



EVALUATION OF NSW WATER SHARING PLANS

Evaluation of the major NSW Murray–Darling Basin regulated river water sharing plans

2004 – 2015

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Foreword

This document is one of two evaluation reports examining NSW surface and groundwater sharing plans within the NSW Murray–Darling Basin. Report drafting commenced in 2012 with considerable revision prior to draft release in 2018. Minor corrections and format changes have been made to the final report versions. The material contained within these reports is current to 2015 for regulated river plans (2016 for the NSW Border Rivers) and to 2016 for groundwater plans.

Since this report was written considerable effort has been applied to the development of replacement water sharing plans and associated water resource plans made under the *Basin Plan 2012*. Many of the findings and recommendations contained within these evaluation reports have been addressed during this process.

There are references in this document to the NSW Department of Primary Industries - Water (DPI Water). This is the former name of the NSW Department of Planning, Industry and Environment (DPIE).

Summary of recommendations

General recommendations for all groundwater water sharing plans	
Appropriateness	<ol style="list-style-type: none"> 1. Adopt a program logic approach to establish and review plan objectives. 2. Develop SMART objectives. Both broad and targeted objectives should be established to achieve specific economic, social and environmental outcomes. Consideration should be given as to whether the objectives are consistent with the <i>Water Management Act 2000</i> and the objectives established in the Basin Plan 2012. 3. Review plan internal logic to ensure the vision, objectives, strategies and performance indicators are clearly structured, relate to each other, and apply to the plan rules. Consider whether more appropriate, objective–linked strategies should be developed, to improve clarity of direction for WSP rules and to improve measurement of success 4. Review plan objectives and scope to improve the recognition of connections to adjacent surface and groundwater sources. 5. Consider including analysis of climate variability and change, as well as potential changes in industry base to assess implications for water availability, and water demands 6. Improve public availability of evidence sources supporting plan development, implementation and monitoring, in order to support plan implementation and communication to stakeholders and the water market. 7. Develop a communication plan that serves the needs of the community and the water market during WSP operation. 8. As WaterNSW has a key operational and communication role, consider whether the WaterNSW Operating Licence and/or Work Approvals should include requirements to implement communications plans. 9. Review alignment of plan objectives with state priorities for natural resource management during the development of the WRPs.
Efficiency	<ol style="list-style-type: none"> 10. Establish a state–wide policy with respect to the establishment of numerical extraction components. Numerical extraction components may be appropriate to be used as a tool to ensure clearly specified water rights. 11. Consider the policy requirement for an operating protocol for rates of rise and fall of dam releases; is the protocol required given it hasn't been implemented during first 10–year term? If the review considers a protocol is required, then DPIE may require compliance by the holder of the works approval. 12. Consider whether each of the discretionary amendment provisions is still necessary.
Effectiveness – Economics	<ol style="list-style-type: none"> 13. Revise the economic objectives, related strategies and performance indicators using the program logic approach to allow evaluation of economic objectives. 14. Establish a fit for purpose monitoring, evaluation and reporting program based on the revised performance indicators.

General recommendations for all groundwater water sharing plans

Effectiveness – Social /Cultural	<p>15. Revise the social and cultural objectives, related strategies and performance indicators using the program logic approach to allow evaluation of social and cultural objectives. This should include recognition of spiritual, social and customary values of water to Aboriginal people.</p> <p>16. Consider developing appropriate performance indicators for values of groundwater for Aboriginal people.</p>
Effectiveness – Environmental	<p>17. Define specific environmental outcomes clearly linked to WSP rules and associated performance indicators.</p> <p>18. Design monitoring programs for specific performance indicators, implement them reliably and publish the results</p>

Recommendations to strengthen water sharing plan evaluation

19. Develop a “fit for purpose” performance monitoring program, aligned with NSW’s monitoring requirements under the *Basin Plan 2012*.
20. Identify and collect contextual data to inform effectiveness evaluations. This includes information on climate and economic factors which influence WSP outcomes but are not managed by the WSP.
21. Build plan performance monitoring into the business planning model within the department.
22. Improve groundwater system knowledge by identifying and investigating key gaps, for example surface and groundwater interactions.
23. Improve public availability of evidence sources supporting plan development, implementation and monitoring.

Glossary

3T	The 3T rule in the Plan applies to river flows that occur below Copeton Dam and in the catchment of the three tributaries: Horton River, Myall and Halls Creeks, located upstream of Tareelaroi Weir.
AAP	Annual Allocation Plan
ACCC	Australian Competition and Consumer Commission
AEA	Murray Additional Environmental Allowance
AEW	Adaptive Environmental Water
AWD	Available water determination (also called allocations)
Basin Plan, BP 2012	The Murray–Darling Basin Plan 2012 under the Commonwealth Water Act 2007.
BGA	Blue–Green Algae
BLR	Basic Landholder Rights
BMA	Barmah–Millewa Allowance
BMO	Barmah–Millewa Overdraw
Broad objectives	Statements of desired outcomes to which the plan will contribute. At least one broad objective is required for each of the economic, social / cultural and environmental aspects of the vision statement.
BRRRMC	Border Rivers Regulated River Management Committee
CEWH	The Commonwealth Environmental Water Holder, a statutory position under the Commonwealth Water Act 2007, responsible for the management of water licences held by the Commonwealth for environmental purposes.
CEWO	The Commonwealth Environmental Water Office operates on behalf of the CEWH.
Continuous accounting	Complex rules that apply to the accounts of specific categories of access licence in specific WSP areas. These rules provide opportunity for to reduce year–to–year water availability variations. Incremental AWD announcements are made through the water year when water is available.
DPI	NSW Department of Primary Industries
ECA	Environmental Contingency Allowance
ECAOAC	Environmental Contingency Allowance Operations Advisory Committee
EFRs	Environmental Flow Rules
EWA	Environmental Water Allowance
GPAWR	General Purpose Water Accounting Reports (DPI Water 2017b)
GRRMC	Gwydir Regulated River Management Committee.
GS	General Security access licence
HS	High Security access licence
IGA	Intergovernmental Agreement
IMEF	Integrated Monitoring of Environmental Flows
LRRMC	Lachlan Regulated River Management Committee
LTADEL	Long Term Average Annual Extraction Limit
MAA	Murray Additional Allowance

MCRMC	Macquarie Cudgegong River Management Committee
MLDCRC	Murray Lower Darling Community Reference Committee
MLDRIN	Murray Lower Darling Rivers Indigenous Nations organisation
MMWMP	Macquarie Marshes Water Management Plan
MRRMC	Murrumbidgee Regulated River Management Committee
Murray AEA	Murray Additional Environmental Allowance
NRC	Natural Resources Commission.
NRRMC	The Namoi Regulated River Management Committee
OEH	NSW Office of Environment and Heritage
PI	Performance Indicator(s).
Plan implementation reviews	The reports previously known as the plan implementation audits (DPI Office of Water 2013a and 2013b). They examine whether the rules of a plan were implemented correctly and within the required timeframes. The frequency of reporting is determined by related legislation and agreements, for example the WMA 2000 specifies no more than 5-year intervals for WSPs, and the BP 2012 requires annual reporting.
Plan internal logic	Internal plan structure referring to clear links from objectives to rules. The structure of a WSP is directed by the <i>Water Management Act 2000</i> to include a vision, objectives, strategies and PIs. Rules should link to strategies, which then link to targeted objectives, which link to broad objectives, which should all link to the plan vision.
Plan internal logic relationship diagram	Flow charts showing the relationships between broad and targeted objectives, strategies and rules for economic, social / cultural and environmental outcomes.
Plan rules	Legal mechanisms by which the plan implements water management strategies. At least one plan rule or rule set is required to implement each strategy. The term may refer to an individual plan clause, sub clause or multiple clauses depending on how the plan has been written.
Plan strategies	Statements of water management activities or levers a plan uses to deliver targeted objectives.
Plan Suspension – Murrumbidgee	The Plan was suspended from the 1st of November 2006 until the 16th of September 2011, due to extreme drought. The Plan suspension was necessary to allow the system to be adaptively managed through an unprecedented extreme climatic sequence, which the Plan was not designed to cope with.
Plan Suspension – Murray–Lower Darling	The Plan was suspended from the October 2006 until 16 September 2011, due to extreme drought. Diminished surface water availability meant that available water determinations were low for general security access licences.
Plan Suspension – Macquarie Cudgegong	The Plan was suspended from the 1st of July 2007 until the 16th of September 2011, due to extreme drought. Diminished surface water availability meant that available water determinations were low for general security access licences.
Plan Suspension – Lachlan	The Plan was suspended from the 1st of July 2004 until the 16th of September 2011, due to extreme drought. Diminished surface water availability meant that it was difficult to meet Basic Landholder Rights and replenishment flows. Available water determinations were also low.

Planned environmental water	Environmental water identified by the Plan rules. Note that planned environmental water does not include environmental water provided by water licences (e.g. those held by NSW Office of Environment and Heritage or the Commonwealth Environmental Water Holder)
Program logic	Established framework for evaluation, a linear series of steps that set out what needs to occur for a project to meet its desired outcomes – in this instance for a plan to achieve its objectives.
PSV	Provisional Storage Volume(s)
Relationship	For the purposes of this document ‘relationship’ refers to the linkages between broad and targeted objectives, targeted objectives and strategies, and strategies and rules. These relationships should be based on a conceptual model underpinned by evidence such as response models or other rationale. The strength of relationships should drive the selection of the most appropriate broad or targeted objective, strategy or rule because without strong relationship foundations any evaluation of plan success will be limited.
RFOs	River Flow Objectives
SF	Stimulus Flow: The aim of the stimulus flow is to provide a flow in the river that mirrors a naturally occurring hydrograph, targets pre-season cues to fish breeding and to regularly wet and inundate interconnected riparian areas.
SMART	<p>Specific – define a specific area or item for improvement.</p> <p>Measurable – quantify or provide an indicator of progress.</p> <p>Achievable – state what results can realistically be achieved given available resources and who will do the work.</p> <p>Relevant – choose goals that matter and are relevant to water resource planning including stakeholders.</p> <p>Time-bound – specify when the result(s) can be achieved and delivered.</p>
Targeted objectives	Statements of the desired outcomes a plan will achieve. At least one targeted objective is required for each broad objective. All targeted objectives must be linked to at least one plan strategy.
Triple bottom line reporting	Evaluation of economic, social / cultural, and environmental outcomes guided by the legislation.
Water allocation assignment trade	A water allocation assignment trade (formerly known as a ‘temporary water transfer’) is the assignment or transfer of currently available water allocation from one access licence (water account) to another.
Water sharing plans (WSP) and water resource plans (WRP)	Water sharing plans are established under the WMA 2000 and are prepared for all water sources in NSW. Water resource plans are a requirement of the BP 2012 and cover water sources in the Murray–Darling Basin. WSPs will be a component of WRPs for water sources in the basin area.
Water year	1st July to 30th June.
WMA 2000, the Act	NSW <i>Water Management Act 2000</i> .
WQA	Water Quality Allowance
WQOs	Water Quality Objectives

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Introduction

This summary presents an overview of the first evaluation results of the development and implementation of the water sharing plans (WSP) for the major regulated rivers of the Murray–Darling Basin in NSW. Full details are available in the report cards for each WSP contained in the appendices to this report. The evaluation aims to determine plan appropriateness, efficiency of implementation and effectiveness in meeting plan objectives consistent with the requirements of the *Water Management Act 2000* (the Act). The plans and evaluation periods covered by this report are listed in Table 1.

Table 1: Regulated river water sharing plans evaluated

Water Sharing Plan	Commencement Date	Original WSP Cease Date ¹
NSW Border Rivers	July 2009	June 2016
Gwydir	June 2004	June 2014
Upper and Lower Namoi	June 2004	June 2014
Macquarie Cudgegong	June 2004	June 2014
Lachlan	June 2004	June 2014
Murrumbidgee	June 2004	June 2014
NSW Murray and Lower Darling	June 2004	June 2014

The evaluation of WSPs brings together evidence from planning, implementation and monitoring activities using a multiple lines of evidence approach. This information is often variable in scale, coverage and duration. A program logic is used to structure the evidence. Plan elements are separated for evaluation purposes. This allows high level outcomes and the steps taken to achieve them to be identified

The evaluations focus on three key elements – appropriateness, efficiency and effectiveness.

- Appropriateness – looks at whether the scale, scope, prioritisation and internal logic of a WSP were and are still suitable for the circumstances.
- Efficiency – assesses the level of implementation of WSP rules; whether their implementation was optimised and whether implementation issues should be considered in reviewing and amending the WSP.
- Effectiveness – gauges the extent to which the objective outcomes were achieved, and the contribution of the WSP strategies to this objective achievement.

Each set of report cards detail the findings and the evidence base used for each assessment. The evaluations will inform the ongoing improvement of the WSPs, their implementation and monitoring. Specifically, the evaluations will assist the development of water resource plans (WRPs), which are required for implementation of the Murray–Darling Basin Plan.

¹ These dates reflect the original cease dates of the relevant water sharing plans at plan commencement.

Background to the plans

The first round of WSPs in NSW were developed from the late 1990s to 2004, for rivers and groundwater areas presenting a high risk to economic, social and environmental outcomes, due to the high level of development and competition for water resources. The WSPs were the outcome of a series of reforms to water policy and management, including nationally agreed reforms, through the Council of Australian Governments (COAG) in 1994, followed by the modernisation of water legislation in NSW through the *Water Management Act 2000*. The National Water Initiative (NWI) was introduced in 2004 and built on the COAG reform.

Key elements of these reforms, implemented by the WSPs, included:

- Separation of water access licences from land title;
- Creation of fully tradeable water access licences that define the number of shares in available water from a specified water management area or water source;
- Clarification of existing water licences as rights to “shares” in the water resource, subject to available water determinations (AWDs), with defined accounting rules, priority of access, and level of reliability;
- Establishment of a broader water market, building on earlier reforms, with associated trading or “dealing” rules and a reduction in water trading constraints and transaction costs;
- The establishment of an overall limit to diversions from the water source, to protect both environmental values and water users’ security and reliability (this was initially established through the Murray–Darling Basin Cap on Diversions);
- Establishment of planned environmental water and associated rules;
- Clarification of basic landholder rights (BLR), including native title rights, harvestable rights and domestic and stock rights;
- System operation rules.

The NSW regulated river WSPs in the Murray–Darling Basin that are the subject of this evaluation, evolved from environmental flow rules established in the late 1990s (earlier in the Macquarie and Gwydir), as well as pre–existing management arrangements dating from the 1980s and 1990s.

River Management Committees (RMCs) were established representing water users, local government, community and environmental interests, as well as key government agencies. Following the commencement of the Act, the RMCs were consulted on the environmental flow rules and were then charged with developing the WSPs. Following legal drafting of the RMCs’ proposals, the WSPs were made available for public consultation, accompanied by explanatory documents.

The Minister for Water Resources made the WSPs in 2004 (2009 for the NSW Border Rivers), with the concurrence of the Minister for the Environment.

Key externalities and context during the evaluation period

During the plan evaluation period, all plan areas experienced severe and extended drought, beyond the most severe drought previously on record. Many of the plans had to be suspended during the drought, as the conditions exceeded the assumptions on which the WSPs were based. WSPs that were suspended included:

- the Lachlan, suspended immediately on commencement on 1st of July 2004;
- the Murrumbidgee, suspended on the 10th of November 2006;
- the NSW Murray and Lower Darling, suspended in October 2006; and
- the Macquarie Cudgegong, suspended in July 2007.

All WSPs were reinstated on the 16th of September 2011. During suspension, plan rules were implemented to the extent possible. At times this meant that rules were implemented with modifications, the objective of these modifications was to balance water distribution across various community needs during a time of extreme water shortage. In many cases the environmental water foregone was “repaid” once the plans re-commenced.

The Gwydir, Namoi and NSW Border Rivers plans were not suspended during the drought. However, low water availability due to the extremely dry conditions did affect some of the WSPs’ operations.

In addition to climate, environmental, social and economic outcomes are also driven by many other factors external to water management. The broader reforms and investment across the Murray–Darling Basin must also be considered. The broader economic circumstances in the regulated river valleys were influenced by commodity prices, technology change, the global financial crisis and the exchange rate, among other factors. Social outcomes were affected by economic factors, as well broader demographic changes and educational factors, among other factors. Environmental outcomes are also affected by climate (including the extreme drought), land use and introduced species.

In addition, during the 2004–2014 period, water management in the Murray–Darling Basin was the subject of significant reform and investment that was not envisaged when the WSPs were developed. This included the Commonwealth Water Act 2007 and Basin Plan 2012, the development of environmental water portfolios by Commonwealth and state governments, as well as significant investment in water efficiency projects to generate water savings. These were associated with changes in the governance of water management and environmental water.

Evaluation methodology

Best practice evaluation is based on a program logic approach. This is a linear step by step process that outlines the steps that need to occur for a project to deliver its desired outcomes. It also identifies any assumptions that may underpin step linkages and identifies the elements that need to be delivered to achieve those outcomes. The evaluation of a WSP involves bringing together evidence from planning and implementation to provide a total picture, using a multiple lines of evidence approach. However, this information is often variable in scale, coverage and duration. Program logic separates the elements of a program, such as a WSP, for evaluation purposes, and identifies high level outcomes and the steps to achieve them. It was developed for the World Bank in the late 1960s (Bamberger and Hewitt 1986) and has been widely used in Australian natural resource management (Australian Government 2009, Roughley 2009, DECCW 2010). It has also been identified as a viable method to assist evaluation for the NSW Government Evaluation Guidelines (DPC 2016).

Applying program logic to the planning cycle allows evaluation to be completed in stages (Figure 5) which can be progressively evaluated as more information becomes available during a plan’s term. This flexible approach allows some form of review to occur, even though outcomes may not yet be directly attributable to a plan.

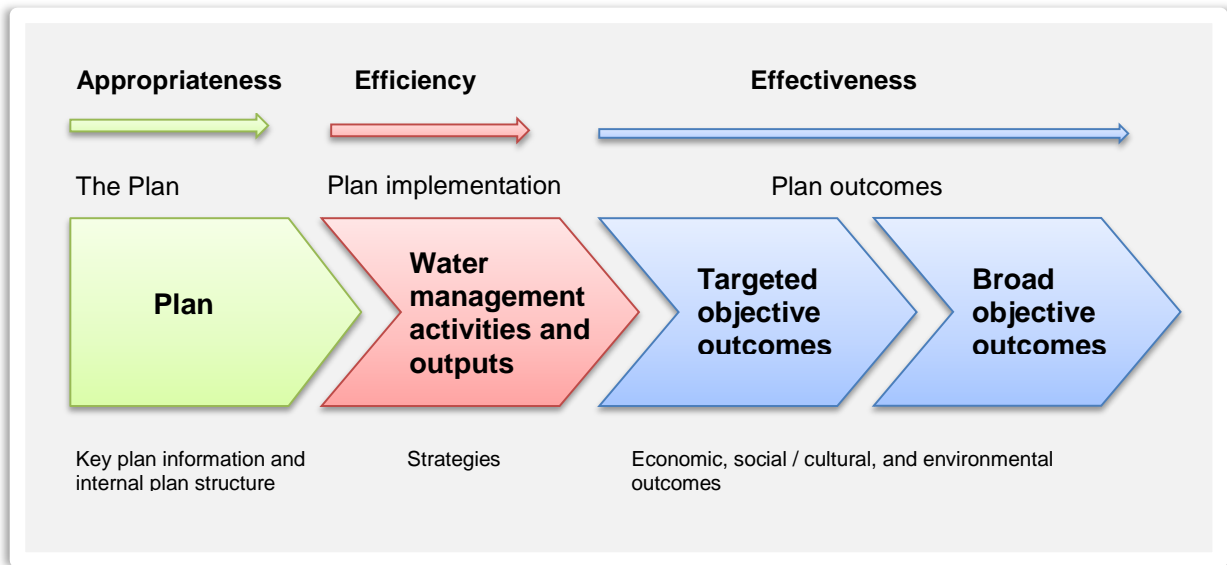


Figure 1: Plan operation elements following program logic and their related evaluation stage

Plan evaluation considers the following elements:

- **Appropriateness** – whether the scale, scope, prioritisation and internal logic of a plan were and are still suitable for the circumstances. This relies on information including geographical scale, types of water sources covered, the level of risk assigned to each water source and the plan’s internal logic. This also involves an assessment of the original intent of the plan, and whether this intent is still relevant.
- **Efficiency** – the level of implementation of plan rules, and whether their implementation was optimised. This element focusses on the water management activities required to implement a WSP rules and the resulting outputs (e.g. volumes of water delivered, flows provided, water trading statistics). This evaluation involves mapping the implementation process, identifying if there are better ways of achieving the same outcomes, and benchmarking against best practice. This relies on analysis of information including WSP implementation performance reviews and audits conducted during the plan term. This part of the evaluation forms the basis for continual improvement. The outputs feed directly into the targeted outcomes.
- **Effectiveness** – The extent to which the objective outcomes were met. That is, how successful was the implementation of specific strategies, in contributing to achieving the objectives of the WSP.

