to deliver higher priority needs based on projected climate and hydrologic conditions, rather than making decisions tied to the historical record

c) following the Clause 72 review, notify licence holders of potential reductions in the long-term average annual extraction that may occur as a result of climate change impacts.

117 Walker, B. (2019) *Murray-Darling Basin Royal Commission Report*

118 Young, W.J., Bond, N., Brookes, J., Gawne, B., and Jones, G.J., (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.

119 Adapted from Figure 7 of MDBA (2019) *Climate change and Murray-Darling Basin Plan, MDBA Discussion Paper*

5 Ensuring sustainable extraction

A fundamental role of a water sharing plan is to establish limits on the volume of water that can be extracted by licensed users. The Plan establishes two limits which operate concurrently, the NSW limit established through the LTAAEL, and the Basin Plan limit established through the Sustainable Diversion Limit (SDL).

Setting these limits is critical. An extraction limit that is too high will potentially not set aside adequate water for the environment and may limit the ability of the Plan to meet the key requirements of the Act.[120] Overly restricting extractions may limit water users' ability to use available water resources and impact the economic and social opportunities within Plan communities.

The SDL and LTAAEL are defined and assessed differently. They:

- cover different water sources
- have different water use exclusions
- are assessed using different approaches with different compliance triggers.

The Water Group's Extraction Limits document[121] provides a detailed comparison of the SDL and LTAAEL and outlines how compliance with the limits is assessed and the key differences between the limits.

SDLs are reviewed through other Murray-Darling Basin processes, with past reviews undertaken by MDBA and the CSIRO. This chapter focuses on the Murrumbidgee Regulated River LTAAELs as this represents the extraction limit devised and specified by NSW in the Plan.

5.1 The LTAAEL is not based on an assessment of environmental sustainability

The LTAAEL establishes a limit on extractions under the Plan and is a key component to measure if the economic and environmental objectives are achieved.[122] The legislative settings for establishing the LTAAEL are set out in the Act[123] and the Plan.[124]

The LTAAEL is not a fixed number but is assessed using models. It varies as additional years are added to the simulation and as model or scenario updates incorporate best

120 Section 5(3) of the Act.
121 DPIE (2021) *Extraction Limits – How the extraction limits work and differences*
122 See Clauses 8(1) and (3), and Clauses 9(1-3) of the Plan.
123 Section 8F requires the auditing of compliance with the long-term extraction limit under a water sharing plan; Section 20(2)(a) requires the bulk access regime established by a water sharing Plan to recognise and be consistent with any limits to the availability of water that are set (whether by the relevant management plan or otherwise) in relation to the water sources to which the regime relates; and Section 8(1A)(b) requires a water sharing plan to commit water as planned environmental water in at least 2 ways including by reference to the long-term average annual commitment of water as planned environmental water.
124 Clause 12 of the Plan establishes the components of the bulk access regime, whereby water allocations are to be adjusted where there is an increase in the LTAAEL; Clause 16 of the Plan sets out provisions impacting the establishment and maintenance of planned environmental water where any water not committed beyond the LTAAEL or as planned environmental water due to provisions outlined in the Plan is to be available for environmental outcomes; Clauses 29 to 32 sets out the inclusions, exclusions, calculation and assessment of LTAAEL along with Clause 36 that outlines actions to be taken where there is a non-compliance with LTAAEL.

available information. This is because the LTAAEL is estimated under Plan provisions[125] as the long-term average extraction simulated by a hydrological computer model approved by the Minister.[126] The Plan outlines that the LTAAEL is the sum of the Murrumbidgee long-term average extraction (Murrumbidgee extraction) and Lowbidgee long-term average annual extraction (Lowbidgee extraction).

The Murrumbidgee extraction limit is the lesser of long-term annual extractions that are simulated to occur under two modelled scenarios that represent levels of development, water use behaviour and water management rules that existed at specific points in time:

- Cap conditions scenario – generally reflects irrigation development, operation and management rules as at 1993/94[127]
- Plan conditions scenario - reflects water storages and water use development in place in the 1999/2000 water year; basic landholder rights and access licence share components in place on 1 July 2004;[128] Plan rules in place on 1 July 2004; and the level of development of plantation forestry in place on 1 July 2009.[129]

The Lowbidgee extraction limit is the long-term annual extractions simulated to occur under the Cap conditions scenario.

The Plan establishes that the LTAAEL is to exclude:

- share components of access licences cancelled under the Snowy Water Inquiry Outcomes Implementation Deed
- share components of access licences under a 71U dealing (see **Chapter 10**)
- allocations assigned under a 71T or 71V dealing into the Plan area (see **Chapter 10**)
- water for the environment as outlined in the environmental flow rules (minimum daily flow rules, transparent and translucent flows) and environmental water allowance rules.[130]

The Act further stipulates that water savings in a system and water committed as licensed environmental water[131] is not to be factored into the extraction limit.[132]

125 DPIE (2021) *Extraction Limits – How the extraction limits work and differences*
126 Clause 30(5) of the Plan.
127 The Cap represents the target established under the Murray Darling Basin Agreement, which is used to manage diversions (or extraction) to levels occurring with 1993/94 irrigation infrastructure and management rules (NSW Department of Water and Energy (2007) *Murrumbidgee River Valley IQQM Cap implementation summary report issue 4*). Under the Cap, Basin states, including NSW, provided data to the MDBA on the volume of water taken each year compared to the annual Cap targets. The MDBA then assessed whether extractions were less than or greater than the annual Cap target. Compliance action was taken where there was a debit of 20 percent or more against the long-term Cap limit. With the introduction of water resource plans, States will transfer from Cap compliance to reporting on SDL. SDL compliance responsibilities have moved to the Inspector-General of Water Compliance from the 2020-2021 water year (MDBA (n.d.) *Compliance with limits on water use*). Cap compliance reporting will remain in force until it is repealed by the Murray Darling Basin Ministerial Council. When it is repealed, the LTAAEL will still need to be less than or equal to the Cap. DPIE (2021) *Extraction Limits – How the extraction limits work and differences*.
128 This represents the version of the Plan that was in place as at 1 July 2004.
129 See Clause 30 of the Plan.
130 Clause 29 of the Plan.
131 Licensed environmental water as defined in Section 8(1(b))(i) water that is committed by an adaptive environmental water condition under Section 8B, 8C, 8D or 63B or (ii) taken or permitted to be taken under a licence of an environmental subcategory, or (iii) taken or permitted to be taken under a licence of a class prescribed by the regulations for the purposes of this paragraph.
132 Section 8F(4) and (5) of the Act.

From Plan commencement until 2022 amendments, notes in the Plan identified the:

- model version identifier[133]
- numeric estimate of the LTAAEL based on a given modelled scenario[134]
- numeric estimate of the volume and percentage of water established as planned environmental water arising from limiting long-term average annual extractions. Previous versions of the Plan identified that approximately 50 percent of the long-term average annual flow in the water source (estimated to be 4,360,000 Megalitres (ML) per year) was to be preserved and contribute to the maintenance of basic ecosystem health.[135]

The removal of these notes from the Plan in 2022 reduced transparency for stakeholders on the estimate of the extraction limit and supporting information on scenario models used in these estimates, and the estimate of the identification of planned environmental water. The Water Group advised that these notes have been removed from water sharing plans due to estimates becoming outdated with model revisions and creating confusion amongst stakeholders. The Water Group indicated that information is made available regarding LTAAEL estimates via its LTAAEL compliance assessment reporting.[136] The Commission continues to support the inclusion of numeric estimates of LTAAEL within the Plan, as the legislative instrument is the key tool to provide transparency to stakeholders on average annual extraction and what this represents as a proportion of long-term flow in the water source.

The LTAAEL is not based on an evaluation of environmental needs. There has not been a specific assessment of whether the Plan's LTAAEL meets the objects of the Act, including maintaining the health of water-dependent ecosystems. As outlined in Plan provisions, the LTAAEL represents the total long-term extractions that could occur at specific points in time based on levels of development and water management rules. This is useful for identifying whether there has been growth in extractions above what occurred historically but does not limit extractions to levels that ensure achievement with the Plan's objectives.

The Commission understands that these LTAAELs were set in 2004 as an interim Cap only, to prevent further growth in water usage and ensure that the health of water sources and their dependent ecosystems did not deteriorate further. The intention was that these interim limits would be assessed and revised over time as better information became available to assess their sustainability and adequacy for meeting the objectives and priorities of the Act. However, a sustainability assessment has never been undertaken for the LTAAELs. The Commission's view is that the LTAAEL should be based on a maximum level of extraction that protects, over the long-term, the water source and its dependent ecosystems in addition to the Plan's environmental, social and cultural objectives.

Further, the extent to which 50 percent of the long-term average annual flow is being preserved in the Plan, and any impact of current river operational rules on the 'surplus' water made available for the purpose of ecosystem health, is yet to be established. Stakeholders have previously stated that river operations have shifted in recent years, with rivers being run more efficiently. This may be a reflection of the *WaterNSW Act 2014*, which defines the functions and objectives of WaterNSW and has a principle objective '*to capture, store and release water in an efficient, effective, safe and financially responsible manner*'.[137] This legislative driver for efficiency by the river operator may potentially result in less

133 For example, 2016 Plan, Clause 50 (1b), Note 1 and 2.
134 *Ibid.*
135 For example, 2016 Plan, Clause 16(1b), Note 1.
136 DCCEEW (n.d.) *Compliance against the long term annual average extraction limits*
137 Section 6(1a) of the *WaterNSW Act 2014*.

'surplus' water for the environment. As highlighted in **Chapter 4**, projected reductions in inflows as a result of climate are more likely to impact on environmental surplus water rather than reductions in water made available for extraction.

The environmental flow rules and the environmental water allowance are currently excluded from the LTAAEL. The adequacy of these rules to meet the requirements of the environmental assets in the Plan is discussed in **Chapter 7**, with the Commission noting that several improvements could be made to achieve improved environmental outcomes.

To address these issues, the Water Group should undertake a scientifically based process to identify the needs of the water source and its dependent ecosystems, and establish the LTAAEL based on protecting these needs from extraction. Environmental water requirements established under the long-term watering plan provide the best available scientific evidence on these needs. In addition, the LTAAEL should be responsive to the potential impacts of climate change outlined in **Chapter 4**.

Recommendation R5 (LT) – Priority 1

The Water Group should set a sustainable LTAAEL that:

a) sets aside the water required to protect the water source and its dependent ecosystems

b) enables the achievement of the Plan's environmental, social and cultural objectives

c) establishes a limit framework that is responsive to the impacts of climate change

d) is not reliant on the SDL to achieve the Plan's environmental outcomes.

5.2 LTAAEL compliance is not transparent or based on actual extraction data

The Water Group is responsible for implementing LTAAEL provisions in the Plan, including annual assessments of compliance with extraction limits in accordance with Plan provisions.[138] According to the Water Group, this includes developing the procedures to implement LTAAEL provisions and providing associated modelling services.[139]

LTAAEL compliance is used to trigger responses that control growth in extractions that may arise from increased river operational efficiency, changes in water user behaviour, river operators or water management policy.

The Commission understands that improved understanding of floodplain harvesting extraction volumes are yet to be accounted for and considered by the Murrumbidgee Regulated River LTAAEL. The Water Group has advised that it is in the process of developing two floodplain management plans for the Murrumbidgee River Valley with associated declared floodplains.[140] The Water Group has indicated that this process will allow it to determine any risks to the water source occurring as a result of floodplain harvesting and take of overland flow. The Commission supports the incorporation of all legal water take, including previously unmetered extractions such as floodplain harvesting, into the modelled estimate of the LTAAEL. The Commission notes that inclusion of

138 Interview: DPIE, 24 June 2020.
139 Interview: DPIE, 17 June 2020.
140 DCCEEW (n.d.) *Southern floodplain management plans*

floodplain harvesting volumes might trigger actions that reduce allocations to ensure compliance with the LTAAEL.

According to the Plan, actions to address LTAAEL non-compliance are triggered when modelled long-term extractions based on the current conditions scenario:

- exceed the lowest extraction limit set by the Cap conditions scenario or the Plan scenario by 3 percent or more, or
- exceed the average of the Cap conditions scenario and the Plan scenario, or
- exceed the extraction limit established by the Cap conditions scenario.[141]

The current conditions scenario, as outlined in the Plan,[142] is a hydrological model that should be updated annually to best reflect current:

- water storages and development
- basic landholder rights, access licence share components, and plantation forestry
- Plan rules in place.

To date, the Water Group has published two Murrumbidgee Regulated River LTAAEL compliance assessment reports covering the period 2020-2022.[143] It is unclear if the Plan was compliant prior to 2020, as no assessment was undertaken. A lack of implementation of Plan LTAAEL provisions, means the Water Group may not have determined whether 'growth in use' adjustments were required under the Plan. Adjustments to address growth in use are important to limit adverse environmental impacts to ecosystems[144] and adverse impacts to downstream users.[145]

The two completed Murrumbidgee Regulated River LTAAEL assessments found extractions in the Plan area to be compliant with the long-term limit. However, these compliance assessment reports are only high-level summaries of the assessment process. The Commission has the following concerns:

- It is unclear whether the LTAAEL modelling has excluded environmental flow rules, environmental water allowance rules and licensed environmental water as required by the Plan and the Act respectively.[146]
- While guidelines are available detailing some of the criteria that have been used to select the scenario models used for assessing compliance with LTAAEL,[147] there is no requirement, nor is it transparent whether the scenario models used for LTAAEL assessment have been independently reviewed, or are fit for purpose based on

141 Clause 32 of the Plan.
142 Clause 31 of the Plan.
143 DPE-Water (2022) *LTAAEL compliance assessment for Murrumbidgee Regulated River Water Source*; DPE-Water (2023) *LTAAEL compliance assessment for Murrumbidgee Regulated River Water Source*
144 Note 3 below Clause 50(1) of the 2016 version of the Plan states that '*by limiting long-term average annual extractions to an estimated 1,925,000 ML/year, this Plan ensures that approximately 50% of the long-term average annual flow in this water source (estimated to be 4,360,000 ML/year) will be preserved and will contribute to the maintenance of basic ecosystem health'.*
145 DPIE-Water (2021) *Floodplain Harvesting- why is reform vital?*; DPIE-Water (2021) *An overview of legal limits*
146 Information provided in DCCEEW documents indicates that LTAAEL compliance can include water for non-consumptive purposes, stating that the Commonwealth has requested that NSW not formally recognise licensed water despite this being a requirement of the Act (DPIE (2021) *Extraction Limits – How the extraction limits work and differences*)
147 DPE (2022) *Guidelines to select scenario models for assessing compliance to long-term average annual extraction limits*

observed data.[148] Clarity around the models used for assessment, and any revisions made to the model or Cap conditions scenario, Plan scenario and current conditions scenarios since model accreditation would improve transparency for stakeholders. The importance of independent assessment of LTAAEL models and assurance has been outlined previously by the Commission as part of its audits, the Commission's response to the Section 10 review and by the Inspector General of Water Compliance.[149]

- It is unclear why the LTAAEL does not indicate the current total modelled extraction across the Plan area given this is defined in the Plan as the sum of the Murrumbidgee and Lowbidgee extraction.
- Transparency in these compliance assessments could be strengthened by disaggregating the modelled scenario limits into each form of take and identifying where modelled take is set as a static value.

In addition, the Commission has overarching concerns regarding the approach applied for Murrumbidgee Regulated River LTAAEL compliance. As specified by Plan requirements, LTAAEL compliance is undertaken by comparing two modelled scenarios over the long term. This framework leads to the following issues:

- The model's ability to be responsive to real world changes, identify growth in use and the validity of the compliance assessment are dependent on whether the current conditions scenario appropriately simulates real-world current levels of extraction. While the current conditions scenario should be updated on an annual basis to best reflect current levels of development, water user behaviour and water management rules,[150] it is the Commission's understanding that there is no independent review, verification or accreditation of these updates to determine whether the changes are fit for purpose, or the overall model performance.
- The accuracy of the model representation for simulating changes in water use should be given equal weighting to the accuracy of metering equipment to measure extractions. However, while multiple safeguards are being rolled out to improve metering accuracy, including tamper proof meters, installation by duly qualified persons, and independent oversight by the Natural Resources Access Regulator (NRAR), there are no similar safeguards that promote accuracy of the representation of extractions in the annual current conditions scenario model updates.
- There is no independent agency to ensure models and model scenarios reflect best available information, and this information is not transparent. Stakeholders cannot independently verify that the level of extractions produced by the modelled scenarios is appropriate, nor that they are fit for purpose for identifying growth in use, reducing stakeholder confidence in the LTAAEL assessment compliance framework.
- There is no requirement to assess accuracy of the model against the actual extraction data collected for the period in question.

Given the significant investment by water users and the NSW Government in the metering reforms, it would be a reasonable progression in water management planning and compliance to use actual metered extraction data to inform, track and validate modelled extraction and ensure actual extraction complies with long-term limits. This approach would align with the SDL compliance assessment framework undertaken as part of the

148 DPE-Water (2022) *LTAAEL compliance assessment for Murrumbidgee Regulated River Water Source*; DPE-Water (2023) *LTAAEL compliance assessment for Murrumbidgee Regulated River Water Source*

149 Natural Resources Commission (2023) *Final report - Audit of the implementation of the Lachlan, Murrumbidgee and NSW Murray and Lower Darling regulated rivers water sharing plans*; Inspector-General of Water Compliance (2023) *Sustainable Diversion Limit Compliance Statement for 2021-2022*

150 Note in Clause 31: '*It is intended that the Department's current conditions hydrological computer model will be extended each water year and used to calculate long-term average annual extraction under this clause.*'

Basin Plan, which requires the use of annual actual take (extractions) as part of the assessment process. The Inspector-General of Water Compliance's assessment of the interim register of take[151] for the 2021-22 period found that the Murrumbidgee had an 18 percent cumulative balance in excess of the long-term limit. The cumulative balance is trending toward the SDL compliance threshold of 20 percent after only three years of operation.[152] This indicates that, where assessment of extractions is reported against observed or actual data and over the short time period of the last three years, there is a trend that extractions in the Plan area are tracking towards the non-compliance threshold.

Recommendation R8 – Priority 2

To improve transparency of the assessment of LTAAEL compliance reports, the Water Group should transition to use actual metered data to validate the LTAAEL compliance process.

Recommendation R9 (LT) – Priority 2

To improve transparency of the assessment of LTAAEL compliance reports, the Water Group should:

a) clarify whether models used in the LTAAEL assessment of compliance have been independently reviewed and deemed fit for purpose

b) provide visibility of any revisions and inclusions to the scenario models used in the LTAAEL assessment of compliance

c) provide disaggregated extraction information for each modelled scenario and identify where modelled extraction is set as a static value

d) undertake annual independent reviews of the current conditions scenario to ensure it best represents current level of extraction.

5.3 Extraction limit compliance actions may impact environmental outcomes

If an assessment of extraction limits demonstrates non-compliance, the Plan outlines a series of actions to be taken to address the growth in use. Clause 36 identifies that the Minister can reduce future allocations for supplementary water access licences or regulated river (general security) access licences.

These corrective actions do not distinguish between access licences held by environmental water holders and all other extractive licence holders. This means that actions to address over-extraction and comply with extraction limits (established for the purpose of providing for environmental needs) affect both water that contributes to over-extraction and water that provides for environmental needs.

These actions perversely impact on HEW in any LTAAEL and SDL non-compliance actions. In particular, SDL 'make good' measures are contradictory as HEW is excluded from the total consumptive take determined under the SDL.[153] This means that, to address SDL non-

151 Inspector-General of Water Compliance (2023) *Sustainable Diversion Limit Compliance Statement for 2021-2022*

152 The Commission notes that SDL compliance assessments have been undertaken yearly as required since 2019-20.

153 MDBA (2022) Sustainable Diversion Limit Accounting and Reporting Framework, Murray–Darling Basin Authority Canberra, 2022

compliance, all entitlement holders (including HEW) within a licence category are reduced equally, even though volumes associated with HEW are not counted as an extraction and do not contribute to growth in use. This approach impacts HEW reliability and potentially environmental outcomes, without contributing towards improving SDL compliance, and is an inefficient method of addressing growth in use.

Recommendation R6 – Priority 1
The Water Group should modify actions taken to address LTAAEL or SDL non-compliance by specifying that allocations for entitlements held by environmental water holders will not be reduced in 'make good' actions.

5.4 Models used to represent the LTAAEL should be improved

The Water Group is the custodian of the Plan model that is used to:

- inform water sharing plan development
- undertake LTAAEL compliance
- undertake scenario modelling to inform water management options and policies.

The Water Group currently uses the Integrated Quantity and Quality Model (IQQM) for its hydrological modelling of the Plan. This model has been built based on irrigation data and assumptions, including:

- irrigation licences, crop areas, extraction and storage
- river and storage operation rules
- water extracted for other purposes including town water supply and domestic and stock access licences.

The model is calibrated and validated over relatively short periods of time using climatic inputs (rainfall and evaporation data) and gauged flow data. The Murrumbidgee River Valley IQQM Cap implementation summary report describes the model configuration and inputs used to simulate the LTAAEL.[154]

At the time of the IQQM model's development it was noted that improvements could be made to improve the model's fitness for purpose,[155] including:

- updating loss estimates to improve upon the average flow-loss relationship that is applied across the Plan
- updating user behaviour of intra-valley trade
- improving modelling of inflows into the Plan
- updating coding to overcome software limitations in IQQM.[156]

154 NSW Department of Water and Energy (2007) *Murrumbidgee River Valley IQQM Cap implementation summary report issue 4*

155 Where fitness for purpose considers prediction of total valley diversions and end of system valley flows under Cap levels of development.

156 NSW Department of Water and Energy (2007) *Murrumbidgee River Valley IQQM Cap implementation summary report issue 4*

Recent documentation outlining modelling updates to the IQQM model for Basin Plan purposes indicated only the intra-valley trade and software upgrades had been undertaken to date.[157]

As the Water Group's models have historically been used for Cap compliance purposes, these have been peer reviewed by the MDBA or on behalf of the MDBA by independent technical experts.[158] However, the general model development and calibration undertaken for Cap compliance purposes have not undergone significant improvements to date.[159] As such, the Commission considers that commentary relating to the efficacy of the models continues to hold true.

Limitations associated with current models include deficiencies in simulation of low flows and poor simulation of conditions under a drying climate.[160] The Commission understands that migrating and updating the current IQQM software to the eWater Source modelling software provides an opportunity to address model shortcomings. However, to date, migration of the Plan model to Source has not occurred. Based on the Commission's assessment of model changes, the changes to the model have been limited. The Commission supports expediting migration to the Source model platform to facilitate the required improvements in model configuration, calibration and ultimately model performance.

The Plan's Cap compliance model was designated a 'fair' overall confidence interval ranking, in relation to errors in the model.[161] However, the models now used for LTAAEL compliance purposes were originally developed for the purpose of '*comparing the outcomes of different scenarios for planning purposes*' rather than for the '*[assessment of] compliance on an annual basis or to track or predict evolving water practice*' and have largely been retrofitted for the purpose of long-term extraction limit compliance.[162]

As a consequence of the known limitations with model configuration, input data and applicability of results for different purposes, experts have recommended improved transparency around '*modelling assumptions, inputs, conceptual design, approaches, calibrations and results'* and that they should be *'routinely documented in a way that can be readily subjected to expert scrutiny, as well as being summarised in a plain English format and communicated to stakeholders who are reliant on modelling outcomes*'.[163] The Commission supports greater transparency around model limitations, including for the purpose of LTAAEL reporting and compliance.

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157 Other changes to the IQQM model as part of the revised Baseline Diversion Limit model included: model enhancements (Balranald monthly targets, representation of the Upper Billabong Creek system and Yanco Creek system recalibration); the Burrinjuck Dam translucent release window and Blowering Dam translucent minimum release volume; updates to entitlement held under the Water for Rivers program; deliveries made to the Nimmie-Caira system; and representation of SDLAM projects (DPE (2022) *Murray Basin Plan Implementation - Murrumbidgee Surface WRP – Modelling – Baseline Diversion Limit Scenario Report (update December 2021), Attachment A to Schedule F*).

158 Podger, G.M., Barma, D., Neal, B., Austin, K. and Murrihy, E. (2010) 'River system modelling for the Basin Plan Assessment of fitness for purpose', *CSIRO: Water for a Healthy Country National Research Flagship;* Turner G., Vanderbyl, T and Kumar, S. (2019) *Final report of the Independent Panel's review of the Sustainable Diversion Limit Water Accounting Framework*

159 DPE (2022) *Murray Basin Plan Implementation - Murrumbidgee Surface WRP – Modelling – Baseline Diversion Limit Scenario Report (update December 2021), Attachment A to Schedule F*

160 Podger, G.M., Barma, D., Neal, B., Austin, K. and Murrihy, E. (2010) 'River system modelling for the Basin Plan Assessment of fitness for purpose', *CSIRO: Water for a Healthy Country National Research Flagship*

161 Turner G., Vanderbyl, T and Kumar, S. (2019) *Final report of the Independent Panel's review of the Sustainable Diversion Limit Water Accounting Framework*

162 *Ibid.*

163 *Ibid.*

It is difficult for users to verify what improvements have been made to the model and whether the model is considered by independent experts to be fit for purpose. For stakeholders, this generates both a lack of trust and confidence in the outputs and water management policy derived from the model.

The Commission and the Water Group, as part of the Section 10 review, raised that modelling and assumptions remain significant areas of risk for compliance with the priorities of the Act.[164] As such, the Commission supports increased transparency on model limitations, performance and independent reviews. The Commission also supports increased use of observed data, such as observed flow data and metered extraction data, as additional lines of evidence in conjunction with model simulations to inform compliance assessments and broader water policy options.

Recommendation R7 (LT) – Priority 1

To improve quality and transparency of models used to represent the Plan's LTAAEL, the Water Group should:

a) action areas recognised as requiring model improvement

b) use best available observed data for model development, assumptions and calibration

c) transition from IQQM to eWater Source and use this opportunity to rebuild and recalibrate models and scenarios using best available information

d) provide greater transparency of model revisions, inclusions, limitations and independent review.

[164] DPE (2023) *Review of the activities of the department under Section 10 of the Water Management Act 2000*. For the period July 2017 to December 2022.

6 Developing a sustainable and robust allocation policy

A fundamental role of water sharing plans is to specify rules for the allocation of water to licensed users. The Plan establishes rules to allocate the volume of water that can be extracted under access licences each year, given a range of climatic conditions. Allocation processes provide an opportunity to facilitate compliance with the Act's water sharing principles. While the LTAAEL seeks to provide long-term sustainable water management (**Chapter 5**), the allocations assessments and AWDs provide flexibility for annual and sub-annual decision-making to ensure the water sharing is undertaken as intended by the Act and Plan. This is particularly important as the volume of entitlement on offer in the Plan area, excluding supplementary take, exceeds the total useable storage capacity of the two headwater dams.[165]

AWDs are a regular process, usually undertaken twice per month until full allocations are achieved.[166] During this process, an assessment of the available water resources determines how much water can be allocated for consumptive use. The resource assessment considers current storage volumes and assumes a minimum expected inflow to the major storages and from tributaries. A portion of the resource is reserved to secure high priority needs over a defined planning horizon of 12 to 24 months.[167] Existing commitments, including carryover, are accounted for as well as transmission, evaporative and operational losses. The remainder of the resource is then allocated to licence holders in line with the Plan's allocation priorities.

Assessment of allocations commences on 1 July, based on a horizon of 12 months (i.e. the current water year). This is then checked against the 24-month horizon to track whether allocations for high priority licences can be assured for the subsequent year. Reserves for high priority licences for the subsequent year are not established at the commencement of the water year but rather progressively built as inflows occur.

This chapter focuses on the use of the allocations process to manage extraction in a sustainable and robust manner. The Commission found that the allocations process creates risk to essential services and inverts the principles of the Act. A key issue that should be addressed in the replacement Plan is to reduce the need for reactive policy measures in response to drought conditions. This should be achieved by operationalising climate risks into the allocation policy to ensure allocations can respond to a range of feasible climate conditions and not just a repeat of the historic record.

This finding relates to the following identified issues:

- assessment of allocations against water sharing principles (**Section 6.1**)
- allocation method flexibility and responsiveness to feasible climate conditions (**Section 6.2** and **Section 6.3.2**)
- supply shortfall risks arising from the lowest accumulated inflow assumptions (**Section 6.3**)
- limited oversight and transparency of operational discretion (**Section 6.4**)
- Irrigation Infrastructure Operator statutory conveyance entitlements and ensuring equitable sharing arrangements (**Section 6.5**).

165 Usable store: 2,631 GL vs entitlements: 2,686 GL plus 2 GL of basic landholder rights and 946 GL of supplementary access to uncontrolled flows; Part 5 of the Plan.
166 DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*
167 *Ibid.*

6.1 Allocations are not based on assessment of the Act's water sharing principles

Section 9 of the Act imposes a duty[168] that compels '*all persons exercising functions… to give priority to* …' the water sharing principles to protect the water source and its dependent ecosystems and basic landholder rights.[169]

As the allocations process is a function under the Act, the Section 9 duty requires both the Water Group and WaterNSW to give priority to the water sharing principles in the order specified during resource assessments and AWDs.

Making AWDs depends on a range of policies and procedures that sit outside the Plan, as well considerable discretionary decision-making. Several measures outside of the Plan provisions have been adopted that improve alignment with the priorities outlined in the Act. One example is the specification of the 'second year reserve' discussed below. However, the Commission considers additional processes are needed to ensure that water allocations are made consistent with the Act's principles.

Some cases where the Act's principles may call for changes in the water allocation policy, which are not included in the current water allocation methodology,[170] include:

- allocations to the EWAs and provisional storage volume (PSV) should be given priority over general security allocations[171]
- reducing water for environmental needs in the event of a supply shortfall to prioritise critical human needs. The Commission notes instances in other plan areas where supply shortfalls have led to water being borrowed from higher priority needs to meet lower priority needs[172]
- a process for ensuring water for the second-year reserve is secured throughout the year creating a risk it may not be met.

The Commission acknowledges the Corrective Action Plan,[173] which the Water Group has agreed to implement in response to the Section 10 review.[174] Included in this work program is the development of a framework with overarching guidance and an updated review method that will seek to promote the principles and increase assurance that the principles of the Act have been given effect. The Commission has provided feedback to the Water Group as part of the Section 10 review outlining that discretionary decision-making within the AWD process does not align with the priorities of the Act. The Commission notes that the Corrective Action Plan identifies that steps to resolve current issues raised regarding the AWD process are to include:

- scoping of the Commission's concerns regarding the AWD process

168 Section 9(1)(b) of the Act.
169 Section 5(3) of the Act.
170 DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*
171 EWA 1 (Plan Clause 63), EWA 3 (Plan Clause 65), PSV 1 (Plan Clause 69), PSV 2 (Plan Clause 70).
172 Natural Resources Commission (2022) *Final report Audit of the implementation of the Namoi, Gwydir and Macquarie regulated water sharing plans*
173 DPE-Water (2023) *Corrective Action Plan – Review of the activities of the department under Section 10 of the Water Management Act 2000*
174 Under Section 10 of the Act, the Minister is to review the work and activities of the Water Group at intervals of not more than five years. This is to ensure that the Water Group has '*been effective in giving effect to the water management principles of this Act and the State Water Management Outcomes Plan*'. The Water Group completed a Section 10 review for the period of July 2017 to December 2022 in 2023 (Information taken from DPE-Water (n.d.) *Statutory reporting*).

- collaboratively working with the Water Group and other relevant agencies to resolve these concerns.[175]

The Commission notes that this work program is yet to commence.

6.2 Clause 72(2) of the Plan does not reference environmental needs

Clause 72(2) of the Plan requires the river operator to manage the water supply system to supply water to meet priority needs during a repeat of the period of lowest accumulated inflows. The 'priority needs' include basic landholder rights, full allocation for domestic and stock access licences, local water utility access licences and full allocation for several higher priority sub-categories of high security access licences. An allocation of 0.95 ML per unit share must be able to be provided to the remaining lower priority sub-categories. Clause 72(2) does not explicitly identify the needs of the environment.

The Commission considers that Clause 72(2) should be amended to provide consistency with the Act's principles by explicitly specifying that the needs of the water source and its dependent ecosystems must be provided for during the period of lowest accumulated inflows.

Recommendation R11 a) – Priority 2
In addition to related items outlined in **Recommendation R4**, the Water Group should revise Clause 72(2) (Maintenance of water supply) to require the river operator to be able to firstly supply sufficient water to protect the water source and its dependent ecosystems during a repeat of the period of lowest accumulated inflows

6.3 The lowest accumulated inflow assumption increases supply shortfall risks

The AWD process identifies the total resource pool that can be allocated by combining stored water volumes with the lowest accumulated inflow volume assumed to occur until the end of the next water year. Any water from the total resource pool that is in excess of current commitments can be allocated to licence holders.[176]

Assuming the lowest accumulated inflow provides larger opening allocations and reduces the volume required to be stored to secure the second-year reserve. While the Plan performed satisfactorily over the review period, and the Commission did not identify any supply shortfalls that impacted critical supplies since the Millennium drought, evidence suggests the risks to supply shortfalls will increase going forward under a drying climate (**Chapter 4**). If shortfalls occur, they can impact critical needs, including environmental, basic landholder rights, domestic and stock and local water utilities. Shortfalls can also lead to planned environmental water being allocated to extractive users.

Risks associated with these assumptions are amplified when the assumed inflow is not based on best available data, including climate change data, or reconciled against actual inflows (**Chapter 4**).