The evaluation of effectiveness is strongly influenced by the two previous evaluation stages (Appropriateness and efficiency) (see Figure 2). The Plan objectives detail what the Plan aims to achieve (Appropriateness); and are grouped into three types of outcomes: economic, social and cultural, or environmental. This triple bottom line approach is guided by the Act (Section 3).

These three types of outcomes were quantified by monitoring change from baseline conditions where available (i.e. the starting point for comparison) using the predetermined Plan performance indicators. Additionally, specific outcome investigations and modelling were used to improve result certainty. The achieved outcomes were then assessed against the desired outcomes as specified in the WSP objectives. Under program logic, objective outcomes are split into targeted and broad outcomes:

- **Targeted objective outcomes** are clearly defined, measurable and directly attributable to a plan’s operation and outputs. They typically relate to specific water management activities, for example controlling river flows, setting water levels, maintaining water supply and controlling the extraction of water.

- **Broad objective outcomes** are less clearly defined and there are many factors external to a plan that influence the success of a broad objective, for example land use, management of externally controlled environmental water, commodity prices, climatic conditions and other natural resource programs. Their assessment is based on a plan’s contribution towards reaching a broad objective, rather than achievement of the broad objective itself.

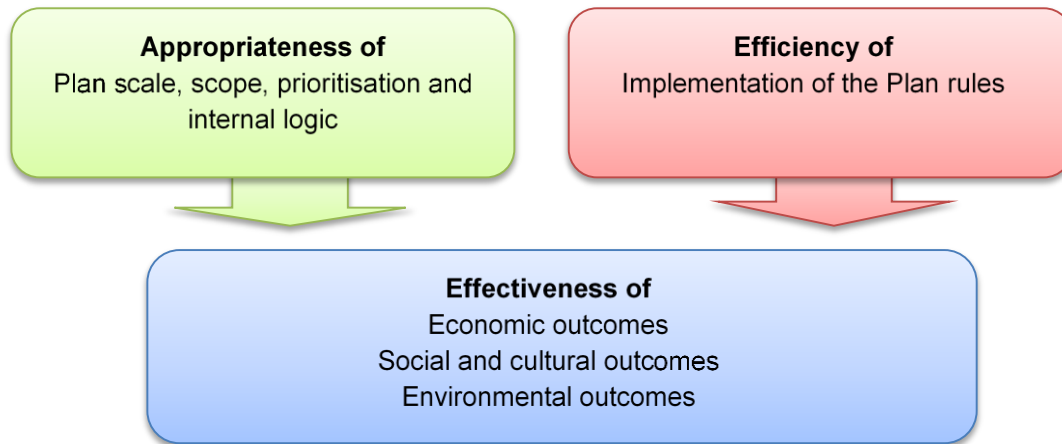


Figure 2: Interaction of evaluation elements

The following key principles underpin the evaluation approach:

- Plan objectives can only be evaluated if they relate to water management activities the plan controls through strategies and rules, and they have a clear linkage. Similarly, any rules that do not link clearly to an objective cannot contribute to the plan’s evaluation.
- If the plan has not been operational during the evaluation period (e.g. if the plan was suspended) but the plan rules were still being implemented to achieve the same outcomes, then their implementation can be assessed.
- If plan strategies or rules have not been implemented or delivered, any effectiveness evaluation will be diminished or may not be possible.
- Evaluation of broad objectives is reliant on the achievement of targeted objectives and plan strategies. The program logic approach assumes if targeted objectives and related strategies indicate progress, then progress is also being made towards the related broad objectives, such progress is detailed in the report cards.
- Baseline is assumed to be WSP commencement. However, evaluation of some outcomes may use a varied baseline if rules were in place prior to commencement.
- Evaluation is based on existing available evidence only. Raw datasets have not been analysed.

General findings and recommendations

This section lists the general findings arising from the evaluation that are common across all the relevant WSPs. More specific findings for each individual plan are listed in Chapter 6. The report cards for each individual WSP provide further detail on the reason for the finding, the supporting evidence and detailed recommendations.

Appropriateness

The *Water Management Act 2000* requires a WSP to include:

- (a) A vision statement,
- (b) Objectives consistent with the vision statement,
- (c) Strategies for reaching those objectives,
- (d) Performance indicators to measure the success of those strategies.

The application of this clear and logical framework is part of the appropriateness evaluation.

All WSPs were found to be mostly appropriate, but there is room for significant improvement. Appropriateness can be improved through the revision of the WSP objectives, strategies and performance indicators using the SMART (specific, measurable, achievable, relevant and time-bound) principle. This will provide clearer direction for plan rules, as well as a more robust framework to monitor and evaluate whether WSPs are effective.

All WSPs need to have clearer strategies. Currently all strategies link with the WSP rules but do not provide adequate direction for the WSP rules. The strategies are only used as headings in the WSP structure and do not clearly line up with the WSP objectives.

The performance indicators set out in the WSPs are clear but not comprehensive. Additional information is needed in the performance indicators to evaluate the performances of the WSPs. For example, where the objective and/or performance indicator is “change in ecological condition of the water source and dependant ecosystems”, more specific definition is required on what a change in ecological condition is and what change or lack of change is sought. The lack of this more specific definition of performance indicators and a lack of a clear link to the strategies and rules in the WSPs, makes it difficult to reach definitive conclusions about the performance of a plan.

Other general issues identified with the appropriateness of the WSPs include:

- Lack of recognition of groundwater interactions affecting the WSP scope for all WSPs
- None of the WSPs identified the potential future risks to water resources from issues such as climate change and change in industry base.
- Issues were identified with the public availability of supporting documents.
- The WSPs are not specifically aligned with the state priorities for natural resource management (although the 2004 plans were in place prior to the state priorities).
- Recent community feedback suggests that a more formalised ongoing communication protocol is required for communication arrangements during the operation of WSPs.

Recommendations on appropriateness were common across all plans, including:

1. Adopt a program logic approach to establish and review plan objectives.
2. Develop SMART objectives. Both broad and targeted objectives should be established to achieve specific economic, social and environmental outcomes. Consideration should be given as to whether the objectives are consistent with the *Water Management Act 2000* and the objectives established in the Basin Plan 2012.

3. Review plan internal logic to ensure the vision, objectives, strategies and performance indicators are clearly structured, relate to each other, and apply to the plan rules. Consider whether more appropriate, objective–linked strategies should be developed, to improve clarity of direction for WSP rules and to improve measurement of success
4. Review plan objectives and scope to improve the recognition of connections to adjacent surface and groundwater sources.
5. Consider including analysis of climate variability and change, as well as potential changes in industry base to assess implications for water availability, and water demands
6. Improve public availability of evidence sources supporting plan development, implementation and monitoring, in order to support plan implementation and communication to stakeholders and the water market.
7. Develop a communication plan that serves the needs of the community and the water market during WSP operation.
8. As WaterNSW has a key operational and communication role, consider whether the WaterNSW Operating Licence and/or Work Approvals should include requirements to implement communications plans.
9. Review alignment of plan objectives with state priorities for natural resource management during the development of the WRPs.

Efficiency

Overall the WSPs have been implemented efficiently, especially when considering the challenging context of the extreme Millennium Drought. However, there is room for implementation improvement for all WSPs, including some issues common to all, or most, WSPs.

Assessment of compliance with the Long–term Average Annual Extraction Limit (LTAAEL) has not occurred annually as specified in the WSPs due to the unavailability of annually updated water use development data. Importantly, it was identified that Murray–Darling Basin Cap assessments use a different methodology and are not a reliable surrogate for compliance. However, LTAAEL assessment and model updates have occurred or are currently occurring, after most of the plan terms. Where they have been completed, assessments have shown compliance with the LTAAEL (or at minimum that long term extractions remain below the trigger for response set by the WSPs).

A review of the WSPs is recommended to achieve an approach to assessing compliance with the LTAAEL that can be practically and routinely implemented, while enabling timely identification of any risk of growth in use. In addition, information on compliance with the LTAAEL is not currently readily obtainable and it is recommended that in future DPIE consider making this available on its website.

For the WSPs which were suspended (Murrumbidgee, NSW Murray and Lower Darling, Lachlan and Macquarie Cudgegong) the drought conditions and resulting plan suspension has impacted on environmental water releases, basic landholder rights (BLR), announcement of AWDs, carryover provisions, system operations and in some cases on water trading rules. In most cases these issues have been resolved once the plan was reinstated. The evaluations recommend review of the WSPs with a view to clarifying what will happen under extreme drought (in particular drought of record or worse), in terms of:

- Whether and in what circumstances a WSP is suspended;
- Practical constraints on the ability to deliver BLR during drought, due to transmission losses;
- Practical constraints on the ability to deliver replenishment flows, and that this depends on ability to convey specified volumes of water to nominated effluent creeks;
- Governance and criteria for decisions on BLR availability and reserves, during drought and/or when a WSP is suspended;

- Governance and criteria for decisions on AWDs, during drought and/or when a WSP is suspended;
- Decision making protocols for account management when a WSP is suspended;
- Decision making protocols for carryover when a WSP is suspended; and
- More clearly specify how minimum flow levels are to be addressed during extreme drought.

The evaluation found several trade related rules were either not implemented (e.g. conversion factors) or were varied during plan suspension. These have been referred to a state-wide DPIE review of trading rules, related to compliance with Basin Plan Water Trading Rules (refer to Basin Plan 2012, Chapter 12).

It is also recommended that:

1. Establish a state-wide policy with respect to the establishment of numerical extraction components. Numerical extraction components may be appropriate to be used as a tool to ensure clearly specified water rights.
2. Consider the policy requirement for an operating protocol for rates of rise and fall of dam releases; is the protocol required given it hasn't been implemented during first 10-year term? If the review considers a protocol is required, then DPIE may require compliance by the holder of the works approval.
3. Consider whether each of the discretionary amendment provisions is still necessary.

Effectiveness

Effectiveness – economic

The introduction of the WSPs, along with a range of other reforms, played a key role in enabling water trade (Aither 2017), as well as enabling water users to gain improved control over managing their exposure to risk around their water account and portfolio (e.g. through measures such as carryover and allocation (AWD) rules).

The reforms implemented by the WSPs (see section 2) provided options for industry to manage business risks associated with climatic variability, surface water availability, and commodity markets. This contributed positively to the economic outcomes in WSP areas. The increased potential to trade water provides opportunities to take advantage of differential water availability between licence categories. Changing demand levels within a water year can also be serviced through the water market.

Recent analyses suggest that water trading has enabled water users to adjust to limited water availability during the Millennium Drought (Aither 2017). Allocation trade has been particularly beneficial to this end. Other entitlement holders have been able to realise the value of their assets by selling part, or all, of their entitlement.

However, there is difficulty in differentiating the economic impacts and benefits from other external factors, such as the drought and reforms in the Murray–Darling Basin, as well as broader economic and social changes.

Key drivers of annual changes in farm incomes include changing commodity prices, costs of farm inputs, varying seasonal conditions and irrigation water availability (ABARES 2015). The WSPs have almost no effect on most of these, except for being a factor in irrigation water availability.

Therefore, while it can be reasonably concluded that the WSPs contributed to economic benefits for regional communities, it is recommended to consider clearer identification of SMART objectives and performance indicators, related to the plan rules.

Effectiveness – social/cultural

The WSPs and their implementation contributed to the social values and benefits provided by the river systems. The plans provide for BLR, which allow water to be extracted for domestic and stock purposes. However, the Millennium Drought limited their ability to secure these rights.

Beyond anecdotal information, there is little information available on the social impacts of the WSPs on communities within the WSP areas. Neither domestic and stock water availability, nor recreational use appears to have been systematically monitored, and there are no clear links between these indicators and plan rules. No native title rights have been granted within the water sources and no licences have been issued for Aboriginal cultural purposes.

The WSPs have not provided cultural outcomes for Aboriginal communities. No licences have been activated for cultural purposes, and a gap remains in the WSPs in terms of ability to influence Aboriginal social outcomes. DPIE has an Aboriginal Water Initiative Program that aims to improve Aboriginal involvement and representation in water planning and management within NSW. At the time the WSPs were developed, input from Aboriginal people and the capacity of government to report outcomes for them in water management were extremely limited. Plan objectives, and strategies to achieve these objectives should be developed, for the provision of water for native title rights, and recognition of spiritual, social and customary values of water to Aboriginal people.

The Aboriginal Water Initiative Program aims to improve Aboriginal involvement and representation in water planning and management within NSW. The DPI Aboriginal Water Initiative Program has commenced engagement with the Aboriginal communities in New South Wales. The community's objectives and outcomes for the management of the water resources of the WRP area are founded in several traditional owner groups' obligations to the whole river system and associated river communities as an indivisible group. Achieving their objectives requires consideration of values and uses that may extend across multiple WRP areas. Consultation to date has shown that these Aboriginal communities have a multi-faceted relationship with access to and use of water. This relationship ranges from a spiritual and cultural association, to an economic focus, to location of special places. Communities welcome engagement and are interested in further discussions to improve opportunities to provide for Aboriginal values and uses. While consultation makes clear that Aboriginal values and uses across the landscape should be considered in a holistic, connected sense, some important values and uses at specific locations have been identified

Effectiveness – environmental

Environmental monitoring shows both positive and negative environmental outcomes. During the drought, small environmental flow releases helped to support drought-affected vegetation and refuges for fish and wildlife. However, analysis of flow percentiles for low and medium flows shows that associated flow targets were not met for significant periods. Following the end of the drought and re-commencement of the WSPs, significant volumes of environmental water were delivered, usually generating the expected environmental responses.

However, it is difficult to differentiate these results from outcomes of environmental water reforms and the development of environmental water portfolios by state and Commonwealth governments. It seems reasonable to conclude that the WSPs have contributed to environmental outcomes by regulating for environmental flow rules and by creating tradeable water access licences. The latter of which enabled the development of environmental water portfolios.

It is recommended that for future WSPs, more specific environmental outcomes are defined, clearly linked to WSP rules and associated performance indicators. In addition, monitoring programs need to be designed for specific performance indicators, reliably implemented and their results published.

Key findings for individual plans

This section lists the major specific findings from the evaluation of each WSP. These are additional to the general findings for all WSPs described above. The individual report cards provide further detail on the reason for the finding, the supporting evidence and detailed recommendations.

Gwydir

The evaluation found that the WSP:

1. Is appropriate for its intended purpose (e.g. the sharing of water within a defined water management area) however improvements could be made to strengthen the WSP monitoring and evaluation framework and address interactions with connected water sources.
2. Has been implemented as expected and as efficiently as possible (with only minor issues identified).
3. Has been effective to some degree in achieving some of its objectives, although there is insufficient information to assess others.

Appropriateness

The evaluation identified that the objectives do not represent a full list of the WSP intended outcomes; they are a mixture of broad and targeted outcomes that do not clearly link together. One objective relates to a combination of economic, social and environmental outcomes. The performance indicators align with the objectives of the WSP. However, the WSP specified the same performance indicators for multiple objectives, demonstrating clear overlap between the WSP objectives. Further detail provided in Appendix 1 (Table 1) and Appendix 2.

Efficiency

The evaluation of the Gwydir WSP identified several issues for WSP efficiency:

- Minimum daily flows were not always met in accordance with WSP rules due to operational constraints.
- Contrary to WSP rules, procedures for the management of rates of change to releases from Copeton Dam have not been established.

Further detail is provided in Table 2 of Appendix 1.

Effectiveness – economic

As described in section 5, the creation of tradeable water access licences separated from land titles, is likely to have supported positive economic outcomes and/or mitigated negative outcomes. Available data shows an increase in water trading during the WSP period (Aither, 2017).

Overall the economic effectiveness was difficult to assess. Some of the stated performance indicators could not be directly attributed to the introduction of the Plan or water management activities and few additional analyses were available.

Therefore, it is recommended that DPIE consider clearer identification of SMART objectives (using program logic) and performance indicators, related to the Plan rules and differentiated from external factors, to the extent possible. In parallel, it is recommended that DPIE endeavour to establish a fit for purpose monitoring, evaluation and reporting program based around the previous recommendation. The effectiveness evaluation is fully outlined in Table 3 of Appendix 1.

Effectiveness – social/cultural

The Gwydir WSP has provided full access to water for BLR, Domestic and Stock Access Licence holders, and Local Water Utility requirements. No native title rights have been granted within the water source and no licences have been issued for Aboriginal cultural purposes.

There is little information available on the social impacts of the WSP on communities within the WSP area.

It is recommended DPIE consider including appropriate social and cultural strategies and performance indicators, including Aboriginal social and cultural objectives, strategies and performance indicators that are directly linked to values of water for Aboriginal people.

Effectiveness – environmental

The Gwydir Wetlands are in a more robust condition with improvements from initial surveys during the 1990s and 2000s, when it was classed as being in an impoverished, declining state. Despite the Gwydir Wetlands experiencing extremely dry conditions during the WSP period, the use of environmental water has successfully increased the resilience of the system to cope with extended dry periods, leading to improved condition and extent of floodplain vegetation and availability of colonially nesting water bird habitat. There is some information to suggest fish communities have been supported by the WPS.

The stated environmental contingency allowance (ECA) purpose, provision of inundation of higher-level benches in the river reaches between Copeton Dam and the Gwydir River at Gravesend, was found to be impractical to implement due to operational constraints at Copeton Dam. Improved environmental outcomes may be achieved through the refocusing of environmental water use to create conditions for the rebuilding of instream low to medium level benches. This is likely to be the first step in improving nutrient cycling in regulated rivers (Woodward et. al. 2015).

It is recommended that DPIE develop clearly defined and monitored performance indicators directly addressing the instream functions and habitats of the water source, to focus monitoring and improve the ability to make future environmental effectiveness assessments.

There is potential for future environmental outcomes to be improved through the review and refinement of some aspects of the WSP. Currently there is no plan mechanism or management protocol that addresses the movement of the in-stream portion of supplementary flow events. As the volume of water involved is substantial, consideration should be given to including it in Part 3 of the WSP where other water reserved for the environment is recognised. Providing WSP based direction for this water may improve environmental outcomes within the water source and in effluent systems, such as Mallowa Wetlands, that do not currently have a specified share of water.

In anticipation of the implementation of the Basin Plan, the WSP provisions referring to the Interim North–West Unregulated Flow Management Plan also requires review.

Recommendations of the evaluation include:

1. Consider developing clearly defined performance indicators and associated performance monitoring programs that closely align with WSP objectives and strategies. Consider developing design of monitoring programs to attempt to clearly differentiate between Plan rules / implementation and other external factors.
2. Consider implementing the NSW Cold Water Pollution Strategy to effectively address water quality impacts from Copeton Dam.
3. Consider reviewing the Environmental Contingency Allowance Operations Advisory Committee role and responsibilities to reflect the changes that have occurred in environmental water management in NSW and the Murray–Darling Basin.
4. Consider the continued applicability of the Interim North–West Unregulated Flow Management Plan in developing the WRP for the area.

5. Endeavour to investigate further refinement of environmental rules and their operation to enhance environmental outcomes without impacting economic or social outcomes.

Further detail regarding the evaluation of the Gwydir WSP can be found in Appendix 1 and Appendix 2.

Lachlan

The evaluation considered that the WSP:

1. Is appropriate for its intended purpose, but improvements could be made to strengthen the Plan monitoring and evaluation framework and address interactions with connected water sources.
2. Has been implemented efficiently in some respects, while in others Plan rules have not been followed. The practicality of these rules needs to be reviewed.
3. Has been effective to some degree in achieving some of its objectives, although there is insufficient information to assess others.

Appropriateness

The appropriateness findings of the evaluation of the Lachlan WSP were similar to the general findings and recommendations in section 5. The objectives of the Lachlan WSP are more specific than some other WSPs and therefore provide a better framework for evaluation and to guide the rules. However, the strategies are the same as other WSPs and would benefit from review.

Efficiency

Overall, the WSP has been implemented reasonably efficiently despite being suspended from July 2004 until September 2011 due to drought conditions.

The drought and resulting WSP suspension impacted on:

- Translucent flows from Wyangala Dam and Lake Brewster;
- Minimum daily flows at Geramy.
- Annual environmental contingency allowance (ECA) release plans were not prepared.
- Replenishment flows to effluent creeks for domestic and stock purposes were only able to be provided intermittently due to high transmission losses.
- Low AWDs were made for local water utility and high security licences, that were not consistent with the priorities identified in the WSP.

In addition, in common with all WSPs, the suspension of the WSP and the challenges in balancing community water needs during the drought raises the question of whether review of the WSP can achieve improved clarity on arrangements for extreme drought.

Environmental flow rules were not always implemented as per the WSP rules, or were not reported as such:

- In 2010–2011 the ECA and Water Quality Allowance (WQA) were used to partially offset operational losses incurred by a decision not to completely fill Lake Brewster in order to enable completion of a pelican breeding event.
- Since this time, the ECA and WQA have been reported as unused each year, and therefore forfeited.
- However, it is understood that the WQA is in fact debited by WaterNSW adjusting releases on a daily real-time basis, to allow shandyng of water to meet blue–green algae dilution rates and/or substitute for blue–green algae–contaminated Lake Brewster water; evaporation losses and additional transmission losses from Wyangala. This use is consistent with the

WSP. It is not clear why this does not appear in the General–Purpose Water Accounting Reports or the audit report.

- The purposes of the ECA appear to not align with WSP rules on accrual and availability of the ECA. These rules should therefore be revised to a more outcomes–based approach, while maintaining reliability of consumptive water users.

Several reviews and protocols identified in the WSP were not developed, including:

- An operating protocol for management of rates of change of Wyangala Dam releases.
- Numerical estimates of channel capacity.

WSP amendments have largely not been required and, when needed, were implemented reasonably efficiently. A limited review of rules did occur relating to constraints to trade within the water source. This led to upward revision of the allocation trade limit across Lake Cargelligo Weir from 31 GL/year to 82 GL/year. The WSP was amended 21 December 2012 to implement this change.

In addition to the common recommendations identified above in section 5, the Lachlan Regulated River Water Source WSP evaluation report makes several specific recommendations for efficiency. These include:

1. Consider reviewing the translucency rule trigger and timeframe to optimise contribution to the environmental objectives, while ensuring no impact on reliability
2. Review of the WSP to provide for:
 - An advisory committee for ECA; and
 - Link to contemporary environmental water management governance, planning and reporting arrangements, including NSW Office of Environment and Heritage (OEH)–led Long Term Watering Plan, annual watering priorities and ECA release plan.
3. Consider reviewing the WSP to consider the low usage rates of the ECA, and how to enable use for the purposes set out in the WSP.
4. Consider amending the WaterNSW works approval to provide more transparent governance, procedures and accounting for the WQA.
5. Consider whether requirement for Adaptive Environmental Water (AEW) use plans still provide the appropriate balance of water security for the environment with operational flexibility, given contemporary environmental water management governance, planning and reporting arrangements
6. Consider specifying more clearly the net accounting approach to Booberoi Creek.
7. Review to confirm whether channel capacity constraints are to be included in WSP. If they are to be included in WSP, DPI Water to consider requiring WaterNSW to review and update the estimates.
8. Consider whether any further amendments for conditions of Jemalong conveyance licence are required.
9. Consider whether the planned environmental water review clause is still required, given broader context of water recovery under Murray–Darling Basin Plan and contemporary environmental water governance.
10. consider whether amendments to WSP provisions to provide for floodplain harvesting are required in the Lachlan.

Effectiveness – economic

The effectiveness evaluation aligned with that for all WSPs (section 5) and no specific findings were made with respect to the Lachlan.

As described in section 5, the creation of tradeable water rights separated from land title, is likely to have supported positive economic outcomes and/or mitigated negative outcomes, by for example allowing trade of available water during the drought. Available data shows an increase in water trading during the plan period.

Overall the economic effectiveness was difficult to assess. Some of the stated performance indicator measures could not be directly attributed to the introduction of the WSP or water management activities. Little additional analyses were available.

Therefore, it is recommended that DPIE consider providing clearly defined performance indicators and associated performance monitoring programs that closely align with WSP objectives and strategies and meet SMART criteria.

Effectiveness – social/cultural

The WSP and its implementation contributed to meeting the BLR, social needs and amenity values of rural communities. However, the Millennium Drought constrained the effectiveness of the contribution to these outcomes. Throughout the duration of the WSP, water was shared between all water uses, including the environment, according to the priority of access provided in the WSP (except when the plan was suspended).

There is little information available on the social impacts of the WSP on communities within the WSP area.

No native title rights have been granted within the water source and no licences have been issued for Aboriginal cultural purposes. It is recommended DPIE consider including appropriate social and cultural strategies and performance indicators when reviewing the WSP, including Aboriginal social and cultural objectives, strategies and related rules.

During the suspension period of the WSP (2004/2005 – 2010/2011), local water utilities received reduced water allocations in some years, varying from 50% to 100% across the seven–year period. For the final three years of the evaluation period, full AWD allocations were provided for in all water years (2011/2012, 2012/2013, 2013/2014).

As no licences are required for extraction of water for BLR, it is difficult to accurately assess the ability of WSP to meet BLR requirements. Water to meet these needs is included in the WaterNSW operational protocols and is delivered on top of water ordered by licence holders. BLR requirements, including stock and domestic requirements, were only partially met during some periods of drought conditions. During the WSP suspension period, provision of BLR requirements required suspension of access to licensed water allocations carried over from previous years.

During the suspension period, only two out of seven years had full AWD allocations for domestic and stock licences (29% of water years), with 2009/2010 only allocating 15% AWD. For the final three years of the evaluation period 2011/2012 – 2013/2014, full AWDs were provided for domestic and stock licences in all water years (100%).

Effectiveness – environmental

Monitoring shows positive environmental outcomes. Analyses of the performance of the environmental flow rules over 100–year scenarios using Integrated Monitoring of Environmental Flows (IMEF) wetland inundation models and the IQQM river model have shown that the WSP objectives have largely been achieved. However, it is difficult to differentiate these outcomes from outcomes of environmental water reforms and the development of environmental water portfolios by state and commonwealth government agencies. It seems reasonable to conclude that the WSP has contributed to environmental outcomes, by preventing supplementary water access, and by making the environmental contingency allowance (ECA) and the water quality allowance (WQA) available.

Environmental water showed benefits for wetland biota such as colonial nesting birds in Booligal Swamp. Field observations of actual environmental flows support modelling conclusions, especially in relation to post–drought responses.

While the WSP was suspended from July 2004 to September 2011, small environmental flow releases helped to support drought–affected vegetation in the nationally significant Booligal Wetland and the Great Cumbung Swamp. Throughout 2010/2011 to 2013/2014, environmental watering events, coinciding with natural events, led to the inundation of wetland, river and floodplain habitats. This resulted in multiple bird breeding events in Booligal Wetlands, Lake Brewster, and Murphy’s Lake. Improvement in the condition of water–dependent vegetation, abundance of aquatic vegetation and abundance of frog species was also observed. There is limited information available regarding the condition or response of fish species in the Lachlan Regulated River.

The low flow regime generally met the baseline criteria, except for the 2009/2010 year where there were extended periods below the ‘natural’ 95th percentile flows. The moderate to high flow regime was only successfully implemented during years with large floods.

The environmental effectiveness of the WSP should also be viewed in the context of the findings and recommendation of the efficiency evaluation, with respect to the ECA and WQA rules.

The evaluation makes recommendations similar to all the WSPs:

1. Consider providing clearly defined performance indicators and associated performance monitoring programs that closely align with WSP objectives and strategies.
2. Consider investigating further refinement of environmental rules and their operation to enhance environmental outcomes without impacting economic or social outcomes.

Further detail regarding the evaluation of the Lachlan WSP can be found in Appendix 3 and Appendix 4.

Macquarie Cudgegong

The evaluation found that the WSP:

1. Is appropriate for its intended purpose, but that improvements could be made to strengthen the monitoring and evaluation frameworks and address interactions with connected water sources.
2. Has been implemented efficiently in some respects, while in others WSP rules have not been followed. In particular, the environmental water rules were not followed, despite environmental water being managed for the objectives intended by the WSP. These rules require review.
3. Has been effective to some degree in achieving some of its objectives, although there is insufficient information to assess others.

Appropriateness

In most respects, the Macquarie–Cudgegong appropriateness evaluation findings are the same as the general findings in section 5. However, this WSP’s objectives are particularly high level and vague. The objectives do not represent a full list of the WSPs intended outcomes and they do not clearly link together. It is recommended that a revised, more specific list of objectives is prepared and linked to strategies and rules. The current performance indicators align with the objectives of the WSP, but the objectives do not align with the SMART principle, which makes it difficult to evaluate success. The performance indicators should be revised alongside the objectives.

Efficiency

Overall, the WSP has been implemented reasonably efficiently despite the WSP being suspended from July 2007 until September 2011 due to drought conditions. The drought conditions and resulting WSP suspension did impact on environmental water releases from Windamere Dam, Environmental Water Allowance (EWA) release programs, BLR, announcement of AWDs, carryover provisions and extraction conditions. In most cases these issues have been resolved since the WSP was re-instated.

The general evaluation findings and recommendations in section 5 apply. However, the evaluation found that rules for accrual and releases from the EWA sub-allowances were not followed.

Difficulty in following the WSP EWA rules reflects:

- Extreme drought to 2012
- That the WSP EWA rules may be too prescriptive, and
- That WSP EWA rules pre-date contemporary governance arrangements of environmental water (e.g. NSW government decision (2008) to appoint OEH as lead agency on discretionary environmental water, Basin Plan reforms (2012), the development of environmental water portfolios (mainly 2006–2014) and environmental water planning (mainly from 2012)).

Decisions about release and accounting of the EWA have been made in full consultation with the Environmental Flows Reference Group (EFRG) and have been directed at the environmental objectives of the WSP. However, the rules were not followed due to their prescriptive and restrictive nature.

It is clearly undesirable that the administrators of the WSP, the environmental water and the accounting are potentially in non-compliance, despite being consistent with environmental objectives. Therefore, it is recommended that the rules are reviewed (and it is understood this is currently underway).

Trading rules between the Cudgegong and Macquarie were temporarily suspended during the WSP suspension in 2007–2008 due to concerns about the ability to deliver any traded water.

System operation rules have been implemented moderately efficiently. Replenishment flows were delivered irregularly during the WSP suspension but have been largely consistent since reinstatement.

The efficiency evaluation covers many other detailed implementation issues. In addition to the general recommendations in section 5, specific evaluation recommendations for the Macquarie–Cudgegong include:

1. Review the Windamere Dam translucency rules with respect to
 - a. suspension of triggered releases due to flooding.
 - b. how under releases are “paid back”.
2. Consider modifying account management rules for the EWA sub-allowances in the Macquarie to better reflect past operational practice, contemporary governance arrangements, and drought management.
3. Review AWD announcement process to simplify accounting in the Macquarie when Burrendong Dam spills while maintaining transparency in the process.
4. Review dealing rules between the Cudgegong and Macquarie Rivers with reference to dry periods.
5. Consider whether amendments to WSP provisions to provide for floodplain harvesting are required in the Macquarie, consistent with the “Healthy Floodplains” project.

Effectiveness – economic

The effectiveness evaluation aligned with that for all WSPs (section 5) and no specific findings were made with respect to the Macquarie.

As described in section 5, the creation of tradeable water rights separated from land title, is likely to have supported positive economic outcomes and/or mitigated negative outcomes. Available data shows an increase in water trading during the WSP period.

Overall the economic effectiveness was difficult to assess. Some of the stated performance indicators could not be directly attributed to the introduction of the WSP or water management activities and few additional analyses were available.

Therefore, it is recommended that DPIE review the economic objectives and related strategies (using the program logic approach) and define performance indicators that can measure the effectiveness of rules in achieving the revised economic objectives. In parallel, it is recommended that DPIE establish a fit for purpose monitoring, evaluation and reporting program based on the revised performance indicators.

Effectiveness – social/cultural

The WSP and its implementation contributed to meeting the BLR, social needs and amenity values of rural communities. However, the Millennium Drought limited the effectiveness of this contribution. Throughout the duration of the WSP, water was shared between all water users, including the environment, according to the priority of access provided in the WSP (except when the WSP was suspended)

There is little information available on the social impacts of the WSP on communities within the WSP area.

No native title rights have been granted within the water source and no licences have been issued for Aboriginal cultural purposes. It is recommended DPIE consider including appropriate social and cultural strategies and performance indicators when reviewing the WSP, including Aboriginal social and cultural objectives, strategies and related rules.

As no licences are required for extraction of water for BLR, it is difficult to accurately assess the ability of WSP to meet BLR requirements. Water to meet these needs is included in WaterNSW's operational protocols and is delivered on top of water ordered by licence holders. BLR requirements, including stock and domestic requirements, were only partially met during some periods of drought conditions. During the WSP suspension period, provision of BLR requirements required suspension of access to licensed water allocations carried over from previous years.

Local water utilities and domestic and stock rights received 100% allocations during the WSP period, except in 2007–08, while the WSP was suspended.

Delivery of water for domestic and stock use (under BLR), as well as domestic and stock access licences, occurred in most years. However, during plan suspension some rights holders and licences did not receive full access.

Recommendations to improve the social/cultural effectiveness of the WSP are as per those in section 5.

Effectiveness – environmental

The evaluation has been unable to find that the WSP has been effective, nor ineffective, in achieving the environmental objective over the 2004–2014 period. While some indicators demonstrate positive environmental outcomes, others continue to indicate negative impacts.

In addition, the evaluation found that effectiveness of WSP implementation could not be differentiated from pre-existing reforms in the Macquarie, the effects of the Millennium Drought,

Plan suspension, EWA implementation not aligning with WSP rules and the development of an environmental water portfolio.

Monitoring results show mixed responses to the implementation of the WSP. However, these must be viewed in the context of both the historically unprecedented Millennium Drought and the resulting suspension of the WSP between 2007 and 2011.

In summary, it can reasonably be concluded that ecological condition is still at risk, but that it is difficult to make a finding on WSP effectiveness in this regard. This is because of the drought conditions through most of the WSP term, the management of the EWA, and many other external factors.

It is recommended that DPIE develop clearly defined performance indicators (and associated performance monitoring programs that closely align with the WSP objectives and strategies). The indicators should directly address the instream and floodplain wetland functions and habitats of the water source, and how these are expected to be affected by the WSP rules. This will focus monitoring and improve the ability to make future environmental effectiveness assessments.

Further detail regarding the evaluation of the Macquarie and Cudgegong WSP can be found in Appendix 5 and Appendix 6.

NSW Murray and Lower Darling

The evaluation considered that the NSW Murray and Lower Darling Regulated River WSP:

1. Is appropriate for its intended purpose (e.g. the sharing of water within a defined water management area), however improvements could be made to strengthen the WSP's monitoring and evaluation framework and address interactions with connected water sources.
2. Has been implemented efficiently in some respects. The suspension of the WSP and the challenges in balancing community water needs during the drought raises the question of whether review of the WSP can achieve improved clarity on arrangements for extreme drought.
3. Has been effective to some degree in achieving some of its objectives, although there is insufficient information to assess others.

During the evaluation period, the NSW Murray and Lower Darling Valley experienced severe and extended drought. This led to the WSP being suspended from October 2006 until 16 September 2011. It is unclear whether additional restrictions were in place during 2004 - 2006 in the Lower Darling. This was necessary to allow the system to be adaptively managed through an unprecedented extreme climatic sequence, which the WSP was not designed to cope with. While the Minister was not bound by the WSP rules during the suspension period, the rules were implemented whenever water availability allowed.

Based on the overall findings of the evaluation, while considering the impact of externalities (including the extended drought), it is considered that the WSP has been successful to a large degree in achieving its objectives and original intent.

Appropriateness

The appropriateness evaluation findings are the same as the general findings in section 5. The objectives do not represent a full list of the WSPs intended outcomes and they do not clearly link together. It is recommended that a revised, more specific list of objectives is prepared, linked to WSP strategies and rules. The current performance indicators align with the objectives of the WSP, but the objectives do not utilise the SMART principle and therefore are difficult to evaluate. The performance indicators should be revised alongside the objectives.

The WSP scope and scale was found to be satisfactory as it covers the full extent of the regulated river within the WSP area. It is also considered appropriate as interactions with connected water sources have been adequately addressed in this WSP or other relevant WSPs. The WSP clearly indicates how it relates to interstate water sharing and operational agreements for the River Murray and includes the Murray–Darling Basin Agreement system operation rules as an Appendix. The WSP may benefit from a note indicating its interaction with the relevant unregulated and groundwater WSPs.

Efficiency

Overall, the WSP has been implemented reasonably efficiently despite being suspended from October 2006 until September 2011 due to drought conditions. The drought conditions and resulting WSP suspension did impact on environmental water releases, EWA release programs, BLR, announcement of AWDs, carryover provisions and extraction conditions. In most cases these issues have been resolved since the WSP was re-instated.

In terms of environmental water provisions, the drought suspension impacted on the Barmah–Millewa Allowance (BMA) provisions. During the suspension of the WSP, water was borrowed from the BMA accounts and made available for consumptive use. The borrowed water was repaid when the WSP was reinstated. At other times, the BMA was operated in accordance with WSP rules. Following this experience, it is recommended that DPIE consider reviewing the WSP to clarify the arrangements for management of the BMA in the event of extreme drought, the repayment of water borrowed from the BMA accounts and to simplify the planned environmental water rules.

It appears that the Murray–Lower Darling environmental contingency allowance (ECA) and the Murray Additional Environmental Allowance (Murray AEA) were not released. This was in accordance with WSP rules, as triggers were not met. However, it is recommended that DPIE review whether these allowances are still required and whether triggers are appropriate.

All necessary systems are in place to apply and manage AEW conditions should they be requested. In addition, OEH developed AEW use plans and committed licences to AEW. AEW was created during the WSP term, including as a water savings measure under “The Living Murray” initiative.

BLR protected through Domestic and Stock related WSP rules have been largely met except for the years of WSP suspension where some supplies were only available intermittently, due to the extremely dry conditions and difficult in transmitting the water considerable distances.

Assessment of compliance with the LTAAEL has not occurred annually as specified in the WSP due to the unavailability of annually updated water use development data. For the Murray Lower Darling, Cap compliance assessments are carried out by the MDBA, using their “MSM–BIGMOD” model. However, this differs from the LTAAEL method for the NSW WSP. Review is recommended to achieve an approach to LTAAEL compliance assessment that can be practically implemented, while enabling timely identification of any risk of growth in use.