175 DPE-Water (2023) *Corrective Action Plan – Review of the activities of the department under Section 10 of the Water Management Act 2000*
176 DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*

6.3.1 Inflow sequence should incorporate the best available inflow data

The lowest accumulated inflow sequence is simulated using a hydrologic model over a repeat of the historical record.[177] However, in 2014, an amendment to the Plan[178] restricted the lowest accumulated inflows calculation to be based on data held by the Water Group before 1 July 2004,[179] removing the impact of new record lowest accumulated inflows that occurred during the:

- Millennium drought from 2008 to 2010[180]
- Tinderbox drought from 2018 to 2020.[181]

In addition to these droughts, hydrological modelling has found a significant reduction in Blowering Dam inflows over the last 20 years, partially due to reductions in low inflow releases from the Snowy Hydro Scheme.[182]

At the time the amendment was made, the use of data from before 1 July 2004 was characterised as the '*agreed level of allocation risk, specified in the water sharing plan, balancing water allocation for productive use, versus water needed for security against drought*.'[183] Hydrological modelling undertaken to identify impacts of applying a new 'drought of record' was claimed to impact general security licence allocations '*by 8 per cent, on average, and up to 20 per cent in some years*.'[184] However, the available evidence does not support this level of impact.

Evidence provided by the Water Group to the Commission showed that an additional storage reserve of 70 GL was needed to secure water supplies in the Murrumbidgee during a repeat of the Millennium drought. Without this reserve Blowering and Burrinjuck dams fell to below dead storage level and the Murrumbidgee River and Billabong Creek dried out, with no end of system flows. This reserve was modelled to reduce general security licence allocations by 3 percent on average[185] with reductions occurring mainly during high allocation years. The larger reserve also improved town water supply and stock and domestic reliability with no change in high security entitlement reliability.

The Commission notes that the Plan has not been updated to include lowest accumulated inflow periods after 2004 or the 70 GL reserve to improve water security.

177 IQQM version C106 reporting diversions against the 1993/94 level of development.
178 Sub-section 2.7 (1-4) of the *Water Management Amendment Act 2014 No 48*
179 Clause 72 (1) of the Plan.
180 DPIE (2021) *Murrumbidgee Valley snapshot: 2017 – 2020 Drought*
181 The Tinderbox drought set a new record low inflow into Burrinjuck Dam for any 24-month consecutive period being 17 percent lower than the Millennium drought. Blowering Dam inflow from 2017 to 2020 was the second lowest 36-month inflow sequence on record and 64 percent of the long-term average annual inflow. However, combined lowest accumulated inflow during this period were not as low as during the Millennium drought (DPIE (2021) *Murrumbidgee Valley snapshot: 2017 – 2020 Drought*; DPIE (2022) *Draft Regional Water Strategy - Murrumbidgee Strategy*; DPIE (2020) *Murrumbidgee Surface Water Resource Plan Incident Response Guide – Schedule G*
182 DPE-Water (2022) *Draft Regional Water Strategy Murrumbidgee – Discussion Paper draft regional challenges*; Devanand, A., Leonard, M. and Westra, S. (2020) *Implications of Non-Stationarity for Stochastic Time Series Generation in the Southern Basin*, pilot Study undertaken by Adelaide University.
183 NSW Parliament Hansard (2014) *Water Management Amendment Bill 2014 Second Reading*; DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*
184 NSW Parliament Hansard (2014) *Water Management Amendment Bill 2014 Second Reading*
185 The impact would likely be less as the modelling assumed river operator behaviour that produced the largest impact on general security allocation reliability.

6.3.2 Inflow sequence should incorporate best available climate data

Climate modelling has shown the Murrumbidgee catchment to be highly vulnerable to climate change,[186] simulating periods of substantially lower inflow than observed in the historical record.[187] There is growing consensus that past hydrological records are not a reliable indicator for future extreme events, including droughts that result in minimum inflows.[188]

However, the allocations policy outlined in the Plan and expanded upon in the Water Group's Water Allocation Methodology[189] (hereafter referred to as the methodology) does not specifically address the impact of climate change. The focus of the methodology is to guide river operators during 'normal' operating conditions. The methodology embeds static assumptions that lack flexibility and cannot respond to conditions outside of the historical record. When these conditions arise, reactive policy measures are implemented, when in the public interest to do so, including by announcing temporary water restrictions (under a Section 324 order), activating the NSW *Extreme Events Policy*, or suspending the Plan, in whole or in part.

While these measures can prevent access to account water and prioritise dwindling supplies for critical needs, they do not address the primary cause of overallocation (i.e. allocating more than what is stored in dams) and often licence holders will maintain their overallocated account balances.

In addition, each of these policy responses are applied in an *ad hoc* manner, creating uncertainty for business operations and the water market. The Commission notes that, due to this uncertainty, these policy responses are generally not supported by water users. Instead, a replacement Plan should seek to operationalise and incorporate climate risks into the allocation policy to ensure allocations can respond to a range of feasible climate conditions and not only a repeat of the historic record. This approach will reduce the need for reactive policy measures in response to drought conditions.

Stakeholders support expanding the range of climatic events the Plan can accommodate, for example:

> *'The impacts of climate change could result in higher evaporation rates, decreased snow and snow melts, higher minimum and maximum temperatures and changing rainfall patterns resulting in less run off. The water sharing plan must be able to accommodate changes in extreme events.'*[190]

The Commission has observed that allocations policies in other states tend to be more conservative, often adopting more extreme planning scenarios to mitigate the reliance on reactive policy responses.[191]

6.3.3 Assumed lowest accumulated inflows should be reconciled

The assumed lowest accumulated inflow is considered as an additional reserve of water that is yet to be stored in the reservoir. The assumed inflow is allocated to licence holder

186 DPE-Water (2022) *Draft Regional Water Strategy Murrumbidgee – Discussion Paper draft regional challenges*
187 *Ibid.*
188 *Ibid.*; Devanand, A., Leonard, M., & Westra, S. (2020), *Implications of Non-Stationarity for Stochastic Time Series Generation in the Southern Basins,* Pilot Study undertaken by Adelaide University.
189 DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*
190 Submission: Riverina Local Land Services, received 6 July 2023.
191 Interim Inspector-General of Murray–Darling Basin Water Resources (2020) *Impact of lower inflows on state shares under the Murray–Darling Basin Agreement*

accounts in the opening allocation, with the expectation that the inflow will occur to replace the water allocated. This approach increases the supply shortfall risk when the assumed inflow does not occur as expected and when these inflows have been allocated to water users. Evidence suggests that, in other valleys, the river operator has implemented a practice of borrowing water from critical needs to supply the shortfalls in non-critical needs.[192] The Commission notes that Plan provisions do not exclude this practice in the Murrumbidgee valley.

The allocation process does not require reconciliation of actual volumes of water received with those anticipated. The Water Group indicated that, if a shortfall is identified, a pause on any new allocations or a restriction on general security water balances is put in place until the assumed lowest accumulated inflow amount is restored.[193] However, the Plan should be amended to require reconciliation of inflows, identification of these shortfalls and responsive actions until the shortfall has been restored.

6.3.4 Clauses limiting the review of the period of lowest accumulated inflows should be changed

The Commission acknowledges recent Plan amendments[194] that require a review of the period of lowest accumulated inflows by the date of expiry of the Plan on 30 June 2026. However, the amendment provisions permit changes to the lowest accumulated inflow that are reasonably necessary so as to '*not jeopardise the critical needs of basic landholder rights, domestic and stock access licence holders and local water utility access licence holders*'[195] without considering environmental needs as required by the Act's principles.

In addition, the Plan identifies that the review '*cannot substantially alter the long-term average annual amount of water able to be extracted under water access licences*'.[196] While a note in the Plan recognises that changes can still be made that affect the long-term average extraction if the Minister is satisfied it is in the public interest to do so,[197] the Commission considers this clause to be inconsistent with the Act and recommends it be removed. In effect, this clause indicates that changes that may be necessary to ensure that basic landholder rights and local water utility needs are met can only be made if they do not affect extractive usage. This reverses the priorities of the Act. Further, it implies climate change considerations cannot be implemented in the Plan if they affect extractive use.

192 Natural Resources Commission (2022) *Final report Audit of the implementation of the Namoi, Gwydir and Macquarie regulated water sharing plans*
193 Natural Resources Commission (2023) *Final report Audit of the implementation of the Lachlan, Murrumbidgee and NSW Murray and Lower Darling regulated rivers water sharing plans*
194 Clause 72(5) of the Plan.
195 Clause 72(6) of the Plan.
196 Clause 72(7) of the Plan.
197 Clause 72 note of the Plan.

Recommendation R10 – Priority 1

The Plan should include a provision that requires the Water Group to reconcile the Plan's lowest accumulated inflows against actual inflows and address any shortfall before issuing increased allocations.

Recommendation R11 b) – Priority 2

In addition to related items outlined in **Recommendations R4 and AR1**, the Water Group should revise Clause 72(6) (review of lowest accumulated inflows) to include a requirement to not jeopardise critical environmental needs.

6.4 Discretionary decisions have limited oversight or transparency

The Plan's allocation provisions provide only high-level requirements, leaving most discretionary decision-making to the Water Group and river operators. This flexibility is generally needed to allow the Water Group and river operators to respond to changes in climate hydrology and water user behaviour.

The Plan does not establish how most of the day-to-day discretionary decision making is to be conducted. The Act's Section 9 duty requires these decisions to prioritise protection of the water source and dependent ecosystems, as well as basic landholder rights. There is a lack of transparency regarding whether discretionary decision-making appropriately implements the Section 9 duty. The Water Group published an allocations methodology that provides an overview of some discretionary decisions that are part of the allocations process.[198] In addition, regularly published AWDs,[199] WaterNSW's stakeholder updates and the annual general purpose water accounting reports[200] provide details on some of the discretionary decisions made.

These discretionary decisions can have a significant impact on the achievement of Plan outcomes. Detailing some of these decisions in the Plan, improving decision-making transparency, and strengthening oversight can improve the allocations process. The following operational decisions should be detailed in the Plan:

- Decisions on whether physical spills from Murrumbidgee storages contribute towards the IVT balance with the Murray regulated water source.[201] This decision can lead to prioritisation of general security allocations in either the Murrumbidgee or Murray plan areas. High-level equity principles are used to guide this decision. The Commission notes the 2018 multilateral Flexible Trade Adjustment project sought to review and codify the IVT spill management practices.[202]
- Specification of monthly targets[203] for building the second-year reserve, which provides essential commitments over a 24-month planning horizon.[204] The Plan should specify the planning horizon, total reserve volume required and monthly accumulation targets, as

198 DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*
199 DPIE (n.d.) *Available water determinations*
200 DPE-Water (n.d.) *NSW General Purpose Water Accounting Reports*
201 DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 15 July 2022*; DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 19 April 2022*
202 DPI (2018) *Fact Sheet: Murrumbidgee Inter-Valley Trade account (IVT)*
203 See Table 3: DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*
204 Water allocation statement identifies the reserve covers essential supply for Plan subclauses 18, 21, 22, 23, 26, 27, 41 in addition to 'environmental needs': DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*

well as requirements for adherence to these targets. Current operations only set aside these reserves when the Plan area enters drought conditions. Under normal conditions the reserves have a zero balance,[205] even when the remaining assumed lowest accumulated inflow would be insufficient to meet the reserve.[206]

Other discretionary decisions cannot be detailed in the Plan and require additional transparency and oversight to ensure decision-making processes align with the priorities of the Act. Key focus areas for additional oversight are as follows:

- **Lowest accumulated inflows assumptions** are based on hydrological and operational assumptions including water held in dams and weirs, unregulated inflows, Snowy Hydro required annual releases and system efficiency measures.[207]
- **Day-to-day inflow assumptions** in excess of the lowest accumulated inflows are estimated based on consultation between Water Group staff members and consider tributary inflows and other factors.
- **Estimating current carryover and IVT balance commitments**, which must be prioritised above new allocations, are required during the initial allocation as this occurs before carryover volumes and the IVT balance have been reconciled from the previous water year.[208]
- **Storage evaporation losses** are assumed based on fixed evaporation rates and the estimated combined storage surface area.[209] A maximum annual evaporation loss of 90 GL is generally assumed (based on an evaporation rate of 909 millimetres per year).[210] However, this is lower than the maximum annual evaporation rate observed of 1,150 millimetres per year in 1982 (corresponding volume loss not identified).[211]
- **Transmission losses** from water delivery are typically budgeted for as at least 350 GL[212] for higher priority deliveries, with larger budgets reserved with increased general security allocations.[213] Unused transmission loss budget is released to the consumptive pool, but the allocations methodology does not identify actions taken when budgeted transmission losses underestimate actual losses.
- **Operational efficiency losses** related to unavoidable surplus delivery. This loss component is typically budgeted for as 3.5 percent to 5 percent of all regulated deliveries and averaged around 60 GL between 2011/12 and 2021/22.[214]

As identified in **Section 6.1**, resolution of issues regarding discretionary decision making within the AWD process is identified as a corrective step in the Water Group's Corrective Action Plan[215] in response to the Section 10 review. While the Corrective Action Plan identifies that the Water Group will work to identify and collaboratively address the

205 DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 4 October 2022*; DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 15 September 2022*; DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 17 October 2022*

206 DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 1 November 2022*; DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 15 November 2022*; DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 1 December 2022*; DPE-Water (2022) *Murrumbidgee Regulated River Water Source Water allocation update 15 December 2022*

207 DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*

208 *Ibid.*

209 *Ibid.*

210 *Ibid.*

211 *Ibid.*

212 285 GL for the Murrumbidgee River and 70 GL for Yanco Creek.

213 *Ibid.*

214 *Ibid.*

215 DPE-Water (2023) *Corrective Action Plan – Review of the activities of the department under Section 10 of the Water Management Act 2000*

Commission's concerns regarding the AWD process,[216] this work program is yet to commence.

Recommendation R12 – Priority 3

To improve transparency, the Water Group should clarify decision making related to the spilling of the IVT and the second-year reserve in the Plan.

6.5 Irrigation infrastructure operator conveyance entitlements may produce equity issues

The Plan specifies the highest priority for conveyance entitlements for Murrumbidgee Irrigation Ltd (Murrumbidgee Irrigation) and Coleambally Irrigation Co-operative Ltd (Coleambally Irrigation) to meet their off-river conveyance requirements.

Murrumbidgee Irrigation's conveyance entitlement[217] comprises an initial fixed minimum volume plus an initial prorated volume based on high security allocations (40 to 62 percent of total allocation).[218] After this is met, Murrumbidgee Irrigation is allocated additional volumes based on general security allocations up to a maximum of 243,000 ML. Coleambally Irrigation's conveyance entitlement[219] comprises an initial fixed minimum volume (86 percent of total allocation)[220] with additional volumes based on general security allocations up to a maximum of 130,000 ML. The Plan allows for up to 30 percent of unused allocations on these conveyance entitlements to be carried over.[221]

Initial minimum conveyance entitlements and carryover are prioritised alongside other river operational conveyance losses with the sub-category of high security access licences and receive higher priority over most other licence categories and some planned environmental water provisions.[222] The priority exceeds that provided to regulated river (conveyance) entitlements held outside of irrigation networks that align with general security allocations. The Commission notes that the Plan has established a lower level of priority for regulated river (conveyance) access licences, as permitted under Section 58 (4) of the Act, than what is provided for under Section 58 (1)(c) of the Act and Section 6 (1)(a) of the *Water Management (General) Regulation 2018*.

Conveyance requirements vary year-to-year contingent on seasonal and weather conditions, and over the long term from investments in infrastructure modernisation and improvements in delivery efficiency. Permanent trades out of the irrigation network also reduce conveyance needs and shift part of the conveyance burden to the river operational conveyance budget underwritten by all water users. The Plan established that irrigation network conveyance requirements can be adjusted by the Minister to reflect variable needs. However, the Commission is not aware of such adjustments being made during the review period.

The lack of adjustment of conveyance entitlement to adapt to changing conditions may result in excess allocation of high priority conveyance water under these licences, which

216 DPE-Water (2023) *Corrective Action Plan – Review of the activities of the department under Section 10 of the Water Management Act 2000*
217 Clause 42 of the Plan.
218 98,000 ML to 150,250 ML out of 243,000 ML; Clauses 42(1) and 42(2)(d) of the Plan.
219 Clause 43 of the Plan.
220 111,600 ML out of 130,000 ML: Clauses 43(1)(a) and 43(1)(d) of the Plan.
221 Clauses 47(2)(c-d) of the Plan.
222 Including EWA 1, EWA 3, PSV 1 and PSV 2.

can then be carried over. The Commission notes that carryover of conveyance entitlement was close to the maximum carryover limit in 2017-18 for Murrumbidgee Irrigation, and in 2022-23 and 2023-24 for both irrigation network operators.[223] In several other years both operators carried over much smaller volumes.

The Commission is not aware of any evidence identifying the materiality of any potential impacts arising from a discrepancy between conveyance requirements and conveyance allocation and recommends the Department review if any revisions to the entitlements are warranted.

Irrigation network conveyance water is managed separately from river operational conveyance leading to potential equity issues. The Commission understands that when conveyance allocations exceed the conveyance requirements, the surplus (if not carried over) may be allocated to eligible water users as internal additional water allocations that are not available to all water users within the Plan's consumptive pool.[224] This contrasts to any excess arising from river operational conveyance requirements, which is 'spilled' back into the shared consumptive pool.[225] This practice may result in equity issues as well as potentially inverting the Act's priorities as additional water for lower priority licences may be allocated internally before requirements for higher priority licence allocations have been achieved.[226]

The Commission acknowledges that irrigation network operators have made substantial improvements to the efficiency of their operations over time, in part with the assistance of government resources, which may lead to surplus conveyance allocations and potential benefits provided to irrigation network members. The Commission considers that improved operational efficiency should be encouraged, so long as efficiency dividends do not inadvertently undermine environmental outcomes through reductions in return flows or materially affect equity considerations for water users outside of the irrigation networks.

Finally, if the Plan area is experiencing drought conditions, and no general security allocations are made, irrigation network conveyance entitlement should only reflect conveyance requirements for critical needs to align with policy for river operational conveyance. It is not clear if the opening initial allocation for irrigation network conveyance entitlements exceeds that required for critical needs.

223 DPE-Water (2024) *Allocations dashboard*

224 Interview: Coleambally Irrigation, 25 September 2024; 5 percent allocation enhancement from Murrumbidgee Irrigation issued from efficiency savings.

225 DPE-Water (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*

226 Unless the Minister otherwise determines regulated river (high security) access licence receives at least 95 percent initial allocation up to 100 percent depending on conditions. When regulated river (general security) access licence reaches 95 percent then regulated river (high security) access licence and regulated river (general security) access licence proceed to their maximum 100 percent concurrently with regulated river (high security) access licence allocation always great than regulated river (general security) access licence until they both reach 100 percent. If regulated river (high security) access licence and regulated river (general security) access licence have 95 percent then any 'additional water' has higher priority than the 5 percent shortfall in regulated river (high security) access licence.

Recommendation R13 (LT) – Priority 3

To ensure ongoing equity and meet Plan conveyance requirements, the Water Group should:

a) review the Plan's conveyance provisions for irrigation networks and, based on the materiality of potential impacts, determine whether changes are warranted to increase flexibility and ensure conveyance allocations best reflect conveyance needs

b) review irrigation network excess conveyance spill arrangements and carryover provisions and, based on the materiality of potential impact, determine whether changes are warranted to ensure there is equitable sharing of excess conveyance allocations between irrigation networks and all other river water users.

7 Strengthening environmental protections

Significant environmental assets, including internationally and nationally significant wetlands, are situated in the Plan area and surrounding unregulated river sources. They are highly dependent on flows from the regulated Murrumbidgee River to support their important ecological functions and values. The Murrumbidgee River downstream of Burrinjuck and Blowering dams also forms part of the Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment, which is listed as an Endangered Ecological Community under the NSW *Fisheries Management Act 1994*. Alteration to the natural flow regime is one of the key factors that have contributed to the decline of this community and its subsequent listing.

It is important to acknowledge that water-dependent ecosystems and communities of the Murrumbidgee catchment have experienced extreme climatic conditions during the term of the Plan, with the driest year and lowest inflows on record (2019) and significant flooding (2016-17 and 2021-22). These climatic extremes and their quick succession undoubtedly affected the environmental outcomes in the Plan area. Other issues include the prevalence of cold water pollution downstream of the Murrumbidgee's major storages (Burrinjuck and Blowering dams),[227] with both scoring 'poor' on the thermal pollution water quality index.[228]

The Plan includes broad and targeted environmental objectives. The broad objective seeks to: '*protect and contribute to the enhancement of the ecological condition of the water source and its water-dependent ecosystems over the term of this Plan.*'[229] The Plan's targeted objectives relate to the protection and contribution to enhancement of:

- the recorded distribution or extent, and the population structure, of target ecological populations,[230] notably Murray cod, flatheaded galaxias, southern pygmy perch, trout cod, silver perch and Macquarie perch, native vegetation (river red gum and black box) and high diversity hotspots and significant habitat
- longitudinal and lateral connectivity within and between water sources [this includes unregulated river sources and the Murray River] to support target ecological processes[231]
- water quality within target ranges for the water source [as defined in the *Water Quality Management Plan for the Murrumbidgee Water Resource Plan Area SW9*[232]] to support water-dependent ecosystems and ecosystem functions.

Strategies within the Plan are intended to achieve these objectives. However, issues with Plan provisions and external factors mean that objectives are not always realised.

While changes have occurred to Plan provisions since the original Plan was replaced in 2016, evidence remains that the Plan still does not adequately prioritise the environment. Stakeholders have noted that rules managing planned environmental water are '*excessively complex and give a higher regard to water storage and access for extractive licences than to the achievement of [water sharing plan] environmental objectives'*.[233]

All water in the river is important for supporting environmental values and achieving environmental outcomes. This includes operational water, consumptive water orders,

227 The Plan area includes two storages (Burrinjuck and Blowering) that are a high priority for mitigation under the NSW Cold Water Pollution Strategy.
228 DPIE (2020) *NSW 2020 five yearly matter 12 report*, p.71.
229 Clause 8(1) of the Plan.
230 Clause 8(2)(a) (i) of the Plan.
231 Clause 8(2)(a) (ii) of the Plan.
232 DoI (2019) *Water quality management plan for the Murrumbidgee water resource plan area SW9*
233 Submission: Inland Rivers Network, received 30 June 2023.

planned environmental water (rules-based) and environmental water holdings.[234] Acquisition of 19 properties on the Nimmie-Caira floodplain and their water entitlements in 2013 resulted in a significant contribution to the valley's environmental water portfolio.[235] Environmental water holdings (predominantly CEWH) have been important for addressing inadequacies in the Plan's environmental water provisions (for example, for managing water quality risks).[236] However, it is not appropriate to rely on environmental water holdings for managing issues within the scope of the Plan, and the requirements of the Plan under the Act.

While it is difficult to apportion the contribution of some Plan provisions to environmental outcomes,[237] this chapter attempts to identify where planned environmental water provisions have contributed to the Plan's environmental objectives (where information is available).[238] It also indicates where improvements can be made to deliver better outcomes for the water source, surrounding unregulated river water sources (that are dependent on and connected to the regulated river) and their water-dependent ecosystems. Key issues explored here include:

- provisions that are inconsistent with the priorities of the Act (**Section 7.1**)
- minimum daily flow rules are inadequate for maintaining river health in critical times (**Section 7.2**)
- transparent flows are important for supporting low flows during dry conditions, but these rules could better align with environmental water requirements and be better protected (**Section 7.3**)
- translucent flows from Burrinjuck Dam have not been delivered as intended by the Plan, are not effectively protected and cannot be effectively released with HEW (**Section 7.4**)
- EWA provisions have contributed to environmental outcomes but are complex and are not treated consistently with the priorities of the Act under channel sharing arrangements (**Section 7.5**)
- Pre-requisite Policy Measures (PPMs) were recently implemented in the Plan area but can be improved to support efficient and effective environmental water deliveries (**Section 7.6**)
- environmental water deliveries are not treated equitably when delivering environmental water for off-channel outcomes, for example, floodplain wetlands (**Section 0**).

234 Environmental water holdings in the Murrumbidgee are significant relative to other Murray-Darling Basin valleys comprising 787,543 ML of Commonwealth environmental water (see DCCEEW (2023) *Environmental water holdings: Murrumbidgee catchment water holdings at 31 August 2023*), 85,011 ML of water from The Living Murray program and 49,929 ML of NSW DCCEEW environmental water holdings (see DPE (2023) *Current water holdings*: *Cumulative water for the environment holdings ('held') recovered to June 30 2022)*

235 The acquisition included 381,000 ML of Lowbidgee supplementary water entitlement i.e. Commonwealth environmental water.

236 Submission: CEWH, received 7 July 2023.

237 There is a lack of monitoring of the effectiveness of environmental provisions. In addition, concurrent releases may 'mask' the effects of some environmental provisions, for example, bulk irrigation deliveries as noted in Growns, I. and Reinfeld, I. (2014) 'Environmental flow management using transparency and translucency rules', *Marine and Freshwater Research*, 65, pp. 667-673.

238 At the time of this Plan review, the Water Group, in consultation with DPE-Biodiversity, Conservation and Science was analysing the achievement of environmental water requirements in NSW regulated rivers, including the Murrumbidgee. This information was not available in time for this Plan review but should inform the Water Group's replacement Plan process and future water sharing plan reviews.

7.1 The Plan is inconsistent with the Act's priorities

When the original Plan was developed '*most of the rules for the environmental water provisions [were] made contingent on supplies to water users and are generally tied to the resource availability for water users rather than environmental needs'*.[239]

This is inconsistent with the water sharing principles of the Act, which state that the '*sharing of water from a water source must protect the water source and its dependent ecosystems*' and neither this, nor sharing of water for basic landholder rights, must be prejudiced by sharing or extraction of water under other rights.[240]

This issue remains relevant today as the current Plan's environmental provisions are constrained by a focus on water users' needs. The Commission's view is that consistent with Section 5(3) of the Act, the Plan must first ensure that there is adequate water at the necessary times to protect the water sources and their dependent ecosystems. This requires that the Department clearly identify what the fundamental ecosystem health needs of the water sources are and that the water sharing plan protects them. Evidence indicates that the Plan currently does not provide adequate protection for fundamental ecosystem health. Examples where the Commission considers the Plan is inconsistent with the Act include:

- uncertainty that the LTAAEL is sustainable (see **Chapter 5**)
- minimum daily flows are inadequate to prevent persistent stratification and bypass key portions of the system (**Section 7.2**)
- transparent flows intended for environmental purposes are not protected from extraction and evidence indicates they are not adequate to provide for fundamental ecosystem health during drier periods (**Section 7.3**)
- lack of evidence that the translucent flow rules are designed and implemented consistent with the needs of the environment as intended (**Section 7.4**).
- the rules are not based on the timing and hydrological needs of the environment (discussed in more detail throughout this chapter); and channel capacity and sharing rules that apply to EWA deliveries (see **Section 7.5**).

7.2 Minimum daily flows are inadequate to support ecosystem resilience during critical times

Minimum daily flow rules are intended to provide for connectivity, including with downstream water sources, by providing an end of system flow. They are an important provision for achieving the Plan's connectivity objective, specifically in relation to longitudinal connectivity.[241] Their purpose is to contribute to maintaining flows in the river and providing for connection with the Murray. Recent amendments to the Plan explicitly state that minimum daily flows cannot be used to provide for basic landholder rights or access licence orders downstream of the respective gauges.[242] This is a positive step, providing important protection for these flows.

The Murrumbidgee LTWP recognises that maintaining end of system flows, through minimum daily flow rules, is important for completing the lifecycles of water-dependent

239 Murrumbidgee Regulated River Management Committee (2004) *Murrumbidgee Water Sharing Plan: Background document, Part A*, unpublished, p. 35.
240 Section 5(3) of the Act.
241 Clause 8(2)(b)(ii) of the Plan.
242 DPE-Water (2023) *Changes to the Murrumbidgee regulated water sharing plan – factsheet*

biota by providing movement and dispersal opportunities.[243] These flows are particularly important during drier periods for maintaining refuge pools and supporting basic river health.

The Plan includes minimum daily flow rules for Murrumbidgee River at Balranald gauge (410130),[244] and Billabong Creek at Darlot gauge (410134)[245] in the Yanco Creek system. The operating requirements for the delivery of minimum flows are included in the WaterNSW Murrumbidgee Work Approval.[246] Unlike the Plan, the Work Approval allows for variability of 25 percent below these minimum flow targets for a defined period, and exceedance of these targets by up to 25 percent for offsetting shortfalls.[247] This inconsistency between the Plan provisions and Work Approval with respect to flexibility in the delivery of minimum daily flows should be addressed during Plan replacement. The Plan should also include a requirement for publishing the targeted flows and require a compliance test against the targeted flows and its publication to improve transparency in the delivery of minimum daily flows.

The minimum daily flow requirement, as established in the Work Approval, for the Murrumbidgee River downstream Balranald Weir varies by month (**Appendix 3**, **Table 7A-1**). This detail does not currently sit in the Plan but was developed to assist implementation by WaterNSW. However, the rule for Billabong Creek is static, meaning it does not reflect seasonal flow variation.

Based on updated analysis from the Plan audit,[248] the Plan's minimum daily flow rules were largely met during the period 1 July 2016 – 30 June 2023.[249] End of system flow rules were met 99.4 percent of the time at Billabong Creek at Darlot (except for 16 days) and were met the majority of the time (except for 137 days) on the Murrumbidgee River at Balranald gauge. While minimum daily flow rules have contributed towards the Plan's longitudinal connectivity objective, there is considerable evidence that they are inadequate to meet the Plan's intended environmental outcomes. Two examples of this are described in **Section 7.2.1** and **Section 7.2.2** below.

243 DPIE (2020) *Murrumbidgee Long term Water Plan Part A: Murrumbidgee catchment*, p. 30.

244 Clause 58(1) of the Plan requires that the operator must maintain a minimum daily flow at Murrumbidgee River at Balranald gauge (410130) throughout the water year based on a formula of the 95th percentile natural daily flow for the month minus 300).

245 Clause 58(2) of the Plan requires that the operator must maintain a minimum daily flow of 50 ML per day in the Billabong Creek at Darlot gauge (410134) throughout the water year.

246 The WaterNSW Murrumbidgee Work Approval 40WA405734 (unpublished) includes a table of minimum daily flow at Balranald. Conditions of the Work Approval are available on the *NSW Water Register*. However, the table of minimum daily flow requirements and 25 percent variation in these flows are not listed under the conditions on the register.

247 Clause 58 of the Plan provides no such variation or flexibility in the delivery of minimum daily flows or discretion in how they are calculated.

248 Natural Resources Commission (2023) *Final report: audit of the implementation of the Lachlan, Murrumbidgee and NSW Murray and Lower Darling regulated rivers water sharing plans*

249 Murrumbidgee River downstream Balranald gauge (410130) had no flow data 5 September 2019 – 20 January 2020 and again between 27 July 2022 – 28 September 2022.

7.2.1 Rules are inadequate for mitigating stratification in the lower Murrumbidgee River

What is stratification?

Stratification is when surface water and water deeper down the water column do not mix for a prolonged period of time, becoming separated by a distinct temperature boundary known as the thermocline.

Persistent stratification can have perverse outcomes for aquatic biota as the lack of mixing between surface and bottom waters leads to a depletion of oxygen as it is consumed through respiration but not replenished.[250] This can occur in standing and slow flowing water bodies such as weir pools.

Stakeholders raised concerns about the adequacy of the minimum daily flow rules, particularly in the Murrumbidgee River, and the ability to mitigate prolonged weir pool stratification and maintain suitable refuge for native fish and other aquatic biota. A review of weir pool stratification, hypoxic conditions and fish deaths[251] in the lower Murrumbidgee in 2019 found that stratification was unlikely during periods with considerable intervalley trade requiring significant movement of water between valleys.[252] These transfers were found to be important for mitigating prolonged stratification and contributed to water quality outcomes. However, where there are large IVTs into the Murrumbidgee and low intervalley transfer volumes to the Murray, as occurred in 2018-19, this would contribute to very low flows during high-risk periods for stratification.[253]

The review also indicated that current minimum daily flow rules on their own (without environmental water deliveries and IVTs) would be insufficient for managing stratification. The minimum daily flow rule is therefore also likely insufficient for achieving the Plan's water quality objective (within target ranges to support water-dependent ecosystems and ecosystem functions) during periods of low flow without intervention. Given climate change projections (**Chapter 4**), this is an important issue as it poses a risk to ecosystem resilience during periods of low flow and indicates changes to Plan rules are warranted.

The Commission compared the Plan's minimum daily flow rules against relevant EWRs from the Murrumbidgee LTWP[254] and found the rule for Billabong Creek (410134) is close to the base flow EWR (BF1) in the Murrumbidgee LTWP, which is greater than 50 ML per day.[255] However, the minimum daily flow rule for the Murrumbidgee River downstream Balranald Weir (410130), albeit variable through the year, is in the very low flow range for critical months when there are heightened risks to river health. Specifically, the minimum flow requirement for December – April, a timeframe of increased risk of pool stratification, is closer to the lower threshold of the very low flow environmental water requirement, which has a range of 170 to 500 ML per day.[256]

Based on pool stratification and hypoxic conditions observed in the lower Murrumbidgee weir pools between late January to early April 2019, it is evident that the existing minimum

250 Baldwin, D. S. (2019) *Weir stratification and hypoxic water management - Murrumbidgee River 2019*
251 A fish kill event occurred in Redbank Weir pool 26 – 27 January 2019. Thousands of fish were affected including Murray cod, silver perch, golden perch and bony herring.
252 *Ibid.*
253 *Ibid.*
254 The Murrumbidgee LTWP is considered best available information regarding environmental water requirements. The Commission understands the plan is undergoing review in parallel with the Plan review.
255 DPIE (2020) *Murrumbidgee Long term Water Plan Part B: Murrumbidgee catchment*
256 Very low flows are intended to provide for partial or complete connectivity in a reach. These flows can improve dissolved oxygen saturation and reduce stratification in pools.

daily flow rule is inadequate for mitigating these water quality events in the lower Murrumbidgee River.[257] Environmental water deliveries (including HEW) were used to manage the event. However, a reliance on environmental water holdings to manage such events is unsustainable and inconsistent with the intended purpose of these holdings.

Alternative rules in conjunction with changes to river operations (i.e. temporary opening of weir gates depending on operational feasibility and consideration of impacts to licence holders (including environmental water holders) and domestic and stock access) are needed to mitigate prolonged stratification and support river health during periods of low flow. As a minimum, the daily flow rule should align with the baseflow environmental water requirement for this reach (greater than 500 ML per day) set out in the Murrumbidgee LTWP, particularly for high-risk periods, until further information is available about the requirements for destratifying flows.[258] However, delivering higher minimum daily flows during drought times could incur greater operational losses and may affect reliability over the long-term.

Any changes in weir pool operation would need to be considered in the context of whether a local water utility draws on the weir pool, for example, Balranald weir, and the potential risks that weir pool drawdown poses to town water supply and basic landholder rights, particularly during drought conditions.

The replacement Plan should also be informed by further modelling and analysis of mechanisms for managing water quality events and maintaining critical refugia during drought conditions. This is particularly important given the climate projections for the catchment, including more extreme events (see **Chapter 4**).

7.2.2 Key reaches of Yanco Creek system are bypassed when delivering minimum daily flows to Billabong Creek

Clause 58(3) of the Plan requires a minimum daily flow of 50 ML per day in Billabong Creek (part of the Yanco Creek system), at Darlot.[259] Billabong Creek discharges into the Edward River, which is a tributary of the Murray.

The Plan rule is intended to support connectivity including with the Murray. However, the Commission understands that delivery of these flows appears to bypass significant sections of the Yanco Creek system, seemingly driven by operational efficiency. The Commonwealth DCCEEW[260]advised that water can be delivered into Billabong Creek at Finley Escape within four days, whereas it would take around 19 days to travel from the major storages to the same location. Additional sites are being proposed in the Yanco Creek system (as part of the SDLAM program) to address this issue and ensure that key reaches are not bypassed.[261] The Commission supports the inclusion of these additional sites and associated minimum daily flow rules in the replacement Plan, to provide connectivity and associated environmental benefits through the Yanco Creek system to the Murray.

The Commission understands that a review of EWRs will be undertaken as part of the five-year review of the Murrumbidgee LTWP. Whilst LTWPs are not statutory instruments, the EWRs in both the Murrumbidgee and Murray-Lower Darling LTWPs should be considered in

257 Baldwin, D. S. (2019) *Weir stratification and hypoxic water management - Murrumbidgee River 2019*
258 DPIE (2020) *Murrumbidgee Long term Water Plan Part B: Murrumbidgee catchment*
259 The gauge at Darlot measures the flows that discharge into the Edward River.
260 Acting on behalf of the CEWH.
261 Additional baseflow provisions are being proposed for Yanco Creek, Columbo Creek and additional sites along Billabong Creek.

the replacement of the Plan, with Plan rules better aligning with base flow EWRs to help improve river health. Minimum daily flow rules are a key example of where this alignment could be beneficial. Murray Lower Darling Rivers Indigenous Nations (MLDRIN) also supports partnering with Murrumbidgee traditional owners to ensure that minimum flow rules reflect not only environmental needs but also cultural requirements.[262]

Recommendation R14 – Priority 1

To align the Plan's minimum daily flow provisions with connectivity and water quality objectives and provide clarity in delivery of these flows, the Water Group should ensure that the replacement Plan:

a) specifies that minimum daily flows at Balranald must be targeted, but that compliance be assessed within 25 percent variation (consistent with the Murrumbidgee Work Approval), and prescribe how the compliance test works

b) requires monthly publication of targeted flows for the Murrumbidgee River downstream of Balranald Weir (410130) and the outcomes of the compliance test against targeted flows, including reasons for differences, to improve transparency and accountability

c) provides for connectivity with the Murray to support movement and dispersal opportunities for aquatic biota

d) maintains pool refugia and mitigates the risk of prolonged pool stratification in the lower Murrumbidgee River during periods of low flow, particularly when there are limited intervalley transfers to the Murray

e) aligns minimum daily flow requirements for the Murrumbidgee River downstream of Balranald Weir (410130) with baseflow environmental flow requirements from the Murrumbidgee LTWP and require updates to these requirements when improved knowledge of destratifying flow requirements becomes available

f) incorporates additional minimum daily flow rules for the five sites along the Yanco Creek system to achieve connectivity along the length of the system rather than bypassing river reaches when delivering flows to Darlot gauge (410134).

7.3 Transparent flows are important during dry catchment conditions

Transparent flow rules exist for both Blowering[263] and Burrinjuck[264] dams. These rules seek to release 100 percent of natural dam inflows to a certain volume for the purpose of providing flows immediately downstream of these storages.

Transparent flow rules are tailored for each storage, but a key distinction is the level of protection of these releases from extraction. Transparent releases from Blowering Dam are protected from extraction by access licence holders to the Tumut River junction with the Murrumbidgee River (around 85 river kilometres).[265] Transparent releases made from Burrinjuck Dam do not have an equivalent rule protecting transparent releases from

262 Submission: MLDRIN, received 7 July 2023.
263 Clause 59 of the Plan.
264 Clause 60 of the Plan.
265 The Plan rules for Blowering Dam require that inflows arising from the operation of the Snowy Hydro Scheme must be deducted to determine the natural inflows to the storage and volume to be released.

extraction (for use in meeting access licence water orders).[266] Further, unlike planned environmental water rules in other valleys such as the Lachlan, the Plan does not provide for the protection of these rules-based environmental releases from take for basic landholder rights.[267]

Transparent flow rules are particularly important for providing low flows during periods of lower-than-average rainfall. Transparent releases comprised a significant portion of releases during the Plan's drier years, for example, 38 percent and 75 percent of releases from Burrinjuck Dam in 2018-19 and 2019-20 respectively.[268] However, there is limited information to indicate that the rules are adequate to support basic river health during drier periods.

Stakeholders raised concerns about the lack of evidence underpinning the transparent flow rules, stating there is a '*lack of rationale for the target volume of 560 ML/d natural daily inflows in the management of transparent flows from Blowering Dam in regard to environmental outcomes'*.[269]

The Murrumbidgee LTWP was developed in 2020 (subsequent to the gazettal of the Plan). The Murrumbidgee LTWP provides the latest information regarding EWRs for the Murrumbidgee catchment water sources.[270] When comparing the maximum daily transparent flow for both storages it appears that:

- the Blowering Dam transparent flow rule would provide for very low flows based on environmental water requirements for Tumut River at Tumut town gauge (410006)[271]
- the Burrinjuck Dam transparent flow rule would provide baseflow based on environmental water requirements at downstream Burrinjuck gauge (410008).[272]

The Commission believes that the transparent flow rules should target base flows to support fundamental ecosystrem functions. This means that the transparent flow rule for Blowering Dam (clause 59 of the Plan), should be revised so that it aligns with the baseflow environmental water requirement in the Murrumbidgee LTWP for the Tumut River (at gauge 410006) i.e. >600 ML/day.[273] This would ensure the environmental provisions is based on best available evidence.

Figure 4 compares 2019-20 water year releases from Burrinjuck Dam with the very low flow and baseflow EWRs for the gauge downstream of Burrinjuck Dam upstream of Tumut River junction (410008). This was the year that transparent releases contributed to 75 percent of releases made from Burrinjuck Dam. During this very dry period, releases did not fall below the very low flow EWR for this gauge. While other releases occurred during this

266 The Plan rules for Burrinjuck Dram require up to 615 ML per day of inflows be released downstream throughout the year. Translucent releases intended to reinstate some natural flow variability are made in addition to these transparent flows for the period 22 April – 21 October (see **Section 7.4.1**). Also note there is a clause in the Plan relating to under delivery of environmental water (Clause 61, Division 1, Part 10), which requires the river operator to deliver outstanding amounts of water at a later date, if water required to be released is not delivered for operational reasons. This provision was included in the Plan as part of amendments in 2022.

267 Clause 52(4) of the Water Sharing Plan for the Lachlan Regulated River Water Source 2016 protects daily environmental releases from use to supply access licence requirements, basic landholder rights and diversion to or storage in any weir or water storage.

268 Based on annual of releases from 2018-19 and 2019-20 (See DCCEEW (n.d.) *Murrumbidgee general purpose water accounting reports*)

269 Submission: Inland Rivers Network, received 30 June 2023.

270 DPIE (2020) *Murrumbidgee Long term Water Plan Part B: Murrumbidgee catchment*

271 Situated downstream of Blowering Dam but upstream of the junction with the Murrumbidgee River.

272 Situated downstream of Burrinjuck Dam but upstream of the junction with the Tumut River.

273 DPIE (2020) *Murrumbidgee Long term Water Plan Part B: Murrumbidgee catchment*

water year, it is likely that the transparent releases contributed to supporting very low flows in the reach downstream of Burrinjuck Dam.

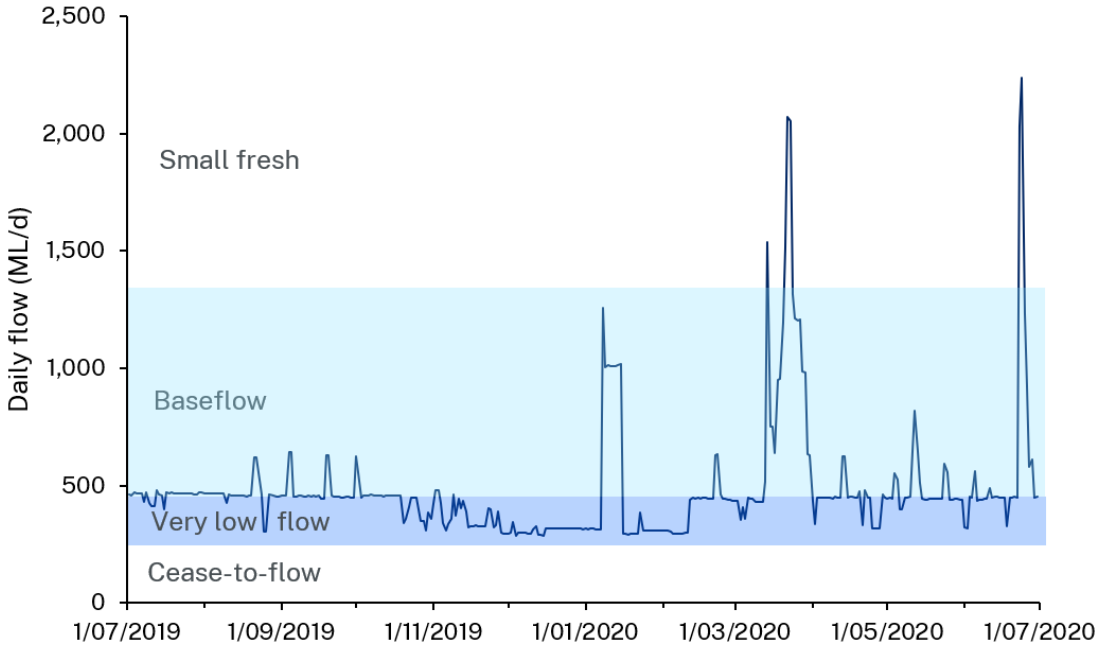

Figure 4: Comparison of 2019-20 flow data for Murrumbidgee River gauge 410008 (between Burrinjuck dam and Tumut River junction) with very low flow and baseflow environmental water requirements

Stakeholders also raised issues around operator discretion over releases being '*equal to or greater than the natural daily inflows*' and the lack of protection of this release, which is intended for environmental purposes from take by domestic and stock users.[274] The Commission notes that introduction of protection of transparent flows would be consistent with mechanisms in place for protection of environmental water in other valleys.

Recommendation R17 – Priority 2
The Water Group should revise transparency provisions to align with baseflow environmental water requirements (particularly for Tumut River downstream Blowering Dam) and ensure the replacement Plan effectively protects transparent releases from extraction along the length of the Murrumbidgee Regulated River Water Source to support fundamental ecosystem health.

274 Submission: Inland Rivers Network, received 30 June 2023; Clause 59(5) of the Plan states that water released from Blowering Dam as transparent flows must not be used to supply access licence water orders between Blowering Dam and the junction of the Tumut and Murrumbidgee rivers. However, the Plan notes it does not protect this water from persons exercising their basic landholder rights.

7.4 Translucent releases are not fit for purpose

The Plan sets out requirements for translucent releases from Burrinjuck Dam.[275] These releases are intended to '*mimic the variability of daily, monthly and seasonal patterns of the natural river system by 'passing through' a portion of dam inflows'*.[276] This variability is important for a range of ecological processes including habitat maintenance via scouring of in-channel habitat.

Translucent flow rules were introduced in the Murrumbidgee in 1998 in recognition that the river's ecological functions '*could not be improved without restoration of part of the natural hydrograph*'.[277] Before the rules were put in place, a greater portion of winter and spring flows were stored in Burrinjuck Dam for summer irrigation releases.[278] This was a significant deviation from the natural flow regime of the Murrumbidgee River, which is influenced by snowmelt that contributes to late winter-spring flows.

Translucent flow rules in the current Plan are complex[279] and there is limited evidence to indicate whether they are achieving their intended purpose. The only targeted monitoring of the effectiveness of translucent flow rules the Commission is aware of dates from around two decades ago when the Integrated Monitoring of Environmental Flows program was operating.[280] This monitoring program (1999-2002) focused on riffle habitat downstream of Burrinjuck Dam. It found that, while the translucent releases increased flow variability between April and October and contributed to short-term reductions in biofilm mass, there were limited changes in periphyton composition in the period the monitoring occurred. In addition, significant summer water orders were found to dwarf translucent releases, while water quality of releases (including cold water pollution) constrained the benefits associated with flow variability provided by translucent releases.[281]
The monitoring program reporting raised concerns that remain relevant to this Plan review[282] (see **Sections 7.4.1** - **7.4.3**) and should be addressed during the replacement Plan process.

7.4.1 Translucent releases have been inconsistent with Plan rules

The Commission's recent audit of the Plan found that translucent releases from Burrinjuck Dam were under target across two water years (2016-17 and 2018-19) for a total of 22 days.[283] The audit report subsequently recommended that WaterNSW make releases that are consistent with Plan provisions.

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275 Clause 60 in Division 1, Part 10, Schedule 2 and Schedule 3 of the Plan.
276 DPI (2018) *Review of translucency rules in NSW inland rivers*
277 Hardwick, L., Chessman B., Westhorpe D., Mitrovic S. (2012) *Assessing translucent environmental water release in the Murrumbidgee River below Burrinjuck Dam 1999-2002. Report 1 – Background. Regulated and unregulated rivers of the Murrumbidgee catchment and the effect of translucent releases – an Integrated Monitoring of Environmental Flows background report. NSW DPI, Office of Water.*
278 Water greater than the minimum flows required for dam maintenance and domestic and stock needs downstream of Burrinjuck Dam was stored in the dam for summer irrigation (DPI (2018) *Review of translucency rules in NSW inland rivers*)
279 The rules are based on timeframes, inflows to Burrinjuck Dam, effective storage volume of Burrinjuck Dam and an assessment of catchment condition.
280 DPI (2018) *Review of translucency rules in NSW inland rivers*
281 Hardwick, L., Wolfenden, B., Ryan, D., Chessman, B., Westhorpe, D. and Mitrovic, S. (2014) *Assessing translucent environmental water releases in the Murrumbidgee River below Burrinjuck Dam, 1999-2002 Report 3. Effect of translucent releases on biofilms and periphyton in the Murrumbidgee River. NSW DPI, Office of Water.*
282 *Ibid.*
283 Natural Resources Commission (2023) *Final report: audit of the implementation of the Lachlan, Murrumbidgee and NSW Murray and Lower Darling regulated rivers water sharing plans*, p. 35; WaterNSW indicated that infrastructure constraints and difficulties in making releases during maintenance contributed to challenges in operating to a fixed volume, as required by the translucency rules.

As part of the Plan review, the Commission compared calculated versus actual translucent releases, and found variations compared to Plan rules. For example, there was a difference of 15 percent in actual versus calculated translucent flows for the 2020-21 water year.[284] This variance would likely have had implications for the environmental benefits associated with translucent releases.

Stakeholders raised concerns about the way translucent releases had occurred during the term of the Plan, and that river operations were resulting in *'sub-optimal outcomes [...] from the environmental flow rules, in particular the translucent flow releases'*,[285] with set, constant releases not achieving the flow variability intended by this provision.

Amendments to the Plan in 2022 included a provision that requires WaterNSW to deliver outstanding amounts of water at a later date, if water required to be released is not delivered for operational reasons.[286] While this is a positive inclusion, it is not clear how it would address impacts from releases that are inconsistent with the Plan's translucent flow rules. Further, the new rule does not explicitly ensure accountability in providing for flow variability for environmental purposes. However, it does require that underdelivered water is released in a manner designed by DCCEEW Biodiversity, Conservation and Science, and approved by the Minister.

7.4.2 There are challenges delivering translucent flows with HEW

Translucent releases in the Murrumbidgee are currently unable to be delivered in a coordinated way with HEW to optimise environmental outcomes, in contrast to other valleys, such as the Lachlan.[287]

Clause 78 of the Plan sets out environmental flow reuse and piggybacking (i.e. ordering of HEW on top of a flow event) operating rules. These rules were included in the Plan to give effect to PPMs. However, the rules and corresponding procedures do not stipulate that HEW can piggyback a translucent flow. Without changes to these provisions, environmental water managers risk being debited for the translucent component if they order the release of HEW.[288] Current arrangements also appear to be inconsistent with the principles underpinning PPMs that are intended to maximise benefits arising from water recovered for the environment under the Basin Plan,[289] given the current rules do not support optimum environmental outcomes (**Section 7.6**).

7.4.3 Issues with translucent flows, including their limited protection, remain unresolved

Stakeholders expressed frustration that issues with the translucent flow rules had not been addressed during the development of the Murrumbidgee Surface Water Resource Plan, stating that:

> *'translucency rules (and their complexity) were discussed at length as part of the 2016 review of the Murrumbidgee [water sharing plan]. The then Minister initiated a Review [of translucency rules], and a report was finalised in 2018 yet consideration of alternatives was not progressed through the 2020 [water sharing plan] process'*.[290]

284 Based on data from Table 23 from the DPE (2023) *General purpose water account report for the Murrumbidgee catchment 2021-2022*
285 Submission: Coleambally Irrigation Cooperative Limited, received 29 June 2023.
286 Clause 61, Division 1, Part 10 of the Plan.
287 DPI (2018) *Review of translucency rules in NSW inland rivers*
288 Submission: CEWH, received 7 July 2023.
289 DPE (2023) *What are prerequisite policy measures?*
290 Submission: Murrumbidgee Irrigation Limited, received 7 July 2023.

The review of translucent flow rules highlighted concerns that the Plan rules do not effectively protect translucent releases from extraction, for example, when a supplementary event is announced.[291] This contrasts with other plans, such as in the Lachlan River valley. The review also highlighted that translucent releases are only protected immediately below Burrinjuck Dam (for approximately 9 percent of the Murrumbidgee River).[292] This limited protection significantly erodes the benefits the environmental water provision can provide.

The replacement Plan process is an opportunity to address the significant issues with the translucency rules and their delivery and consider alternative rules that will support flow variability and associated environmental benefits along the length of the river. This includes revisiting the simplified translucent flow rule proposed during the development of the original Plan (which was replaced by the current Plan).[293] However, any changes should be considered in conjunction with other environmental water provisions and must not lead to a net reduction in planned environmental water.[294] The Commission notes that the introduction of protection of translucent flows would be consistent with mechanisms in place for protection of environmental water in other valleys (for example, active management in the northern Basin).

Recommendation R15 – Priority 1

The Water Group should modify the Plan's translucent flow rules to:

a) simplify the rules and provide for flow variability and associated environmental benefits

b) allow for HEW to be released on top of translucent flows HEW accounts being debited for the translucent flow component

c) provide for protection of translucent flows along the length of the Murrumbidgee Regulated River Water Source

d) require a compliance / non-compliance test regarding non-delivery of translucency rules

e) to improve clarity, require publication of plans for release of underdelivered translucent flows that are developed by the NSW Environmental Water Manager and approved by the Minister.

7.5 Environmental water allowances have contributed to environmental outcomes

EWAs are intended to contribute towards the Plan's objective '*to support environmental watering in the water source to contribute to maintaining or enhancing ecological condition in streams, riparian zones, dependent wetlands and floodplains*.'[295] EWAs can also contribute to the Plan's connectivity objective.

291 Clause 50 of the Plan does not limit the announcement of supplementary access where a translucency release is moving through the system.
292 DPI (2018) *Review of translucency rules in NSW inland rivers*
293 *Ibid.*
294 As required under the *Basin Plan 2012.*
295 Clause 8(2)(b) of the Plan.

The Plan has three EWAs (EWA1, EWA2 and EWA3).[296] This is unique compared to other regulated plans that have one EWA for each major storage.[297] The EWA accounts are to be credited and debited and released in an order consistent with Plan rules, but the rules are complex. Stakeholders involved in the development of the Murrumbidgee Surface Water Resource Plan and this review support simplification of the rules.[298]

EWA water can be used on a discretionary basis.[299] Decisions to use this water are informed by the Murrumbidgee Environmental Water Advisory Group (EWAG)[300] as per Clause 71 of the Plan.

EWA water has been delivered in all water years from 2016-17 to 2022-23, with the largest volume delivered in the first year of the Plan (see **Box 2**).[301] Between 2016-2023, there have been 28 watering events that included EWA water, totalling 573 GL (**Appendix 3**, **Table 7A-2**). In many cases the delivery of EWA water was coordinated with delivery of HEW and contributed to a range of benefits, including breeding of both waterbirds and the threatened Southern Bell Frog (*Littoria raniformis*).[302] Stakeholders recognised these benefits:

> *'Where the Plan seems to be working well is when it is partnered with environmental water allocations. Preliminary outcomes of Commonwealth environmental watering actions at selected wetlands in the mid and lower Murrumbidgee after the final monitoring of the water year show a wide range of benefits. Particularly when natural flows are at a peak and environmental water can extend the flood – which can be a critical trigger for bird breeding events.'*[303]

Under the original Plan gazetted in 2003, the intent was for the EWAs to be '*managed for release during wet conditions to enhance natural flows to reinstate some of the natural inundation patterns of wetlands*'.[304] While the use of EWA water during these periods remains important and will be even more so when constraints are relaxed (**Chapter 11**), EWA releases have also served important purposes in drier times.

For example, during the 2018-19 water year, when the Murrumbidgee catchment experienced very dry conditions and low general security allocations affecting HEW allocations, EWA water comprised 60 percent of environmental water delivered (**Appendix 3, Table 7A-2**). Carryover provisions allowed unused EWA1 and EWA2 from 2017-18 to be carried forward for use in the 2018-19 water year, with a total of 117.5 GL of EWA water

296 Rules relating to environmental water allowances are set out in Clauses 62-67, Division 2, Part 10 of the Plan.
297 For example, the Gwydir, NSW Murray and Lower Darling and Lachlan each have one environmental water allowance for each major storage in the Plan area. Lachlan has two; one each for Wyangala and Lake Brewster.
298 Submission: Inland Rivers Network, received 30 June 2023.
299 Via an order made by the NSW Environmental Water Manager, which the river operator is required to release (as per Clause 66(1) of the Plan). The Plan notes that at its commencement, the Minister conferred the lead role in managing environmental water allowances established under water sharing plans to the NSW DPE – Office of Environment and Heritage (now NSW DCCEEW Biodiversity, Conservation and Science).
300 NSW DCCEEW Environment and Heritage (2024) *Murrumbidgee Environmental Water Advisory Group*
301 Based on data for 2016-17 to 2021-22 water years.
302 The Southern bell frog (*Littoria rainformis*) is listed as endangered under NSW *Biodiversity Conservation Act 2016* and vulnerable under Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; As identified through monitoring programs undertaken by or commissioned by the CEWH and NSW government agencies.
303 Submission: National Parks Association of NSW, received 30 June 2023.
304 Murrumbidgee Regulated River Management Committee (2004) *Murrumbidgee Water Sharing Plan: Background document, Part A*, unpublished, p. 35.

delivered.[305] Importantly, these EWA deliveries helped support native fish, turtles and frogs during periods of low flow, and waterbird breeding events in Nap Nap to Waugorah Lagoon, Nimmie-Caira and Coleambally Irrigation Area wetlands.[306]

Box 2: Murrumbidgee native fish (Lowbidgee fresh) event 2016-17[307]

The Lowbidgee fresh environmental watering event was one of the largest deliveries of EWA water since the commencement of the Plan in 2016. The event totalling 371 GL comprised around 135 GL of EWA and 236 GL of HEW.

A large portion of delivered EWA water was debited from the EWA3 account. This was debited first given the potential for a portion of this water to be forfeited consistent with Plan rules.

The environmental watering event was designed to help minimise a rapid flood recession by preserving the hydrograph. To achieve this, target flow rates and different ordering points were selected along the regulated river including at Wagga Wagga, downstream Gogeldrie weir and downstream Maude weir. This approach mitigated the risk of adverse impacts to native fish and riparian vegetation associated with a rapid decline in flow, and assisted with dilution of deoxygenated blackwater returning to the river from the floodplain that can contribute to poor water quality.

While the Plan's EWA provisions have contributed to environmental outcomes, there is an opportunity to ensure these deliveries are prioritised in terms of channel capacity and sharing arrangements. Current rules prioritise most other categories of water over EWA deliveries. Specifically, Clause 74 of the Plan is inconsistent with the requirements of the Act.

The Act sets out clear priorities for flow provision, with the protection of the water sources and their ecosystems being the first. However, the Plan shifts this priority when channel capacity constraints exist, meaning that basic landholder rights, followed by domestic and stock licences, and orders made by local water utility and regulated river (high security) licence holders take priority over EWA deliveries and orders placed by regulated river (general security) licence holders.

Any remaining channel capacity is then shared between EWA delivery and regulated river (general security), which erodes the potential environmental outcomes that can be realised by an EWA delivery. Under Clause 74, EWA water is treated equivalent to general security water. However, only one of the Plan's three EWAs is credited based on the available water determination for general security licences (EWA1).
Treatment of all categories of EWA in this order (as general security) potentially erodes the environmental outcomes that can be achieved by the Plan's discretionary environmental water provisions and is inconsistent with the principles of the Act. The Plan replacement process provides an opportunity to prioritise EWA deliveries and improve the associated outcomes.

305 Carryover rules for EWA 1 and EWA 2 are set out in Clause 67 of the Plan.
306 DPE (2019) *A year in the Murrumbidgee catchment: 2018-19. Outcomes from the use of water for the environment in the Murrumbidgee catchment for 2018–19*
307 This event summary is based on information from DPE (2022) *Murrumbidgee Bulk Entitlement Delivery Trials 2016 & 2017*

Recommendation R16 a) and b) – Priority 1

To improve protection of environmental water, the Water Group should:

a) determine how the categories of EWA and associated crediting and debiting rules can be simplified for accounting purposes and operability

b) ensure that EWA water delivery is prioritised in channel sharing arrangements consistent with the Water Sharing Principles of the *Water Management Act 2000*.

7.6 Environmental outcomes can be maximised with changes to PPMs

PPMs are designed to improve the efficiency and outcomes of HEW deliveries by enabling piggybacking of these releases with other dam releases and tributary inflows and providing for return flows (environmental water reuse). These measures seek to '*minimise the volume of water recovered [for the environment] by allowing for more efficient and effective use of HEW to maximise environmental outcomes under the Basin Plan, without impacting on the reliability of other water users*'.[308]

Provisions for enabling PPMs were introduced to the Plan as part of a 2022 amendment order.[309] However, there were a total of seven PPM actions in the Murrumbidgee valley between January 2020 and June 2022 (see **Appendix 3**, **Table 7A-3**), which appear to have taken place prior to the Plan amendments commencing. The Water Group advised the Commission that these events were undertaken as trials and demonstrate cooperation between environmental water holders, the Water Group and WaterNSW.

The PPM events were intended to provide a range of benefits including supporting fish movement and recruitment and mitigating the effects of hypoxic blackwater events on native fish. Optimising the effectiveness of environmental water deliveries through PPMs will be further realised with relaxation of constraints and the management of overbank flows for environmental purposes (**Chapter 11**).

While PPMs have provided several benefits in the Murrumbidgee, there are limitations that need to be resolved regarding their scope and application. Some of these issues require policy and procedural changes, rather than changes to the Plan:

- **An inability to piggyback on translucent flows** (see **Section 7.4**) – this would necessitate policy changes that sit outside of the Plan but likely also within the Plan, specifically Clause 78.
- **PPMs do not protect Lowbidgee supplementary water instream** – CEWH holds significant Lowbidgee supplementary water access entitlement that becomes available during high flows. Rather than using this water in the Lowbidgee, the CEWH is seeking changes so that orders of this water can also remain in-channel and be protected by PPMs '*within and beyond the Murrumbidgee*'.[310]

308 NSW Department of Industry (2019) *Prerequisite policy measures: procedures manual for the Murrumbidgee Regulated River*

309 *Water Sharing Plan for the Murrumbidgee Regulated River Water Source Amendment Order 2022*; Clause 78 of the Plan gives effect to PPMs and refers to the Murrumbidgee Prerequisite Policy Procedures Manual (see NSW Department of Industry (n.d.) *Draft Prerequisite policy measures: procedures manual for the Murrumbidgee Regulated River),* while Clauses 46(4) and 46(5) set out accounting arrangements, and Clause 88 provides for amendment of debiting and operating rules.

310 Submission: CEWH, received 7 July 2023.

- **A lack of systems for re-crediting of environmental water** – the Commission understands that Coleambally Irrigation Limited has adopted a system for re-crediting return flows, but an equivalent system is not in place for the Murrumbidgee Irrigation Area making it difficult to determine the proportion of return flows for downstream environmental outcomes.
- **PPMs do not currently apply to discretionary planned environmental water** – stakeholders indicated that there would be benefits in expanding PPMs to also apply to the Plan's EWAs.[311] This would allow, for example, the reuse of EWA water and maximise the environmental outcomes from these deliveries. The Commission supports the application of PPMs to EWA deliveries but acknowledges this is a broader policy issue that would require consideration of impacts to licence holders (including reliability) across a range of catchments, including the Murray and Lower Darling.
- **A lack of clarity on piggybacking during regulated and unregulated flows** – Section 7.15 of the Basin Plan 2012 intended that unimplemented policy measures (in this case piggybacking) would 'allow for the call of held environmental water from storage during unregulated flow events'[312], i.e. on top of unregulated events such as natural flooding. The NSW Murray and Lower Darling Plan gives effect to PPMs and refers to the Murrumbidgee PPM Procedures Manual.[313] However, unlike the Basin Plan this manual implies that piggybacking can occur during both regulated and unregulated flow events. For example, the manual refers to allowing for 'the release of environmental water on top of other in-stream flows, including unregulated flow event'. The Commission considers 'other in-stream flows' could constitute regulated flows. This should be clarified during the replacement Plan process given the Plan refers to the procedures manual.

These issues should be addressed in conjunction with findings from the Water Group's recent annual review and evaluation of PPMs.[314] This may necessitate changes to Plan rules, and the Murrumbidgee PPM Procedures Manual referenced in Clause 78 of the Plan.[315]

Recommendation R16 c) and d) – Priority 1

To improve protection of environmental water, the Water Group should:

c) ensure that the Plan's provisions for implementing the PPMs provide for effective piggybacking of translucent flows and protect in channel supplementary flows (of held environmental water, including Lowbidgee supplementary water) intended to remain in channel for environmental outcomes

d) ensure that the Plan and Murrumbidgee PPM Procedures Manual are clear about the circumstances where piggybacking can occur (i.e. unregulated flows).

311 Submissions: CEWH, received 7 July 2023; Inland Rivers Network, received 30 June 2023.
312 Section 7.15 of the Commonwealth *Basin Plan 2012*.
313 DPE (2022) *Prerequisite Policy Measures: Procedures Manual for the Murrumbidgee Regulated River (2022)* p. 7.
314 DCCEEW (2024) *Prerequisite policy measures: NSW annual evaluation and review 2022-23*
315 NSW Department of Industry (2019) *Prerequisite Policy Measures: Procedures Manual for the Murrumbidgee Regulated River*

7.7 Environmental water deliveries are not treated equitably

The Murrumbidgee valley has significant environmental water holdings. This water is delivered to a range of sites largely in the mid and lower Murrumbidgee. However, unlike consumptive water users, specifically those with regulated river (general security) access licences, environmental water holders' accounts are debited for water that is used to fill weir pools to enable HEW to be delivered to off-channel locations, such as North Redbank wetlands (part of the Lowbidgee Floodplain).

The Commonwealth DCCEEW[316] raised concerns that this is inequitable:

> *'Environmental water holders should not be penalised because the environment deliveries require different timing than traditional irrigation schedules. River operations and the [water sharing plan] needs to accommodate more effectively and equitably the water delivery requirements (timing) of all entitlements holders and not penalise one user type when meeting their needs'.*[317]

The Commission considers the current arrangements potentially erode the environmental benefits afforded by delivery of HEW to off-river sites by first filling weir pools. Furthermore, these arrangements are also inconsistent with the *Intergovernmental Agreement on Implementing Water Reform in the Murray-Darling Basin June 2013* (revised 2019). Section 5.2 of the agreement requires that HEW is treated the same as 'like entitlements held for other purposes' i.e. it will not be subject to 'less favourable conditions'. This is an equity issue that should be further explored during Plan replacement.