During the years of WSP suspension, changes were made under the critical water planning process, aimed at maximising water available for essential supplies. Several rules of the WSP were not implemented. Access to account water by general security, high security and conveyance access licences was at times suspended. Limits were relaxed on carryover of unused water account balances set out in the WSP for general and high security licence holders (the WSP provides no carryover for high security and only 50% of entitlement for general security). General priorities of extraction conditions set out in the WSP were not always complied with from 2009 to 2011. It is recommended that DPIE consider reviewing the WSP to improve clarity around arrangements during extreme drought.

During WSP suspension (2006 –2011), the dealings were conducted according to the WSP rules. However, deadlines for general and high security allocation assignments within the Murray were relaxed to increase the opportunity for licence holders to meet their water needs in the dry

conditions. Account water assignment across the Barmah choke in the NSW Murray was permitted during 2007 to 2011. Changes to the dealing rules made while the WSP was suspended, were aimed at opening the water market as much as possible and giving licence holders greater flexibility in dealing with extremely limited water allocations (this was authorised by the MDBA). The WSP, however, contains dealing deadlines which are potentially inconsistent with the Basin Plan water trading rules and DPIE is reviewing these as part of a state-wide DPIE Trade Review. Note it is unclear whether additional restrictions were in place during 2004-2006 in the Lower Darling.

The efficiency evaluation covers many detailed implementation issues, which can be found in the Efficiency Report Card (Table 2, Appendix 11).

In addition to the general issues and recommendations identified in section 5, the following (summarised) key specific recommendations were identified:

1. Consider reviewing the WSP to:
 - a. Clarify the arrangements for management of the BMA in the event of extreme drought and the repayment of water borrowed from the BMA accounts.
 - b. Simplify the planned environmental water rules.
2. Consider reviewing whether the Lower Darling ECA and the Murray AEA are required and whether triggers are appropriate.
3. Consider reviewing the WSP to clarify what will happen under new drought of record conditions, in terms of operational constraints of inter-valley trades in the Murray.
4. Review account management rules for general and high security and conveyance licences to maximise the water available for critical water supplies during dry times, and triggers to move to these rules.

Effectiveness – economic

The effectiveness evaluation aligned with that for all WSPs (section 5) and no specific findings were made with respect to the Murray–Lower Darling.

As described in section 5, the creation of tradeable water rights separated from land title, is likely to have supported positive economic outcomes and/or mitigated negative outcomes. Available data shows an increase in water trading during the WSP period.

Overall the economic effectiveness was difficult to assess. Some of the stated performance indicator measures could not be directly attributed to the introduction of the WSP or water management activities. Little additional analyses were available.

Therefore, it is recommended that DPIE review the economic objectives and related strategies (using the program logic approach) and define performance indicators that can measure the effectiveness of WSP rules in achieving the revised economic objectives. In parallel, it is recommended that DPIE establish a fit for purpose monitoring, evaluation and reporting program based on the revised performance indicators.

Effectiveness – social/cultural

The WSP and its implementation contributed to meeting the BLR, social needs and amenity values of rural communities. However, the Millennium Drought limited the effectiveness of this contribution. Throughout the duration of the WSP, water was shared between all water users, including the environment, according to the priority of access provided in the WSP (except during WSP suspension).

There is little information available on the social impacts of the WSP on communities within the WSP area.

No native title rights have been granted within the water source and no licences have been issued for Aboriginal cultural purposes. It is recommended DPIE consider including appropriate social and cultural strategies and performance indicators when reviewing the WSP, including Aboriginal social and cultural objectives, strategies and related rules.

As no licences are required for extraction of water for BLR, it is difficult to accurately assess the ability of WSP to meet BLR requirements. Water to meet these needs is included in WaterNSW's operational protocols and is delivered on top of water ordered by licence holders. BLR requirements, including stock and domestic requirements, were only partially met during some periods of drought conditions. During the WSP suspension period, provision of BLR requirements required suspension of access to licensed water allocations carried over from previous years. Local water utilities received 100% allocations during the WSP period in the Lower Darling Regulated River Water Source, and in all years except 2007/08, 2008/09 and 2009/10 in the NSW Murray Regulated River Water Source, while the WSP was suspended during the drought.

Delivery of BLR for domestic and stock use occurred in most years. However, during WSP suspension, some rights holders and licences did not receive full access and some replenishment flows were not able to be delivered. (see efficiency report card, Table 2, Appendix 11). Domestic and stock access licences had full allocations for the NSW Murray Regulated River Water Source in all years except 2007/2008 – 2009/2010, when the WSP was suspended, and for the Lower Darling Regulated River Water Source in all years.

Recommendations to improve the social/cultural effectiveness of the WSP are as per those in section 5.

Effectiveness – environmental

The evaluation has been unable to find definitively that the WSP has been effective, nor ineffective, in achieving environmental objectives over the 2004–2014 period. However, the WSP has contributed to environmental outcomes, especially since the WSP suspension ended. While some indicators show positive environmental outcomes, others continue to show negative impacts.

In addition, the evaluation found that effectiveness of WSP implementation could not be differentiated from pre-existing reforms in the Murray–Lower Darling, the effects of the Millennium Drought, WSP suspension and the development of environmental water portfolios by state and commonwealth government agencies.

The WSP was developed with an understanding that detrimental effects on the condition of water-dependent ecosystems and water quality in the river and wetland systems had resulted from significant changes to the flow regime as a result of surface water development. In addition, the WSP built on the environmental provisions of the Murray–Darling Agreement, including the BMA and The Living Murray Agreement. The latter was in the process of being implemented when the WSP was made, including environmental water recovery measures from water savings projects.

Monitoring of the outcomes of these changes encompassed both pre- and post-WSP periods. Monitoring results show mixed responses to implementation of the WSP. However, these must be viewed in the context of both the historically unprecedented Millennium Drought and the resulting suspension of the WSP between 2006 and 2011.

At some major sites in the NSW Murray area, vegetation condition was poor and limited waterbird breeding was recorded during the Millennium Drought. Vegetation recovered through the natural flooding of 2010–12, with limited improvement since then. During the 2010/11 and 2011/12 years, the EWA was used with other environmental water sources at Barmah–Millewa, which led to a breeding event considered to be the best in the valley for a decade.

Analysis of flow regime shows that WSP performance indicator assessment criteria were not achieved compared to the baseline WSP target. This was the case for both the low flow and high

flow regime. In all cases, the exceptions were the years 2010–11, 2011–12 and 2012–13, which were associated with drought–breaking floods.

Water quality in the Lower Darling has been found to be predominantly very poor in the 2007–2012 period. Water quality in the NSW Murray has been found to be predominantly good to very good in the 2007–2012 period. While blackwater events have been a problem in the Murray and Lower Darling Valleys during the evaluation period, in some cases environmental water was successfully used to mitigate blackwater events and maintain good water quality.

In summary, it can reasonably be concluded that ecological condition is still at risk, but that it is difficult to make a finding on WSP effectiveness in this regard. This is because of the drought conditions through most of the WSP term and many other external factors. These external factors include the development of environmental water portfolios, which was enabled by the creation of tradeable water rights, but was not an objective, strategy or rule of the WSP.

It is recommended that DPIE develop clearly defined and monitored performance indicators (alongside more specific objectives and strategies that meet SMART criteria). The indicators should directly address the instream and floodplain wetland functions and habitats of the water source and how these are expected to be affected by the WSP rules. This will focus monitoring and improve the ability to make future environmental effectiveness assessments.

Given the major changes in environmental water management in NSW and the introduction of the Basin Plan in 2012, the WSP rules would benefit from review and significant revision.

Recommendations are those in the general section 5. Further detail regarding the evaluation of the NSW Murray and Lower Darling WSP can be found in Appendix 11 and Appendix 12.

Murrumbidgee

The evaluation considered that the WSP:

1. Is appropriate for its intended purpose (e.g. sharing water within a defined water management area), but improvements could be made to strengthen the WSP's monitoring and evaluation framework, to better explain the objectives of the WSP and provide direction for implementation and evaluation.
2. Has been implemented as expected and efficiently overall, but there is room for improvement in the future. In particular, the complexity of some planned environmental water rules made them difficult to implement in line with the WSP.
3. Has been effective to some degree in achieving some of its objectives, although there is insufficient information to assess others.

During the evaluation period, the Murrumbidgee region experienced a severe and extended drought. Subsequently, the WSP was suspended on the 10th of November 2006 and not reinstated until the 15th of September 2011. This was necessary to allow the system to be adaptively managed through an unprecedented extreme climatic sequence, which the WSP was not designed to cope with. While the Minister was not bound by the WSP rules during the suspension period, the rules were implemented whenever water availability allowed.

Based on the overall findings and the impact of externalities (including a period of extended drought) it is considered that the WSP has been successful to a large degree in achieving its objectives and original intent. However, this is difficult to differentiate from external factors, such as climate, economic factors and broader reforms in the Murray–Darling Basin.

Appropriateness

The appropriateness evaluation findings are the same as the general findings in section 5. The objectives do not represent a full list of the intended outcomes of the WSP and they do not clearly link together. It is recommended that a revised, more specific list of objectives is prepared and

linked to WSP strategies and rules. The current performance indicators align with the objectives of the WSP, but the lack of a SMART approach to the objectives, makes it difficult to evaluate success. The performance indicators should be revised alongside the objectives. WSP scale was found to be satisfactory after the Lowbidgee was incorporated into the WSP in October 2012.

Efficiency

Overall the WSP has been efficiently implemented. However, there is room for improvement in the future. In particular, the complexity of the environmental flow rules for Burrinjuck and Blowering Dams made them difficult to implement in line with the WSP. These issues also impacted the operation of EWAs and provisional storage volumes (PSVs). It has also been identified that WSP rules around trading deadlines could be improved.

System operation rules have been implemented moderately efficiently. Replenishment flows were delivered irregularly during the years of WSP suspension and therefore, the minimum flow requirements, in Billabong Creek at Darlot, were unable to be maintained. Other system operation rules such as the account management of PSVs were not implemented at times during WSP suspension, largely due to extended drought conditions, and errors in the accruals in the EWA2 and EWA3 accounts on which the PSV accruals rely. During the WSP's implementation, there were issues with managing the EWA accounts which led to miscalculations of the amounts available. This led to incorrect PSV account balances or the PSVs not being implemented. The scheduled review of the (PSVs) rules did not occur within the 12-month timeframe set in the WSP.

The full details of the efficiency evaluation and recommendations are available Table 2 of Appendix 13. In addition to the general recommendations in section 5, key efficiency recommendations (summarised), included:

1. Consider reviewing environmental water rules to more clearly specify the criteria for end of system flows during extended drought. The operational criteria in the WaterNSW works approval should be considered for inclusion within the WSP.
2. Review the WSP to:
 - a. Simplify the environmental water rules to be more outcomes-based and simpler (more efficient) to implement.
 - b. Simplify the criteria for calculation of transparency and ensure they can be practically implemented.
 - c. Clarify the procedure and decision-making criteria, triggers and governance arrangements for the EWA during drought.
 - d. Clarify the procedure for reconciliation and “repayment” of under or over delivery through either drought or errors.
3. Consider whether amendments to WSP provisions to provide for to floodplain harvesting are required in the Murrumbidgee.

Effectiveness – economic

The effectiveness evaluation aligned with that for all WSPs (section 5) and no specific findings were made with respect to the Murrumbidgee.

As described in section 5, the creation of tradeable water access licences separated from land titles, is likely to have supported positive economic outcomes and/or mitigated negative outcomes. Available data shows an increase in water trading during the WSP period.

Overall the economic effectiveness was difficult to assess. Some of the stated performance indicator measures could not be directly attributed to the introduction of the WSP or water management activities and few additional analyses were available.

Therefore, it is recommended that DPIE review the economic objectives and related strategies (using the program logic approach) and define performance indicators that can measure the

effectiveness of WSP rules in achieving the revised economic objectives. In parallel, it is recommended that DPIE establish a fit for purpose monitoring, evaluation and reporting program based on the revised performance indicators.

Effectiveness – social cultural

The WSP and its implementation contributed to meeting the BLR, social needs and amenity values of rural communities. However, the Millennium Drought limited the effectiveness of this contribution. Throughout the duration of the WSP, water was shared between all water uses, including the environment, according to the priority of access provided in the WSP (except when the WSP was suspended)

There is little information available on the social impacts of the WSP on communities within the WSP area.

No native title rights have been granted within the water source and no licences have been issued for Aboriginal cultural purposes. It is recommended DPIE consider including appropriate social and cultural strategies and performance indicators when reviewing the WSP, including Aboriginal social and cultural objectives, strategies and related rules.

As no licences are required for extraction of water for BLR, it is difficult to accurately assess the ability of WSP to meet BLR requirements. Water to meet these needs is included in WaterNSW's operational protocols and is delivered on top of water ordered by licence holders. BLR requirements, including stock and domestic requirements, were only partially met during some periods of drought conditions. During the WSP suspension period, provision of BLR requirements required suspension of access to licensed water allocations carried over from previous years.

Local water utilities and domestic and stock rights received allocations, except for reductions or irregular delivery while the WSP was suspended during the Millennium Drought.

Recommendations to improve the social/cultural effectiveness of the WSP are as per those in section 5.

Effectiveness – environmental

The WSP has been reasonably effective in achieving environmental objectives over the 2004–2014 period. While some indicators show positive environmental outcomes, others are more ambiguous.

When the environmental flow rules were in operation, it appears that some of the rules had limited impacts on environmental outcomes, largely due to external factors (e.g. drought conditions) and water column nutrient dynamics. However, larger releases from the EWA accounts and licences held for environmental purposes had more impact, particularly for targeted watering of wetlands.

Monitoring studies focussed on building scientific knowledge and understanding about the Murrumbidgee. This will assist future decision making and evaluation, but knowledge gaps during the evaluation period made it difficult to assess environmental outcomes.

Wetlands studied were still in recovery after a significant drought. Both frogs and waterbirds appear to have benefited from wetland flooding. There was also a positive impact through dilution of organic carbon in wetlands, reducing the risk of blackwater events. River red gum health improved and a halt in decline of black box woodlands was observed. The low flow and moderate to high flow regimes did not meet baseline WSP criteria, except in flood years.

In summary, it can reasonably be concluded that ecological condition is still at risk, but it is difficult to make a finding on WSP effectiveness in this regard. This is because of the drought conditions through most of the WSP term and many other external factors. These external factors include the development of environmental water portfolios, which was enabled by the WSP's creation of tradeable water rights, but is not directly aligned to an objective or strategy of the WSP.

Recommendations are those in the general section 5. Further detail regarding the evaluation of the Murrumbidgee WSP can be found in Appendix 13 and Appendix 14.

Upper and Lower Namoi

Based on the overall findings of the evaluation, while considering the impact of externalities (including the extended drought), it is considered that the WSP has been successful to a large degree in achieving its objectives and original intent.

Overall, it is considered that the WSP:

1. Is appropriate for its intended purpose (e.g. the sharing of water within a defined water management area); however, improvements could be made to strengthen the WSP monitoring and evaluation framework and address interactions with connected water sources.
2. Has been implemented as expected and as efficiently as possible (with only minor issues identified).
3. Has been effective to some degree in achieving some of its objectives, although there is insufficient information to assess others.

Appropriateness

The appropriateness evaluation findings and recommendations are the same as the general findings in section 5. The objectives do not represent a full list of the intended outcomes of the WSP and they do not clearly link together. It is recommended that a revised, more specific list of objectives is prepared, linked to WSP strategies and rules. The current performance indicators align with the objectives of the WSP, but the lack of a SMART approach to the objectives, makes it difficult to evaluate success. The performance indicators should be revised alongside the objectives.

Efficiency

Overall the WSP has been efficiently implemented. However, there are several issues that were identified for further action and improvement, associated with minimum daily flows, BLR growth, assessment of the LTAAEL, annual assessment of Tamworth Regional Council's extraction growth, supplementary water access in the Lower Namoi and conversion factors for conversion of access licence category dealings. Please refer to Table 2 of Appendix 9 for further details. DPIE is currently addressing these issues during the development of the Namoi WRP.

Minimum daily flows were only periodically maintained during 2004 to 2012. They were not always released when required (even when the conditions set out in the WSP were met). The minimum daily flow provisions were set aside in the 2004–2005, water year by DPIE (then, Department of Natural Resources) because of travel time between Keepit Dam and Walgett.

Effectiveness – economic

The effectiveness evaluation aligned with that for all WSPs (section 5) and no specific findings were made with respect to the Namoi.

As described in section 5, the creation of tradeable water access licences separated from land titles, is likely to have supported positive economic outcomes and/or mitigated negative outcomes. Available data shows an increase in water trading during the WSP period.

The WSP has allowed the development of an active water market in the Namoi Valley for both allocation and entitlement trade. There has been an increase in number and volume of both allocation and entitlement trades in the water source since the commencement of the WSP. Over the evaluation period, there has been a significant growth in water use by the cotton industry, demonstrating a move to higher value crops. However, these changes cannot be clearly

differentiated in economic data from pre-existing water reforms in the 1980s and 1990s, as well as broader economic, social and climate factors.

Overall the economic effectiveness was difficult to assess. Some of the stated performance indicator measures could not be directly attributed to the introduction of the WSP or water management activities and few additional analyses were available.

Therefore, it is recommended that DPIE review the economic objectives and related strategies (using the program logic approach) and define performance indicators that can measure the effectiveness of WSP rules in achieving the revised economic objectives. In parallel, it is recommended that DPIE establish a fit for purpose monitoring, evaluation and reporting program based on the revised performance indicators.

Effectiveness – social/cultural

The WSP and its implementation contributed to meeting the BLR, social needs and amenity values of rural communities. Throughout the duration of the WSP, water was shared between all water uses, including the environment, according to the priority of access provided in the WSP.

There is little information available on the social impacts of the WSP on communities within the WSP area for the evaluation period.

No native title rights have been granted within the water source and no licences have been issued for Aboriginal cultural purposes. It is recommended DPIE consider including appropriate social and cultural strategies and performance indicators when reviewing the WSP, including Aboriginal Social and Cultural objectives, strategies and related rules.

As no licences are required for extraction of water for BLR, it is difficult to accurately assess the ability of WSP to meet BLR requirements. Water to meet these needs is included in WaterNSW's operational protocols and is delivered on top of water ordered by licence holders. BLR requirements, including stock and domestic requirements, were maintained during periods of drought conditions.

Recommendations to improve the social/cultural effectiveness of the WSP are as per those in section 5.

Effectiveness – environmental

The evaluation found that the WSP has contributed to environmental outcomes, but that it is difficult to make a finding on WSP effectiveness in this regard. This is because of the drought conditions through much of the WSP term and many other external factors. Monitoring shows some positive environmental outcomes for organic carbon loads, and mixed responses for fish populations and wetland replenishment. However, it is difficult to differentiate these from outcomes of environmental water reforms and development of environmental water portfolios by state and Commonwealth governments.

It is recommended that DPIE develop clearly defined and monitored performance indicators (alongside more specific objectives and strategies that meet SMART criteria). The indicators should directly address the instream and floodplain wetland functions and habitats of the water source and how these are expected to be affected by the WSP rules. This will focus monitoring and improve the ability to make future environmental effectiveness assessments.

Given the major changes in environmental water management in NSW and the introduction of the Basin Plan in 2012, the WSP rules would benefit from review.

Further detail regarding the evaluation of the Namoi WSP can be found in Appendix 9 and Appendix 10.

NSW Border Rivers

It is considered that the NSW Border Rivers Regulated River WSP:

1. Is appropriate for its intended purpose (e.g. sharing water within a defined water management area), but improvements could be made to strengthen the WSP's monitoring and evaluation framework.
2. Has been implemented as expected and efficiently overall, but there is room for improvement in the future. Transparency releases, BLR growth, some mandatory conditions, minor residual interstate administration issues and conversion of access licence categories remain to be addressed.
3. Has been effective to some degree in achieving some of its objectives, although there is insufficient information to assess others.

Unlike the other WSPs in this summary document the Border Rivers WSP commenced in 2009. The WSP was evaluated for the period 2009–2016. During the evaluation period, the Border Rivers experienced drought breaking floods followed by several drier years.