Recommendation R16 e) – Priority 1
To improve protection of environmental water, the Water Group should ensure that there is equity in the management and accounting of transmission losses with the use of HEW to avoid environmental licence holders wearing conveyance losses in contrast to other licence categories where losses are socialised across water users.

316 Acting on behalf of the CEWH
317 Submission: CEWH, received 7 July 2023.

8 Restoring Aboriginal water rights, values and uses

The Murrumbidgee catchment area spans the country of the Wiradjuri, Nari Nari, Barapa Barapa, Wemba Wemba, Yita Yita, Mutthi Mutthi, Wadi Wadi, Nyeri Nyeri, Ngunnawal/Ngunawal, Wolgalu and Ngarigu peoples. Each nation has strong cultural and spiritual connections with the rivers and wetlands of the Plan area. Water-dependent sites of deep significance to Aboriginal peoples in the Murrumbidgee catchment, include Coolamatong (Lambie Gorge), Wiradjuri Reserve and Gobba Beach, Koonadan, Dippo ceremonial ground, the Toogimbie Indigenous Protected Area and Gayini Nimmie-Caira.[318]

> *'Indigenous people hold distinct cultural perspectives on water that relate to identity and religious attachment to place, environmental knowledge and the exercise of custodial responsibilities to manage interconnected parts of customary estates. The Murray–Darling Basin is a highly significant region for Indigenous people and the 'cultural health' of many of these people's sense of place relies on flows and flooding.'*[319]

The Plan covers 11 LALC areas, with one registered ILUA in the Tumut Brungle LALC area (**Figure 5**). There is no native title determination across the Plan area.

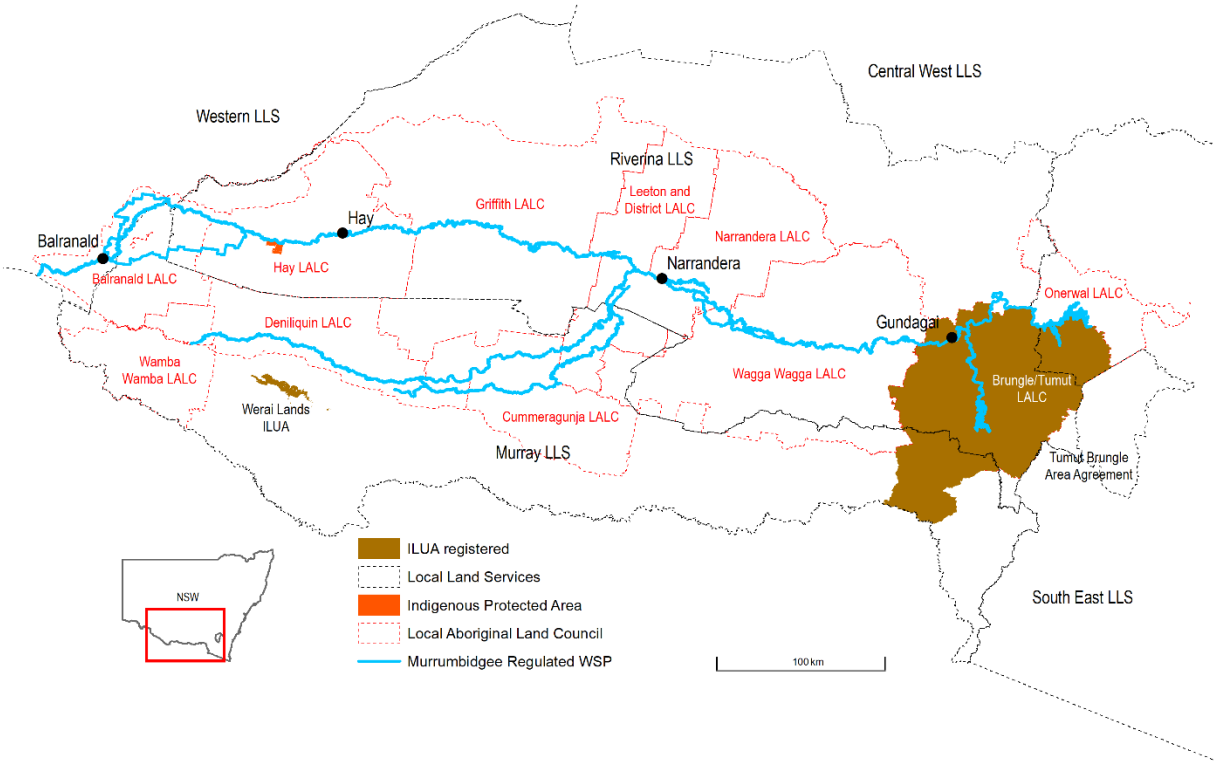

Figure 5: Plan area with connecting LALCs

As of July 2022, the Plan provided a broad Aboriginal cultural objective to '*maintain, and where possible improve, the spiritual, social, customary and economic values and uses of water by Aboriginal people.*'[320] Supporting this were a range of targeted Aboriginal cultural objectives:

a) to provide access to water in the exercise of native title rights

318 DPE (2022) *Draft Regional Water Strategy – Murrumbidgee*
319 Submission: National Parks Association of NSW, received 30 June 2023.
320 Clause 10 of the Plan.

b) to provide access to water for Aboriginal cultural use, including fishing

c) to protect, and where possible improve, identified surface water-dependent culturally significant areas, including important riparian vegetation communities

d) to contribute to the maintenance of water quality within target ranges to ensure suitability of water for Aboriginal cultural uses.[321]

To achieve these objectives, the Plan nominated several strategies and a set of performance indicators to measure the strategies' success.[322]

The Commission sought public submissions for this review, including feedback on the Plan's objectives, strategies and performance indicators. Submissions were received from Aboriginal organisations, LALCs, government bodies, and other peak Aboriginal representatives with a cultural connection and association with the Plan's water sources.

This chapter provides a summary of the key challenges identified in the Commission's analysis and raised by stakeholders, including:

- concerns around a lack of stakeholder engagement in amendments (**Section 8.1**)
- cultural objectives do not align with the *NSW Water Strategy* and are not measurable (**Section 8.2**)
- limitations and restrictions around cultural access licences (**Section 8.3**)
- Plan provisions for water for native title have yet to be tested (**Section 8.4**)
- the Plan should provide water for Aboriginal cultural uses, including fishing (**Section 8.5**)
- cultural access licences are beneficial, but uptake is limited (**Section 8.6**).

Where appropriate, the Commission makes recommendations to address the points above, to improve the Aboriginal cultural objectives of the Plan.

8.1 Concerns around lack of stakeholder engagement in amendments

In 2022, the Plan's Aboriginal cultural objectives were amended and separated from the Plan's social objectives, which was a significant change. Public submissions expressed concerns about the lack of stakeholder engagement in the development of the amendments:

> '*Aboriginal people have a spiritual, customary and economic relationship with water and can provide important insight into 'best practice' for natural resource management.*'[323]

> '*Water Sharing Plans present large gaps in engagement with Aboriginal peoples in water planning, and do not adequately reflect DPE's commitment to work with Aboriginal communities in the development of these plans.*'[324]

> *'The targeted objectives lack relevance and significance to local Murrumbidgee Traditional Owners. This is unsurprising given that the objectives were added without consideration of Murrumbidgee Traditional Owners' priorities, needs, and objectives. The lack of specificity*

321 Clause 10 of the Plan.
322 Clause 10(5) of the Plan.
323 Submission: NSW Aboriginal Land Council, received 23 June 2023.
324 Submission: NSW Aboriginal Land Council, received 23 June 2023.

of these objectives for Murrumbidgee Traditional Owners has implications for advancing their actual objectives and outcomes (in contrast to those identified in the [water sharing plan]).'[325]

The Commission acknowledges that the Water Group and Riverina Local Land Services (LLS) have been working with key Aboriginal stakeholders that are supported by the Plan's water sources, to identify and guide actions to recognise Aboriginal peoples' rights and values associated with water for cultural purposes. The Developing Aboriginal Cultural Water Use Opportunities in the Murrumbidgee Valley project was initiated following a review of the uptake of cultural access licences and recommendations to improve it.[326] This work has been largely focused on the regulated Murrumbidgee River given the cultural access licence in this water source.

The Commission also acknowledges the Water Group is undertaking a Cultural Watering Plan pilot[327] that will work with six diverse Aboriginal communities across NSW to outline:

- the community's cultural water objectives
- ways in which the water could be accessed
- any obstacles to achieving the desired outcomes.

The Commission supports more targeted Aboriginal cultural objectives and recommends the Water Group ensure the findings of the Developing Aboriginal Cultural Water Use Opportunities in the Murrumbidgee Valley project and Cultural Watering Plan pilot are incorporated into the replacement Plan.

8.2 Cultural objectives do not align with the *NSW Water Strategy* and are not measurable

The *NSW Water Strategy* was released in August 2021 and includes a priority (Priority 2)[328] to increase First Nations People's rights for access to and ownership of water. Feedback from stakeholders stated that the Plan's amendments could have gone further to better reflect this priority:

'*The [water sharing plan]'s Aboriginal cultural objectives do not reflect DPE's priority in the NSW Water Strategy to "Recognise First Nations/Aboriginal People's rights and values and increase access to and ownership of water for cultural and economic purposes. [water sharing plans should reflect this priority as an objective to "increase ownership of water for cultural and economic purposes*.'[329]

While the Plan's amended objectives are more targeted, there is a disconnect between the broad and targeted objectives of the Plan, and further changes are needed to demonstrate and measure improvement to Aboriginal spiritual, social, customary and economic values, and uses of water by Aboriginal people. This was reflected in stakeholder feedback to the review:

'...there is a disconnect between the Murrumbidgee Regulated [water sharing plan] 2022 version's broad Aboriginal cultural objective and the targeted objectives that follow. That is, the "broad Aboriginal cultural objective ... is to maintain, and where possible improve, the spiritual, social, customary and economic values and uses of water by Aboriginal people".

325 Submission: MLDRIN, received 7 July 2023.
326 Alluvium (2022) *Recommendations for improving use of Cultural Access Licences*
327 DCCEEW (n.d.) *Cultural watering plans*
328 Priority 2 of the *NSW Water Strategy*
329 Submission: NSW Aboriginal Land Council, received 23 June 2023.

However, the "targeted" objectives are narrow and reductive and do not clearly support the entire "broad" objective. In particular, there is no target objective that relates to economic values and uses. This is significant because the [water sharing plan] states that the success of strategies for achieving the broad Aboriginal cultural objective will be measured based on the success of the targeted objectives.'[330]

'While more targeted than previous versions of the [water sharing plan], some of the Aboriginal cultural objectives are unclear or not well defined which adds to the challenges of 'measuring progress and success...'"[331]

'*Beyond Schedule 12 reporting under the Basin Plan, we are unaware of any specific reporting against the performance indicators or assessment of the effectiveness of the strategies listed in the [water sharing plan], as specified in Part 2 of the [water sharing plan]. It is therefore difficult to assess the extent to which the [water sharing plan] is contributing to environmental, cultural, social and economic outcomes.'*[332]

Further, MLDRIN expressed frustration with the time taken to incorporate the amended objectives:

'*It is only the Murrumbidgee Regulated [water sharing plan] (2022 version) that first included specific Aboriginal cultural objectives, strategies, and performance indicators (Section 10). It is surprising and disappointing that it has taken until the end of 2022 for the [water sharing plan] to more seriously consider and platform First Nations objectives in this way.'*[333]

Recommendation R19 – Priority 2
To improve accountability against cultural objectives, the Water Group should ensure the Plan's objectives, corresponding provisions and performance indicators are co-designed with Aboriginal stakeholders, reflect Priority 2 of the *NSW Water Strategy* and continue to align with the *Water Management Act 2000*.
Recommendation R21 – Priority 3
To improve Aboriginal access licence uptake and use, the Water Group should ensure that the findings of the Developing Aboriginal Cultural Water Use Opportunities in the Murrumbidgee Valley project and the Cultural Watering Plan pilot are incorporated into the Plan.

8.3 Cultural access licences are highly restrictive

Part 7 of the Plan provides opportunities for Aboriginal people to access water by allowing for the granting of an access licence of the sub-category 'Aboriginal cultural'. These are known as specific purpose access licences[334] and are granted by the Minister if they are of the view that the licence is for '... *for the taking of water by an Aboriginal person or Aboriginal community for any personal, domestic or communal purpose, including drinking, food preparation, washing, manufacturing traditional artefacts, watering domestic gardens,*

330 Submission: MLDRIN, received 7 July 2023.
331 Submission: MLDRIN, received 7 July 2023.
332 Submission: CEWH, received 7 July 2023.
333 Submission: MLDRIN, received 7 July 2023.
334 Part 7(45) of the Plan.

cultural teaching, hunting, fishing, gathering, and for recreational, cultural and ceremonial purposes'.[335]

There is a long history of 'trade' and sharing of resources as a cultural practice that saw Aboriginal people grow resources on their Country and often venture outside of their own Country for trade and ceremony.[336] However, trade is not recognised in the purpose for which a specific purpose access licence may be granted.

A review of the Plan needs to better balance the reasons for which this licence can be granted with cultural obligations including economic opportunity of water use for Aboriginal communities and people:

> *'Maintaining spiritual and cultural relationships with land, water and Country are intertwined for Aboriginal peoples. The right to economically develop natural resources, consistent with cultural obligations, is also of significant importance.'*[337]

The Commission recommends that the Water Group remove restrictions on economic gain for all categories of Aboriginal access licences and recognise it as a purpose for which a specific purpose access licence may be granted, to improve economic outcomes for Aboriginal people, including supporting Aboriginal cultural economies.

The Commission has previously highlighted[338] that limitations placed on these types of access licences are inequitable, including that they are highly restrictive, inherently limiting by excluding economic uses[339] and unable to be easily accessed and applied for. These concerns were echoed in public submissions to this review:

> *'We note that Water Sharing Plans may provide for Aboriginal Cultural Access Licences, Aboriginal Community Development Water Access Licenses, and Aboriginal commercial licences however with a range of constraining parameters. We ask that the NSW Government remove constraints on these licences and provide support to Aboriginal communities and Aboriginal Land Councils to access these licences. These provisions must be improved to better meet the needs of Aboriginal water users, ensure the health of our communities, and protect our cultural sites.'*[340]

The Plan currently has an active access licence (Aboriginal cultural).[341] The Plan amendments resulted in a cap on the total entitlement for all access licences (Aboriginal cultural) to not exceed 2,150 ML.[342] The active access licence is for 2,150 ML, effectively meaning no further licences can be issued. The Plan amendments also limit new applications to access entitlements under the existing licence to 10 ML each. This is confusing as the cap on total entitlement has already been reached. The 10 ML limit was not communicated in the published Plan changes factsheet.[343]

The Commission sees no justification for the cap or the 10 ML limit and recommends they be removed to improve access and use across the Plan area by Aboriginal communities, in line with Aboriginal community expectations and their water-dependent site requirements.

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335 Part 7(45)(3) of the Plan.
336 Fuller, R.S, Trudgett, M., Norris, R.P. and Anderson, M.G. (2014) *Star Maps and Travelling to Ceremonies -- the Euahlayi People and Their Use of the Night Sky*
337 Submission: NSW Aboriginal Land Council, received 3 May 2022.
338 See previous reports at Natural Resources Commission (n.d.) *Water Sharing Plan Reviews*
339 Part 2, Clause 12(1) of the Plan.
340 Submission: NSW Aboriginal Land Council, received 3 May 2022.
341 *NSW Water Register: Water Access Licence 27141*
342 Clause 45(4) of the Plan.
343 DPE-Water (2023) *Changes to the Murrumbidgee regulated water sharing plan – factsheet*

Recommendation 18 a) and b) – Priority 1

To support improved economic outcomes from the Plan, the Water Group should work with Aboriginal communities to:

a) better understand cultural obligations and amend the purposes for which Aboriginal access licences may be granted by recognising traditional trade practices e.g., sale, exchange, gifting, and bartering of goods made from water provided under all categories of Aboriginal access licences

b) explore further opportunities to enact all three sub-categories of Aboriginal access licence to support the Plan's Aboriginal cultural objectives.

Recommendation R20 – Priority 2

To deliver better outcomes for Aboriginal peoples, the Water Group should:

a) work with Aboriginal people to simplify the application process and provide stronger support for Aboriginal communities in accessing Aboriginal licence provisions

b) remove the 2,150 ML cap on the total volume of the regulated river (high security) (Aboriginal cultural) access licence and remove 10 ML limit per licence application.

8.4 Plan provisions for water for native title have yet to be tested

The Plan includes a provision for exercise of native title rights, where an application for native title has been successful or an ILUA has been negotiated.[344] The Plan also includes a relevant objective, strategy and performance indicator to monitor the extent to which native title requirements have been met, and a provision to support amendments where native title rights may change under the *Native Title Act 1993*.

One ILUA is registered in the Plan area but currently no native title determinations have been granted.[345] The provision's adequacy therefore remains untested and outcomes unmeasurable with share components for native title at zero.

As with the Commission's previous reviews,[346] the Commission believes the Water Group should proactively consider and work more closely with Aboriginal communities to better align and amend Plan provisions with native title determinations, ILUAs or other land and water agreements (including Indigenous Protected Areas within the Plan area) wherever possible to ensure access to cultural water. This should include sufficient engagement with traditional owners (**Section 8.1**).

8.5 The Plan should provide water for Aboriginal cultural uses including fishing

The Plan area includes eleven LGAs (**Figure 5**), all containing significant populations of Aboriginal peoples. The Plan area averages over 7 percent Aboriginal population in LGAs, compared to the state average of just over 3 percent. Narrandera Shire has the highest at more than 12 percent.[347] A review of population data showed a steady increase in numbers

344 Clause 10 of the Plan.
345 One ILUA is registered in the upper reaches of the Plan area – Tumut Brungle Agreement Area NIA 1998/001. See *National Native Title Tribunal*
346 Natural Resources Commission (n.d.) *Water sharing plan reviews*
347 Australian Bureau of Statistics (2023) *Data by region (map) – LGAs*

since 2011 across the Plan area.[348] Despite this significant and growing population, the Plan describes and provides for only limited water-dependant cultural values and uses.

Water for recreational and cultural purposes for Aboriginal peoples is critical for wellbeing and is an important social outcome of the Plan. The *2023 National Social and Economic Survey of Recreational Fishers* revealed that those who identify as Aboriginal and Torres Strait Islanders are much more likely to go fishing (38 percent) compared to others (21 percent), especially in regional areas.[349] Given the significance of the Aboriginal population in the Plan area, the ability to access water for cultural and recreational purposes, including fishing, is essential.

Clause 10 (2b) of the Plan includes a target to support Aboriginal and cultural use including fishing. The Plan's existing access licence (Aboriginal cultural) is a positive contribution to this target, providing water for cultural purposes and practices. However, there have been water quality events during the term of the Plan that have contributed to fish deaths and conditions unsuitable for recreational uses (see **Section 7.2.1**). Environmental provisions and the protection of environmental water are also important as shown in the *Fish and Flows in the Southern Basin* project:

> *'During completion of this project accompanying consultation with water managers and Aboriginal Traditional Owner groups identified that the achievement of fish outcomes through environmental water delivery would in many cases also achieve certain cultural outcomes for Aboriginal peoples.'* [350]

However, this is dependent on the adequacy of existing provisions and environmental water deliveries (see **Chapter 7**), and other complementary measures that support outcomes for native fish, including water quality. The Plan includes a targeted objective '*to contribute to the maintenance of water quality within target ranges to ensure suitability of water for Aboriginal cultural uses'* (see **Section 7.2.1**).[351]

MLDRIN raised the need to better understand the connectivity relationships of Aboriginal cultural water at the landscape level, particularly the impacts of Plan boundaries and the interaction between the Murrumbidgee regulated and unregulated plans. MLDRIN questioned whether the plans:

> '*allow this water to be accessed and protected across the whole Murrumbidgee system, should that be desired by Nations. In short, current water management arrangements are problematically prohibiting First Nations from delivering water to their own Country in a manner that reflects their cultural responsibilities.'*[352]

While the Plan area has a defined boundary, MLDRIN stated:

> *'The complex network of upstream and downstream obligations held by these Nations means that multiple Nations, including those that sit outside the boundaries of the Murrumbidgee Regulated [water sharing plan], have legitimate interests in this [water sharing plan]. This is because their capacity to practice and perform their cultures in some cases is dependent on the health and management of other waterway sections, regardless of state-defined management boundaries.'*[353]

348 Australian Bureau of Statistics (2023) *Data by region (map) – LGAs*
349 Fisheries Research and Development Corporation (2023) *Social and Economic Survey of Recreational Fishers 2018-2021 New South Wales and ACT*
350 DPI Fisheries (2022) *Fish and flows in the southern Murray-Darling Basin: condensed summary*, p.15.
351 Clause 10 (2)(d) of Plan.
352 Submission: MLDRIN, received 7 July 2023.
353 *Ibid.*

Aboriginal cultural objective strategies also include reserving a share of water to *'...partially mitigate alterations to natural flow regimes in the water source', and '...to maintain longitudinal and lateral connectivity within and between water sources'*[354]. Environmental issues discussed in **Section 7.2.1** include impacts to fish, water quality and riparian zones, all of which are known to have cultural value and linkages to Aboriginal communities and people. These strategies have been ineffective in maintaining or improving benefit to Aboriginal people. Where share components of water are used to mitigate other plan objectives, taking away potential Aboriginal use of water, improved transparency around the volumes and application is required to enable measurability of the effectiveness of the strategy.

Recommendation R22 a) – Priority 3
Consistent with mechanisms in place for environmental water (i.e., PPMs and active management), the Water Group should ensure the Plan provides for protection within and between water sources (intervalley flows) including return flows, for all Aboriginal licence categories.

8.6 Aboriginal cultural access licences provide benefits but uptake is limited

The Plan is unique in NSW in that it has an access licence (Aboriginal cultural) of 2,150 ML.[355] As a regulated river (high security) (Aboriginal cultural) access licence, it has priority over other licence categories, including general security. The licence has provided water for cultural purposes over time, supporting cultural use in the Plan area. However, there have been issues with its implementation, including that this category of licence currently resides outside the mainstream water market,[356] limiting the Plan's achievable economic Aboriginal cultural outcomes.

Most notably there has been limited uptake of the licence entitlement during the term of the current Plan, as shown in a recent review commissioned by the Water Group and undertaken by Alluvium. The review showed around 17,000 ML has been unused over 15 years (**Figure 6**).[357]

The Alluvium review attributed the lack of uptake to a range of factors, and the Commission's public submission process revealed further limitations. Some of these are explored below.

354 Clause 10 (3)(c)(d) of the Plan.
355 *NSW Water Register: Water Access Licence 27141*
356 Godden, L., Jackson, S. and O'Bryan, K. (2020) 'Indigenous Water Rights and Water Law Reforms in Australia', *Environmental and Planning Law Journal*, 37, 655-678.
357 Alluvium (2022) *Recommendations for improving use of Cultural Access Licences.*

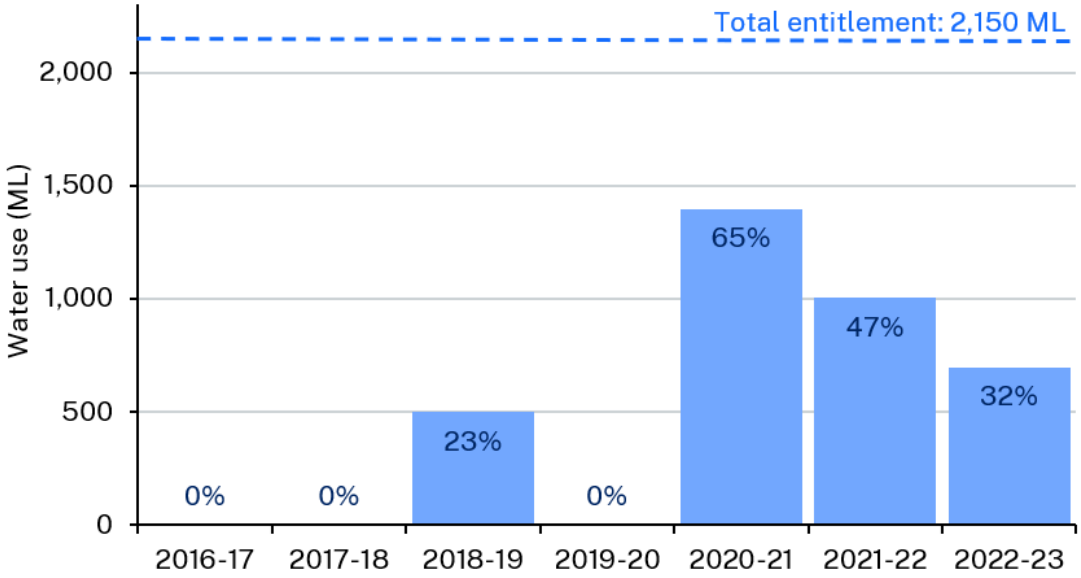


Figure 6: Use of cultural water entitlement during the Murrumbidgee Regulated Plan[358]

8.6.1 Limited scope of use

The broad objectives of the Act seek to recognise and foster benefits to Aboriginal people from their *'spiritual, social, customary and economic use of land and water'*.[359] The Plan's broad Aboriginal cultural objective is consistent with this, i.e. '*maintain, and where possible improve, the spiritual, social, customary and economic values and uses of water by Aboriginal people*'.[360] The access licence (Aboriginal cultural) is currently restricted for use as follows:

> *'The Minister may only grant a regulated river (high security) (Aboriginal cultural) access licence for the taking of water by an Aboriginal person or Aboriginal community for any personal, or communal purpose, including drinking, food preparation, washing, manufacturing traditional artefacts, watering domestic gardens, cultural teaching, hunting, fishing, gathering, and for recreational, cultural and ceremonial purposes.'*[361]

The purposes as written do not include consideration of cultural economies or recognise their long history.[362] For example, the area around Hay was a '*major Indigenous trade route which supported a vast social and cultural network*'.[363] The Commission recommends the Water Group review the conditions under which the Minister may grant an access licence to include cultural economies.

The *Water Management (General) Regulation 2018* (the Regulation) provides two additional sub-categories of Aboriginal access licences: Aboriginal commercial and Aboriginal community development. Neither of these exist currently in the Plan area.[364]

358 Alluvium (2022) *Recommendations for improving use of Cultural Access Licences.*
359 Section 3(c)(iv) of the Act.
360 Clause 10 of the Plan.
361 Part 7, Clause 45(3) of the Plan.
362 O'Donnell, E., Godden, L. and O'Brien, K. (2021) *Final report of the Accessing water to meet Aboriginal economic development needs project*. University of Melbourne.
363 National Indigenous Australians Agency (n.d.) *Toogimbie IPA*
364 *NSW Water Register*; Schedule 3 of the Regulation.

Recommendation R18 b) – Priority 1

To support cultural economies, the Water Group should work with Aboriginal communities to explore further opportunities to enact all three sub-categories of Aboriginal access licence to support the Plan's Aboriginal cultural objectives.

8.6.2 Inability to trade

Section 17(2)(b) of the *Access Licence Dealing Principles Order 2004* does not allow for temporary trade (71T) of unused regulated river (high security) (Aboriginal cultural) access licence allocations. Given it is a high security licence it would hold significant value on the water market. Funds generated from trade could support cultural outcomes and expand the works where the cultural water can be used. The inability to trade is a potential equity issue given other high security water users can trade.[365]

Recommendation R18 c) – Priority 1

To support cultural economies, the Water Group should work with Aboriginal communities to revise trade dealing rules to remove restrictions on allocation trades (dealings) for all categories of Aboriginal access licences.

8.6.3 Limitations on where the entitlement can be used

Riverina LLS administer the existing access licence (Aboriginal cultural). As a result of those administrative arrangements, the eligible areas where the existing access licence (Aboriginal cultural) can be used were effectively restricted to within the Riverina LLS boundary and did not align with the entire length of the Plan (**Figure 7**).[366] The Commission sought clarification and Riverina LLS subsequently confirmed the entitlement is available along the length of the regulated river which spans Riverina, Murray and Western LLS areas.

There are currently only three sites (work approvals), situated in the lower Murrumbidgee, where water available under the licence can be extracted (**Figure 7**). While additional sites can be added, this requires new works to be added to the works approval, which is time-consuming and costly. This limits the benefits that can be realised across Aboriginal nations that span the Murrumbidgee catchment, particularly given the limitations on economic uses for the licence already highlighted. Further, the Commission recognised in its review of the Murrumbidgee Unregulated Plan that cultural water would not be protected from extraction if it was delivered to sites in unregulated river water sources.[367]

365 Section 17(2)(b) of the *Access licence Dealings Principles 2004*
366 As reflected in the Riverina LLS expression of interest *factsheet*
367 Natural Resources Commission (2023) *Review of the Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources 2012*

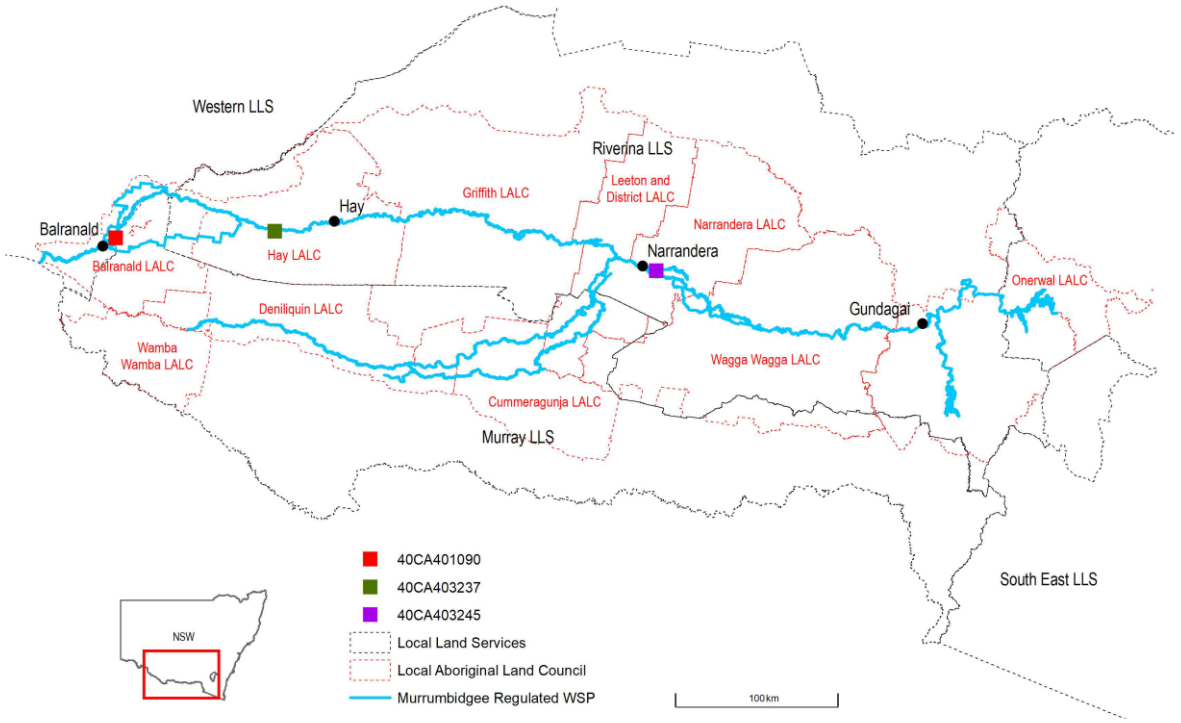


Figure 7: Work approval sites WAL27141

The Commission understands that some sites of cultural significance are situated on the floodplain and that managed inundation of these sites may be required to achieve Aboriginal cultural outcomes. However, like environmental water deliveries, watering these sites for cultural purposes is limited by channel capacity constraints. To address this issue the Commission considers that the relaxation of constraints should also apply to Aboriginal access licences (see **Chapter 11**).

Recommendation R22 b) – Priority 3
To improve outcomes for the Aboriginal community, the Water Group should ensure that, where required, constraints relaxation also applies to Aboriginal access licences.

8.6.4 Limit on the volume available

As noted in **Section 8.3**, the Plan's amendments included a limit on new cultural licence applications to 10 ML per application. The Commission has previously raised concerns regarding an arbitrary limit on access licences (Aboriginal cultural).[368] In conjunction with the current total limit outlined above (2,150 ML), the Plan does not support new applications. As previously noted, the Plan does not allow for additional regulated river (high security) (Aboriginal cultural) access licences above the existing 2,150 ML.[369] It is not clear why this restriction was added, particularly as it would make the addition of the new cultural licence allowance unusable without reducing the current licence in existence.

368 Natural Resources Commission (n.d.). *Water Sharing Plan Reviews – completed reviews*
369 Clause 45(4), Part 7 of the Plan.

8.6.5 Lack of carryover

As a high security licence, the access licence (Aboriginal cultural) does not allow for carryover of entitlement between water years.[370] Stakeholder submissions and the Alluvium review raised concerns regarding the lack of carryover provisions for the licence.[371] The Commission encourages the Water Group to undertake further work into the structure of the access licence to improve flexibility, benefits and risks of carryover for the high security (Aboriginal cultural).