Based on the overall findings and the impact of externalities it is considered that the WSP has been successful to a large degree in achieving its objectives and original intent. However, this is difficult to differentiate from external factors, such as climate, economic factors and broader reforms in the Murray–Darling Basin.

Appropriateness

The appropriateness evaluation findings and recommendations are the same as the general findings and recommendations in section 5. The objectives do not represent a full list of the WSP's intended outcomes and they do not clearly link together. It is recommended that a revised, more specific list of objectives is prepared, linked to WSP strategies and rules. The current performance indicators align with the objectives of the WSP, but the lack of a SMART approach to the objectives, makes it difficult to evaluate success. The performance indicators should be revised in alongside the objectives.

Overall the WSP was considered appropriate for its purpose, scale and scope. The WSP clearly indicates how it relates to interstate water sharing and operational agreements with Queensland, for the Border Rivers, as well as the Interim North–West Unregulated Flow Management Plan that provides for minimum requirements for the downstream Barwon–Darling River. The WSP may benefit from a note indicating its interaction with relevant unregulated and groundwater WSPs.

The performance indicators in the Border Rivers WSP are not aligned with the WSP objectives due to an error in legal drafting. Nevertheless, had the objectives been correctly aligned with the performance indicators, there is still scope for improvement in the ability of the performance indicators to answer the evaluation questions, by aligning them with the objectives and strategies.

Efficiency

Overall, the Border Rivers WSP has been implemented efficiently. Only minor issues associated with transparency releases, BLR growth, some mandatory conditions, minor residual interstate administration issues and conversion of access licence categories remain to be addressed.

Minimum daily flows and stimulus flows were always met when required. Transparency releases were not always implemented according to the WSP rules. To address high daily variability in low flows during dry periods WaterNSW applies monthly averaging and an 80 % target to transparency release rules, consistent with other WaterNSW works approvals in relation to delivery of environmental water. These are not technically consistent with the WSP. All necessary systems are in place to apply and manage AEW conditions should they be requested.

BLR have been provided for all years. It was not able to be assessed if domestic stock BLR use were consistent with the BLR Reasonable Use Guidelines, as no audit information is available. Replenishment flows for BLR domestic and stock rights were met when required all water years.

Assessment of compliance with the LTAAEL has occurred annually as specified in the WSP. However, whilst the assessment process has been undertaken annually, not all model input data used in the assessment has been updated, despite this, recent work for the Healthy Floodplains Project suggests the model remains applicable.

Supplementary flow requirements were met; however, rules relating to limits on extraction rates and direct water use were implemented via supplementary announcements. They were not applied as mandatory licence conditions as the WSP specifies. Rules for managing access licences were efficiently implemented. Water accounts were established from the start of the WSP term.

Mandatory conditions have been implemented moderately efficiently. Most mandatory conditions required by the WSP were placed on work approvals during the licence conversion process from the Water Act 1912 to the *Water Management Act 2000*, at WSP commencement. One condition was not applied but was implemented through another mechanism. Some mandatory conditions remain to be applied. Further details can be found in Table 2 of Appendix 7.

Effectiveness – economic

The effectiveness evaluation aligned with that for all WSPs (section 5) and no specific findings were made with respect to the Border Rivers.

As described in section 5, the creation of tradeable water access licences separated from land titles, is likely to have supported positive economic outcomes and/or mitigated negative outcomes. Available data shows an increase in water trading during the WSP period.

Overall the economic effectiveness was difficult to assess. Some of the stated performance indicator measures could not be directly attributed to the introduction of the WSP or water management activities and few additional analyses were available.

Therefore, it is recommended that DPIE review the economic objectives and related strategies (using the program logic approach) and define performance indicators that can measure the effectiveness of WSP rules in achieving the revised economic objectives. In parallel, it is recommended that DPIE establish a fit for purpose monitoring, evaluation and reporting program based on the revised performance indicators.

Effectiveness – social/cultural

The WSP and its implementation contributed to meeting the BLR, social needs and amenity values of rural communities. Throughout the term of the WSP, water was shared between all water uses, including the environment, according to the priority of access provided in the WSP.

There is little information available on the social impacts of the WSP on communities within the water source.

No native title rights have been granted within the water source and no licences have been issued for Aboriginal cultural purposes. It is recommended DPIE consider including appropriate social and cultural strategies and performance indicators when reviewing the WSP, including Aboriginal social and cultural objectives, strategies and related rules.

Recommendations to this effect are provided in section 5.

Effectiveness – environmental

The evaluation has been inconclusive with respect to the WSP effect on its environmental objectives. While some indicators show positive environmental outcomes, others continue to show

negative impacts. However, it is considered that the WSP has made some contribution to environmental objectives.

There is limited monitoring information available to assess the changed in ecological condition of the water source and dependent ecosystems.

Some IMEF studies showed the potential for flows to improve fish spawning events and algae growth. The overall ecosystem condition of the catchment in the Sustainable Rivers Audit 2 (2008–2010) was rated as poor. This includes poor ratings for fish and vegetation condition.

Analysis of flow regime shows that WSP performance indicator assessment criteria were not achieved compared to the baseline WSP target. This was the case for number of days below 95th percentile and 80th percentile, as well as number of days above 30th, 15th and 5th percentile. In all cases, the exceptions were the years 2010/11, 2011/12 and 2012/13, which were associated with drought breaking floods, and in some cases 2013/204 and 2015/2016.

Water quality in the Border Rivers has been found to be predominantly moderate to good in the 2007–2012 period. However, with no pre–WSP comparison available, it is not possible to make a finding as to the effectiveness of the WSP with respect to its water quality objectives.

The WSP has been effective in preventing increase in extraction, since extraction data shows compliance with the limit. However, note that there are many external factors that will also have contributed to this outcome, including the development of environmental water portfolios by state and commonwealth governments.

It can reasonably be concluded that ecological condition is still at risk, but that it is difficult to make a finding on WPS effectiveness in this regard. This is because the many external factors influencing the condition of the Border Rivers water source.

Further detail regarding the evaluation of the NSW Border Rivers WSP can be found in Appendix 7 and Appendix 8.

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Appendix 1 – Gwydir regulated river report cards and performance indicator summary





Table 1: Appropriateness Report Card



Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Plan scale	Is the scale of the Plan appropriate for water management?	Extent to which scale is appropriate for water sharing management	The geographic scale of the water source in the Plan is considered appropriate for water sharing management.			
Plan scope	Is the scope of the Plan appropriate for water management?	Extent to which interactions with other water sources are addressed appropriately within the Plan or other water sharing plans	<p>The Plan does not adequately recognise the interactions with groundwater or other surface water types beyond those interactions noted below.</p> <p>For example, the CSIRO (2008) Sustainable Yield Reports found that in some valleys increased groundwater use by 2030 would result in some of the current groundwater use being sourced directly from induced stream–flow leakage. Much of this impact has not been explicitly considered in the development of existing surface water sharing plans</p> <p>It does identify environmental flows from the regulated river into the Gwydir wetlands downstream of the water source and into other effluent streams, and from three unregulated rivers into the regulated river.</p>		Consider reviewing this and adjoining surface and groundwater plans to formally recognise connectivity between water sources and provide line of sight from related rules to Plan objectives.	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>It allows access to supplementary flows in specific locations to be restricted until the downstream requirements of the Interim North West Unregulated Flow Management Plan have been met.</p> <p>It also provides specific replenishment flows into downstream unregulated areas for domestic and stock purposes.</p>			
Prioritisation	Is the level of management required under the Plan appropriate for the risk to environmental, economic, or social and cultural values?	Extent of risk to dependent ecosystems, economic, and social and cultural values	<p>The prioritisation of the Plan as high risk (DLWC 1998) is considered appropriate.</p> <p>The level of management applied is considered appropriate based on high levels of pre-Plan water allocation.</p>			
		Extent to which risk is addressed	Risk is addressed through the application of the LTAAEL, water sharing arrangements that respond to variations in water availability, and associated water market.			
		Identified future risks, including climate change, change in industry base, etc.	Future risks are partially addressed through the application of the LTAAEL, water sharing arrangements that respond to variations in water availability and a flexible water market.		Consider including analysis of climate variability and change, as well as potential changes in industry base to assess implications	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			The calculation of the limit uses the drought of record, which may not reflect future climate due to existing climate variability beyond the historic record and the impacts of climate change. In addition, changes to the industry base are not recognised		for water availability and water demands	
Internal logic	Is the vision appropriate for water management?	Whether the vision reflects what is intended for water sharing plans in the Act	The vision is considered appropriate as it is consistent with the Act's intent for water sharing plans to achieve economic, social and environmental outcomes.			
	Are the objectives suitable for water management?	Whether the objectives align with the vision	The objectives align with the Plan vision.			
		Whether the objectives align with the principles and objects of the Act	The objectives align with the principles and objects of the Act.			
		Extent to which the objectives are clear and comprehensive enough to reflect what the Plan intended to achieve	<p>The objectives do not represent a full list of the Plan's intended outcomes.</p> <p>The objectives are mostly a mixture of broad and targeted objectives and do not clearly link together. One objective relates to a combination of economic, social and environmental outcomes.</p>		Consider whether additional objectives should be developed to allow an effective evaluation of the Plan. Both clear broad and targeted objectives should be established to achieve specific economic, social	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			The objectives do not recognise the requirements of downstream wetlands. Water delivery to these systems is a primary function of the environmental contingency allowance (ECA) and there are several Plan rules that address these requirements.		and environmental outcomes. Consider reviewing objectives to capture the full intent of the Plan, for example delivery of flows to downstream wetlands.	
		Extent to which the Plan logic establishes SMART (Specific, Measurable, Attainable, Realistic, Time-bound) objectives	The Plan logic fails to set objectives that can be evaluated using SMART criteria.		Consider whether the Plan logic should be reviewed to improve measurement of success.	High
Are the strategies suitable for water management?	Whether all Plan rules are linked to a strategy	All Plan rules can be linked to a strategy.			Consider whether more appropriate, objective-linked strategies should be developed, to improve clarity of direction for the Plan rules and to improve measurement of success (linked to recommendations regarding the Plan objectives above).	High
	Whether the strategies provide clear direction for the Plan rules	Strategies could be more specific to guide the intent of the Plan rules and to highlight the links with their intended outcomes.				
	Whether the strategies align with the objectives	Not all strategies align with the objectives. Current strategies describe Plan structure only and do not adequately show how the Plan's objectives will be achieved. This is important as the Act requires performance indicators (PIs) to be used to assess Plan strategies.				

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
	Are the PIs suitable for water management?	Whether the PIs align with the objectives and strategies	All PIs align to the objectives, but do not align with the strategies.		Consider reviewing the alignment and relevance of PIs and measures against each objective and strategy (linked to recommendations regarding Plan objectives above).	High
		Extent to which PIs are clear and comprehensive enough to measure what the Plan intended to achieve	Most PIs are clear but not comprehensive. Some additional measures are available for many PIs and have been included in this evaluation where possible.			
Quality of Supporting Documentation	Is documentation explaining the decisions underpinning the Plan available?	Adequacy of documentation supporting the Plan	The Plan has a comprehensive "Part A" document (GRRMC undated), supporting Plan development which is available internally. A range of documents are also available that support Plan implementation.			
		Extent to which documentation is made available to the public	The "Part A" document was publicly available during the Plan's initial exhibition period but is no longer publicly available. General Purpose Water Accounting Reports and Plan Implementation Audit reports are available on the DPIE website (DPI Office of Water 2013a and 2013b, DPI Water 2017b).		Endeavour to improve availability of evidence sources supporting Plan development, implementation and monitoring, to support Plan implementation and communication to stakeholders and the water market.	Low

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Communication	Is the process for communication with stakeholders adequate?	Extent of communication and processes supporting Plan development	Extensive consultation was carried out during Plan development, with the Gwydir Regulated River Management Committee (GRRMC) meeting to explore issues and develop management strategies. The Plan was placed on public exhibition.			
		Communication arrangements in place during Plan operation	<p>Communication has been appropriate; however recent community feedback suggests that a more formalised ongoing communication protocol is required.</p> <p>Generally, communication was on an as needs basis during drought periods, frequent discussions were held with water users.</p> <p>A series of annual General-Purpose Water Accounting Reports (GPWAR) and water implementation reviews are available on the DPIE website (DPI Office of Water 2013a and 2013b, DPI Water 2017).</p>		<p>Endeavour to develop a communication Plan that serves the needs of the community and the water market during Plan operation. Under current institutional arrangements, WaterNSW has a key operational and communication role. DPIE to therefore consider whether the Operating Licence and/or Works Approval for WaterNSW could include a requirement to develop and implement a consistent communications</p>	


















Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
					Plan. (NOTE the Draft Operating Licence for WaterNSW will be proposed by IPART in May 2017.)	
		Arrangements for consideration at term review of Plan	<p>Opportunity will be provided for communication during the water resource Plan development process.</p> <p>Consultation will involve opportunities to make submissions, and face to face meetings will be held with stakeholders.</p>			
Alignment with state priorities for natural resource management plans (S43A)	Is the Plan aligned with state priorities for natural resource management?	Extent of alignment of Plan with state priorities	The 2004 water sharing plans were in place prior to the development of the state priorities for natural resource management and so full alignment is not expected. The NRC considered there is some alignment of priorities, however the lack of available monitoring, evaluation and reporting information at the time of assessment limited the NRC's findings (NRC 2013)		Consider reviewing the alignment of Plan objectives with state priorities for natural resource management during the development of the Water Resource Plan (WRP).	High





Table 2: Efficiency Report Card


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Environmental water provisions	Planned environmental water	Was all water above the extraction limit protected?	<p>Assessment of compliance with the LTAAEL has occurred after the Plan term, in 2016. This assessment indicated that the LTAAEL was exceeded over the long-term by 2.4%, which is below the 3% exceedance threshold specified for response in the Plan.</p> <p>However, the LTAAEL was not assessed on an annual basis as required by the Plan. (see Extraction Limit evaluation findings below).</p>		See Extraction Limit below	High
		Were minimum daily flows released?	<p>Minimum flows were released as per Plan rules on most occasions throughout the Plan term.</p> <p>Operational constraints meant the releases were not always made according to the Plan rules. The work approval for Copeton Dam clarified operational requirements for the Gwydir, including the delivery of these flows however some issues remain.</p>		Consider a review of the minimum daily flows rule to ensure it considers inefficiencies and ineffectiveness of the rule during extremely dry periods.	Medium
	Environmental contingency allowance (ECA)	Was the ECA account managed according to the Plan rules?	<p>Yes. The ECA is credited water during the resource assessment process. This process is separate to the available water determination (AWD) process that credits water to access licence accounts. Note the draft</p>			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			finding was inaccurate and has been revised.			
		Was an annual release program for the use of ECA water prepared and approved?	An annual release program for the use of water from the ECA has been prepared and approved by OEH in line with Plan requirements.			
		Was the ECA Operations Advisory Committee established in 2004, and did it maintain an ongoing role in advising on the use of ECA water?	The ECAOAC required by the Plan was established in 2004 and has had an ongoing role in advising on the use of water from the ECA account since this time. The ECAOAC is managed by OEH with input and advice from other agency staff and the community. During the Plan term the roles and responsibilities of NSW and federal government agencies in the management of environmental water has changed substantially. It is recommended that DPIE consider reviewing ECAOAC roles and responsibilities to reflect contemporary governance of environmental water.		Consider reviewing the ECAOAC role and responsibilities to reflect the changes that have occurred in environmental water management in NSW and the Murray–Darling Basin. DPIE consider standardising the environmental water advisory bodies.	High
		To what extent was the ECA used for all Plan specified purposes?	Over the duration of the Plan, ECA releases were utilised to target the most relevant specified purposes as outlined in the effectiveness evaluation report card. Annual Watering Plans have been developed; however, it has become		Consider reviewing the ECA release purposes rule to modify the use <i>“provision of inundation of higher level benches in the river reaches between Copeton Dam and the</i>	Medium




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			clear that; “(iii) provision of inundation of higher level benches in the river reaches between Copeton Dam and the Gwydir River at Gravesend” was impractical due to operational constraints at Copeton Dam. The focus of this use should be on instream and low – medium level benches and maintenance of instream values within the Gwydir River.		<i>Gwydir River at Gravesend</i> ”.	
	Adaptive environmental water	Is there a process for licences to be committed for adaptive environmental purposes?	All necessary systems are in place to apply and manage conditions should they be requested.			
		Were AEW Use Plans developed?	AEW use Plans approved. Note: An amended Plan for the Gwydir was approved by the Minister in September 2012.			
		Were there additional licences created and AEW conditioned as a result of water savings within the water source?	Construction of the Gingham and Lower Gwydir water supply schemes provided water savings and secured domestic and stock water for relevant users. Four new AEW conditioned water licences for OEH (two supplementary and two high security) were created in 2012.			
Basic Landholder Rights	Domestic and Stock	Were domestic and stock Basic Landholder Rights (BLR) provided for within the Plan?	The Plan identifies water requirements for domestic and stock BLR within the regulated river water source and provides		Consider formalising the historic practice of providing opportunistic BLR flows to Mongyer	Medium





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>for water to be supplied for these purposes.</p> <p>Additionally, some replenishment flows to downstream unregulated creeks are provided for within the Plan. The operational practice has been to supply BLR flows opportunistically to Mongyer Lagoon. This is not reflected in the Plan rules</p>		Lagoon downstream of the regulated river water source.	
		Is domestic and stock BLR growth provided for within the Plan?	Procedures are in place to allow for growth in domestic and stock BLR.			
		Was the water supply managed to ensure sufficient reserves for domestic and stock BLR were maintained?	The water resource assessment process incorporates calculations for BLR requirements.			
		Were domestic and stock BLR provided for in water delivery operating protocols?	Domestic and stock rights were always met during this period.			
		Were replenishment flows delivered when required to satisfy domestic and stock needs, subject to water availability?	Replenishment flows were met when required.			
		Are domestic and stock BLR consistent	Reasonable use guidelines (made under s.52 of the Act and		Endeavour to finalise and publish the	Low




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		with reasonable use guidelines?	provided for in the Plan) have not been made by the Minister.		reasonable use guidelines.	
	Native title	Were native title BLR provided for within the Plan?	Procedures are in place to provide access if native title rights for water are granted in the water source covered by this Plan. <i>Note: No native title rights for water have been established in this Plan area.</i>			
		Is growth in native title BLR protected within the Plan?	Procedures are in place to allow for growth in native title BLR.			
Rules for granting access licences	Granting new access licences	Were Plan rules followed for the granting of access licences?	All access licences granted were in line with the Plan provisions. The Water Management (General) Regulations 2004 and 2011 set out the specific purpose access licences and application conditions. <i>Note: Construction of the Gingham Pipeline provided water savings and secured domestic and stock water for relevant users. Four new AEW conditioned water licences for OEH were created in 2012 under clause 16(2) and 16(2A) and not under clause 28.</i>			
Limits to the availability of water	Extraction limits	Was an extraction limit established?	An extraction limit was established for the water source.			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		<p>Was the long-term average annual extraction assessed against the LTAAEL at the end of each water year?</p>	<p>Assessment of compliance with the LTAAEL has not occurred annually as specified in the plan due to the unavailability of annually updated water use development data.</p> <p>However, assessment and model update has occurred after the Plan term in 2016.</p> <p>Amendment of the Plan is recommended to achieve an approach that can be practically implemented, while enabling timely identification of any risk of growth in use.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate-adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total</p>		<p>Consider reviewing the Plan to achieve an approach that</p> <ul style="list-style-type: none"> - Can be practically, cost-effectively and reliably implemented - Enable timely identification of any risk of growth in use. <p>Endeavour to resolve the process for the collection of water use development data so the IQQM model can be updated at an appropriate frequency.</p> <p>Consider implementing NSW Plan limit compliance assessment as routine business, alongside “Permitted take” (SDL) assessment under Basin Plan. High priority due to risks for NSW and for water rights holders if “growth in use” not identified and addressed early.</p>	<p>High</p>