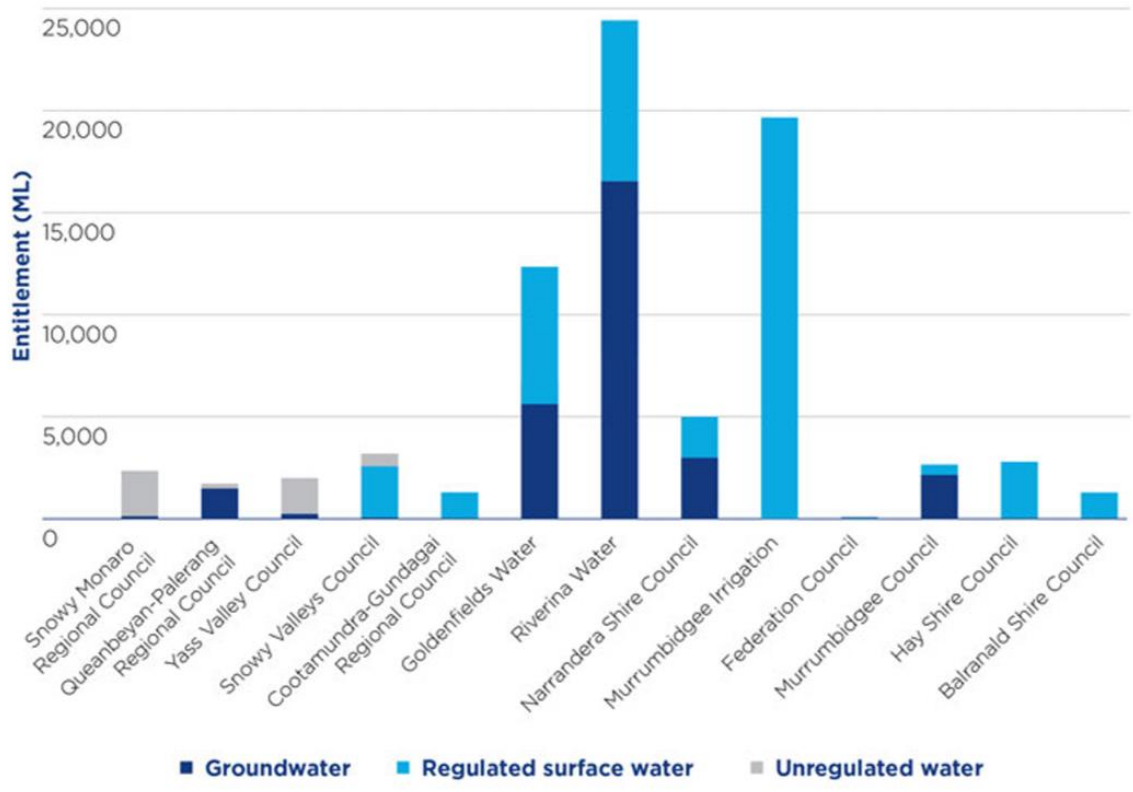
In summary, while the existing licence provides some benefits, the limited uptake, due to limitations of the licence rules, prevents the full benefit of the licence from being realised by Aboriginal people. The Commission encourages the Water Group to implement Alluvium's recommendations to address the lack of uptake.

370 Clause 47 (1) of the Plan.
371 Alluvium (2022) *Recommendations for improving use of Cultural Access Licences.*

9 Meeting the future needs of communities

Ensuring there is sufficient water to meet towns' water requirements is a critical component of water sharing plans. In the Plan, water for town water supply purposes is provided as local water utility access licences and regulated river (high security) [town water supply] access licences.

The regulated river provides water for towns and communities, including Balranald, Jerilderie and Jugiong. Town water supply needs are also met through Coleambally and Murrumbidgee Irrigation, where water provided from the regulated river to the irrigation supply networks provides water for Griffith, Leeton, Yanco, Wamoon and Yenda. Regional water schemes in the Plan area, including Goldenfields Water and Riverina Water, supply water for towns including Lockhart, Holbrook, Wagga Wagga, Temora, West Wyalong and Young. These schemes have been historically fed water via groundwater entitlement with some additional water provided by the regulated river. However, there are indications this pattern of water supply and use may shift to a greater reliance on surface water from the regulated river in future (**Section 9.3**). **Figure 8** shows the councils and irrigation corporations holding access to regulated river entitlement.



Notes:

- Queanbeyan's town water is supplied by Icon Water from the ACT water supply scheme. No local water utility entitlements are held for the town of Queanbeyan.
- Excludes town water supply entitlements of less than 100 ML held by Edward River, Carrathool, Hilltops and Coleambally Irrigation Co-operative limited.

Source: Department of Planning and Environment water licence database

Figure 8: Town water entitlements in the Murrumbidgee region[372]

372 DPE (2022) *Draft Regional Water Strategy – Murrumbidgee strategy*

A total of 16 town water licences have been issued in the Plan (**Appendix 4, Table 9A-1**). The total volume that may be extracted by these licences is 43,585 ML.[373] This represents approximately one percent of the total share component on issue, and as such, is typically a very small proportion of water allocated and supplied by the Plan.

This chapter outlines key issues around town water supply identified in the review, including that:

- there is stakeholder uncertainty around temporary water restriction orders (**Section 9.1**)
- river operation changes and a drying climate places some communities at risk, particularly Jerilderie, Jugiong and Wanganella (**Section 9.2**)
- town water supply entitlement for Riverina Water may need to be reassessed to ensure continuity of supply (**Section 9.3**).

9.1 There is stakeholder uncertainty around temporary water restriction orders

The rules and requirements applicable to supply town water are set out in the Act,[374] the Regulation[375] and the Plan. Under Section 58(1) of the Act local water utility licences are to be given priority in water sharing arrangements over other licenced usage. During consultation, stakeholders raised concerns regarding the prioritisation given to local water utility licences, with a perception that regulated river (high security) access licences had greater certainty than utility licences. The Commission reviewed gazettes from 2004 to the current period and noted the following:

- 10 November 2006 to 19 August 2011:[376] the Plan was suspended with temporary water restrictions put in place for regulated river (high and general security) access licences,[377] and trading restrictions (limiting 71T and 71Z) placed on local water utility licences.
- 26 July 2007: temporary water restrictions were introduced limiting regulated river (high and general security) access licences to 0 percent of the volume of water in allocation accounts.
- 25 June 2009: temporary water restrictions changed to limit take of water to no more than 60 percent of water credited to an allocation account for regulated river (high and general security) access licences, and imposed council water restrictions as per Section

373 The total volume of water entitlement issued for town water supply purposes (including local water utility access licences and regulated river (high security) access licences has not changed across the 2016 and 2022 versions of the Plan.

374 See Section 56 (access licences), Section 57 (categories of licence), Section 58 (priorities between different categories of licence), Section 60 (rules for making an available water determination), Section 63 (determine of applications), Section 66 (conditions of access licence generally), 71M (transfer of access licences), Section 104 (duration of approval), Part 2, Division 1, Section 13 and 14 (conversion of local water utility entitlement and approvals) of the Act.

375 See Division 1 (includes direction on categories of licences, specific purpose access licences, available water determinations), Part 4 Irrigation Corporations (a number of Irrigation Corporations supply town water in the Murrumbidgee Plan) of the Regulation.

376 The gazette switched the operation of the Plan rules whereby prioritisation under Section 60(1) of the Act do not apply, introducing distribution rules under 60(3). The Commission notes that, under these distribution rules, priority is given to (a)(i) water for domestic purposes for users exercising basic landholder rights and (ii) water for domestic purposes or essential town services authorised by an access licence. These distribution rules place taking of water for domestic supply and town water supply above other regulated river water users.

377 An update of the temporary water restriction was introduced on the 17 November 2006 changing the restriction from a percentage of the volume in an allocation account to a fraction of a share component in regulated river (high and general security) access licences.

137 of the *Local Government (General) Regulation 2005* where water is taken for domestic purposes under an access licence or a basic landholder right.

- 19 August 2011: the suspension of the Plan was repealed.

The Commission does not have full transparency around the restrictions put in place by the *Local Government (General) Regulation 2005* across the Plan area in 2009. This is due to restrictions occurring at an LGA level, with actions being difficult to trace across all councils and utilities. However, the gazette states that it is a requirement to '[apply] *the more limited restriction'* of water used for domestic purposes. Under this requirement, it may be that a restriction of greater than 60 percent[378] of water in a local water utility account may have been applied in 2009 as a result of the gazette. This is in line with the feedback from local water utility access licence holders during the Plan review. Town water utility licence holders indicated that, as a result of restrictions put in place during the 2009 period, they had purchased regulated river (high security) access licences to diversify their water supply risk and offset any uncertainty around water restrictions occurring as a consequence of Ministerial discretion.

The Commission supports placement of restrictions on access licences in order of licence priority, as stipulated in Section 58 the Act.[379] While the Commission recognises that Section 58(3) of the Act allows for a reprioritisation for water licence categories, this has not been implemented in the Plan. As such, the priorities outlined in Section 58(1) of the Act should be met by the Plan.

To avoid ongoing stakeholder uncertainty the Commission would support providing clarity within gazettal orders where temporary water restrictions are imposed on water taken for domestic purposes under access licences or basic landholder rights. This would avoid any reductions in access that are inconsistent with the supply of water and prioritisation outlined in the Act and the Plan.

The Commission recognises that town water supply requirements are reserved to improve reliability of this water as 'higher priority needs' as part of the water allocation process.[380] The Commission has undertaken analysis of the allocations process as part of its review (see **Chapter 6**) and supports improvement to the allocations process as an additional means to ensure improved reliability of higher priority needs and town water supply.

Recommendation R23 – Priority 1
To support the prioritisation of water for town water supply, the Water Group should ensure that any temporary water restrictions imposed on water taken for domestic purposes under access licences or basic landholder rights are clearly articulated in gazettal orders to avoid reductions in access that are inconsistent with the supply of water and prioritisation outlined in the Plan and Act.

378 Noting that a 60 percent temporary water restriction was applied to regulated river (high and general security) access licences in the 25 June 2009 gazette.
379 See Section 58 of the Act regarding prioritisation of licences.
380 DPE (2022) *Water Allocation Methodology – Murrumbidgee Regulated River Water Source*

9.2 River operation changes and a drying climate place some communities at risk

To assess future risks to town water supply, the Commission reviewed shortfall information associated with the Draft *Regional Water Strategy*.[381] The shortfall[382] assessment provides an analysis of surface water entitlement reliability under different climate scenarios. It is recognised that the assessment of town water shortfalls has limitations, as current modelled data cannot consider risks to future town water supply drawing on groundwater to meet town water requirements, or where town water supply needs are meet by the irrigation schemes, including Griffith.

According to the shortfalls assessment, issues with supply of adequate water under a dry climate scenario may be experienced by Jerilderie, Jugiong and Wanganella.[383] The Commission understands that town water supply for Jerilderie and Wanganella will be impacted by the Yanco Creek Modernisation Project. This SDLAM Project will replace the Wanganella Weir with a fully automated regulator, potentially resulting in improvements to town water management where this is delivered to the weir/regulator.[384]

The Commission is aware that this project may impact the volumes required to be delivered to weirs or result in change in delivery efficiencies. Regardless, there is a need for WaterNSW and the Water Group as operators and decision-makers to recognise the risks in maintaining town water supply to the communities of Jerilderie, Jugiong and Wanganella under a drying climate, and ensure the secure provision of water to these communities as a priority. This is particularly critical given feedback received by the Commission that WaterNSW, as the river operator, has been diverting water away from Yanco Creek and Billabong Creek to meet end of system targets more efficiently (**Chapter 7**). The Water Group may wish to consider that, in conjunction with the Yanco Creek Modernisation Project, operational flow rules be developed for Yanco Creek to ensure the ongoing prioritisation of delivery of water for town water supply purposes.

These river operation changes will have significant impacts on meeting town water supply requirements for communities along these waterways, with greater risks to communities under a drying climate. Diversion of flows away from Yanco and Billabong Creek will also affect water quality along these tributaries. This will impose greater costs upon councils required to treat water to meet drinking water standards where alternative water supply is not available. It may also result in water being unavailable to the regional water supply schemes. There is evidence that this may already be occurring under current arrangements in the Plan, with Riverina Water indicating that at times it cannot draw from Colombo Creek,

381 The Commission reviewed information as part of the Safe and Secure Water Program. The Safe and Secure Water Program consider issues and risks across: **water security** – including water availability and future risk to water supply with climate change; **water quality** – the presence or absence of water infrastructure that impacts on public health outcomes such as lack of filtration equipment on surface water treatment facilities reducing the quality of water; **environment** – risks to human health or the environment due to sewage management. The risk rankings assigned by the Safe and Secure Water Program aim to prioritise projects that address the highest risk to town water supplies. Given water quality and environment risks consider aspects that cannot be addressed by the Plan, such as infrastructure and sewage management respectively, the Commission focused its assessment of risks to town water supply in information developed for the Draft *Regional Water Strategy*.

382 Shortfalls are measured by the number of days where a town's surface water supply is less than its water demand. Here the analysis uses the following percentages: 10 percent, 25 percent, 50 percent and 75 percent as thresholds to show how much demand was not met. Taken from DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling* p. 12.

383 *Ibid.*, pp. 55-56.

384 DPE (2022) *Yanco Creek Modernisation Project Overview*

to supplement water supply in the Urana to Oakland network due to blue green algal issues.[385]

Assessments in the Draft Murray and Murrumbidgee Regional Water Strategies do not indicate significant shortfall risks for Balranald water supply.[386] However, during periods of low flow in December 2018 to May 2019, water quality of the Murrumbidgee River at Balranald deteriorated significantly leading to algal blooms and fish kills.[387] This resulted in additional water treatment requirements for Balranald water treatment plant to maintain a potable water supply, at significant cost to the Council.[388] While not subject to demand shortfalls, it is anticipated that low flows and water quality events may occur more frequently under a drying climate (see **Chapter 4** for further discussion of climate change projections).[389] Water quality impacts to Balranald weir that may be addressed by changes to flow Plan rules are further discussed in **Chapter 7**.

9.3 Riverina Water town water supply entitlement may need to be reassessed

Riverina Water supplies water across the LGAs of Wagga Wagga City Council, Lockhart Shire Council and parts of Federation and Greater Hume Council (**Figure 9**). Historically the regional water scheme has primarily drawn water from groundwater entitlements to meet town water supply requirements. However, the regional water scheme recently switched this balance to draw predominantly on its surface water entitlement, 'topping up' the difference in water supply requirements using groundwater entitlement.[390] The groundwater source is considered fully allocated and any future growth in town water requirements for Wagga Wagga and the Riverina Water supply network would need to be met by the Plan. At the current time, Riverina Water considers that groundwater entitlement will continue to be the predominant water supply source.[391]

The Department of Defence is managing PFAS contamination at the Forest Hill RAAF base. This is being managed across local and NSW Government agencies, including Riverina Water, Wagga Wagga City Council, the NSW Environment Protection Authority, NSW Department of Climate Change, Energy, the Environment and Water, and NSW Health.[392] Contamination occurred at the RAAF base due to use of firefighting products containing PFAS. Use of these products by the Department of Defence was phased out in 2004.[393] The Department of Defence has been monitoring the movement of PFAS in the groundwater from the RAAF base.[394] Early predictions indicated PFAS may reach Riverina Water's supply bores in the next 50 years.

385 Interview: Utilities, 19 September 2023.
386 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*
387 Submission: Balranald Shire Council, received 4 October 2023.
388 *Ibid*.
389 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*, p. 12.
390 As advised by Riverina Water, 7 February 2024. Riverina Water has 14 GL of entitlement from the alluvial groundwater source and 7 GL of surface water entitlement in the Plan.
391 As advised by Riverina Water, 7 February 2024.
392 Riverina Water (2023) *PFAS - An important update to our community - Riverina Water Chief Executive Officer Andrew Crakanthorp*
393 *Ibid*.
394 The Department of Defence completed investigations on PFAS contamination in 2018, with sentinel monitoring wells installed on and around the RAAF Base Wagga to detect further movement of PFAS. As advised by Riverina Water, 7 February 2024.

In August 2023, as part of the Department of Defence PFAS monitoring program, low levels of PFAS were detected at two sentinel groundwater monitoring wells approximately 650 metres from the Riverina Water East Wagga borefield.[395] Following this detection, Riverina Water conducted sampling at the East Wagga, West Wagga and North Wagga borefields. A positive PFAS detection occurred at a West Wagga bore. Given the distance of the West Wagga bore from the RAAF base, the cause of the positive detection is undergoing investigation.

Riverina Water is managing PFAS levels within the Australian Drinking Water Guidelines. The detection at the West Wagga bore of 0.015-0.02 µg/litre is below the guidelines for PFAS concentration of 0.07 µg/litre for potable water.[396] Where PFAS concentrations cannot be managed below the guidelines, alternative approaches may be required. This may involve the introduction of additional water treatment technologies to reduce PFAS concentrations or identification of alternative water supply sources. As groundwater sources are fully allocated, this would require access to additional surface water entitlement.

There are no current risks to the safety of town water supply[397] but it may be necessary to reassess town water supply water entitlement. Section 66 of the Act allows for:

- Section 66(3) - variation of a local water utility access licence to reflect variation in population
- Section 66(4) – Minister may at any time increase the utility's entitlement to water.

Given PFAS migration is occurring earlier than anticipated, the Commission supports an assessment of Riverina Water's town water entitlement requirements as a priority. This will ensure that there are no shortfalls experienced across the communities serviced by the Riverina Water supply network in the event of ongoing migration of the PFAS contamination, where PFAS concentrations cannot be practically managed below the Australian Drinking Water Guidelines.

395 Commonwealth Defence (2024) *PFAS detections at Wagga Wagga*
396 Riverina Water (2023) *PFAS - An important update to our community - Riverina Water Chief Executive Officer Andrew Crakanthorp*; National Health and Medical Research Council (2011) *National Water Quality Management Strategy. Australian Drinking Water Guidelines 6*. Last updated 2022.
397 Riverina Water (2023) *PFAS - An important update to our community - Riverina Water Chief Executive Officer Andrew Crakanthorp*

Figure 9: Riverina Water supply network[398]

Recommendation R24 – Priority 1
Where PFAS concentrations cannot be practically managed below Australian Drinking Water Guidelines, the Water Group should determine any requirement for additional surface water local water utility access licence entitlement to service the Riverina Water network, with Plan updates to occur following assessment and implementation under the Act.

398 Riverina Water (2020) *Riverina Water Revised Delivery Program 2020/2021 - 2023/2024 and Operational Plan 2020/2021*. See Appendix 4.

10 Improving economic outcomes through trade

10.1 Legislative settings for trade in the Plan

The rules and requirements applicable to access licence dealings, more commonly known as trade[399] are set out in the Act,[400] *Access Licence Dealing Principles Order 2004*, the Regulation,[401] and the Plan.

As identified in the NRC's audit of the southern regulated water sharing plans,[402] the Plan has specific clauses that identify the trades permitted under the Act, i.e., 71O, 71Q, 71R, 71T, 71U, 71V and 71W.[403] However, the Plan is silent regarding restrictions on trades 71N, 71P, 71QA and 71S permitted under the Act.[404]

The Commission notes that there have been changes to the dealings provisions following the 2022 updates to the Plan. The specifics of these changes to Plan provisions are outlined in **Appendix 5, Table 10A-1.** Analysis of these changes indicates they did not introduce any additional Plan specific guidance on 71N, 71P, 71QA and 71S trades but that the 2022 Plan provides:

- greater clarity on prohibition of 71O and 71R trades
- potentially greater restriction on 71T trades due to the requirements that must be met prior to a trade being permitted
- potentially reduced restrictions on 71V trades.

10.2 Trade is a significant contributor to economic outcomes in the Plan

Across the Basin, there has been significant growth and activity in water trading. Whole-of-Basin markets have an annual average value of more than $1.8 billion per year, against an underlying value of entitlements of approximately $30 billion.[405]

Allocation prices in the Basin reflect seasonal conditions, where reduced water availability triggers an increase in the value of any allocation trades (as demonstrated in **Figure 10**). The value of Basin entitlement trades does not track seasonal conditions, instead it shows ongoing growth in the value of water licences (**Figure 11**). Against a backdrop of the rising

399 NSW legislation refers to access licence dealings, more commonly referred to as trade. Given dealings terminology is less recognised by stakeholders the Commission has referred to dealings throughout this chapter as trades.
400 See Division 4 of the Act.
401 See Section 12 and 13 of the Regulation.
402 Natural Resources Commission (2023) *Audit of the implementation of the Lachlan, Murrumbidgee and Murray regulated water sharing plans*
403 71O – conversion of access licence to new category; 71Q – assignment of rights dealings; 71R –- amendment of share component dealings (change of water source); 71T – assignment of water allocation dealings; 71U – interstate access licence transfer; 71V – interstate access licence assignment of water allocation; 71W – nomination of water supply works dealings. See Clauses 52 to 57 of the Plan.
404 71N – term transfers of entitlements under access licences; 71P – subdivision and consolidation of access licences; 71QA – assignment of individual daily extraction components; 71S – amendment of extraction component of access licences. See Clauses 52 to 57 of the Plan.
405 Quinlivan, D. (2022) *Water market reform: final roadmap report*

value of water, there is an overarching trend for increasing participation by irrigated industries in water markets.[406]

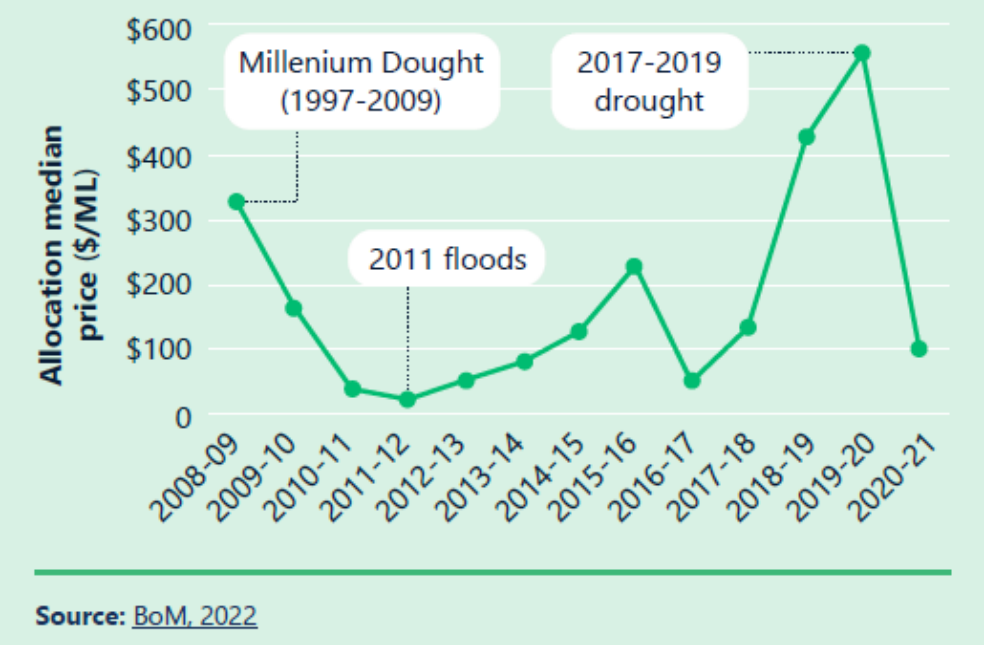


Figure 10: Annual median allocation prices (surface and groundwater) in the Murray-Darling Basin[407]

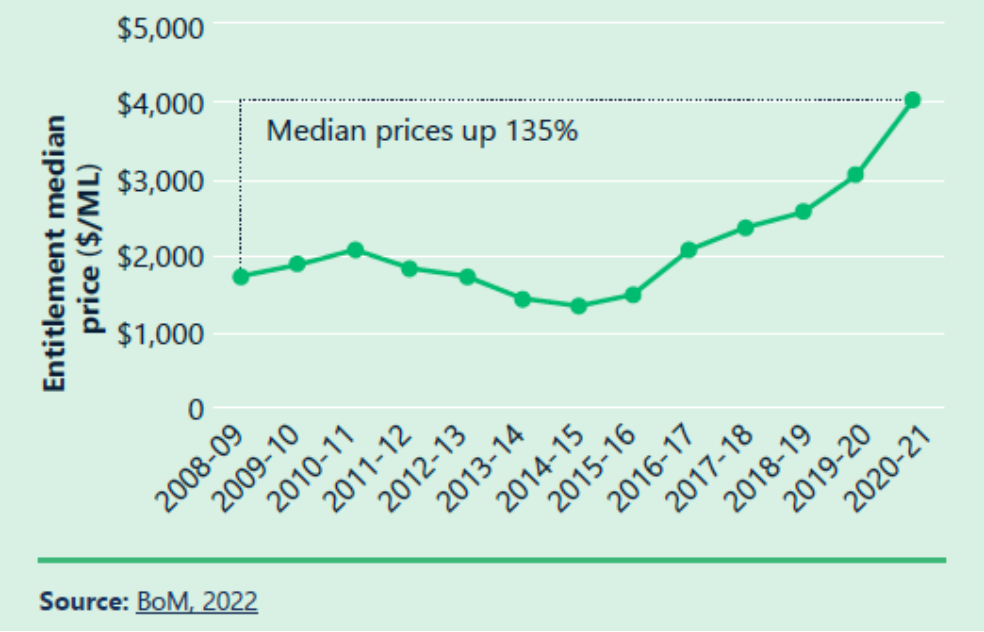


Figure 11: Annual median entitlement prices (surface and groundwater) in the Murray-Darling Basin[408]

406 Downham, R. and Gupta, M. (2021) *Trends in water entitlement holdings and trade: Analysis of ABARES survey data*, ABARES research report.

407 Aither (2022) *Murray-Darling Basin Social and Economic Conditions Report – A report prepared for the Murray Darling Basin Authority*.

408 *Ibid.*

Most of the trade in the Basin occurs in the southern connected system (**Figure 12**). Of the trades permitted under the Act and the Plan, only 71P, 71Q, 71T, 71V and 71W trades occurred for the period 2016- 2021 (**Table 3**).[409] Of these trades the most frequent trades were:

- 71T – assignment of water allocations (temporary transfer, within the Plan area)
- 71Q – assignment of rights (permanent sale of water entitlement)
- 71V – interstate assignment of water allocations (temporary transfer, interstate trade)

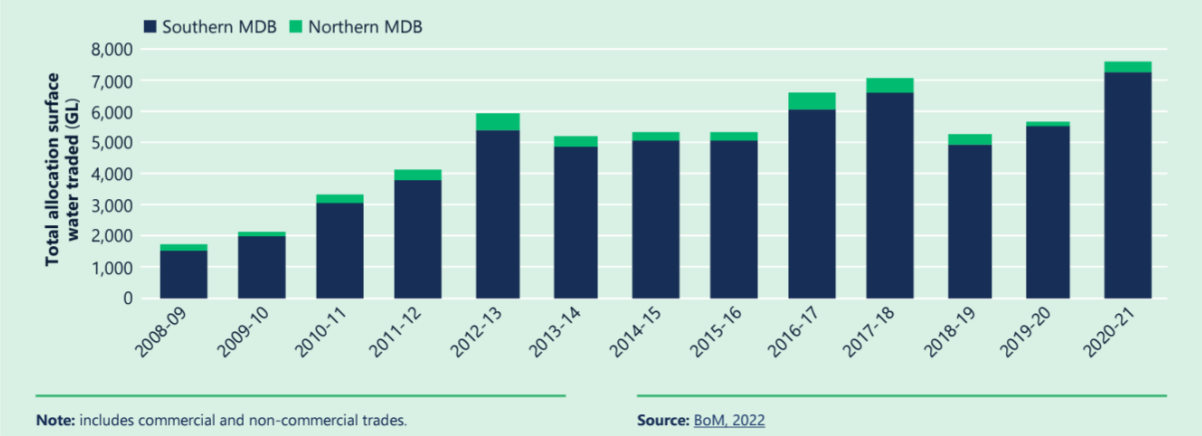


Figure 12: Total annual allocation trade volumes in the Murray-Darling Basin (2008-2009 to 2020-2021)[410]

Table 3: Number of dealings in the Plan

Dealing type*	Number of trades (to 2021)[411]	Number of trades (to 2023)[412]
71P	34 dealings	
71Q	395 dealings	
71T	7,377 dealings	10,390 dealings
71V	259 dealings	281 dealings
71W	88 dealings	

*Note dealing tyle 71O, 71R, 71S, 71U, 71N and 71M had no trades.

Overall, stakeholders were broadly supportive of the Plan's trade arrangements:

> *'Annual allocation trade, including [Intervalley Trade] IVT, within justified limits, has allowed water to move between uses via a market mechanism supporting economic outcomes in both the Murrumbidgee and Murray Valleys.'*[413]

409 Trade data to trade type was only provided for the period to June 2021 due to reported limitations of the Water Licensing System (WaterNSW, Personal Communication, 25 October 2023). Data provided for the audit of the southern valleys was manually edited by WaterNSW to provide data to the permanent trade type. The Commission is of the view that data to 2021 provides sufficient indication of trades occurring in the Plan area and identify any limitations of current trading arrangements.

410 Aither (2022) *Murray-Darling Basin Social and Economic Conditions Report – A report prepared for the Murray Darling Basin Authority*

411 As per trade data provided by WaterNSW to June 2021. See also footnote 443.

412 As per trade data provided by WaterNSW to June 2023. See also footnote 443.

413 Submission: Coleambally Irrigation Co-operative Limited, received 29 June 2023.

The Australian Competition and Consumer Commission (ACCC) has called for broad reforms to water markets across the Basin (**Box 3**). Since that time, a roadmap has been developed to guide the Australian Government on water reform implementation.[414] The Commission broadly accepted the ACCC recommendations and has not sought to revisit these reforms. The Commission has previously identified support for changes to water markets that improve transparency, avoid restrictions on trade where this is deemed inefficient, and better reflect the actual physical constraints of delivery of water associated with water trade.[415]

Box 3: Summary of the ACCC review of water markets[416]

In August 2019 the Australian Government directed the ACCC to conduct an inquiry in to markets for tradeable water rights in the Murray-Darling Basin.

In March 2021 the ACCC released its final report, finding significant deficiencies in current water trading arrangements and the agricultural industries that depend on these markets across the Basin. The ACCC detailed 29 recommendations for water market reform and 70 proposed actions to improve water market effectiveness. The recommendations focused on four key themes:

- **Governance of the Basin water markets** – the rules and processes through which decisions relating to water trade are made and implemented and form the basis of regulation of water markets; and the organisations with roles and responsibilities for development of water market rules, their implementation and regulation.
- **Market integrity and conduct** – introduction of a mandatory code of conduct for water markets to include integrity protections such as price reporting requirements, and prohibitions such as market manipulation and insider trading.
- **Trade processing and water market information** – identifying there is a need to improve the quality and flow of market data to provide market participants with the information they require to make trading decisions.
- **market architecture** – addresses the overlap between water markets and river operations to provide price signals to market participants on the costs of trade, including better reflecting conveyance losses resulting from trade and improved guidance to river operators on managing competing priorities for water delivery.

Findings raised by the ACCC align and go beyond those issues previously raised by the Commission as part of our water sharing plan reviews.

Following the ACCC inquiry, Mr Daryl Quinlivan was appointed as the Independent Principal Adviser to develop water market reforms having regard to the ACCC report and recommendations. The roadmap has outlined reforms that align closely with the ACCC recommendations or an alternative approach to suggested reforms where this was deemed to be more cost effective or implementable, such as avoiding the establishment of an additional water management agency.

414 Quinlivan, D. (2022) *Water market reform: final roadmap report*
415 Natural Resources Commission (n.d.) *Water Sharing Plan Reviews – completed reviews*
416 ACCC (n.d.) *Murray-Darling Basin water markets inquiry 2019-21 – project overview*; Quinlivan, D. (2022) *Water market reform: final roadmap report*; ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*; Natural Resources Commission (n.d.) *Water Sharing Plan Reviews – completed reviews*

10.3 Minor reforms are required to trade approval

Over the period 2016-2023 the volume of water traded within the Plan area via 71T was significant at 8,827,228 ML.[417] A slight majority of 71T trades (53 percent of the total volume traded) were for regulated river (general security) access licences, with supplementary water access licences the next most common category at 28 percent (**Figure 13**).

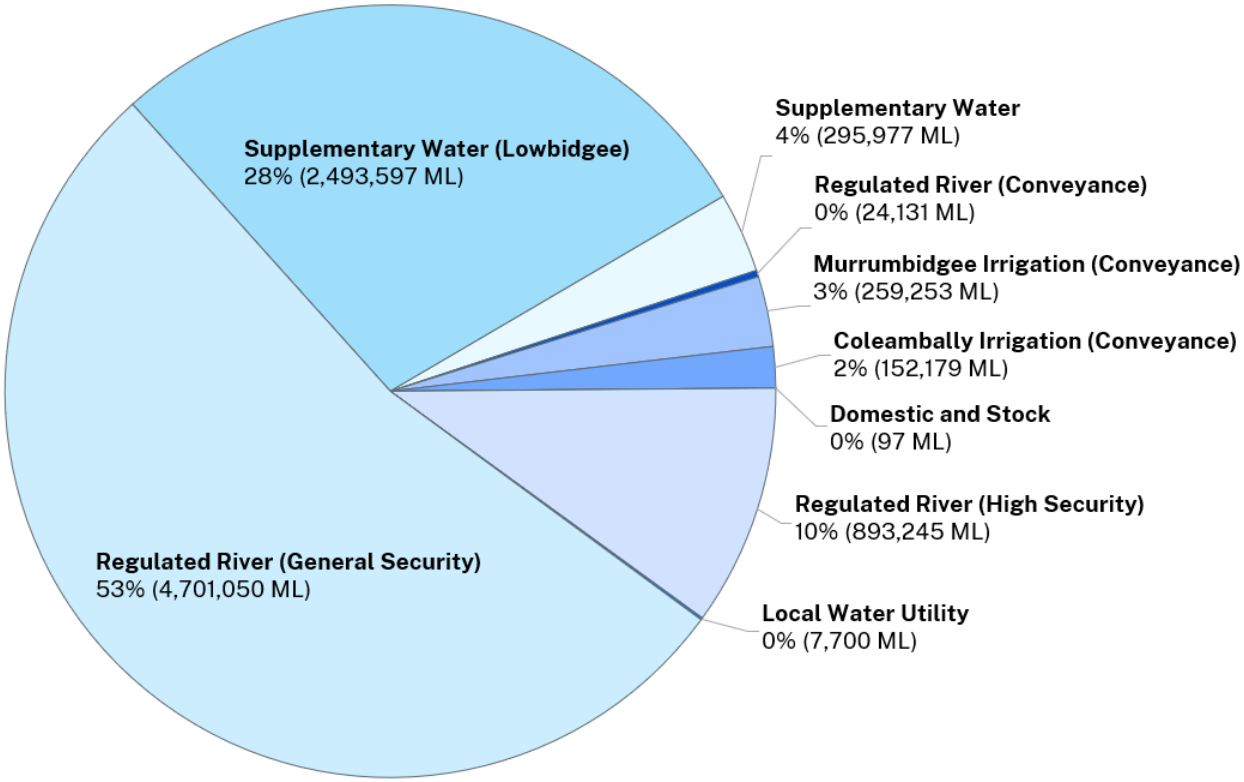


Figure 13: Total volume of 71T trades 2016-2023 by licence category[418]

The Commission did not hear significant stakeholder feedback indicating issues with intravalley allocation trades in the Plan. The substantial movement of water via 71T over the 2016-2023 period, and the significant number of individual trades this represents (**Table 3**) indicates that intravalley allocation trades are largely performing well and supporting economic outcomes in the Plan.

In the Plan audit, the Commission raised that, under current approvals and administration requirements for 71T trades, there is a risk of insufficient balance at the time of the temporary trade occurring.[419] While the licence procedure manual highlights that at the time of the 71T trade the account balance needs to be checked, it is not a requirement that an account balance is reconciled to ensure there is sufficient balance at the time of a trade.

The Commission would support the introduction of a Plan provision that requires mandatory account balance reporting and verification at the time of an allocation trade approval (71T)

417 As per trade data provided by WaterNSW to June 2023.
418 *Ibid.*
419 See Observation 8.1 and Suggested Action 8.1 of Natural Resources Commission (2022) *Audit of the implementation of the Namoi, Gwydir and Macquarie regulated water sharing plans – final report*

to avoid water licence holders holding insufficient balance and therefore going into a negative account balance.

Stakeholders also raised the consideration of conveyance losses as water shifts from upstream to downstream use within the valley. The Commission understands that the current approach to conveyance losses with intravalley trade is for these losses within the system to be shared amongst water users.[420] While this may represent a source of inequity in the Plan, potential approaches to capture losses are at present hampered by the inability to accurately measure losses, impacting implementation.[421] As information and data availability improves, this may warrant future consideration.

Recommendation R25 a) – Priority 2

To improve economic outcomes through trade, the Water Group should include a provision that requires mandatory account reconciliation prior to approval of a water allocation trade (71T), to ensure sufficient account balance or avoid accounts going into a negative account balance.

10.4 Constraints impacting IVT should be reviewed to improve efficiency of trade arrangements

While not as substantial as intravalley trades, 71V trades (interstate allocation trades)[422] represent a substantial volume of water, with a total of 62,937 ML traded over the 2016-2023 period.[423] **Appendix 5, Table 10A-2** provides a full list of interstate trades permitted in the Murrumbidgee.

Trades under 71V are subject to requirements under the Murray Darling Basin Agreement[424] and IVT procedures. The Commission was unable to obtain a copy of the IVT procedures from the Water Group for the review. The Water Group indicated that the Murrumbidgee IVT procedures will remain in their current form, with potential improvements incorporated in the MDBA Schedule D Review, which is due to be finalised and published in early 2024. Any subsequent changes to the IVT procedure will occur on a trial basis following approval of the Basin Officials Committee. Changes to the Plan would occur post a successful trial period.[425]

Interstate trading of allocation to and from the Plan area is permitted due to the Murrumbidgee falling within the southern connected system (**Figure 14**).

420 ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*
421 *Ibid.*
422 Trade across Plan boundaries.
423 As per trade data provided by WaterNSW to June 2023.
424 Schedule D of the Murray Darling Basin Agreement (provided in Schedule 1 of the *Water Act 2007*) outlines rules for transferring water entitlements and allocations.
425 As advised by DPE-Water, 12 December 2023.

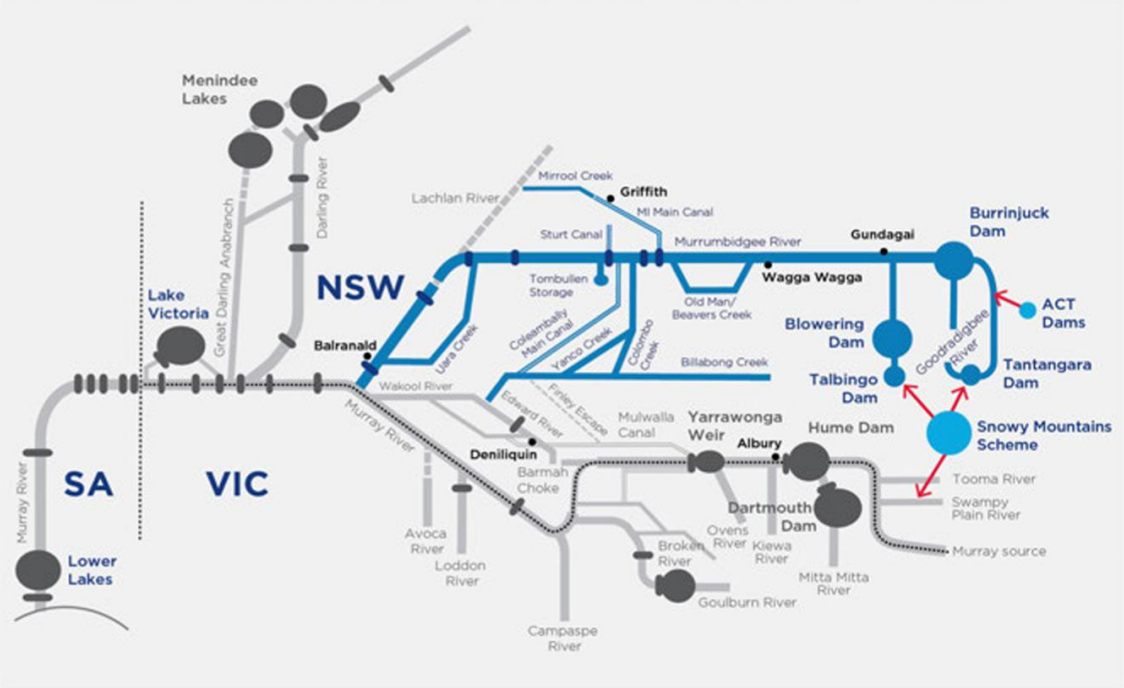


Figure 14: Schematic of the southern connected system[426]

Within the southern connected system, there are unique trading zones where water allocations can be traded in the Murrumbidgee, NSW Murray, Lower Darling, Victorian and South Australian regulated river water sources.[427] One of the trade restrictions in these trading zones is the Murrumbidgee IVT Limit, which restricts trade between the Murrumbidgee and NSW Murray regulated river water sources.[428]

The IVT account reflects the net balance of surface water volume that was a temporary trade (71V) or a tagged trade out of the Plan at any point in time and that is therefore still owed to the Murray plan.[429] When water is traded out of the Plan to the Murray plan, Murray River operators (the MDBA) meet the requirements of the volume traded and delivered in the Murray system, via Murray River water. The MDBA then holds a balance sheet of the water 'borrowed' by the Plan and can call on this water at a later date. The MDBA uses the IVT accounts to meet water demands within the Murray system during periods of peak demand. This typically occurs between October and April and reduces the reliance on Murray River dam storage to meet water deliveries. By calling on water during peak periods, the MDBA helps manage water supply constraints in the Murray, particularly the Barmah Choke.[430]

Temporary trade between the Murrumbidgee and Murray plans is dependent on the following IVT account balance triggers:

- trade of water out of the Murrumbidgee Plan:
  - Closed: 100 GL
  - Open: 85 GL
- trade of water into the Murrumbidgee Plan:

426 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee strategy*
427 *Ibid.*
428 *Ibid.*
429 NSW Government (2018) *Murrumbidgee Inter-Valley Trade Account (IVT) – Fact sheet*
430 *Ibid.*

- Closed: 0 GL
- Open: 15 GL.[431]

The upper limit of 100 GL is the currently understood volume of water that can be physically transferred out of the valley via Balranald, in one year, without incurring excessive transmission losses.[432] The lower limit of 0 GL is due to the inability to readily deliver water upstream from the Murray to the Murrumbidgee.[433]

The IVT account balance may increase through:

- trade of water out of the Murrumbidgee Plan
- physical delivery of water from the Murray to the Murrumbidgee (Billabong Creek) using Murray Irrigation Limited infrastructure.

The IVT account balance may decrease through:

- trade of water into the Murrumbidgee Plan
- physical delivery of water to the Murray from the Murrumbidgee via Balranald.

In addition, the IVT account balance may increase or decrease due to changes in the Required Annual Release[434] delivered by Snowy Hydro Limited. These changes have only historically occurred in exceptional circumstances.[435]

The ACCC examined issues related to IVT as part of its Murray-Darling Basin water markets inquiry report,[436] and found:

- IVT limits do not adequately cap or restrict the volume delivered from an IVT account
- there is greater demand for IVT than currently permitted under IVT restrictions, and it is unclear whether current IVT settings represent the most suitable mechanism to manage third party impacts
- trade processing favours water users/traders with the most up to date IT systems, which may not provide equitable access to IVT opportunities
- ability to undertake tagged trade undermines existing IVT restrictions and creates inequitable access to IVT
- IVT water delivery issues require greater consideration including guidance for river operators managing delivery risks
- there needs to be improved understanding and management of conveyance losses in managing IVT accounts.

These issues correspond with stakeholder feedback, including:

- support for the removal of tagged trades from interstate trading exemptions[437]

431 NSW Government (2018) *Murrumbidgee Inter-Valley Trade Account (IVT) – Fact sheet*
432 WaterNSW (n.d.) *Murrumbidgee IVT*
433 It is understood that water can be delivered from the Murray to the Murrumbidgee via Murray Irrigation infrastructure. However, this reportedly occurs very occasionally, and is subject to agreement (NSW Government (2018) *Murrumbidgee Inter-Valley Trade Account (IVT) – Fact sheet*).
434 Section 12 of the *Snowy Water Licence*
435 NSW Government (2018) *Murrumbidgee Inter-Valley Trade Account (IVT) – Fact sheet*
436 ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*
437 *IRN submission* to the WRP process; *Coleambally Irrigation Co-operative Limited submission* to the WRP process

- improved transparency of trade limits and whether there is scope for them to be updated[438]
- support for IVT restrictions to be codified in the Plan, with stakeholders to be consulted on any changes to trade limits[439]
- ensuring that hydrological connectivity and needs of the environment are considered in interstate trades.[440]

Of the issues listed by the ACCC and stakeholders, the Commission considers that the removal of tagged trade sits outside the scope of this review.[441] However, for all other issues noted above there is scope for further improvement as part of the Water Group's IVT procedures or within WaterNSW's existing roles and responsibilities as they manage IVT processing. These issues are discussed further below.

The ACCC report raised that brokerage firms have developed strategies to aggregate water rights on brokers' accounts prior to IVT openings (**Figure 15**). This facilitates faster submission of trade applications, minimises clients' transaction costs, and increases the likelihood of a higher percentage of clients' trades being approved prior to the trade limit being reached. This led to more than half of all water traded out of the Murrumbidgee in the 2019-2020 water year (to 30 November 2019) coming from brokers' accounts.[442] The Commission has not analysed recent accounts to determine the extent to which this practice is continuing in the Murrumbidgee. However, given there has been no significant shift in IVT administration and processing by WaterNSW, whereby a system of first come, first served processing of trade continues, brokerage strategies would likely continue to succeed where implemented.

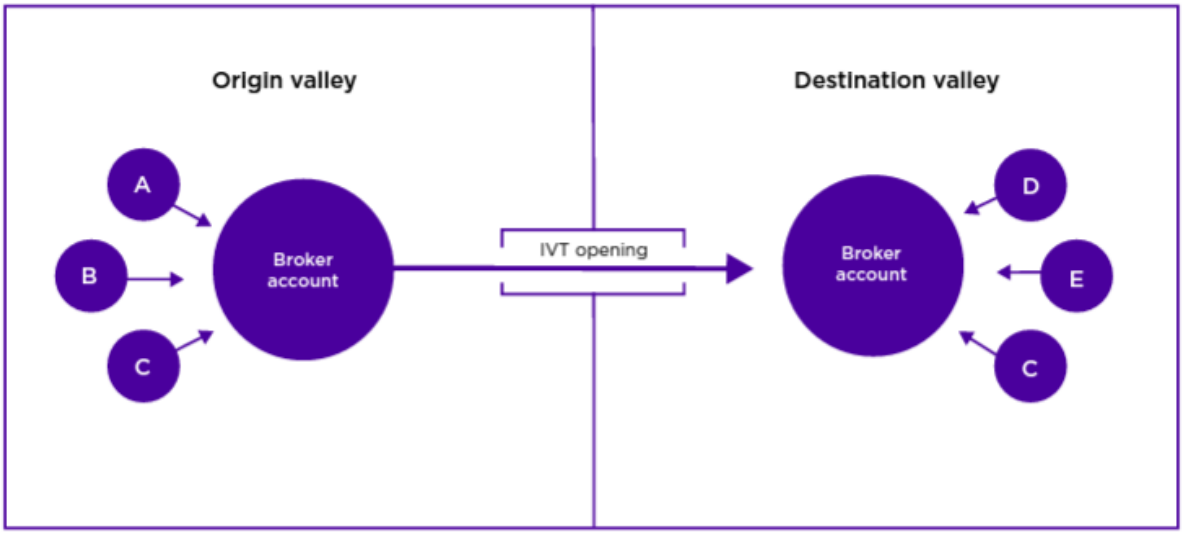


Figure 15: Visual representation of aggregation of water rights by brokerage firms through an IVT opening[443]

438 Submission: Murrumbidgee Irrigation Ltd, received 7 July 2023; *AgnVet submission* to the water resource planning process; *CEWO submission* the water resource planning process.
439 Submission: Coleambally Irrigation Co-operative Limited, received 29 June 2023; *IRN submission* to the water resource planning process; *AgnVet submission* to the water resource planning process.
440 *CEWO submission* to the water resource planning process.
441 The removal of tagged trade exemptions formed part of the changes enacted via the *Water Amendment (Restoring Our Rivers) Bill 2023*. The *Water Amendment (Restoring Our Rivers) Act 2023* commenced on the 7 December 2023. The Act made changes to the *Water Act 2007* and *Basin Plan 2012*. Taken from Commonwealth DCCEEW (n.d.) *Restoring our Rivers Act 2023*
442 ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*
443 *Ibid.*

WaterNSW reviewed the IVT application and assessment approach in 2021,[444] resulting in changes to WaterNSW trade processing arrangements.[445] Stakeholder feedback indicated that the processing improvements have been minor, with changes focused on greater transparency of the IVT account balance. It was perceived that traders with the best IT systems are still the most capable of accessing interstate trade opportunities.[446]

The significant volume of interstate (71V) trades was recognised in the ACCC report, which indicated that IVT trades have grown to a substantial volume, beyond what was anticipated when the southern connected systems were established.[447] Also observed was:

- improved water quality outcomes with the large volumes of water from intervalley transfers, as high flows mean that stratification is unlikely to develop in the lower Murrumbidgee weir pools[448]
- a potential for large water deliveries with IVT to create environmental impact. While it is noted that environmental pressures are less in the Murrumbidgee than in other reaches in the southern connected system, the potential for damage needs to be considered in design of market architecture.[449]

The Victorian Government undertook a review of IVT rules, with final changes to trade and operating rules introduced in June 2022.[450] The refinements to trade rules have resulted in:

- trade opportunities being made available through three fixed announcement timings (1 July, 15 October and 15 December), to be linked to cumulative water use in the water year rather than IVT deliveries
- establishment of operating limits over summer and autumn with 1,100 ML per day base flows and three 3,000 ML per day pulses each water year, with adaptive management to adjust the allowable size of a pulse if required.[451]

The fixed nature of the IVT announcements aims to improve equity of access to IVT trade, while the operating rules aim to minimise impacts of movement of IVT water through the Goulburn River. The changes to trade rules are anticipated to improve river access for recreational uses, improve biocultural outcomes, minimise significant environmental damage, and have positive impacts for water users through reductions in transmission losses and meeting traded demands through unregulated flows.[452] Operating rules were issued to provide guidance to river operators and assist in implementation of these updates for the Goulburn River.

The Commission notes that, while the upper limit of 100 GL aims to minimise excessive transmission losses,[453] these caps are artificial as in many cases the volume called out by the MDBA exceeds the 100 GL volume (**Figure 16**).

444 DPIE (2022) *Draft Regional Water Strategy – Murrumbidgee strategy*
445 WaterNSW (n.d.) *Murrumbidgee IVT*
446 Interview: Coleambally Irrigation, 25 September 2023.
447 ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*
448 Baldwin, D.S. (2019) *Weir stratification and hypoxic water management - Murrumbidgee River 2019*. A report prepared for the CEWH and the MDBA.
449 ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*
450 Victorian Government (2022) *Goulburn to Murray Trade Review – Final report and recommendations*
451 *Ibid.*
452 *Ibid.*
453 WaterNSW (n.d.) *Murrumbidgee IVT*

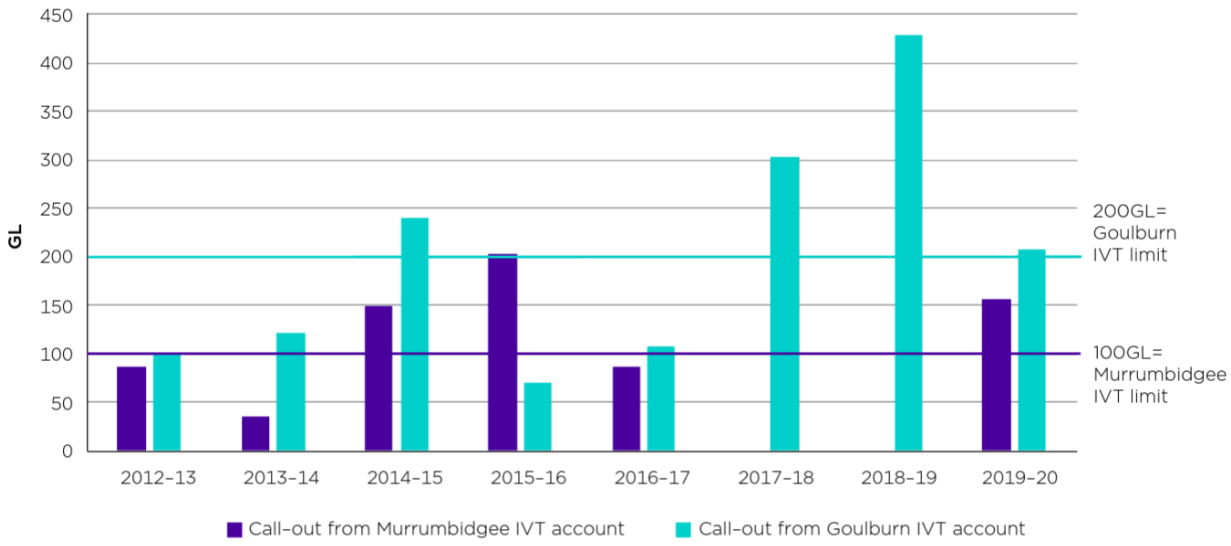


Figure 16: Volumes of call-out from IVT accounts, 2012–13 to 2019–20[454]

This means that under the current Plan and external guidance,[455] there have potentially been third-party impacts[456] through transmission losses. There is therefore an opportunity to reconsider whether the caps on IVT represent the most appropriate mechanism to restrict trade. A review of the administrative requirements is warranted, including whether fixed announcements of IVT water availability may be implementable for the Plan. The introduction of fixed announcement dates for the Plan IVT will improve transparency for water users of upcoming trade opportunities and may overcome some of the existing imbalance between licence holders to take advantage of these trades.

The Commission notes that, in the revision of the arrangements for the Goulburn IVT rules, river operators were provided detailed guidance on the movement and use of IVT water. This is a critical change, given the physical movement of water managing environmental impacts and conveyance losses is the key component of improving current IVT arrangements.[457] The ACCC raised additional options that may warrant consideration including shifting the impacts of conveyance losses on to the Murray system, whereby with an 100 GL cap limit only 95 GL would be available for call out, meaning that the balance of 5 GL would be utilised for conveyance of the water, shifting the 'burden' of the losses to the Murray water users.[458]

Recommendation R25 b) – Priority 2
To improve economic outcomes through trade, the Water Group should consider the need to revise current constraints to IVT (71V), administrative requirements and river operator rules. Where required, the Water Group should update IVT Plan provisions that restrict 71V, and associated procedures documentation.

454 ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*
455 Schedule D, Murray Darling Basin Agreement.
456 Third party impacts such as price signals are not factored in to the costs associated with a trade, for example if water is traded downstream, any conveyance losses are borne across the system.
457 ACCC (2021) *Murray-Darling Basin water markets inquiry – final report*
458 *Ibid.*

11 Reducing the impact of flow constraints on environmental outcomes

A flow constraint is any physical or operational barrier limiting the flow of managed water in river systems.[459] Constraints refer to maximum limits for managed flows, including for managed environmental water along specific river reaches that are caused by:

- operational limitations, including requirements to protect infrastructure and private property from inundation by managed flows and maximise reliability of supply for consumptive use
- physical limitations, such as impacts to physical structures including low-lying bridges and roads (channel capacities), or the rate that water can be released from a storage (release capacities)
- legal liabilities associated with releasing higher environmental flows.

Constraints restrict the maximum flow rate the river operator can release for managed or regulated flows under normal conditions. This operational practice protects landholders from inundation arising from small overbank flows under normal operations. Constraining managed flows leads to fewer low-level inundation events and reduces social and economic impacts associated with these events (**Section 11.3**). It is important to note that constraints do not impact flows occurring associated with unregulated flows or natural flows associated with flooding or uncontrolled flow events.

However, in some cases, the operation of constraints to restrict managed flows means that river operators are unable to release water in a manner that allows for the connection of rivers with their dependent ecosystems, thereby limiting environmental outcomes that can be achieved in the Plan area. HEW cannot be used to generate the overbank flow events required to maintain the health of the river, wetland and floodplain environments.[460]

Consequently, most overbank ecosystems only receive inundation during uncontrolled or unregulated flow events, when flows are beyond river regulation capacities. Over time, overbank environments have been inundated less frequently leading to overall ecosystem decline (**Section 11.2**).[461] In addition, cultural access licenced water cannot be used to create overbank flow events that are required to maximise cultural outcomes.

The Basin Plan required a strategy to relax constraints to allow higher managed flows to improve environmental outcomes.[462] The Constraints Management Strategy identified measures to '*allow environmental water to be used to maximum effect and to maximise the benefits of … held environmental water.*'[463] As part of commitments under the Basin Plan, the NSW Government has developed the Reconnecting River Country program to assess options for relaxing constraints and, subject to funding, proposes to relax constraints to enable higher environmental flows and address adverse social and economic impacts, particularly to riparian landholders (**Section 11.5**).

459 DPE-Water (2023) *Reconnecting River Country Program: Flow options*
460 MDBA (2013) *Constraints Management Strategy 2013 to 2024*, MDBA Publication No. 28/13.
461 DPE-Water (2023) *Reconnecting River Country Program: Flow options*
462 Basin Plan Section 7.08
463 MDBA (2013) *Constraints Management Strategy 2013 to 2024*, MDBA Publication No. 28/13.

11.1 Constraints are listed in a Plan note, not the provisions

Constraints are outlined as 'operating channel capacities' in Clause 73(1) of the Plan. This clause requires WaterNSW to determine and specify the operating channel capacities throughout the water source, in accordance with procedures established by the Minister, after considering the following:

(a) the inundation of private land or interference with access

(b) the effects of inundation on the floodplain and associated wetlands

(c) the transmission losses expected to occur

(d) the capacities of structures in the water supply system.

A note within this clause identifies the operational constraints determined at the commencement of the Plan, as follows:

(a) 9,000 ML per day in the Tumut River at Oddy's Bridge

(b) 9,300 ML per day in the Tumut River at Tumut

(c) 32,000 ML per day in the Murrumbidgee River at Gundagai

(d) 1,400 ML per day in the Yanco Creek at the Offtake.

The identified constraints do not form a binding part of the Plan as they are identified as a Plan note rather than as a Plan provision.[464] In addition, the Commission understands that no procedures have been established by the Minister for specifying these constraints. WaterNSW have revised the maximum operational flow rates to respond to changes in river hydrology or other factors.[465] For example, in 2013, WaterNSW revised the constraint at Gundagai to be 29,560 ML per day and introduced a new constraint at Wagga Wagga of 22,000 ML per day, based on revised rating curve data, assessment of local flooding impacts,[466] and community concerns around inundation.[467]

However, given the significance of any tightening of constraints on the achievability of Plan outcomes, these revisions should be required to be included in the Plan. Plan remakes should include the flow rates and stream gauges for constraint levels as Plan provisions. The Plan should require that any adjustment of these flow rates is applicable only after their incorporation as an amendment to the Plan.

In addition, the Commission notes that WaterNSW's WaterInsights[468] portal currently lists constraints at the locations and flow rates identified in the Plan note. The portal should be updated to reflect the 2013 revised operational limits.

464 Clause 5(8) of the Plan states that '*notes in the text of this Plan do not form part of the Plan*'.
465 For example, in instances where river channel capacity changes due to siltation, or additional third-party risks arise due to increased development on low-lying riparian lands.
466 WaterNSW (2017) *Annual Compliance Report Murrumbidgee 2016-17 Final*, p. 48.
467 Productivity Commission (2023) *Murray–Darling Basin Plan: Implementation review 2023*
468 WaterNSW (n.d.) *WaterInsights portal*

11.2 Relaxing constraints can provide significant environmental benefits

The natural flow regime of the Murrumbidgee River has been significantly changed by river regulation and consumptive water use, leading to fewer overbank flows connecting wetlands and floodplain environments.[469] Under current rules, most of these areas have not received environmental watering frequently enough to maintain ecological condition,[470] leading to ecosystem degradation and direct negative impacts on native flora and fauna.[471]

As lateral connectivity between rivers and wetlands decreases, so too does the ability of aquatic species to move between them, limiting the availability of food and nutrients for animals and vegetation. The risk of hypoxic events also increases when water eventually reaches floodplains, due to the infrequent flushing of organic matter.[472]

Relaxing constraints can provide significant environmental benefits. Riverine environments can be inundated with the timing, frequency, extent and duration of higher flows they depend on for ecosystem viability and health. The targeted delivery of environmental water can improve lateral connectivity over a range of lower lying environmental sites, reconnecting the lower reaches of the wetlands, floodplains, creeks and billabongs that provide important habitat for local wildlife.

In the Plan area, higher flows are particularly important for reconnecting the Mid-Murrumbidgee River Wetlands and the Lowbidgee Floodplain Wetlands, which are both listed in the Directory of Important Wetlands of Australia.[473] Hydrological modelling of potential outcomes shows that by relaxing constraints, water for the environment in the Mid-Murrumbidgee could reach up to 48 percent more wetland area, and almost 200 percent more native vegetation area.[474] Relaxed constraints provide healthier river and wetland habitats for native vegetation, fish and other fauna.[475,476]

River operators benefit from increased operational flexibility under a relaxed constraint scenario. The river operator can vary the release of environmental flows including by providing larger volumes over a shorter duration. These variable releases can improve environmental outcomes by reducing the impacts of riverbank notching and erosion associated with prolonged periods of constant water levels.[477] Greater operational flexibility can also result in more effective and efficient use of environmental water allowing river operators to:

- reconnect rivers with their dependent ecosystems in low-level floodplain and wetlands
- reinstate more natural flow patterns, and, at times, varying flow rates to a greater extent, interspacing consistent releases that lead to riverbank notching and erosion

469 DPE-Water (2023) *Murrumbidgee Environmental Benefits and Risks Analysis Synthesis Reports*
470 *Ibid.* ; Productivity Commission (2023) *Murray–Darling Basin Plan: Implementation review 2023*
471 DPE-Water (2023) *Murrumbidgee Environmental Benefits and Risks Analysis Synthesis Reports*
472 Productivity Commission (2023) *Murray–Darling Basin Plan: Implementation review 2023*
473 DAWE (2005) *Directory of Important Wetlands - Australian Wetlands Database*
474 DPE-Water (2023) *Murrumbidgee Environmental Benefits and Risks Analysis Synthesis Reports*
475 DPE-Water (2023) *Reconnecting River Country Program: Flow options*
476 See DPE-Water (2023) *Murrumbidgee Environmental Benefits and Risks Analysis Synthesis Reports*, for an evaluation of environmental benefits to fish, vegetation, waterbirds, ecosystem production and water quality.
477 Lauchlan Arrowsmith, C.S. Vietz, G. Wakelin-King, G. Grove, J. Rutherfurd, I. Cheetham, M. Martin, J. Gower, T.G. Al Baky, A. Woods, and K. Lam, D. (2022). *Geomorphic Assessment for the NSW Reconnecting River Country Program in the Murray and Murrumbidgee Rivers*, report prepared for Water Infrastructure NSW, DPE.

- trigger breeding and movement of native fish, waterbirds and other water-dependent animals
- release and transfer carbon and nutrients underpinning the aquatic food web
- enhance native fish populations and support healthy river and wetland ecosystems
- improve the health of forests, woodlands and shrublands along river corridors and on low-lying floodplains
- allow the existing environmental water portfolio to be managed more efficiently and effectively for greater environmental benefit.[478, 479]

11.3 Relaxing constraints can significantly impact social and economic outcomes

River regulation and operational management has led to fewer low-level overbank flows, to the benefit of some riverine landholders who experienced social and economic impacts associated with low-level inundation.

Relaxing constraints for environmental flows will result in periodic low-level inundation of public and private land,[480] which can impact property, business operations and landholder livelihoods. The Commission notes that several submissions outlined strong opposition to relaxing constraints for environmental flows, expressing concern about the impacts of prolonged flooding and inundation in recent years related to uncontrolled natural flooding.[481]

Low-level inundation can impact social and economic outcomes for riverine landholders, businesses and communities through:

- temporarily impeded access
- loss and damages to agricultural operations (crops, improved pastures, horticulture) from inundation, as well as an increase in grazing pressure from native animals seeking refuge from inundated public reserves over extended periods
- costs, damages and losses to farm infrastructure (tanks, troughs, pumps, fences)
- farm management costs related to relocating stock and pumps, distribution of debris across paddocks, weed control, animal health, clean up and farm planning
- costs and damage to public infrastructure including roads, tracks, culverts, bridges, levees and landscaping
- costs and damage to residential properties, and specialist activities including turf farms and quarries.[482]

The scale of potential impacts will depend on the frequency, duration and timing of the low-level overbank flows, as well as the flow rate targeted for relaxed constraints.

The Commission acknowledges that the Reconnecting River Country Program is working on improving and verifying the number and extent of landholders affected by inundation

478 DPE-Water (2023) *Reconnecting River Country Program: Flow options*
479 Productivity Commission (2023) *Murray–Darling Basin Plan: Implementation review 2023*
480 DPE-Water (2023) *Reconnecting River Country Program: Flow options*
481 Submissions: Riverina Local Land Services, received 6 July 2023; Individual, received 7 July 2023; Individual, received 29 June 2023
482 DPI-Water (2016) *Murrumbidgee River Constraints Measure – Concept Proposal Business Case*; MDBA (2015) *Murrumbidgee reach report: Constraints Management Strategy*

based on revised model simulations. However, the Water Group informed the Commission that the revised information is not finalised or published. The Commission has used previously published information from the MDBA (dated 2015) and the NSW Proposed Business Case (dated 2016), which may not reflect revised estimates.

In 2016, the NSW Government estimated 1,056 private properties were affected in the Plan area by a relaxed constraint flow rate of 40,000 ML per day at Wagga Wagga.[483] This total was categorised based on the level of potential inundated area per property (**Figure 17**).

The Commission notes that the NSW Government seeks to address adverse social and economic impacts associated with constraints relaxation through proposed program measures (formerly known as the impact management toolbox) (**Section 11.5**).