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. Water use development data is not volatile on an annual basis but is more appropriately assessed at the 3–5year frequency.</p> <p>However, the Plan implies that they will be updated, and the model must be run on an annual basis.</p> <p>It is recommended that this approach be reviewed, given that this has proven to be impractical over the 10–year implementation of the Plan. Furthermore, the amended Plans will need to reflect Basin Plan requirements for application and compliance with the SDL.</p>			
	Variation of extraction limits	Were extraction limits varied?	<p>No changes to extraction limits have been required.</p> <p>(Note that the Basin Plan “Sustainable Diversion Limit” (SDL) is not implemented through the Plan until 2019 and effectively builds on existing NSW limits).</p>			
	LTAAEL compliance	Was LTAAEL exceeded?	<p>Assessment of LTAAEL compliance has occurred after the Plan term and has found that LTAAEL was exceeded by 2.4%</p>		See above recommendations concerning Plan term review of LTAAEL	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>over the long term (DPI Water Modelling Unit Head <i>pers comm</i>). This is within the 3% threshold above which the Plan rules require a response. It is understood the exceedance risk is being addressed through the Healthy Floodplains Program and associated amendments addressing floodplain harvesting.</p> <p>Assessment of compliance with the LTAAEL did not occur annually as specified in the Plan due to the unavailability of water use development data.</p> <p>LTAAEL compliance is not readily identifiable in publicly available information.</p>		<p>rules and implementation.</p> <p>Consider reviewing Plan rules to reduce risk of LTAAEL exceedance by more than 3%.</p> <p>Endeavour to make available on its website, the ongoing LTAAEL compliance status.</p>	
		Was extraction managed within LTAAEL?	<p>No adjustment to the maximum AWD limits set in the plans have been needed.</p>			
		Was a Compliance Assessment Advisory Committee established, if required, to advise on strategies to ensure the LTAAEL was not exceeded?	<p>On expiration of the initial term of the CAAC, membership was not renewed.</p> <p>This was due to the extended dry conditions, no growth-in-use issues to be addressed and new approval processes required for appointment of such committees.</p>		Consider the necessity of the Compliance Assessment Advisory Committee for this water source.	Low
	General security access licence volume limits.	Were the volume limits set for any consecutive volume limits.	<p>Generally, all general security access licence holders did not exceed the volume limits set for any consecutive 3-year period.</p>			






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		3-year period complied with?	Any individual account exceedances were addressed through the accounting system. <i>Note: the annual limit of 1.25ML/unit share was amended to 3ML/unit share subsequent to the evaluation period (DPI Water 2016).</i>			
	AWDs	Were AWDs for all categories of licences calculated and announced in line with Plan provisions?	AWDs for all categories of licences were calculated and announced in line with the Plan provisions for the nominated periods. Full allocations for domestic and stock, local water utility and high security access licences were announced during the term of the Plan. Allocations for general security access licences were low, with zero allocations announced during the 2008/2009 and 2013/2014 water years			
Rules for managing access licences	Water allocation and account management	Were water accounts established for all licences?	Water allocation accounts were established for all licence holders.			
		Were accounts managed in accordance with the Plan rules?	Accounts have been managed in line with the Plan rules.			
	Carryover provisions	Was carryover managed in accordance with the Plan rules?	Rules relating to the carryover of balances in water allocation accounts from one year to the			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			next were applied through the account management system.			
	Extraction conditions	Were the general priority of extraction conditions set out in the Plan complied with?	General priority of extraction conditions set out in the Plan was always complied with.			
		Were numerically specified extraction components introduced by amending water access licences e.g. in relation to times, rates or circumstances that water may be taken?	Numerically specified extraction components were not required to be introduced.		Endeavour to progress a state-wide policy for the establishment of numerical extraction conditions. DPIE consider implementing numerical extraction components where required.	Medium
	Supplementary water	Were supplementary water announcements made in accordance with Plan requirements?	Supplementary water announcements were made in accordance with Plan requirements. <i>Note. An Order under section 323 of the Act prohibited the taking of water under supplementary licences from the Gwydir water source except when it was announced. This was repealed on 5 Nov 2010.</i>			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were individual supplementary events managed in accordance with Plan rules and targets?	<p>Individual supplementary events were managed in accordance with Plan rules and targets.</p> <p>Each supplementary event is assessed on a case by case basis and as a result may or may not have restrictions placed on it. Events were managed in accordance with the Plan rules. Extraction of announced supplementary access events is limited to 50% of the individual event volume available after pre-existing requirements have been met (including volumes to meet the 3T rule).</p> <p><i>Note: Operational practice has been to achieve equitable sharing between water users of the extractable 50% of individual supplementary flow events through a 3-year rostering program administered by WaterNSW.</i></p>			
		Did supplementary water users comply with Plan rules?	<p>Supplementary water users generally complied with Plan rules and no more than 50% of an event was extracted. Any exceedance of individual account limits was corrected through the accounting system.</p> <p>The non-extractable 50% component of supplementary flow events is not identified in Part 3 where other planned environmental water is recognised, this should be</p>		<p>Consider recognising the non-extractable 50% portions of supplementary flow events as environmental water in Part 3 of the Plan.</p> <p>Consider the addition of Plan rules to control how the 50% non-extractable portions of</p>	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			reviewed. The Plan does not contain rules that control how these environmental portions of supplementary events are to be distributed.		supplementary flow events are to be distributed.	
Dealings	Minister's dealing principles	Were dealings in line with the Minister's dealing principles, the Act and the Plan?	All dealings have been made in line with Minister's dealing principles. <i>Note: Prohibited dealings in this Plan area include: interstate (transfer and assignment of allocation) and allocation assignments between water sources.</i>			
	Constraints within water source	Were dealings in line with rules relating to constraints within the water source?	All dealings were undertaken in line with Plan rules relating to constraints within the water source.			
	Change of water source	Were dealings in line with rules relating to change of water source?	Change of water source dealings are not possible as conversion factors have not been established.			
		Were conversion factors established when required?	Conversion factors were not established. The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (ACCC 2009 and ACCC 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Current NSW Regulations do not allow trade from an unregulated water source into a regulated water source. Trade is allowed from a regulated water source into an unregulated water source. However, given the principle of no impact on third parties from dealings, these trades rarely proceed.</p> <p>DPIE is reviewing trade between regulated systems including conversion factors with the introduction of the Murray Darling Basin Plan.</p>			
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water source?	<p>Conversion of access licence category dealings that do not require conversion factors are possible.</p> <p>Conversion of access licence category dealings are not possible where conversion factors are required as the factors have not been established.</p>		<i>see next</i>	<i>see next</i>
		Were conversion factors established when required?	<p>Conversion factors were not established.</p> <p>The ACCC in their position paper and final advice on Water Trading Rules (ACCC 2009 and ACCC 2010) recommended that conversion factors not be established due to the potential</p>		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			impact on reliability of other licences.			
Mandatory conditions	Access licence conditions	Were mandatory conditions for access licences placed on licences?	Mandatory conditions required in the Act and in the Plan, were placed on the licences during the conversion of licences from the WA to the WMA before the plans commenced.			
	Water supply works approvals	Were mandatory conditions for works approvals placed on the works approvals?	Mandatory conditions required in the Act and in the Plan, were placed on the approval during the conversion of licences from the WA to the WMA before the plans commenced.			
System Operation rules	Replenishment flows	Were replenishment flows provided in accordance with the Plan?	At all times, replenishment flows were met when required.			
		Was the water supply managed to ensure sufficient reserves for replenishment flows were maintained?	The water resource assessment process incorporates calculations for replenishment flow requirements.			
	Water delivery and channel capacity constraints	Were initial estimates of maximum water delivery and operating channel capacity updated?	The initial estimates of maximum water delivery or operating channel capacity included as noted in the plans have not been updated. This is a common issue to all plans, according to the Plan implementation review (NSW Office of Water 2013a and 2013b).		Confirm whether channel capacity constraints are to be included in the Plan. If they are to be included in the Plan, DPIE may consider requiring WaterNSW	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			Dry conditions have meant that this has not been required or a priority. Rules operating during periods of constraint governing sharing of capacity between the ECA and water orders need clarification.		to review and update the estimates.	
	Rates of change to releases from storages	Was an operating protocol for the management of rates of change to releases from Copeton Dam developed?	The Minister has not established procedures for setting rules for the development of protocols to minimise the effects of flow release from storages.		Consider the policy requirement – is the operating protocol required, given it hasn't been implemented during first 10-year term. If this review considers the protocol is required, then DPIE may consider requiring compliance by holder of works approval.	Medium
	Supply of orders when remaining allocations are low	Were water orders grouped for release when supplies were low?	Water orders were grouped in line with Plan provisions. As a consequence of extremely dry conditions and low volumes of available water, WaterNSW, in consultation with the Gwydir Valley Customer Service Committee and other relevant stakeholders, utilised a block release strategy throughout the 2009–2010 water year in order to improve delivery efficiencies and provide the greatest benefit from the available water.			








Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Dam operation during floods and spills	Were rules for operating Copeton Dam in floods and spills followed?	The Plan states dam safety rules must be followed but does not provide detailed rules as these are set and controlled by an external process. Provided these external rules are met, there are some operational rules that can be implemented if they are consistent with the existing safety rules.			
Plan Amendments	Changes to the water source	Were any changes to the water source required?	No changes have been made to the water source.		Consider whether these amendment provisions are still necessary.	
	Other amendments (Supplementary water)	Were changes to supplementary water rules set out in the Plan required?	There have been no changes to supplementary water as set out in the Plan.		Consider whether these amendment provisions are still necessary.	
	Amendments relating to planned environmental water (made under s.8A of the WMA 2000)	Were any changes required to planned environmental water rules?	No changes allowed for in the Plan have been made to environmental water provisions.		Consider whether these amendment provisions are still necessary.	
	Amendments relating to floodplain harvesting	Were any changes made to water sources or Plan provisions to provide for floodplain harvesting?	No changes to water sources or Plan provisions have been made to provide for floodplain harvesting licences.		Consider whether amendments required in the Gwydir, consistent with the "Healthy Floodplains" project.	


Table 3: Effectiveness Report Card


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>Protect, maintain and enhance the environmental values of the Gwydir Regulated River Water Source</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p> <p>Change in water quality in this water source</p> <p><i>Additional PI identified</i> Change in surface water extraction relative to the LTAAEL</p>	<p>The Plan was developed with an understanding that detrimental effects on the condition of water– dependent ecosystems and water quality in the Gwydir River and its terminal wetland systems had resulted from significant changes to the flow regime as a result of surface water development. Changes in water sharing arrangements to address these issues commenced prior to the introduction of the Plan with results of monitoring encompassing both pre and Plan term periods.</p> <p>Rules providing environmental water and those aimed at mimicking a more natural flow regime provide an improved sharing balance and outcomes for the environment.</p> <p>The ecological monitoring of the Gwydir Wetlands shows that it is now in a more robust condition and a greatly improved situation from initial surveys during the 1990s and 2000s, where they were classed as being in an impoverished state and in decline. Despite the wetlands experiencing extremely dry conditions during the Plan period, the use of environmental watering has successfully increased the resilience of the system to cope with extended dry periods leading to improved condition and extent of floodplain vegetation and availability of colonially nesting water bird habitat (Albertson 2015).</p>		<p>Good</p>	<p>Consider providing clearly defined performance indicators and an associated performance monitoring programs that closely align with plan objectives.</p> <p>Consider investigating further refinement of environmental rules and their operation to enhance environmental outcomes without impacting economic or social outcomes.</p> <p>consider investigating refinement of environmental rules and operation to provide an improved flow regime.</p>	<p>High (all)</p>


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>Other factors that have influenced the response are;</p> <ul style="list-style-type: none"> • The complementary use of CEWO entitlements to achieve greater environmental outcomes through, for example, 'piggy backing' on supplementary flows and/or the environmental contingency allowance (ECA) and • The implementation of the Wetland Recovery Plan in the Gingham Channel. <p>There continue to be gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Gwydir Regulated River Water Source. However, monitoring undertaken within the system shows that fish community structure has been maintained throughout the Plan term, suggesting that flows are sufficient to maintain these populations despite the impact of cold water releases. Studies related to cold water pollution and other water quality parameters have highlighted the downstream impact of Copeton Dam is unlikely to be mitigated without significant investment to alter release structures.</p> <p>Little monitoring has taken place within the main channel of the Gwydir aside from the fish and water quality work mentioned. Flows that have otherwise been directed into the Lower Gwydir and Gingham wetlands (for example, during 3T events) have more recently been directed into the Mehi River and on to the Mallowa Creek</p>				



Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>system. Benefits to these systems include greater variability of flows particularly in the Mehi River which aid instream and wetland values, and additional flows into the Mallowa system, where significant floodplain wetlands occur. Greater water quality improvement outcomes such as replenishment of isolated instream waterholes are expected in these systems that have not previously benefitted from this share of the 3T event particularly when antecedent conditions have been dry.</p> <p>In stream flow regime</p> <p>Analysis of the flow regime shows that WSP Performance Indicator assessment criteria were not achieved, compared to the baseline WSP for the 90th, 80th, 30th, 15th, and 5th percentile flows.</p> <p>It is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term and many other external factors.</p> <p>Change in water extraction relative to Plan limit</p> <p>The Plan has been effective to a degree in preventing increase in extraction, since the Plan limit (LTAAEL) compliance assessment has shown that exceedance (2.4% over the long term) is less than the 3% trigger for response in the Plan rules.</p>				

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>Manage the Gwydir Regulated River Water Source to ensure equitable sharing of water between all uses</p>	<p>Extent to which local water utility requirements have been met.</p> <p>Extent to which domestic and stock rights requirements have been met <i>Additional PI component identified</i></p> <p>Extent to which licenced domestic and stock requirements have been met</p> <p>Extent to which native title rights requirements have been met <i>Additional PI component identified</i></p> <p>Extent to which licenced water has been made available and used for Aboriginal purposes.</p> <p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p> <p>Change in economic benefits derived from</p>	<p>Throughout the duration of the Plan, water was shared between all water uses, including the environment, according to the priority of access provided in the Plan.</p> <p>Local water utilities and domestic and stock rights received 100% allocations since the commencement of the Plan.</p> <p>While no native title rights for water were established in the Plan area during the term of the Plan, the Plan makes provision for these requirements.</p> <p>The environmental water provisions for planned environmental water make some contribution towards the preservation of cultural and heritage values of water to Aboriginal people; however, there has been a lack of uptake of Aboriginal cultural specific purpose licences.</p>		<p>Good</p>	<p>Endeavour to clearly identify the range of values of water to Aboriginal people to equitably share water between all uses</p>	<p>Medium</p>


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	water extraction and use					
<p>Protect the Gwydir Regulated River Water Source by ensuring that extraction minimises any adverse impacts</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p> <p>Change in water quality in this water source</p> <p><i>Additional PI identified</i> Change in surface water extraction relative to the LTAAEL</p>	<p>Although there are gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Plan area, the monitoring that has been undertaken particularly in the wetlands downstream of the water source indicates the Plan has been successful in reducing the impacts of water extraction.</p> <p>Change in flow regime</p> <p>Analysis of the flow regime shows that WSP Performance Indicator assessment criteria were not achieved, compared to the baseline WSP for the 90th, 80th, 30th, 15th, and 5th percentile flows.</p> <p>It is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term and many other external factors.</p> <p>Change in water extraction relative to Plan limit</p> <p>The Plan has been effective to a degree in preventing increase in extraction, since the Plan limit (LTAAEL) compliance assessment has shown that exceedance (2.4% over the</p>		Medium		

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>long term) is less than the 3% trigger for response in the Plan rules. However, note that there are many external factors that will also have contributed to this outcome, including the Millennium Drought, water user response to risk and the development of environmental water portfolios.</p>				
<p>Improve water quality in the Gwydir Regulated River Water Source</p>	<p>Change in water quality in this water source</p>	<p>Due to the regulation of the Gwydir River, particularly with the construction of Copeton Dam and associated river regulation structures in the Gwydir River downstream, significant water quality issues particularly relating to thermal depression have occurred.</p> <p>Although currently difficult to manage at the source due to structural constraints, the impacts of cold water releases can be somewhat mitigated with improved operation of the re-regulation weirs and storages downstream in the Gwydir. A review of existing arrangements, potential for adjustment and likely benefits or negatives or altered operations may lead to improved water quality outcomes.</p> <p>NSW has developed a Cold Water Pollution Strategy to address these issues over the long-term (Cold Water Pollution Interagency Group (CWPIG) 2012). Until the NSW Cold Water Pollution Strategy is fully implemented and an effective cold water mitigating structure is constructed at Copeton Dam, it is unlikely major</p>		<p>Medium</p>	<p>Endeavour to continue to implement the NSW Cold Water Pollution Strategy.</p> <p>Endeavour to review existing operational arrangements of re-regulation weirs and storages downstream of Copeton Dam to identify potential to improve water quality outcomes in the Gwydir River.</p>	

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>improvements in this significant water quality issue will occur.</p> <p>Additional flow related water quality issues in the water source include the impact of low dissolved oxygen and nutrient /carbon flux. Reduced flows and altered flow regimes also have the potential to be an issue for water quality in refugial waterholes in the lower reaches of the Gwydir. De-oxygenation and elevated water temperature and blue-green algal blooms during summer periods most typical issues observed.</p>				
<p>Provide opportunities for ecologically sustainable market based trading of surface water entitlements in the Gwydir Regulated River Water Source</p>	<p>Change in economic benefits derived from water extraction and use</p>	<p>The Plan was developed with an understanding that the pre-plan entitlement and extraction levels were environmentally unsustainable. Plan rules established a LTAAEL, clearly defined water entitlements and accounting rules, with a range of dealing options for the transfer of water and entitlements. The trading framework provided opportunities for ecologically sustainable market based trading of entitlements, demonstrated by the number and volume of both water allocation and general trades in the water source since the commencement of the Plan.</p> <p>The Plan has allowed the development of an active water market in the Gwydir Valley for both the temporary and permanent trade of water allocations and entitlements.</p>		<p>Good</p>		

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority												
Manage the Gwydir Regulated River Water Source to preserve and enhance basic water rights	<p>Extent to which native title rights requirements have been met</p> <p>Extent to which domestic and stock rights have been met</p>	<p>Basic landholder rights were always provided since the commencement of the Plan, with full access for BLR provided.</p> <p>Priority of access was managed such that the requirements of the Act were maintained, and the system managed in such a way to ensure maintenance of supply as required by the Plan.</p>		Good														
Ensure extraction from the Gwydir Regulated River Water Source is managed properly within the Murray Darling Basin Ministerial Council Cap	<p><i>Additional PI identified</i></p> <p>Change in surface water extraction relative to the long term annual average extraction limit</p>	<p>The Plan includes a LTAAEL of 392 GL/yr and rules for adjusting water-sharing if diversions grow beyond this limit.</p> <p>The Plan limit is below Cap and the Plan rules are intended to ensure that long-term average diversions do not exceed those that would result from 1993/94 development levels (as well as providing environmental benefits). The Gwydir Valley maintains a cumulative cap credit (as at end of 2014–2015 water year), demonstrating that the Plan is effective in ensuring extraction for the Gwydir Regulated River Water Source is managed appropriately within the MDBC Cap.</p> <table border="1"> <thead> <tr> <th>Water Year</th> <th>Total Diversions (Reg & Unreg) (GL)</th> <th>Annual Cap (GL)</th> </tr> </thead> <tbody> <tr> <td>2004–2005</td> <td>165</td> <td>271</td> </tr> <tr> <td>2005–2006</td> <td>230</td> <td>367</td> </tr> <tr> <td>2006–2007</td> <td>140</td> <td>81</td> </tr> </tbody> </table>	Water Year	Total Diversions (Reg & Unreg) (GL)	Annual Cap (GL)	2004–2005	165	271	2005–2006	230	367	2006–2007	140	81		Good	<p>Consider reviewing Plan rules to reduce risk of LTAAEL exceedance by over 3%.</p> <p>(see also efficiency recommendations above regarding practical implementation of the LTAAEL)</p>	High
Water Year	Total Diversions (Reg & Unreg) (GL)	Annual Cap (GL)																
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		<table border="1"> <tr> <td>2007–2008</td> <td>89</td> <td>72</td> </tr> <tr> <td>2008–2009</td> <td>154</td> <td>194</td> </tr> <tr> <td>2009–2010</td> <td>57</td> <td>70</td> </tr> <tr> <td>2010–2011</td> <td>271</td> <td>383</td> </tr> <tr> <td>2011–2012</td> <td>243</td> <td>249</td> </tr> <tr> <td>2012–2013</td> <td>425</td> <td>407</td> </tr> <tr> <td>2013–2014</td> <td>421</td> <td>452</td> </tr> <tr> <td>2014–2015</td> <td>141</td> <td>161</td> </tr> </table> <p><i>Source: NSW Annual Water Resource (CAP) Reports to the MDBA</i></p> <p>However, compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL.</p> <p>This differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets. LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from</p>	2007–2008	89	72	2008–2009	154	194	2009–2010	57	70	2010–2011	271	383	2011–2012	243	249	2012–2013	425	407	2013–2014	421	452	2014–2015	141	161				
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Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>time to time to enable the assessment of compliance to take place. While these conditions do not vary on an annual basis, the Plan implies that they will be updated, and the model will be run on an annual basis. According to Implementation Audit reports, this annual assessment did not occur during the Plan term, because development conditions were not updated in the model on an annual basis.</p> <p>Nevertheless, the cumulative assessment has since been carried out in 2016 (DPI Water Modelling Unit Manager <i>pers comm</i>). This assessment found that the Gwydir was over the LTAAEL by 2.4%. Note that this is below the 3% exceedance threshold triggering respond under the Plan rules.</p> <p>Given the exceedance, it is recommended that DPIE review the Plan rules to manage the risk of exceedance beyond the 3% threshold.</p>				
Manage the Gwydir Regulated River Water Source to preserve and enhance cultural and heritage values	<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p> <p>Extent to which native title rights requirements have been met</p> <p><i>Additional PI component identified</i></p> <p>Extent to which</p>	<p>No native title rights have been granted within the water sources and no licences have been issued for Aboriginal cultural purposes.</p> <p>There are no specific strategies within the Plan that are directly related to the objective, although the Plan recognised environmental water provisions were likely to make some contribution towards the preservation of cultural and heritage values.</p>		Poor	<p>Endeavour to establish Aboriginal Social and Cultural objectives and PI that are directly linked to values of water to Aboriginal people</p> <p>consider the addition of a cultural /heritage</p>	High

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	<p>licenced water has been made available and used for Aboriginal purposes.</p>	<p>There is little information available on the social impacts of the Plan on communities within the Plan area.</p> <p>The Plan has not provided cultural outcomes for Aboriginal communities with no real evidence of the Plan being able to influence outcomes relating Aboriginal spiritual, social and customary values.</p> <p>Given the potential linkages between cultural and heritage values and environmental assets the use of the ECA may support the achievement of this objective.</p>			<p>use category for the ECA</p>	

Table 4: Performance indicator results summary

Performance indicator	Related Plan objectives	Results	Strength of information
<p>Change in ecological condition of this water source and dependent ecosystems</p>	<p>Protect, maintain and enhance the environmental values of the Gwydir Regulated River Water Source</p> <p>Protect the Gwydir Regulated River Water Source by ensuring that extraction minimises any adverse impacts</p>	<p>Fish communities in the Gwydir Regulated River Water Source have not declined between 1999 and 2007, suggesting that the watering regime has maintained the fish species and their abundances (DPI Office of Water 2012). Although spawning of seven abundant fish species does not appear to be strongly related to river discharge, regular spawning was observed between 2005 and 2008, again suggesting the flow regime was maintaining the fish communities (DPI Office of Water 2012, Rolls et al 2013).</p> <p>The stated environmental contingency allowance (ECA) use <i>(iii) provision of inundation of higher level benches in the river reaches between Copeton Dam and the Gwydir River at Gravesend</i> was found to be impractical to implement due to operational constraints at Copeton Dam. The focus of this use could be modified to target instream and low – medium level benches and maintenance of instream values within the Gwydir River. Rebuilding low level benches is likely to be the first step in improving nutrient cycling in regulated rivers (Woodward et. al. 2015).</p> <p>The results from ecological monitoring of the Gwydir Wetlands allows us to determine that it is now in a more robust condition, a greatly improved situation from initial surveys during the 1990s and 2000s, where it was classed as being in an impoverished state and in decline. This is the result of considerable planning and implementation of measures aimed at improving the delivery of environmental water into these systems. Many factors are contributing to these outcomes;</p> <ul style="list-style-type: none"> • All environmental water rules have been implemented. • Establishment of the LTAAEL, with annual extractions remaining below the limit for the Gwydir Regulated River for all years since Plan commencement. • The establishment the minimum flow passing into the wetlands rule (the ‘3T’ rule) • Greater security and volume of held environmental water • Effective and successfully operating ECAOAC • Prescriptive Annual Environmental Watering Plan • Increased focus of environmental water delivery to a greater number of effluent streams, e.g. Mallowa Creek Wetlands, Carole/Gil Gil Creeks. 	<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>Despite the Gwydir Wetlands experiencing extremely dry conditions during the Plan period, prudent use of environmental watering has successfully increased the resilience of the system to cope with extended dry periods leading to improved condition and extent of floodplain vegetation and availability of colonially nesting water bird habitat. Shifting from an approach that is 'reactive' to one that is 'proactive' and combining the approaches of 'restoring natural flows' and whole of season watering has gone a long way to achieving positive outcomes with best use of environmental water reserves (OEH 2015).</p> <p>Other factors that have influenced the response are;</p> <ul style="list-style-type: none"> • The complementary use of CEWO entitlements to achieve greater environmental outcomes through, for example, 'piggy backing' on supplementary flows and/or the ECA • The implementation of the Wetland Recovery Plan in the Gingham Channel • The recent purchase of private property in the Gwydir wetlands and their establishment as National Parks and State Conservation Areas <p>There continue to be gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Gwydir Regulated River Water Source.</p> <p>References:</p> <p>Albertson D. (2015) Lessons & Principles for Watering The Gwydir Wetlands 2015 Planning Document NSW OEH, unpublished.</p> <p>DPI Office of Water (2010), <i>Environmental flow response and socio-economic monitoring. Gwydir Valley – progress report 2009</i> http://www.water.nsw.gov.au/__data/assets/pdf_file/0003/548292/monitor_2009_gwydirvalley_report.pdf</p> <p>DPI Office of Water (2012) <i>Fish assemblages and spawning in the northern Murray Darling Basin: Effects of discharge and temperature in two regulated rivers</i>, NSW Department of Primary Industries, a division of NSW Department of Trade and Investment, Regional Infrastructure and Services, Sydney</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>DPI Water (2017c), <i>Regulated Rivers, Monitoring</i>, http://www.water.nsw.gov.au/water-management/monitoring/regulated-rivers</p> <p>Gwydir Environmental Contingency Allowance Operations Advisory Committee (ECAOAC) 2016, State of the Gwydir Watercourse Report – February – March 2016, unpublished.</p> <p>OEH 2015, Gwydir Valley Annual Environmental Watering Plan (2015/16), OEH, Sydney.</p> <p>OEH (2017), <i>Gwydir valley, Water for the environment</i>. http://www.environment.nsw.gov.au/environmentalwater/gwydir.htm</p> <p>Rolls RJ, Growns IO, Khan TA, Wilson GG, Ellison TL, Prior A, Waring CC (2013) Fish recruitment in rivers with modified discharge depends on the interacting effects of flow and thermal regimes. <i>Freshwater Biology</i> 58 (9), 1804–1819</p> <p>Woodward KB, Fellows CS, Mitrovic SM, Sheldon, F 2015, Patterns and bioavailability of soil nutrients and carbon across a gradient of inundation frequencies in a lowland river channel, Murray– Darling Basin, Australia <i>Agriculture, Ecosystems & Environment</i> 205 1–8</p>	
Change in low flow regime	<p>Protect, maintain and enhance the environmental values of the Gwydir Regulated River Water Source</p> <p>Protect the Gwydir Regulated River Water Source by ensuring that extraction minimises any adverse impacts</p>	<p>Significant pre–Plan changes to the low flow regime within the Gwydir River resulted from water resource development associated with the construction of Copeton Dam. Due to the delivery requirements for water orders, BLR and replenishment flows, the low flow variability of the river has been significantly altered. For example, prior to Copeton Dam’s construction, the Gwydir River often ceased flowing. As the plan does not contain rules that address wetting and drying within the water source, the PI is assumed to be targeting effluent systems such as the Gwydir Wetlands.</p> <p>The alteration in flow regime has resulted in a reduction of the persistence and connectivity between instream waterholes within the downstream reaches of the Gwydir River and in connected wetlands. The Plan has addressed this by incorporating an environmental water rule (the 3T rule) that protects a proportion of tributary inflows entering downstream of Copeton Dam and allows</p>	Good

Performance indicator	Related Plan objectives	Results	Strength of information																		
		<p>these to flow through the water source to the Gwydir Wetlands. This rule has increased the variability of flows at the lower end of the hydrograph. To enable appropriate flow targets necessary for the maintenance of their drought habitat function to be set, a greater understanding of the location, hydrology and physical character of these important refugial waterholes is essential.</p> <p>Low flow regime variability could be further improved by addressing the way water orders are delivered from Copeton Dam. Improving scheduling and ordering of water deliveries may contribute to improved objective outcomes.</p> <p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days below the natural 95th and 80th percentiles.</p> <p>The natural (without development) and the Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database (DPI Water 2017d).</p> <p>The results provided below show that the criteria were not met in most years at the Collarenebri gauge (end of system site). At the Pallamallawa site, the baseline 95th percentile criterion was generally met, except for the 2007/2008, 2009/2010, 2013/2014 water years, that had relatively dry conditions. The number of years meeting the baseline criteria decreased for the 80th percentile assessment.</p> <table border="1"> <thead> <tr> <th colspan="3">Comparison to modelled: plan scenario for the number of days below the 95th percentile flow</th> </tr> <tr> <th></th> <th>418001 (Gwydir at Pallamallawa)</th> <th>418055 (Mehi near Collarenebri)</th> </tr> </thead> <tbody> <tr> <td>Natural 95th percentile flow</td> <td>20 ML/d</td> <td>11 ML/d</td> </tr> <tr> <td>the Plan <i>scenario (baseline target)</i></td> <td>1</td> <td>40</td> </tr> <tr> <td>2004/2005</td> <td>0</td> <td>76</td> </tr> <tr> <td>2005/2006</td> <td>0</td> <td>96</td> </tr> </tbody> </table>	Comparison to modelled: plan scenario for the number of days below the 95th percentile flow				418001 (Gwydir at Pallamallawa)	418055 (Mehi near Collarenebri)	Natural 95 th percentile flow	20 ML/d	11 ML/d	the Plan <i>scenario (baseline target)</i>	1	40	2004/2005	0	76	2005/2006	0	96	
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2004/2005	0	76																			
2005/2006	0	96																			

Performance indicator	Related Plan objectives	Results			Strength of information
		2006/2008	0	165	
		2007/2008	3	97	
		2008/2009	0	61	
		2009/2010	51	314	
		2010/2011	0	115	
		2011/2012	0	54	
		2012/2013	0	28	
		2013/2014	2	86	
Comparison to modelled WSP scenario for the number of days below the 95th percentile flow					
			418001 (Gwydir at Pallamallawa)	418055 (Mehi near Collarenebril)	
		Natural 80 th percentile flow	67 ML/d	38 ML/d	
		the Plan scenario (baseline target)	5	102	
		2004/2005	2	219	
		2005/2006	4	197	
		2006/2008	7	287	
		2007/2008	16	234	
		2008/2009	16	215	
		2009/2010	193	351	
		2010/2011	21	299	
		2011/2012	2	108	
		2012/2013	0	71	

Performance indicator	Related Plan objectives	Results	Strength of information
		2013/2014 11 244 References DPI Water (2017d), <i>Real Time Data – Rivers and Streams</i> , http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url	
Change in moderate to high flow regime	<p>Protect, maintain and enhance the environmental values of the Gwydir Regulated River Water Source</p> <p>Protect the Gwydir Regulated River Water Source by ensuring that extraction minimises any adverse impacts</p>	<p>Existing Plan mechanisms were utilised to improve the existing moderate and high flow regime by increasing the volume of water available to the environment through the purchase of water by CEWO and OEH.</p> <p>Increased awareness of the specific watering requirements of instream features such as benches and effluent breakouts within the Gwydir River and its effluents, in addition to the water requirements of its biota has helped guide the management of ECA releases from Copeton to maximise environmental outcomes. Releases of the ECA and CEWO water have been made from Copeton Dam that ‘piggy back’ on regulated releases and uncontrolled flows to ‘fill in the hole’ in the hydrograph created by irrigator water extraction. This reinstates the shape of the hydrograph as far as possible to maintain as near a natural hydrograph as possible.</p> <p>The Plan also addresses the moderate to high portion of the hydrograph through access arrangements to uncontrolled flow events via supplementary flow sharing. Extraction of announced events is limited to 50% of the individual event volume available after pre-existing requirements have been met (including volumes to meet the 3T rule which addresses the low end of the flow regime).</p> <p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled the Plan scenario was completed for the metrics number of days above the natural 30th, 15th and 5th percentiles.</p> <p>The natural (without development) and the Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 –Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database (DPI Water 2017d).</p>	Good

Performance indicator	Related Plan objectives	Results	Strength of information																																										
		<p>The results provided below show that the criteria were only met in the wet years of 2011/2012 to 2012/2013, and some cases the 2010/2011 and 2013/2014.</p> <p>This demonstrates that without large floods, the Plan implementation has had limited success in mimicking 'natural' moderate and high flows</p> <table border="1"> <thead> <tr> <th colspan="3">Comparison to modelled: Plan scenario for the number of days above the 30th percentile flow</th> </tr> <tr> <th></th> <th>418001 (Gwydir at Pallamallawa)</th> <th>418055 (Mehi near Collarenebril)</th> </tr> </thead> <tbody> <tr> <td>Natural 30th percentile flow</td> <td>787 ML/d</td> <td>289 ML/d</td> </tr> <tr> <td>the Plan <i>scenario (baseline target)</i></td> <td>156</td> <td>53</td> </tr> <tr> <td>2004/2005</td> <td>38</td> <td>26</td> </tr> <tr> <td>2005/2006</td> <td>101</td> <td>23</td> </tr> <tr> <td>2006/2008</td> <td>76</td> <td>0</td> </tr> <tr> <td>2007/2008</td> <td>65</td> <td>19</td> </tr> <tr> <td>2008/2009</td> <td>117</td> <td>8</td> </tr> <tr> <td>2009/2010</td> <td>40</td> <td>0</td> </tr> <tr> <td>2010/2011</td> <td>178</td> <td>0</td> </tr> <tr> <td>2011/2012</td> <td>209</td> <td>90</td> </tr> <tr> <td>2012/2013</td> <td>181</td> <td>77</td> </tr> <tr> <td>2013/2014</td> <td>152</td> <td>20</td> </tr> </tbody> </table>	Comparison to modelled: Plan scenario for the number of days above the 30th percentile flow				418001 (Gwydir at Pallamallawa)	418055 (Mehi near Collarenebril)	Natural 30 th percentile flow	787 ML/d	289 ML/d	the Plan <i>scenario (baseline target)</i>	156	53	2004/2005	38	26	2005/2006	101	23	2006/2008	76	0	2007/2008	65	19	2008/2009	117	8	2009/2010	40	0	2010/2011	178	0	2011/2012	209	90	2012/2013	181	77	2013/2014	152	20	
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Performance indicator	Related Plan objectives	Results			Strength of information
		Comparison to modelled: Plan scenario for the number of days above the 15th percentile flow			
			418001 (Gwydir at Pallamallawa)	418055 (Mehi near Collarenebril)	
		Natural 15 th percentile flow	2,289 ML/d	886 ML/d	
		the Plan scenario (baseline target)	74	15	
		2004/2005	19	16	
		2005/2006	49	12	
		2006/2008	41	0	
		2007/2008	9	0	
		2008/2009	13	0	
		2009/2010	3	0	
		2010/2011	84	0	
		2011/2012	76	84	
		2012/2013	85	58	
		2013/2014	95	4	
		Comparison to modelled: Plan scenario for the number of days above the 5th percentile flow			
			418001 (Gwydir at Pallamallawa)	418055 (Mehi near Collarenebril)	
		Natural 5 th percentile flow	7,513 ML/d	2,630 ML/d	
		the Plan scenario (baseline target)	13	5	
		2004/2005	9	10	

Performance indicator	Related Plan objectives	Results	Strength of information																											
		<table border="1"> <tr> <td>2005/2006</td> <td>3</td> <td>2</td> </tr> <tr> <td>2006/2008</td> <td>0</td> <td>0</td> </tr> <tr> <td>2007/2008</td> <td>3</td> <td>0</td> </tr> <tr> <td>2008/2009</td> <td>3</td> <td>0</td> </tr> <tr> <td>2009/2010</td> <td>0</td> <td>0</td> </tr> <tr> <td>2010/2011</td> <td>8</td> <td>0</td> </tr> <tr> <td>2011/2012</td> <td>31</td> <td>63</td> </tr> <tr> <td>2012/2013</td> <td>10</td> <td>26</td> </tr> <tr> <td>2013/2014</td> <td>0</td> <td>0</td> </tr> </table> <p>References: DPI Water (2017d), <i>Real Time Data – Rivers and Streams</i>, http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url</p>	2005/2006	3	2	2006/2008	0	0	2007/2008	3	0	2008/2009	3	0	2009/2010	0	0	2010/2011	8	0	2011/2012	31	63	2012/2013	10	26	2013/2014	0	0	
2005/2006	3	2																												
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2013/2014	0	0																												
Change in water quality in this water source	<p>Protect, maintain and enhance the environmental values of the Gwydir Regulated River Water Source</p> <p>Protect the Gwydir Regulated River Water Source by ensuring that extraction minimises any adverse impacts</p> <p>Improve water quality in the Gwydir Regulated River Water Source</p>	<p>Pre–Plan regulation of the Gwydir River, including the construction of Copeton Dam and associated downstream river regulation structures, resulted in significant water quality issues. A particularly significant impact has been thermal depression. Although currently difficult to manage at Copeton Dam due to structural constraints (Copeton Dam does not have a structure to mitigate downstream cold water impacts) problems associated with cold water releases may be somewhat mitigated with improved operation of the re–regulation weirs and storages downstream of Copeton Dam.</p> <p>DPIE undertook a study during 2008–2010 addressing the role of Copeton Dam in disrupting water quality patterns in the downstream riverine environment (Westhorpe et. at. 2015). It concluded impacts extended in a continuum approximately 60kms downstream of the dam, with nutrients, chlorophyll a, electrical conductivity and temperature the primary water quality measures disrupted.</p> <p>The impact of reduced flows and altered flow regimes is a potential water quality issue for refugial waterholes in the lower reaches of the Gwydir. De–</p>	<p>Good</p>																											