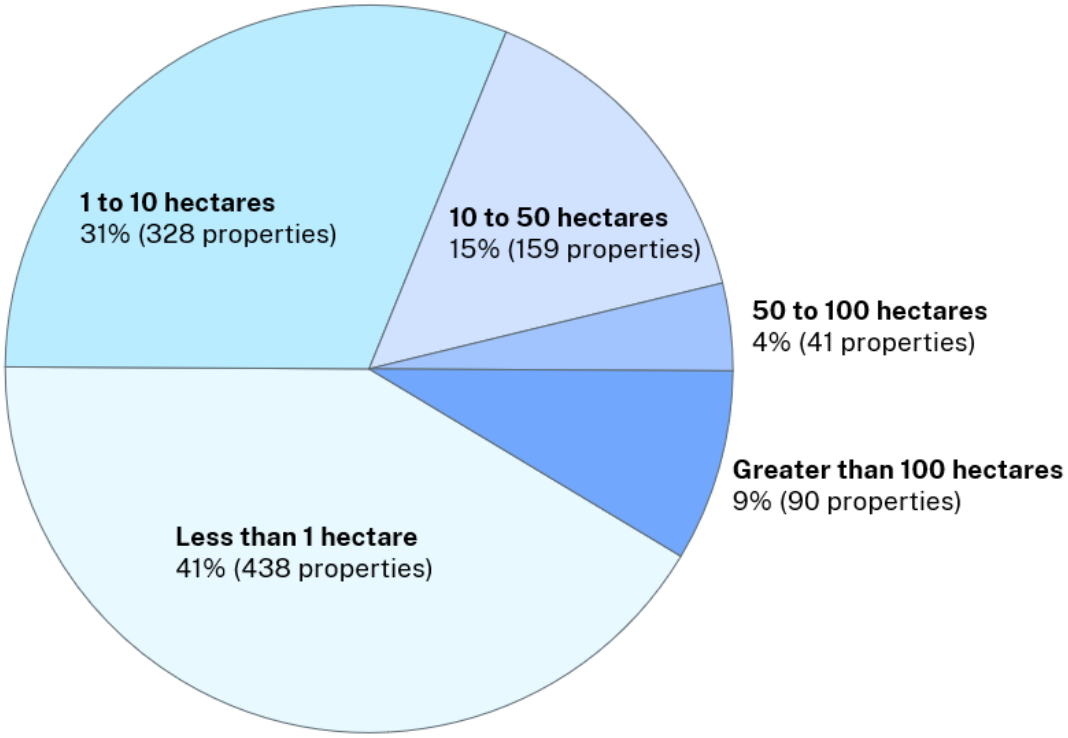


Figure 17: Inundation area of private agricultural properties under modelled flows of 40,000 ML per day at Wagga Wagga[484]

11.4 Relaxing constraints can also have social and economic benefits

Relaxing constraints can also benefit social, economic and cultural (see **Chapter 8**) outcomes, including through improved environmental condition. Social and cultural outcomes may benefit from improvements in amenity, fish populations for recreational fishing, increased flows to water-dependent culturally significant areas, and reductions in hypoxic events. Cultural outcomes may benefit from improved environmental conditions benefiting community outcomes, including connection to Country.

Economic benefits can also be gained by relaxing constraints, including reduced economic impacts related to reduced hypoxic events, increased operational variability, and

483 DPI-Water (2016) *Murrumbidgee River Constraints Measure – Concept Proposal Business Case*
484 Derived from Table A3-2 in *Ibid*.

improvements in soil quality[485] and moisture that enhance agricultural productivity. Enhanced environmental outcomes may also benefit economic outcomes through increased regional tourism. Reinstating some of the low-level inundation that occurred prior to river regulation will also benefit economic outcomes for landholders who depend on that inundation for pastures and river redgum forestry. In addition, complementary programs to implement constraints relaxation measures may provide significant regional investment to:

- upgrade roads, bridges and infrastructure to improve access and keep access routes open
- improve flood mitigation infrastructure
- provide financial support to temporarily or relocate assets during higher flow events
- improve high flow river forecasting and warning systems.

This investment will reduce social and economic impacts associated with uncontrolled low-level flooding events. In addition, these measures can improve community safety and resilience to natural flood events up to the constraint relaxed flow rates, which are expected to increase under climate change (**Chapter 4**).

Finally, as the program to relax constraints was notified as a 'supply measure' under the SDLAM,[486] these measures help reduce the volume of environmental water recovery under the Basin Plan, maintaining larger volumes of water in the consumptive pool for economic purposes.

11.5 Potential social and economic impacts must be addressed

The NSW Government has developed the Reconnecting River Country Program to address potential impacts of relaxing constraints on landholders within flow corridors.[487] This program seeks to engage potentially impacted parties to determine a range of responses that address possible impacts.

A key program requirement is establishing enduring agreements on title representing environmental flow corridor easements. Flow corridors would provide river operators with the right to release water for environmental purposes up to the flow limit, within the flow corridor. Flow corridors would also provide landholders with certainty on the maximum flow extent (including buffers) to be expected from these water releases. The agreements will be negotiated through the proposed landholder negotiation scheme,[488] which will establish the process for negotiating compensation payments through transparent, fair, equitable and consistent negotiations with those landholders likely to be affected.[489] Supplementing the landholder negotiation scheme are the proposed program measures,[490] which identify options available to mitigate potential impacts. [491]

485 Soil quality can be improved through increased cycling of carbon and nutrients between rivers and floodplains.
486 DPE-Water (2023) *Reconnecting River Country Program: Communique from meeting #2 with private landholder reference groups*
487 Productivity Commission (2023) *Murray–Darling Basin Plan: Implementation review 2023*; DPE-Water (n.d.) *Reconnecting River Country Program*
488 DPIE (2022) *Impact Management Toolbox summary*; NSW Government (2022) *Reconnecting River Country Program, Landholder Negotiation Framework- Discussion Paper*
489 DPE-Water (2023) *Reconnecting River Country Program: Communique from meeting #2 with private landholder reference groups*
490 DPE-Water (2023) *Reconnecting River Country Program: Mitigation measures*
491 DPE-Water (2023) *Reconnecting River Country Program: Communique from meeting #2 with private landholder reference groups*

11.6 Higher flow options increase environmental benefits and socioeconomic impacts

The Reconnecting River Country program is investigating three relaxed constraint flow options in the Plan area (**Table 4**). The Commission notes that a preferred flow option has not yet been identified.[492] The three options are specified as flow rates at Wagga Wagga, which generally has the highest average flow in the river,[493] as this location is downstream of most of the major unregulated tributaries and therefore flows tend to reduce downstream.

Table 4: Flow options being investigated in the Plan area[494]

Flow limit option	Flow limits at Wagga Wagga (ML/d)	Note
Base Case	22,000	Current operational limit applied by WaterNSW
Option 1	32,000	Current operational limit at Gundagai in the Plan
Option 2	36,000	
Option 3	40,000	
	45,000	Maximum operational buffer*

*The maximum buffer is not a target for water delivery or a preferred flow limit but is used for impact mitigation purposes.

The Wagga Wagga flow rate for all options under consideration is lower than the Bureau of Meteorology's 'minor' flood level classification for that location.[495]The highest flow rate, Option 3 at 40,000 ML per day, is also lower than recommendations from previous analyses including the MDBA's constraints management strategy (50,000 ML per day at Gundagai)[496] and analysis undertaken to inform development of the original Plan (45,000 ML per day at Wagga Wagga).[497]

Option 3 provides the greatest improvement to environmental outcomes,[498] as larger managed inundation of riverine lands can occur. However, larger inundation can also lead to greater impacts to social and economic outcomes, which need to be addressed as part of the program measures.

The Commission notes that current NSW Government policy seeks to relax constraints only for the delivery of water for environmental purposes. The program does not increase operational limits related to releases of water for non-environmental purposes, including policy around trade water and operational management (i.e. flood management).

492 DPE-Water (2024) *Flow options*
493 MDBA (2015) *Murrumbidgee reach report: Constraints Management Strategy*
494 DPIE (2023) *Murrumbidgee Environmental Benefits and Risks Analysis Synthesis Reports*; DPE-Water (2024) *Flow options*
495 Wagga Wagga: Minor 7.3 metres or 53,860 ML per day; Moderate: 9 metres or 90,330 ML per day; Major: 9.6 metres or 136,400 ML per day
496 MDBA (2013) *Constraints Management Strategy 2013 to 2024*
497 Murrumbidgee Regulated River Management Committee (2004) *Draft water sharing plan for the Murrumbidgee regulated river*, Part A (unpublished)
498 DPIE (2023) *Murrumbidgee Environmental Benefits and Risks Analysis Synthesis Reports*

11.7 Plan provisions should be amended if constraints are relaxed

The Commission has identified additional matters that require resolution if constraints are relaxed. The Commission notes that resolution of these matters likely requires amendments to Plan provisions to ensure the Plan materially contributes to achieving environmental outcomes.

If constraints are relaxed, the NSW Government will need to engage with landholders and river operators to resolve outstanding issues related to:

- Providing river operators with the legal authorising environment to release environmental flows along flow corridors up to the relaxed constraint flow rates. The Plan should reference, as Plan notes, any statutory provisions relied upon to provide transparency and clarity to landholders and the river operator
- river operator discretion to refuse orders of environmental flows for the purpose of achieving environmental outcomes within flow corridors.

Recommendation R26 – Priority 1

To improve environmental outcomes that can be achieved in the event of constraint relaxation, the Water Group should:

a) include provisions that identify the flow rates or flow levels related to normal operations and where environmental flows are being released within relaxed constraint flow corridors

b) ensure provisions promote the release of environmental flows and that the river operator cannot unreasonably refuse to deliver environmental flows up to the relaxed constraint flow levels.

12 Aligning channel capacity sharing with the Act

When total water orders and required deliveries (i.e. basic landholder rights, EWA and water orders) exceed channel operating constraints, the river operator is unable to release enough water to meet all needs. During these times, the river operator must share channel capacity based on the Plan's priority of extraction provisions.[499] Under these provisions, basic landholder rights are provided the highest priority. At the commencement of the Plan, provisions for sharing capacity did not identify where EWA releases sit within the priorities. Amendments made in 2022 placed EWA water in the lowest priority category, to be shared with regulated river (general security) access licences.[500]

Providing the lowest priority for EWA releases potentially contradicts Section 5(3) of the Act, which prioritises water to protect the water source and its dependent ecosystems alongside basic landholder rights.

The 2022 amendments replaced the Plan clause detailing the numerical specification of limits on the volume or rate of extraction for access licences, also known as extraction components, with an amendment provision.[501] In other plan areas, individual daily extraction components have been specified in water access licences to fairly distribute limited water flows in a way that complies with a total daily extraction limit.[502] Irrigation infrastructure operators have also implemented a mechanism to share the available flow rate during a supply restriction by specifying delivery entitlements.[503] Extraction components and delivery entitlements are generally tradable within river sections. The Commission notes that introducing extraction components could provide an equitable and transparent mechanism for sharing limited river capacity.

Recommendation R27 – Priority 2

To align with priorities under the Act, the Water Group should revise Clause 74 of the Plan to specify that environmental water holders, EWA and other environmental releases hold channel capacity priority equivalent to basic landholder rights and above all other extractive users.

499 Clause 74 of the Plan.
500 Clause 74(1)(c) of the Plan.
501 Clause 45 from the Plan dated 6 July 2018.
502 DPIE (2021) *Individual Daily Extraction Components (IDECs): Daily extraction limits in the Barwon-Darling Unregulated Water*
503 Murrumbidgee Irrigation (2018) *Delivery Entitlements- Frequently Asked Questions*

13 Mitigating flood risk through dam provisions

Several Plan provisions have the potential to influence the level of risk and impacts arising from uncontrolled flooding in the Plan area. These include Clause 76 (related to dam operation during floods and spills) and Clause 77 (related to airspace operation rules), as well as Clause 47 (related to carryover provisions) and Division 3 (related to provisional storage volumes). The following discussion focuses on Clauses 76 and 77, as these have the largest potential impact on WaterNSW's ability to mitigate flood risk.

In regional NSW, the WaterNSW's Operating Licence permits WaterNSW to undertake flood mitigation activities,[504] conditional on other legislative requirements and Plan provisions. The Plan requires WaterNSW to operate dams during flood conditions in a manner that ensures the safety of the structure,[505] while mitigating the effects of the flood as far as possible.[506] However, Clause 76(2)(a) of the Plan also requires WaterNSW to 'leave the storage as full as possible'[507] at the end of the flood event, constraining the river operators flood control capabilities, especially during closely spaced flood events.

In addition, Plan provisions limit airspace operation rules, which can assist in mitigating flood impacts through the pre-release of water to provide a storage buffer. The Plan specifies, that when consistent with dam safety requirements, pre-releases are subject to airspace operation rules identified separately for each dam as follows:[508]

- Burrinjuck Dam managed such that '*any volume of airspace that is maintained is to be no greater than that which is likely to be refilled by storage inflows prior to making a release of water from the storage to supply downstream requirements*'.[509] The refill volume is to be based on the minimum forecast recession inflow. In addition, "downstream impacts must be considered before releases to maintain airspace are made"[510] and channel capacity constraints are one of the factors to be considered.
- Blowering Dam managed '*in accordance with the provisions of the Blowering Airspace Deed, to which the Water Administration Ministerial Corporation and Snowy Hydro Limited are parties.*'[511] A note in the Plan identifies that the Deed requires the operator to maintain an airspace volume of up to 190 GL for the purpose of emergency power generation and that a volume equal to any releases made specifically to provide this airspace will be reserved in Snowy Hydro storage for subsequent allocation by the Minister.[512]

These Plan provisions limit the river operator's ability to mitigate flood impacts and create a level of flood risk that can be exacerbated during wet periods with multiple large inflow events. The provisions prioritise water storage and supply needs while potentially increasing the impacts of some uncontrolled floods. It is not evident that these rules are consistent with the Act requirement to take all reasonable steps to maximise social and economic outcomes as the social and economic impacts of additional flooding may well be greater than the benefit of maximising stored water. The lack of flexibility of these provisions will likely be exacerbated by the impacts of climate change.

504 *WaterNSW Operating Licence* Section 1.2.1(k) authorises WaterNSW to undertake flood mitigation and management in all areas of New South Wales, except for the Sydney catchment area as defined by the Act.
505 Clause 76(1) of the Plan; Clause 76(2) of the Plan.
506 Clause 76(2)(b) of the Plan.
507 Clause 76(2)(a) of the Plan.
508 *Ibid*.
509 Clause 77(1)(a) of the Plan.
510 Clause 77(1)(b) of the Plan.
511 Clause 77(2) of the Plan.
512 *Ibid*.

13.1 A broader review is needed to inform Plan amendments

Flood operations are highly complex. They often involve quickly moving inflows from both regulated and unregulated water sources. Infrastructure operators must make decisions using limited weather and hydrological forecast capabilities, which can have a high degree of uncertainty. Operators must consider the impacts of those decisions on the reliability of water access licences, (such as when pre-releases are made but inflows do not eventuate) and potential impacts related to downstream flooding. Operators must also seek to balance third-party flood impacts and water storage needs, as well as environmental benefits that arise from spill events.[513] In addition, flood management, with its intricate connection to human health and property, encompasses multifaceted risks and liabilities and therefore can impose significant liabilities on infrastructure operators.

Effective flood operations require coordinated arrangements between the NSW Government, local councils and the Commonwealth government. These arrangements involve multiple ministerial portfolios and associated departments. Further, a range of entities are involved directly or indirectly with flood management, including the Bureau of Meteorology, the NSW State Emergency Service, WaterNSW, the Water Group, IPART, Snowy Hydro Limited, Local Emergency Management Committees and local government.

NSW's emergency management arrangements for airspace management, flood risk and flood mitigation are determined by legislative, regulatory and policy instruments, including operational licences, approvals, agreements and NSW Government policies. These legislative and policy instruments are outside the scope of Plan reviews established in Section 43A of the Act as detailed in **Section 1.2**.

The Commission considers that changes to Plan provisions should be informed by an inter-agency review of legislative, regulatory and policy instruments related to infrastructure operations for flood management. An inquiry of this scope can ensure a consistent approach is applied across the range of instruments pertaining to infrastructure operators during flood management. This review should build on findings from the 2022 NSW Flood Inquiry,[514] with a focus on evaluating the adequacy of policy related to infrastructure operations for flood management, particularly under climate change. The Water Group should:

- coordinate involvement of relevant departments, agencies and independent experts
- evaluate all relevant legislative, regulatory and policy instruments related to infrastructure operations for flood management
- use best available flood, hydrological and climate modelling to inform the analysis.

Following an inter-agency review the Water Group should amend relevant legislative, regulatory and policy instruments, including water sharing plans, in a consistent manner to align with the review's recommendations.

513 For example, one purpose of the provisional storage volumes is to increase the likelihood of spill events.

514 The 2022 NSW Flood inquiry was an independent expert inquiry into the preparation for, causes of, response to and recovery from the 2022 catastrophic flood event across the state of NSW. The inquiry made 28 recommendations including related to information sharing, the hydrometric network, climate modelling, floodplain management and forecast model capabilities (NSW Government (2022) *NSW Flood inquiry*

Recommendation R28 (LT) – Priority 2

To address any Plan related flood risks, the Water Group should coordinate an inter-agency review of flood management and update the Plan with any necessary changes to relevant Plan provisions.

14 Improving monitoring, evaluation and reporting

A lack of MER is a consistent theme raised by the Commission in its reviews of water sharing plans. This is largely due to a lack of plan-specific MER programs, as well as limited resources dedicated to MER.

This review has found a similar lack of a Plan-specific MER plan. However, the Commission recognises there are several ongoing or historical monitoring programs in place that support an understanding of the condition of water sources in the Plan area, and how environmental assets respond to changes in flow (**Section 14.1**). The Commission also recognises that the Water Group is working to improve MER arrangements for water sharing plans and is progressing a substantial program of work to enable monitoring and reporting of Plan performance (**Section 14.2**). The Water Group advised that the MER plan for the Plan is currently in preparation.

The Commission notes the *NSW Water Strategy*[515] includes an action under Priority 3 to *'invest in long term and effective monitoring, evaluation, reporting and research.'* It is unclear what future funding will be made available for water sharing plan evaluations.

The Commission considers that it should be a priority that the Water Group receives adequate funding to undertake this function. Funding should be commensurate with the importance of MER for assessing water sharing plan effectiveness and supporting the adaptive management of the Plan.

14.1 Existing monitoring programs in the Plan area

While not all Plan performance indicators are monitored and reported against there are existing monitoring programs that provide insight into the environmental condition and outcomes being achieved in the Murrumbidgee catchment. The Commission notes that these programs are not specific to the Plan, but in many cases apply to the broader Murrumbidgee catchment. Examples of existing monitoring activities in the Murrumbidgee catchment are listed below:

- The Basin Plan Environmental Outcomes Monitoring - Fish Program, which is funded by the Australian Government under the Federation Funding Agreement – Environment on Implementing Water Reform in the Murray-Darling Basin, provides a temporal analysis of fish by water resource plan area (including the Murrumbidgee) for the period 2014/15 until 2019/2020.[516] It is anticipated that this will be updated annually based on new survey data.
- The Monitoring, Evaluation and Research Program (Flow-MER) includes seven selected areas including the Murrumbidgee Selected Area.[517] This program is an extension of the Murrumbidgee Long-Term Intervention Monitoring (LTIM) project. While the MER program was designed to assess environmental outcomes associated with delivery of HEW, sites included in the monitoring program also receive delivery of planned environmental water (EWA water).
- DCCEEW Biodiversity, Conservation and Science undertakes monitoring and reporting activities as part of its Water for the Environment MER Program that measures ecological responses to the delivery of water for the environment. The monitoring efforts focus on wetlands that receive water for the environment, which in the Murrumbidgee catchment focuses on the Lowbidgee Floodplain. Biodiversity,

515 DPIE (2023) *The NSW Water Strategy*
516 DPI (2023) *Basin Plan Environmental Outcomes Monitoring*
517 CEWH (2023) *Monitoring Evaluation and Research Program (Flow-MER)*

Conservation and Science measures changes in inundation extent and duration of floodplain wetlands, vegetation condition and extent, and changes in waterbird and frog populations in response to water for the environment. These activities are completed in partnership with CEWH, DPI-Fisheries, DCCEEW and the MDBA.[518]

- DCCEEW maintains the NSW River Condition Index, which reports on riparian vegetation condition, geomorphic condition, hydrologic stress, biodiversity condition, catchment disturbance and water quality. DCCEEW has advised that the river condition index will be updated at five yearly intervals subject to resource availability.[519]
- Section 3 of the Water Resource Plan Murrumbidgee Surface Water MER Plan[520] summarises monitoring activities identified in the Murrumbidgee catchment. These monitoring activities are designed to meet Basin Plan reporting requirements, not specifically the Plan requirements, and focus on:
    - hydrologic monitoring of flow variability at selected gauges in water sources where water is managed
    - native vegetation surveys
    - annual aerial surveys of water birds
    - native fish community sampling
    - sampling for water quality.

Table 14A-1 in **Appendix 6** shows assumed linkages of these monitoring activities to the Plan's objectives and performance indicators as assessed by the Commission.

Datasets from these monitoring activities could be used in the future to assess Plan performance. This highlights the importance of developing specific MER documentation for the Plan. This would allow the Water Group to draw upon these existing programs and link them back to Plan objectives and monitoring themes as part of an integrated MER plan.

14.2 Pathways towards improved MER

In 2022, the Commission audited the Plan and found that provisions related to vision, objectives, strategies, and performance indicators were not implemented during the audit period.[521] The Commission recommended that the Water Group lead the monitoring and evaluation of performance indicators to measure the success of the strategies, and to ensure that the objectives set out in Part 2 of the Plan were met.[522]

The Commission recognises that the Water Group is taking steps to improve MER and support an efficient and effective use of available resources to measure Plan performance. These steps include:

- updating the objectives as part of Plan amendments to make them measurable and more meaningful

518 DCCEEW Biodiversity, Conservation and Science (n.d.) *Water for the environment outcomes 2022-23*
519 DCCEEW (n.d.) *NSW river condition index*
520 Department of Industry, Office of Environment and Heritage and Department of Primary Industries – Fisheries (2019) *Murrumbidgee Surface Water Monitoring, Evaluation and Reporting Plan*
521 Natural Resources Commission (2023) *Audit of the implementation of the Lachlan, Murrumbidgee and NSW Murray and Lower Darling regulated rivers water sharing plans*
522 *Ibid.*

- developing and implementing the Environmental Outcomes Monitoring and Research Program, which ensures the surface water environment is underpinned by science-based decision-making[523]
- developing the NSW MER Framework[524] and customised environmental MER plans as part of water resource plan development
- establishing the Water Group's Water Planning Implementation Unit, including the Water Evaluation and Reporting Team that is focused on improving MER through the development of the Water Sharing Plan Evaluation Framework[525]
- investing in projects to strengthen MER activities such as the development of a framework to prioritise water sources for MER activities.

The Water Group has undertaken a substantial amount of work on its Water Sharing Plan Evaluation Framework, including the development and finalisation of method statements that enable the evaluation of water quality and environmental outcomes and socio-economic outcomes of water sharing plans. These method statements are yet to be made public but identify key evaluation questions and indicators to track performance of Plans in relation to environmental, water quality and socio-economic aspects of a water sharing plan.

The method statements set out the steps required for evidence collection, analysis and development of findings. Water Group has commenced data collection against these method statements. Socioeconomic data collection commenced via the social benchmarking survey during 2023 and 2024 and covered aspects such as amenity, wellbeing, attachment to water and livelihoods. The Water Group has also collated information against economic indicators by water sharing plan area, including data on changes and trends in water trade, industry water use, local economies and industry value. The Commission understands that the Water Group will continue to progress its MER work, with a further method statement to be developed to facilitate the evaluation of cultural outcomes.

Further to work to assess Plan performance, the Water Group[526] developed the Murrumbidgee Surface Water Resource Plan's MER plan, which was designed to meet the broader Basin Plan's reporting requirements. The environmental MER plan is based on program logic developed for the water sharing plan objectives.[527] The program logic is intended to guide monitoring activities, while risk assessments undertaken as part of the water resource planning process are intended to inform areas for further research. The MER plan also maps out existing monitoring programs by research theme.

While significant progress has been made to assess Plan performance against objectives established under the Plan, the Commission would support further improvements to the Plan, to improve assessment of performance and adaptive management by the Plan. The Commission has identified the following improvements:

- While the Plan includes clearer objectives, some Plan provisions have not been updated to support the achievement of the revised objectives. There is a risk therefore that some objectives may not be met.[528]

523 DPIE (n.d.) *Environmental Outcomes Monitoring and Research Program*
524 DPIE (2020) *NSW Water Management Monitoring, Evaluation and Reporting Framework*
525 The Water Group advised that this will be made available in June 2024.
526 The Murrumbidgee Surface Water Resource Plan MER was developed by the Department of Industry – Water, following Machinery of Government changes. This department is now referred to as Water Group.
527 Department of Industry (2019) *Murrumbidgee Surface Water Monitoring, Evaluation and Reporting Plan*
528 For instance, Aboriginal water-dependent cultural values are not adequately identified and protected, and watering needs are not provided for under current Plan provisions.

- It is difficult to assess the Plan's alignment with the Act with respect to applying the principles of adaptive management, as outlined under the water management principles of the Act.[529]
- The Plan lacks equity[530] objectives and corresponding performance indicators. Without these, there is a lack of transparency, and it is difficult to assess the Plan's effectiveness and alignment with the Act[531] with respect to how it manages equitable sharing of water between and within licence categories, and the prioritisation of water users under the Plan.
- The Plan lacks clearly defined climate variability objectives and corresponding performance indicators, including how to prepare or respond to predicted impacts, and how to improve resilience. As such, it is difficult to assess the Plan's effectiveness and alignment with the Act[532] to recognise the impact of climate variability on water availability.
- The Plan's economic performance indicators are not comprehensive, and do not reflect the importance of water for all water-dependent industries and communities. Feedback from stakeholders highlighted that:

  '*The current performance indicators for economic production are extremely narrow, and in no way reflect the importance of water for industries that are dependent upon it, as well as the communities they support. 'Higher value' use is an extremely out-of-date policy concept and should be removed from this Water Sharing Plan. If an indicator highlighting the benefit of trade remains, then the impacts of trade need to also be considered as well. Importantly, as noted above, water-dependent industries frequently support communities, yet the needs and expectations of these communities have been ignored in this Water Sharing Plan. An indicator reflecting this should be added.*'[533]
- The Plan does not have targeted objectives or performance indicators that relate to economic values and water uses by Aboriginal people (see **Chapter 8**):[534]

  '*The Plan objectives were not developed with input from Murrumbidgee Traditional Owners. The targeted objectives lack relevance and significance to local Murrumbidgee Traditional Owners. This is unsurprising given that the objectives were added without consideration of Murrumbidgee Traditional Owners' priorities, needs, and objectives. The lack of specificity of these objectives for Murrumbidgee Traditional Owners has implications for advancing their actual objectives and outcomes (in contrast to those identified in the [water sharing plan]).*'[535]
- The Plan has targeted water quality objectives and associated defined performance indicators. However, reports have identified significant water quality issues in the

529 Clause 5(2)(h) sets clear expectations that '*The principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements*'.

530 Equitable sharing of water is required by the *NSW Water Management Act 2000* (Section 3(e)) and is a critical component for water sharing plans to support community trust and cohesion, effective water market operation and the fair distribution of benefits and cost from water sharing rules. Equitable sharing does not mean equal amounts of water supplied for all users, rather:
- a fair distribution of available water consistent with the priorities under the Act
- consistent application of access rules for licences in the same licence category and the same water source or management zone
- fair and transparent consideration of relative reductions to meet extraction limits.

531 Section 3(e) of the Act sets a clear expectation that water sharing plans should 'provide for the orderly, efficient and equitable sharing of water, and seek to minimise cumulative impacts on water sources.

532 Section 20(2)(c) expects that water sharing provisions of a management plan for a water management area or water source 'must recognise the effect of climatic variability on the availability of water'.

533 Submission: Rice Growers Association, received 7 July 2023.

534 The *NSW Water Strategy* outlines actions to '*recognise First Nations people's rights and values and increase access to, and ownership of, water for cultural and economic purposes*'.

535 Submission: Murray Lower Darling Rivers Indigenous Nations, received 7 July 2023.

catchment including elevated turbidity, total phosphorus, and high nitrogen levels in sites along the Billabong Creek.[536] **Chapter 7** and **Chapter 9** discuss fish deaths in the Plan area, which point towards periodic decline in ecosystem health, and issues with water quality for town water supply at the southern end of the Plan, respectively. The ongoing and reoccurring water quality incidents within the Plan highlight the importance of the adaptive management process as part of Plan performance. Monitoring of water quality indicates that changes may be required to Plan provisions to ensure that the water quality objectives and performance indicators established by the Plan can be achieved. The inclusion of water quality parameters within performance indicators may additionally support tracking of changes in water quality within the Plan. Potential improvements that can be made to Plan provisions to improve water quality outcomes in the Plan are outlined in **Chapter 7**.[537]

- There is a need to ensure that MER data collection and monitoring activities support measurement of Plan performance against outlined objectives such as the achievement of lateral and longitudinal connectivity outcomes between water sources within the Plan and with other water sharing plans, including connected floodplain unregulated water sources, such as billabongs, lagoons, effluents and anabranches.

Public reporting of MER priorities and findings and how they are considered in Plan amendments is necessary to improve transparency and public awareness around Plan outcomes. Submissions received during this review clearly highlight the industry and community demand for transparency of MER to assess Plan performance. For example, stakeholders found that:

> '*Beyond Schedule 12 reporting under the Basin Plan, we are unaware of any specific reporting against the performance indicators or assessment of the effectiveness of the strategies listed in the [water sharing plan], as specified in Part 2 of the [water sharing plan]. It is therefore difficult to assess the extent to which the [water sharing plan] is contributing to environmental, cultural, social and economic outcomes.*'[538]

The Commission is supportive of public reporting of MER on a regular basis. The Commission supports 5-yearly reporting as this would effectively provide a mid-legislative period update, providing data for Plan reviews and Plan implementation audits. It would also enable the Water Group to identify Plan issues early on and inform where future work programs or information might be required to support adaptive management of the Plan. To ensure this occurs, the reporting timeframe needs to be clearly stipulated in the replacement Plan.

The Commission supports the ongoing MER work program and encourages the Water Group to continue to leverage monitoring and data collection of other agencies to efficiently evaluate Plan performance, where appropriate. Ongoing improvements will be required to the Plan to support the MER program and any ensuing adaptive management.

536 DPIE (2022) *Draft Regional Water Strategy: Murrumbidgee Strategy*; Natural Resources Commission (2023) *Review of the Murrumbidgee Unregulated Water Sharing Plan*

537 As identified in **Chapter 7** of this report, changes to Plan provisions may require the establishment of additional water quality monitoring sites beyond the current 26 sites in the Plan to improve understanding of destratifying flow requirements and tailor environmental water requirements to mitigate periods of low dissolved oxygen.

538 Submission: CEWH, received 7 July 2023.

Recommendation R29 – Priority 2

As part of their ongoing MER process, the Water Group should:

a) ensure that the Plan includes equity objectives and objectives that relate to economic values and water uses by Aboriginal people

b) ensure that the Plan includes performance indicators related to

   i. climate variability

   ii. cultural and amenity value of water

   iii. economic values and water uses by Aboriginal people

c) broaden existing performance indicators related to economic outcomes and water quality parameters

d) ensure that Plan provisions support the achievement of the Plan's objectives and performance indicators

e) specify timely and transparent reporting requirements of the results of MER activities to support adaptive management

f) establish appropriate governance arrangements and timeframes for adaptation and improvement.

15 Compensation implications of recommendations

Under the Act, compensation may be payable by the NSW Government to access licence holders – only in some circumstances where water allocations under a water sharing plan are reduced. Section 43A(3A) of the Act requires the Commission to report whether changes proposed to the Plan are to restore water to the environment due to changes in inflows or improvements in scientific knowledge. Specifically, the Act states that:

'(3A) If a report of the Natural Resources Commission under subsection (3) recommends changes to a management plan that will result in a reduction of water allocations in relation to which compensation might be payable under section 87AA, the Commission is to state in the report whether the purpose of the proposed change is:

(a) to restore water to the environment because of natural reductions in inflow to the relevant water source, including but not limited to changes resulting from climate change, drought or bushfires, or

(b) to provide additional water to the environment because of more accurate scientific knowledge that demonstrates that the amount previously allocated to the environment is inadequate.'

Many of the recommendations can be advanced without triggering compensation. The Commission notes that Section 87AA indicates for instance that compensation is not payable due to a reduction in water allocation if *'the reduction in water allocations is for the purpose of restoring water to the environment because of natural reductions in inflow to the water source, including but not limited to changes resulting from climate change, drought or bushfires.'* The Commission has sought to identify where compensation may be payable under Section 87AA of the Act. These impacted recommendations are listed in **Table 5**.

Table 5: Recommendations that may trigger compensation

Recommendation		Cause of change
LTAEEL		
R5	The Water Group should set a sustainable LTAAEL that: a) sets aside the water required to protect the water source and its dependent ecosystems b) enables the achievement of the Plan's environmental, social and cultural objectives c) establishes a limit framework that is responsive to the impacts of climate change d) is not reliant on the SDL to achieve the Plan's environmental outcomes.	Changes due to improved scientific knowledge and climate change
Ensuring a sustainable and robust allocation policy		
R11	In addition to related items outlined in **Recommendation R4 and AR1**, the Water Group should:	Changes due to improved scientific knowledge and climate change

	a) revise Clause 72(2) (Maintenance of water supply) to require the river operator to be able to firstly supply sufficient water to protect the water source and its dependent ecosystems during a repeat of the period of lowest accumulated inflows b) revise Clause 72(6) (review of lowest accumulated inflows) to include a requirement to not jeopardise critical environmental needs.	
R13	To ensure ongoing equity and meet Plan conveyance requirements, the Water Group should: a) review the Plan's conveyance provisions for irrigation networks and, based on the materiality of potential impacts, determine whether changes are warranted to increase flexibility and ensure conveyance allocations best reflect conveyance needs b) review irrigation network excess conveyance spill arrangements and carryover provisions and, based on the materiality of potential impact, determine whether changes are warranted to ensure there is equitable sharing of excess conveyance allocations between irrigation networks and all other river water users.	Changes due to improved scientific knowledge
Environmental protections should be strengthened		
R14	To align the Plan's minimum daily flow provisions with connectivity and water quality objectives and provide clarity in delivery of these flows, the Water Group should ensure that the replacement Plan: a) specifies that minimum daily flows at Balranald must be targeted, but that compliance be assessed within 25 percent variation (consistent with the Murrumbidgee Work Approval), and prescribe how the compliance test works b) requires monthly publication of targeted flows for the Murrumbidgee River downstream of Balranald Weir (410130) and the outcomes of the compliance test against targeted flows, including reasons for differences, to improve transparency and accountability	Changes due to improved scientific information and climate change

	c) provides for connectivity with the Murray to support movement and dispersal opportunities for aquatic biota d) maintains pool refugia and mitigates the risk of prolonged pool stratification in the lower Murrumbidgee River during periods of low flow, particularly when there are limited intervalley transfers to the Murray e) aligns minimum daily flow requirements for the Murrumbidgee River downstream of Balranald Weir (410130) with baseflow environmental flow requirements from the Murrumbidgee LTWP and require updates to these requirements when improved knowledge of destratifying flow requirements becomes available f) incorporates additional minimum daily flow rules for the five sites along the Yanco Creek system to achieve connectivity along the length of the system rather than bypassing river reaches when delivering flows to Darlot gauge (410134).	
R17	The Water Group should revise transparency provisions to align with baseflow environmental water requirements (particularly for Tumut River downstream Blowering Dam) and ensure the replacement Plan effectively protects transparent releases from extraction along the length of the Murrumbidgee Regulated River Water Source to support fundamental ecosystem health.	Changes due to improved scientific information and climate change

Recommendation R10 requires allocations to be adjusted to incorporate latest data regarding climate change. The Commission considers that this would likely not require compensation at the change is recommended to address reduced inflows due to changes in climate.

The Commission acknowledges that there are also other recommendations that may affect water allocations. However, these changes are allowed through amendment provisions provided for in the Plan or in the Commission's view would not affect long-term allocation or are entirely due to changes in climate and therefore not subject to compensation. The Commission advises DCCEEW to seek its own legal advice on this matter.

In considering the requirements under Clause 87AA of the Act, the Commission has not made any determination in relation to entitlements to or the amount of compensation and does not provide legal advice in this report. DCCEEW should seek legal advice regarding any potential compensation implications of implementing the recommendations in this report.

Appendix 1 – Out of scope issues raised

The scope of Plan reviews to be undertaken by the Commission is established in Section 43A of the Act and detailed in **Section 1.2**. However, as outlined in the Act, it is the role of the Commission to have due consideration of public submissions.[539] As part of the Commission's stakeholder engagement process for the Plan review, issues were raised that were deemed to be out of scope.[540] For transparency, these are detailed below.

The Snowy Hydro Scheme

The Snowy Hydro Scheme contributes significant volumes of water to the Murrumbidgee River under the Snowy Water Licence.[541] On average, approximately 25 percent of inflows in to the Murrumbidgee are from the Snowy Hydro Scheme via Blowering Dam.[542] During drought years, the contribution of inflows is even more significant, with the Snowy Hydro Scheme contributing up to 60 percent of inflows.[543] The Snowy Water Licence currently requires an annual release of 1,026 GL from the Snowy-Tumut development.[544] The Commission recognises that any variation to the required annual release volumes released from the scheme would have a significant impact on water availability in the Murrumbidgee. While the Plan does refer to the Blowering Airspace Deed,[545] any variation to operation of the scheme is subject to:

- reviews of the Snowy Water Licence[546]
- the *Snowy Hydro Corporation Act 1997*
- the Snowy Water Inquiry Outcomes Implementation Deed.[547]

Based on this, the Commission considers that any changes to the Snowy Water Licence is out of scope of its review.

Airspace management and emergency flood operations

The Commission recognises that several stakeholders raised concerns regarding airspace management[548] and flood operations in the Murrumbidgee. Airspace and flood management is complex and governed by a range of legislative instruments and policies, including but not limited to the:

- *State Emergency and Rescue Management Act 1989*

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539 Section 43A(4a) of the Act.
540 The Commission has taken that the scope of its review is established in Section 43A of the Act.
541 The Snowy Water Licence was issued to Snowy Hydro Limited in 2002 under Part 5 of the *Snowy Hydro Corporation Act 1997* (NSW) for a period of 75 years. The Snowy Water Licence defines how Snowy Hydro Limited is to account for and release water, including releases into the Murrumbidgee River. Taken from DPE (2022) *Draft Regional Water Strategy – Murrumbidgee*
542 *Ibid*.
543 *Ibid*.
544 Section 12.2 of the *Snowy Water Licence*; it is noted that there is the ability within the Snowy Hydro Licence to call out a drought release in the event that regulated river (high security) access licences have been allocated less than 50 percent in the Plan, where the Murrumbidgee Drought account is in credit. See Section 10.3 of the Snowy Water Licence.
545 Clause 77(2) of the Plan.
546 The ten-year review of the *Snowy Water Licence* was completed in 2018. A licence review implementation program is underway to carry through recommendations of the review including improving environmental water releases and overall water release investigations. See DCCEEW (n.d.) *Updates on the implementation program*
547 The Deed is an agreement between the NSW, Victorian and Australian Governments (the shareholder Governments) following on from the Snowy Water Inquiry in 1998. Taken from Snowy Hydro (n.d.) *Going with the Flow – Snowy Hydro's water licence*
548 Space that is made available in the dam for capturing flood event inflows.

- *NSW Emergency Management Plan* including the sub-plan and the N*SW State Flood Plan*.

While the Plan includes provisions relating to floods and spills,[549] operation of the dam during these events sits underneath Emergency Management Planning arrangements, where the NSW State Emergency Service is the key combat agency for dealing with floods including the coordination and welfare of affected communities.[550] As part of this role, the NSW State Emergency Service undertakes roles in prevention, preparedness and response including providing input into dam emergency plans and dam failure alerts for dams identified as high risk.[551]

Under the *NSW State Flood Plan*, protection and preservation of life is the highest priority during a flood event. Given the management of floods sits under emergency management arrangements, any changes to dam emergency plans and dam operations should be addressed to processes outside the water sharing plan review. The Commission recognises that an artificial flood event, for the purpose of environmental outcomes as is intended to be supported under the Reconnecting River Country Program, has been considered where appropriate to scope (see **Section 11.6**).

Water recovery in the Plan

The Commission acknowledges that there has been substantial water recovery in the Plan area, as part of the Basin Plan, to bridge the gap to the SDL, including purchase of entitlement, adjustments associated with infrastructure projects, and State government recoveries.[552] Water recovery has occurred additionally through Cap adjustments, the Living Murray Program and the Water for Rivers Program.[553] As identified by stakeholder groups, this has come at a cost to regional communities in the Plan area.[554]

While there are substantial licensed water holdings in the Plan area, the Commission has sought to focus on outcomes achieved through the use of planned environmental water, where possible. Additionally, in recognition of the significant cost borne by both the NSW Government and communities, the Commission has highlighted where improvements can be made to Plan provisions to better utilise and protect deliveries occurring as HEW. The Commission recognises there is an ongoing desire amongst water users for the achievements of planned environmental water and HEW to be accounted for separately.[555] This has been highlighted in the review where information is available to enable this analysis to be reported.

Integrated catchment management

The Commission recognises the need for integrated catchment management to achieve Plan outcomes, the importance of which is highlighted by the broader scientific

549 The Blowering Airspace Deed is an agreement between Snowy Hydro and the Water Administration Ministerial Corporation and requires WaterNSW to maintain an airspace volume of up to 190 GL for the purpose of emergency power generation. As mentioned previously, while documented in Clause 77(2), any changes to the Deed sit independent of the Plan.

550 *State Emergency Service Act 1989*; NSW Government (2018) *NSW State Emergency Management Plan*

551 NSW Government (2021) *NSW State Flood Plan. A Sub Plan of the State Emergency Management Plan*

552 136.6 GL (purchase), 279.6 GL (Sustainable Rural Water Use and Infrastructure Program) and 26.2 GL (State Government recovery). Taken from MDBA (2023) *Status of water recovery towards 'Bridging the Gap' to the Sustainable Diversion Limits as at 30 June 2022.*

553 90 GL (Cap adjustment), 52 GL (The Living Murray) and 96 GL (Water for Rivers). Taken from: MDBA (2017) *Pre-2009 water recovery table 2017*

554 NSW Irrigators Council (2023) *Guide to fixing the Basin Plan – Submission to the Productivity Commission Murray-Darling Basin Plan 10 Year Implementation Review*

555 Submission: Coleambally Irrigation Co-operative Limited, 29 June 2023.

community.[556] Currently this sits outside the scope of this review, with reforms needed to support integrated catchment management and ensure there are clear roles and responsibilities for implementation in NSW.

Stakeholder engagement and advisory panels

As part of the review, several stakeholders raised concerns regarding stakeholder engagement. This was identified regarding the remake of the 2016 Plan, Plan amendments made in 2022, the stakeholder advisory panel process, and the lack of engagement of Aboriginal people. The Commission has not commented on the adequacy of stakeholder engagement but has indicated where a lack of engagement has impacted on Plan outcomes.

556 Baumgartner, L.J., Gell, P., Thiem, J.D., Finlayson, M and Ning, N. (2020) 'Ten complementary measures to assist with environmental watering programs in the Murray-Darling river system, Australia', *River Research Applications,* 30, pp. 645-655.

Appendix 2 – Reference data for Chapter 4

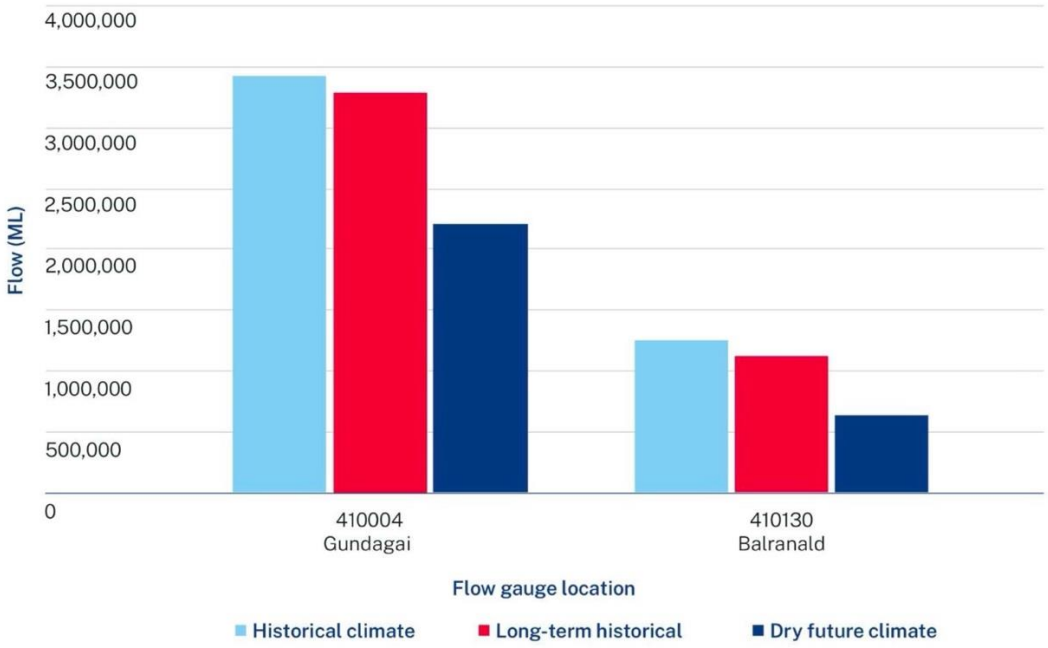

Figure 4A-2: Impact of climate scenario on mean (average) annual flow in the Murrumbidgee River at Gundagai and Balranald[557]

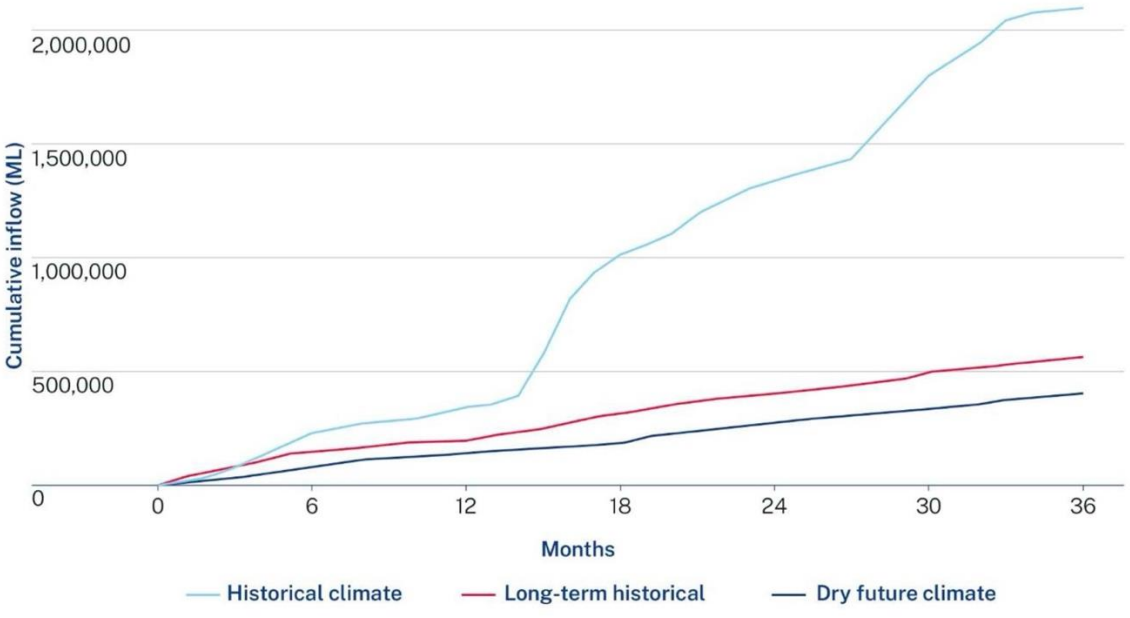

Figure 4A-3: 3-year minimum inflow sequences for combined Burrinjuck and Blowering dams[558]

557 DPE (2022) *Draft NSW Murray and Murrumbidgee Regional Water Strategies – Climate and hydrological modelling*

558 *Ibid.*

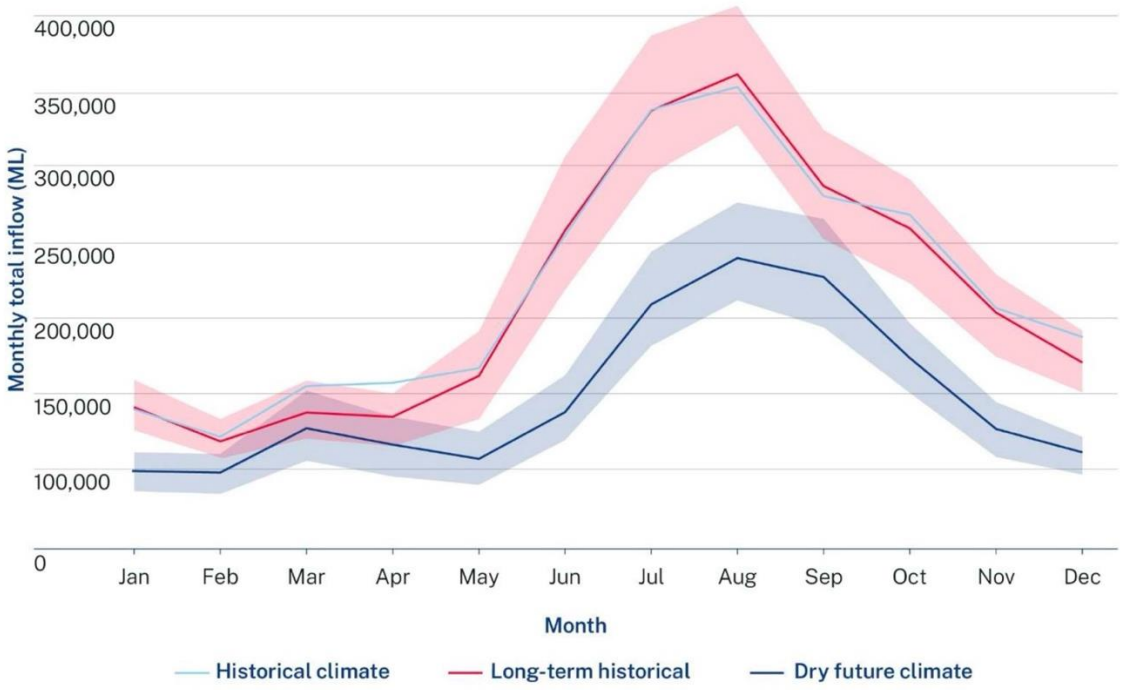

Figure note: red shaded area represents the 95th percentile confidence limit of the long-term historical scenario and the blue shaded area represents the 95th percentile confidence limit of the dry future climate scenario.

Figure 4A-4: Impact of climate scenarios on seasonal combined inflows into Burrinjuck and Blowering dams[559]

[559] *Ibid.*

Appendix 3 – Reference data for Chapter 7

Table 7A-1: Minimum daily flow target for Murrumbidgee River downstream Balranald Weir (410130)[560]

Month	Minimum daily flow at Balranald (ML/day)
January	186
February	180
March	180
April	180
May	297
June	429
July	829
August	1,087
September	1,330
October	1,030
November	568
December	254

Table 7A-2: Environmental watering events in the Murrumbidgee valley that included EWA[561]

Water year and catchment condition	Number of environmental watering events	Environmental watering events comprising EWA	Total EWA volume delivered (ML) and % of deliveries
2016-17[562] Wet conditions	17 events	**8 events (3 events entirely EWA*)** Lowbidgee fresh (event 4) Yanco-Wanganella Swamp (event 6) Nimmie-Caira rookeries (event 7) Murrumbidgee Irrigation Area wetlands (event 8)* Tombullen perch pulse (event 9)* North Redbank – Lake Mermley (event 10) Coleambally Irrigation Area wetlands (event 14)* Nimmie-Caira wetland refuge flows (event 16)	158,597 ML (30% of environmental water delivered in the water year)
2017-18 Dry conditions	14 events	**2 events (1 event entirely EWA*)** Mid-Murrumbidgee River reconnection flow (event 5) Coleambally Irrigation Area Wetlands (event 6)*	74,602 ML (EWA comprised 28% of environmental water delivered in the water year)

560 As set out in the WaterNSW Murrumbidgee Work Approval (unpublished).
561 Based on information from DPE's annual *water for the environment outcomes reporting*
562 Based on Table 4 in Office of Environment and Heritage (2017) *Use of water for the environment in New South Wales: outcomes 2016-17*

Water year and catchment condition	Number of environmental watering events	Environmental watering events comprising EWA	Total EWA volume delivered (ML) and % of deliveries
2018-19[563] Very dry conditions	14 watering events	**7 events (3 events entirely EWA*)** Yanga National Park: recovery of native fish (event 1) North Redbank Wetlands: connectivity flow (event 3) Nap Nap to Waugorah Lagoon: support waterbird breeding (event 5)* Coleambally Irrigation Area Wetlands: waterbird breeding (event 8)* Oak Creek and Gras Innes: support threatened native fish (event 9)* Nimmie-Caira wetlands waterbird breeding (event 11) Lower Murrumbidgee: native fish flow (event 14)	117,524 ML (EWA comprised 60% of environmental water delivered in the water year)
2019-20 Very dry conditions	12 events	**3 events (1 event entirely EWA*)** Coleambally Irrigation Area Wetlands (event 4)* Gayini Nimmie-Caira refuge flows (event 8) North Redbank Wetland (event 9)	28,640 ML (EWA comprised 36% of environmental water delivered in the water year)
2020-21 Wet conditions (100 % general security allocations)	11 events	**5 events** Yanga National Park (event 1) North Redbank (event 2) Gayini Nimmie-Caira wetlands (event 3) Yanco and Forest creeks (event 4) Wanganella Swamp and Middle Wetland pumping (event 5)	114,022 ML (EWA comprised 23% of environmental water delivered in the water year)
2021-22 Wet conditions	11 events	**2 events** Gayini Nimmi-Caira Murrumbidgee flow peak supplementation	19,860 ML (EWA comprised 3% of environmental water delivered in the water year)
2022-23 Wet conditions	6 events	**2 events** Murrumbidgee fish flow (event 3) Yanco, Billabong and Forests creek (event 4)	60,081 ML (EWA comprised 16% of environmental water delivered in the water year)

563 2018-19 water year was a very dry year that affected general security allocations and therefore HEW allocations. EWA carried over from 2017-18 to 2018-19 played an important role in environmental water deliveries during this water year.

Table 7A-3: PPM actions undertaken in the Murrumbidgee valley

Water year and catchment condition	PPM actions	Purpose of environmental watering event
2020-21 Wet conditions	2 PPM actions	The purpose of these PPM events was:[564] ▪ November 2020 event – provide a fish flow pulse to coincide with high flow conditions and facilitate fish passage along the Lower Murrumbidgee River to Redbank Weir (included removal of Balranald Weir) ▪ May 2021 event – provide a fish flow pulse to deliver downstream outcomes in the Murray. In addition to targeting native fish movement and recruitment these events were also intended to support productivity and instream vegetation.
2021-22 Wet conditions	5 PPM actions	The purpose of these PPM events was:[565] ▪ Events 1 and 2 (January and February 2022) – to maintain flow to address potential hypoxic flood water impacts on native fish below Maude Weir ▪ Events 3,4 and 5 (March, May and June 2022) – to manage flow recession at Wagga Wagga at the end of airspace releases from Burrinjuck Dam (PPM events in March, May and June 2022).

564 Information sourced from DPE (2022) *Prerequisite policy measures: NSW annual evaluation and review 2020-21*

565 Information sources from DPE (2023) *Prerequisite policy measures: NSW annual evaluation and review 2021-22*

Appendix 4 – Reference data for Chapter 9

Table 9A-1: Plan entitlement[566]

Licence Category	Number of Water Access Licences	Share component
Domestic and Stock	303	19,260
Domestic and Stock (Domestic)	49	271
Domestic and Stock (Stock)	164	10,626
Local Water Utility	14	23,816
Regulated River (High Security) [Town Water Supply]	2	19,769
Regulated River (High Security) [Aboriginal Cultural]	1	2,150
Regulated River (High Security) [Research]	1	300
Regulated River (High Security)	224	364,426
Regulated River (Conveyance)	3	2,968
Coleambally Irrigation (conveyance)	3	130,000
Murrumbidgee Irrigation (Conveyance)	3	243,000
Regulated River (General Security)	884	1,892,005
Supplementary Water	240	198,780
Supplementary Water [Lowbidgee]	26	747,000
Total	**1,917**	**3,654,371**

566 Data from the *NSW Water Register*. Total entitlement by licence category. Accessed on 31 October 2023.

Appendix 5 – Reference data for Chapter 10

Table 10A-1: Comparison of 2022 and 2016 Plan dealings provisions

Description	Comparison of trade provisions (2022 and 2016 plans)	Overall comment
71O Conversion of access licence to new category	Clause 52 is consistent with Clause 73 Both prohibit 71O trades	No significant changes
71Q Assignment of rights dealings	Clause 53(1) is consistent with 74(1a) Clause 53(2a and 3) is consistent with 74(1b) Clause 53(2b and c) is similar to 74(2a, 2c, 3a, 3b, 3c and 4) 2022 Plan restricts dealings to another water source and does not allow for establishment of conversion factors as permitted under the 2016 Plan. 2022 Plan is potentially more restrictive	2022 Plan is potentially more restrictive
71R Amendment of share component dealings (change of water source)	Clause 54 prohibits all 71R dealings Clause 75 provides provisions under which a 71R dealing may occur 2022 Plan is potentially more restrictive	2022 Plan is potentially more restrictive
71T Assignment of water allocation dealings	Clause 55(1a) is consistent with Clause 76(1c and e) Clause 55(1b) is similar to Clause 76(1d). 2022 Plan only restricts supplementary water (Lowbidgee) to a supplementary water access licence rather than to any access licence of another category. 2016 Plan is potentially more restrictive on supplementary water (Lowbidgee) access licences Clause 55(1c and 2) is consistent with Clause 76(2 and 3) Clause 55(1d) is similar to 76(4) and 76(5) but the 2022 Plan does not allow 71T in the Snowy River catchment (Clause 4c) as in the 2016 Plan. 2022 Plan is potentially more restrictive Clause 55(1e) is consistent with Clause 76(6a) Clause 55(1f) is consistent with Clause 76(6b) Clause 55(1g) adds a requirement that a 71T must be compliant with the IVT procedures and rules in Schedule D of the Murray-Darling Basin agreement. This was not in the 2016 Plan and is potentially more restrictive	2016 Plan is potentially more restrictive on supplementary water (Lowbidgee) access licences 2022 Plan is potentially more restrictive on trades between water sources and requirements that must be met prior to approval of trades
71U and 71V Interstate access licence transfer and assignment of water allocation	Clause 56(1) does not allow for 71U trades unless administrative arrangements are in place. This is consistent with Clause 77(1a and 2a) but the 2016 Plan has additional restrictions of conversion factors (1a and 2b), water supply works restrictions (1c) and licence type restrictions (2c). The 2016 Plan is potentially more restrictive Clause 56(3a) is consistent with Clause 77(4a) Clause 56(3b) is consistent with Clause 77(4b) Clause 56(3c) is consistent with Clause 77(5a) Clause 56(3d) is consistent with Clause 77(5b)	2016 Plan is potentially more restrictive regarding the requirements that must be met prior to approval of 71U and 71V trades

	Clause 56(3e) is consistent with Clause 77(3c) Clause 77(3a and 3b) requires the establishment of administrative arrangements and conversion factors prior to permitting trades, potentially making 71V trades more restricted under the 2016 Plan	
71W Nomination of water supply works dealings	Clause 57(1a) is consistent with Clause 78(1c) Clause 57(1b) is consistent with Clause 78(1a) Clause 57(1b and 1c) is largely consistent with Clause 78(1b). The 2022 Plan allows amendment of a supplementary water (Lowbidgee) access licence to supply works in the Lowbidgee. The 2016 plan is potentially more restrictive Clause 57(1d) is consistent with Clause 78(1d) Clause 57(1e) is largely consistent with Clause 78(4 and 5). The 2022 Plan indicates a requirement that trade is in accordance with the IVT procedures, and specifies that the interstate agreement is Section D of the Murray-Darling Basin Agreement. The 2016 Plan requires the application of conversion factors to permit trades, and places restrictions where trades nominate a water supply work in Maude or Redbank weir pool. Each Plan differs in allowances of trade. It is unclear whether the 2016 or 2022 Plan is potentially more restrictive. Clause 57(1f) is consistent with Clause 78(2) Clause 57(2) is consistent with Clause 78(3)	2016 Plan is potentially more restrictive on supplementary water (Lowbidgee) access licences

Table 10A-2: Permitted trades to and from the Murrumbidgee (Zone 13) based on Schedule D Permissible transfers between trading zones protocol 2010 under the Murray Darling Basin Agreement[567]

Transfer permitted to:	Transfers permitted from:
Entitlement, allocation and tagged trade permitted to:	Entitlement, allocation and tagged trade permitted from:
Vic Murray above Barmah Choke Vic Murray from Barmah Choke to SA border NSW Murray above the Barmah Choke NSW Murray below the Barmah Choke South Australian Murray	None
Back trade only, no tagged trade, to:	Back trade only, and no tagged trade, to:
Greater Goulburn (Vic) Lower Goulburn (Vic) Campaspe (Vic) Lower Campaspe (Vic) Part Loddon (Vic) Lower Broken Creek (Vic) Lower Darling	Great Goulburn (Vic) Lower Goulburn (Vic) Campaspe (Vic) Lower Campaspe (Vic) Part Loddon (Vic) Vic Murray above Barmah Choke Lower Broken Creek (Vic) Vic Murray from Barmah Choke to SA border Lower Broken Creek Vic Murray from Barmah Choke to SA border NSW Murray above the Barmah Choke NSW Murray below the Barmah Choke South Australian Murray Lower Darling

567 NSW Government (2018) *Murrumbidgee Inter-Valley Trade Account (IVT) – Fact sheet*

Appendix 6 – Reference data for Chapter 14

Table 14A-1: - A summary of monitoring activities per MER theme, in the Murrumbidgee valley[568] and its assumed linkages to the objectives and the performance indicators as assessed by the Commission

MER theme	Monitoring activities	Project duration	Assumed link to objective	Assumed link to performance indicator
River flows and connectivity: Extent, condition and diversity of refuge sites	1. Hydrologic monitoring of low flows and flow variability at identified refuge assets using selected gauges and remote sensing	Ongoing	9(1)(a)(b)	9(4)(a)(ii)
River flows and connectivity: Condition and extent of in-stream, floodplain and wetland habitats	2. Hydrologic monitoring of flow variability at selected gauges in water sources where water is managed	Ongoing	9(1)(a)(b)	9(4)(a)(ii)
	3. Inundation extent mapping in the Lower Murrumbidgee	Ongoing	9(1)(a)(b)	9(4)(a)(ii)
	4. Inundation extent monitoring/mapping all Murrumbidgee e-watering sites	2018-Ongoing	9(1)(a)(b)	9(4)(a)(ii)
	5. Development of ecohydraulic models across the Murray-Darling Basin	2018-2019	9(1)(a)(b)	9(4)(a)(ii)
River flows and connectivity: Dissolved organic carbon, nutrient transport and food webs	6. Results from the primary productivity project conducted by the MDBA-MDFRC Collaboration Project (MMCP) may provide transferable outcomes for this objective	2018-2019	9(1)(a)(b)	9(4)(b)
Native vegetation: Condition and extent of native water-dependent vegetation communities	7. Extent assessed at intervals of five years or more via remote sensing in the Murrumbidgee valley	Ongoing	9(1)(a)	9(4)(a)(i)
	8. Joint LTIM-OEH vegetation surveys in the Mid-Murrumbidgee and Lower Murrumbidgee wetlands	Until 2021	9(1)(a)	9(4)(a)(i)
	9. Condition assessment using the Basin-wide vegetation stand condition tool	Ongoing	9(1)(a)	9(4)(a)(i)

[568] Refer to section 3 – Monitoring activities in *Murrumbidgee Surface Water Monitoring, Evaluation and Reporting Plan*

Waterbirds: Waterbird species richness, abundance and breeding	10. MDBA annual aerial surveys of sites in the Lower Murrumbidgee	2010-2019	9(1)(a)	9(4)(a)(i)
	11. Joint LTIM-OEH waterbird surveys the MIA, Mid-Murrumbidgee wetlands, Nimmie-Caira, North Redbank, South Redbank, Western lakes, Yanco & Billabong Creeks	Ongoing	9(1)(a)	9(4)(a)(i)
	12. Event-based surveys of active breeding sites	Subject to conditions	9(1)(a)	9(4)(a)(i)
Native fish: Native fish abundance, population structure, distribution and movement	13. Annual fish community sampling at 33 priority regulated and unregulated fish sampling zones. Metrics include population structure, recruitment, and distribution as prevalence. The fish monitoring data collection has been designed to inform the five-yearly evaluation and reporting cycle	2014-2020	9(1)(a)	9(4)(a)(i)
	14. DPIF undertake annual surveys at ten sites (boat electro-fishing and fyke nets) from Darlington Point to Carrathool in March under LTIM 15. DPIF conducts larval fish sampling during six sampling events annually six sites under LTIM. Sites are from Berembed to Carrathool 16. DPIF undertake assessment in 2014 (Year 1) and 2019 (Year 5) at 22 sites in the mid-Murrumbidgee catchment for LTIM 17. Charles Sturt University sampling in Murrumbidgee wetlands each watering season (Mid-Murrumbidgee, Lower Murrumbidgee, Nimmie-Caira and Redbank systems) for LTIM	2014-2019	9(1)(a)	9(4)(a)(i)
	18. OEH survey of Golden perch populations in Yanga Lakes	2018-2019	9(1)(a)	9(4)(a)(i)
	19. NSW collaboration on genetics, natal origin (origin of birth) and growth dynamics with EWKR, LTIM and MMCP	2015-2020	9(1)(a)	9(4)(a)(i)
Other biota: Frog distribution and population structure	20. Surveys in the Mid-Murrumbidgee, Murrumbidgee and Coleambally Irrigation Areas and the Lower Murrumbidgee floodplain wetlands, complemented by SOS Southern Bell Frog monitoring	Until 2021	9(1)(a)	9(4)(a)(i)
	21. Event-based surveys in response to environmental flows	Until 2021	9(1)(a)	9(4)(a)(i)
Other biota: Macroinvertebrate community structure	22. Assessment of the impacts of flow on macroinvertebrates in fast flowing habitats in the Tumut tributaries and Murrumbidgee tributaries below Burrinjuck Dam	2018-2020	9(1)(a)	9(4)(a)(i)

	23. Regulated river sites for the effects of river regulation and cold water pollution on macroinvertebrate recruitment project			
Water quality	24. Continuous sampling of salinity (EC) at 37 sites 25. Turbidity, total nitrogen, total phosphorus, dissolved oxygen and pH are sampled monthly at 26 sites 26. Continuous water temperature sampled at 39 permanent sites. Two of these sites are temporary 27. Cyanobacteria sampled in Blowering and Burrinjuck Dam. Samples are also collected downstream of each dam. Routine monitoring is also undertaken in key lowland weirs and recreational lakes	Ongoing	9(1)(c)	9(4)(b)
Other: tolerable risk evaluation, habitat assessment and sustainable water extraction	28. Seasonal monitoring of satellite data in unregulated water sources, focused on dry years, to monitor patterns of irrigated water compared to the total water entitlements in unregulated water sources	Ongoing	9(1)	9(4)(a)(i)
	29. Develop foundation datasets for geomorphic, hydrologic and water quality aspects that influence ecological responses	2018-2019	9(1)	9(4)(a)(i), 9(4)(b)
	30. Assessment of LTAAEL volumes and whether the water in excess of the LTAAEL is sufficient to protect or enhance ecological condition	2018-2019	9(1)(c), 10(1)(a)	9(4)(b), 10(4)(b)
	31. Evaluating the influence of water sharing plan rules (non-discretionary water) on the ability of discretionary water to deliver ecological outcomes	2018-2019	9(1)(c)	9(4)(b)