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>oxygenation and elevated water temperatures and blue–green algal blooms during summer periods are the most typical issue observed. A more detailed analysis of the location and water quality status of refugial waterholes would be required to inform this PI.</p> <p>References:</p> <p>Westhorpe DP, Mitrovic SM, Grown IO, Hadwen WL & Rees GN (2015): Disruption in water quality patterns along the river continuum by a large bottom release dam, <i>Australasian Journal of Environmental Management</i>, DOI: 10.1080/14486563.2014.999133. Available online at: http://www.tandfonline.com/doi/pdf/10.1080/14486563.2014.999133</p> <p>NSW Cold Water Pollution Strategy reports available online at: http://www.water.nsw.gov.au/water-management/water-quality/temperature#done</p>	
<p>Extent to which domestic and stock rights requirements have been met</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced domestic and stock access requirements have been met</p>	<p>Manage the Gwydir Regulated River Water Source to ensure equitable sharing of water between all uses</p> <p>Manage the Gwydir Regulated River Water Source to preserve and enhance basic water rights</p>	<p>Provision for domestic and stock rights (a component of BLR) and domestic and stock access licences has been provided for in the Plan; estimated at Plan commencement to be 6,000 ML/year and 4,245 ML/year respectively. Domestic and stock requirements have not been restricted during the Plan term with full access and entitlement available (i.e. AWDs of 100%).</p> <p>Reference:</p> <p><i>AWDs issued throughout the term of the plan from the DPI Water Register (DPI Water 2017e): http://www.water.nsw.gov.au/water-licensing/registers</i></p>	<p>Good All years</p>
<p>Extent to which local water utility requirements have been met.</p>	<p>Manage the Gwydir Regulated River Water Source to ensure equitable sharing of water between all uses</p>	<p>Provision for local water utility requirements has been made in the Plan, estimated at Plan commencement to be 3,836 ML/year. There have been no restrictions on local water utility access since Plan commencement, with full AWD allocations (100%) provided for in all water years.</p> <p>Reference:</p> <p><i>AWDs issued throughout the term of the plan from the DPI Water Register:</i></p>	<p>Good All years</p>

Performance indicator	Related Plan objectives	Results	Strength of information									
		<p><i>DPI Water (2017d), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers</i></p>										
<p>Change in economic benefits derived from water extraction and use</p>	<p>Manage the Gwydir Regulated River Water Source to ensure equitable sharing of water between all uses</p> <p>Provide opportunities for ecologically sustainable market based trading of surface water entitlements in the Gwydir Regulated River Water Source</p>	<p>ABARES (2015) identifies there are many factors that impact on economic performance of the irrigation industry and few of these are affected by the Plan. Both ABARES (2015) and Aither (2017) identify that water trading has enabled irrigators and other water users to adapt to varying water availability, particularly during the Millennium drought. However, these are Murray–Darling Basin–wide conclusions.</p> <p><i>Water markets</i></p> <p>Aither (2017) found that “water markets are a fundamentally important tool for irrigated agricultural producers in New South Wales and are an increasingly important tool for regional urban water suppliers, environmental water managers, and investors as well. They are critical to driving improvements in productivity and efficiency in the NSW economy.”</p> <p>Aither (2017) summarised the water market in the Gwydir catchment since Plan implementation: “Trade is not possible between the Gywdir and other systems due to limited connectivity. Compared with other surface water systems in New South Wales (such as the Murray and the Murrumbidgee) entitlement and allocation trade is less developed...”</p> <p>A summary of water allocation assignments and their value summarised from the <i>NSW Water Register</i> is provided below. A more detailed analysis of this data is available in Aither (2017).</p> <p>The annual volume of water allocation assignments (i.e. temporary trades) varied during the Plan term but has in general increased substantially since the commencement of the Plan.</p> <table border="1"> <thead> <tr> <th colspan="3">Water Allocation Assignments and Volumes of Water traded within the Gwydir Regulated River Water Source</th> </tr> <tr> <th></th> <th>Share (units or ML)</th> <th>No. of Dealings</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>29,957</td> <td>29</td> </tr> </tbody> </table>	Water Allocation Assignments and Volumes of Water traded within the Gwydir Regulated River Water Source				Share (units or ML)	No. of Dealings	2004/2005	29,957	29	<p>Market trading Good</p> <p>Economic benefits Poor</p> <p>Economic reports Not available</p>
Water Allocation Assignments and Volumes of Water traded within the Gwydir Regulated River Water Source												
	Share (units or ML)	No. of Dealings										
2004/2005	29,957	29										

Performance indicator	Related Plan objectives	Results			Strength of information
		2005/2006	45,491	98	
		2006/2008	56,265	112	
		2007/2008	40,174	81	
		2008/2009	58,298	94	
		2009/2010	26,739	56	
		2010/2011	60,034	113	
		2011/2012	36,272	66	
		2012/2013	88,774	120	
		2013/2014	76,790	245	
		2014/2015	67,846	82	
		The volume of term or permanent transfers varied (peaking in the 2012/13 water year).			

Term Transfers	No of dealings	No of Shares	\$/per unit
2004/2005	10	8,629	\$1,738
2005/2006	38	59,498	\$273
2006/2008	5	15,837	\$0
2007/2008	21	36,246	\$931
2008/2009	28	17,069	\$787
2009/2010	8	5,202	\$1,031
2010/2011	23	11,720	\$3,770
2011/2012	17	15,558	\$5,889
2012/2013	16	72,824	\$898
2013/2014	15	9,963	\$977
2014/2015	39	37,493	\$420

Economic reports for the Gwydir Regulated River Water Source are not available.

Departmental Irrigators' surveys (Department of Trade and Investment, Regional Infrastructure and Services 2015; DPI Office of Water 2011) provide the primary data for use in the socio-economic monitoring of the water sharing plans in NSW. The Regulated Gwydir Water Source was included in the 2006, 2010 and 2013 survey; however, results were tabulated with the Border Regulated River Water Source. These monitoring results are based on irrigator responses only and do not include comprehensive economic data.

Dry conditions and little to no flow (e.g. 0% AWDs (general security licences) were announced in 2006–2007 and 2008–2009) may have impacted economic benefits.

Aither (2017) summarises Australian Bureau of Statistics data on land use and water use by irrigated agricultural industries in the Gwydir Catchment between 2005–06 and 2014–15. There has been a significant reduction in water use by the cotton industry, but cotton is still the largest water user; this may partly be explained by increased dryland cotton cropping. Water use and area planted for pasture and other cereals industries has declined.

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>References:</p> <p>ABARES (2015), Ashton, D & Oliver, M 2015, <i>Irrigated agriculture in the Murray–Darling Basin: an economic survey of irrigators, 2012–13 to 2014–15</i>, ABARES research report 15.13, Canberra, December.</p> <p>Aither (2017) <i>Water markets in New South Wales: market outcomes, trends and drivers</i>, Report prepared for NSW Department of Primary Industries, Water</p> <p>DPI Water (2017e) NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers, water trading statistics and processing times</p> <p>DPI Office of Water (2011), <i>Monitoring economic and social changes in NSW water sharing plan areas: A comparison of irrigators’ survey 2006 and 2010 – covering plans commenced in 2004</i></p> <p>DPI Office of Water (2010), <i>Environmental flow response and socio–economic monitoring. Gwydir Valley – progress report 2009</i></p> <p>Department of Trade and Investment, Regional Infrastructure and Services (2015) <i>Monitoring economic and social changes in NSW water sharing plan areas Irrigators’ Surveys 2009/2010 and 2013 – A state wide comparison</i></p>	
<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p>	<p>Manage the Gwydir Regulated River Water Source to ensure equitable sharing of water between all uses</p> <p>Manage the Gwydir Regulated River Water Source to preserve and enhance cultural and heritage values</p>	<p>No native title rights were established in the water source during the term of the Plan. Additionally, no Aboriginal Cultural Access licences have been issued within the Plan area.</p> <p>It is noted that although there are no specific strategies within the Plan that are directly related to the PI, the environmental water provisions make some contribution towards the preservation of cultural and heritage values where they coincide with environmental assets; however, there is no monitoring data available to support this contribution. The ECA is currently used to address environmental goals. Review of the ECA use rules may result in the addition of an Aboriginal cultural use.</p> <p>The DPI Aboriginal Water Initiative Program aims to improve Aboriginal involvement and representation in water sharing.</p>	<p>Poor</p>

Performance indicator	Related Plan objectives	Results	Strength of information
<p>Extent to which native title rights requirements have been met.</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced water has been made available and used for Aboriginal purposes.</p>	<p>Manage the Gwydir Regulated River Water Source to ensure equitable sharing of water between all uses</p> <p>Manage the Gwydir Regulated River Water Source to preserve and enhance basic water rights</p> <p>Manage the Gwydir Regulated River Water Source to preserve and enhance cultural and heritage values</p>	<p>There are provisions in the Plan to provide access to water if native title rights over water are granted under the Federal Native Title Act 2003. No native title rights were established in the water source during the term of the Plan. Additionally, no Aboriginal Cultural Access licences have been issued within the Plan area.</p> <p>References:</p> <p>National Native Title Tribunal (2017) Native Title Determinations, http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/default.aspx</p> <p>DPI Office of Water (2017e), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers</p>	<p>Poor</p>
<p><i>Additional PI identified:</i></p> <p>Change in surface water extraction relative to the long term annual average extraction limit</p>	<p>Protect, maintain and enhance the environmental values of the Gwydir Regulated River Water Source</p> <p>Protect the Gwydir Regulated River Water Source by ensuring that extraction minimises any adverse impacts</p> <p>Ensure extraction from the Gwydir Regulated River Water Source is managed properly within the Murray Darling Basin Ministerial Council Cap</p>	<p>The LTAAEL for the Gwydir Regulated River is 392 GL/yr. This Plan Limit is the long-term average diversion, based on running the Plan Limit simulation model for the full period of simulation: 1st January 1890 to 30th June 2016. Note that the LTAAEL is approximately 23GL below the long-term average MDB Cap, principally due to the additional environmental water created by the 1998 environmental flow rules and their adaptation for the Plan.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. While these conditions do not vary on an annual basis, the Plan implies that they will be updated, and the model run on an annual basis. According to water</p>	<p>Good All years</p>

Performance indicator	Related Plan objectives	Results	Strength of information																								
		<p>implementation review audit reports (DPI Office of Water 2013a and 2013b), this annual assessment did not occur during the Plan term, because development conditions were not updated in the model on an annual basis.</p> <p>Nevertheless, the cumulative assessment has since been carried out in 2016 (DPI Water Modelling Unit Head <i>pers comm</i>). This assessment found that the Gwydir was over the LTAAEL by 2.4%. Note that this is below the 3% exceedance threshold triggering response under the Plan rules.</p> <p>Annual diversion data is available from the NSW water register and is shown in the table below. However, as noted above, the figure cannot be used directly to assess LTAAEL compliance.</p> <table border="1"> <thead> <tr> <th>Water Year</th> <th>Diversion (GL)</th> </tr> </thead> <tbody> <tr><td>2004–2005</td><td>153</td></tr> <tr><td>2005–2006</td><td>219</td></tr> <tr><td>2006–2007</td><td>129</td></tr> <tr><td>2007–2008</td><td>79</td></tr> <tr><td>2008–2009</td><td>143</td></tr> <tr><td>2009–2010</td><td>47</td></tr> <tr><td>2010–2011</td><td>227</td></tr> <tr><td>2011–2012</td><td>199</td></tr> <tr><td>2012–2013</td><td>381</td></tr> <tr><td>2013–2014</td><td>377</td></tr> <tr><td>2014–2015</td><td>153</td></tr> </tbody> </table> <p><i>Source: DPI Office of Water (2013a), Audit of implementation – Regulated river water sharing plan audit report cards, Prepared for the period between 1 July 2004 and 30 June 2009.</i></p> <p><i>DPI Office of Water (2013b), Audit of implementation – Regulated river water sharing plan audit report cards, Prepared for the period between 1 July 2009 and 30 June 2012.</i></p>	Water Year	Diversion (GL)	2004–2005	153	2005–2006	219	2006–2007	129	2007–2008	79	2008–2009	143	2009–2010	47	2010–2011	227	2011–2012	199	2012–2013	381	2013–2014	377	2014–2015	153	
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Performance indicator	Related Plan objectives	Results	Strength of information
		DPI Water (2017e), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers	

Appendix 2 – Gwydir regulated river internal logic diagrams

Relationship diagrams show the internal Plan logic supporting the delivery of each of the Plan's outcomes. One diagram has been created for each of the economic, social / cultural and environmental outcomes. The diagrams show linkages from the Plan vision (green box) through the broad objectives (navy boxes) to the targeted objectives (blue boxes) and the rules (grey boxes). Where gaps in the program logic have been identified, these are shown as 'not specified' in a box of the appropriate colour. Gaps have been identified at the targeted objectives levels in this evaluation.

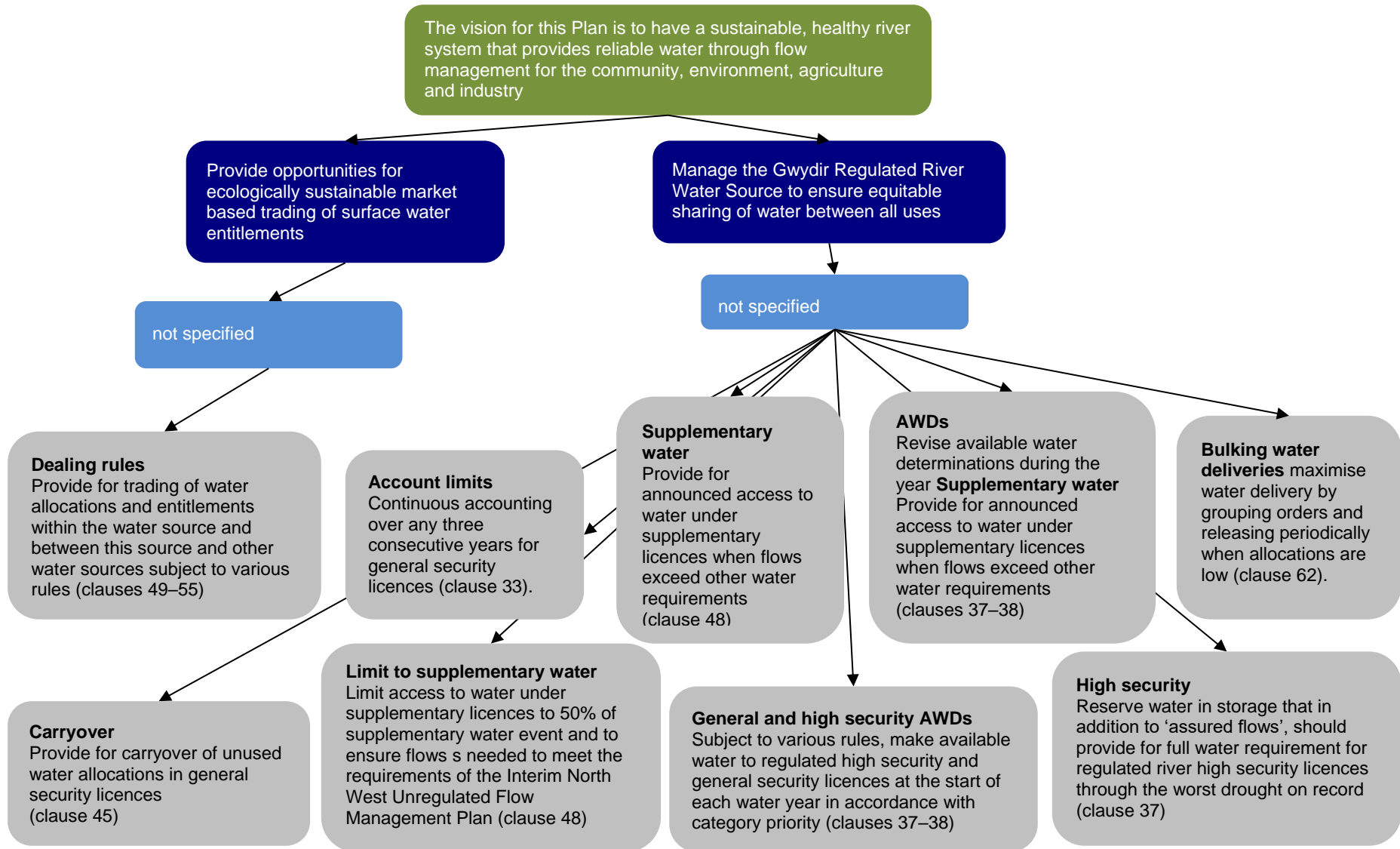


Figure 3: Economic internal logic relationship

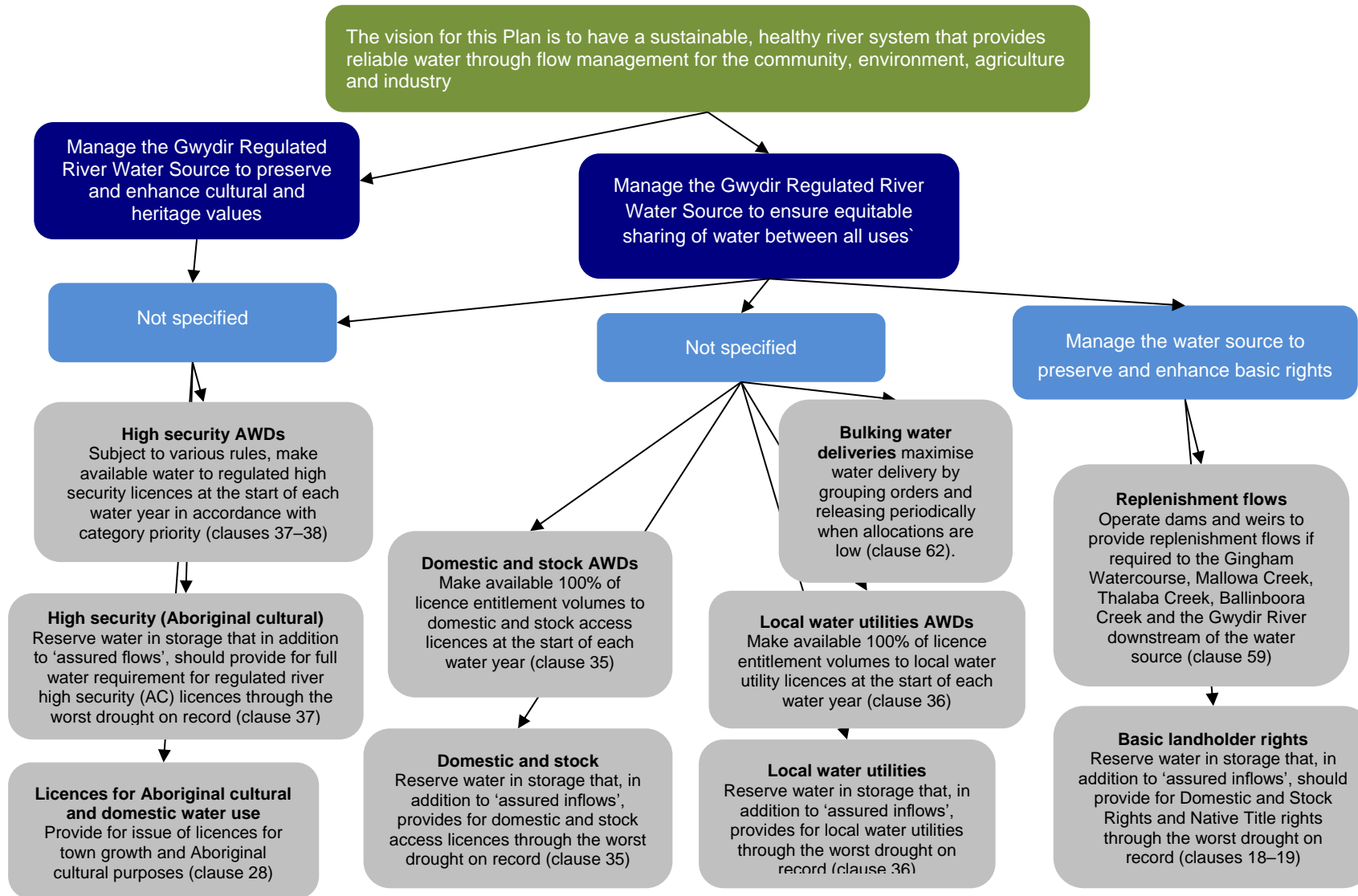


Figure 4: Social / Cultural internal logic relationship diagram

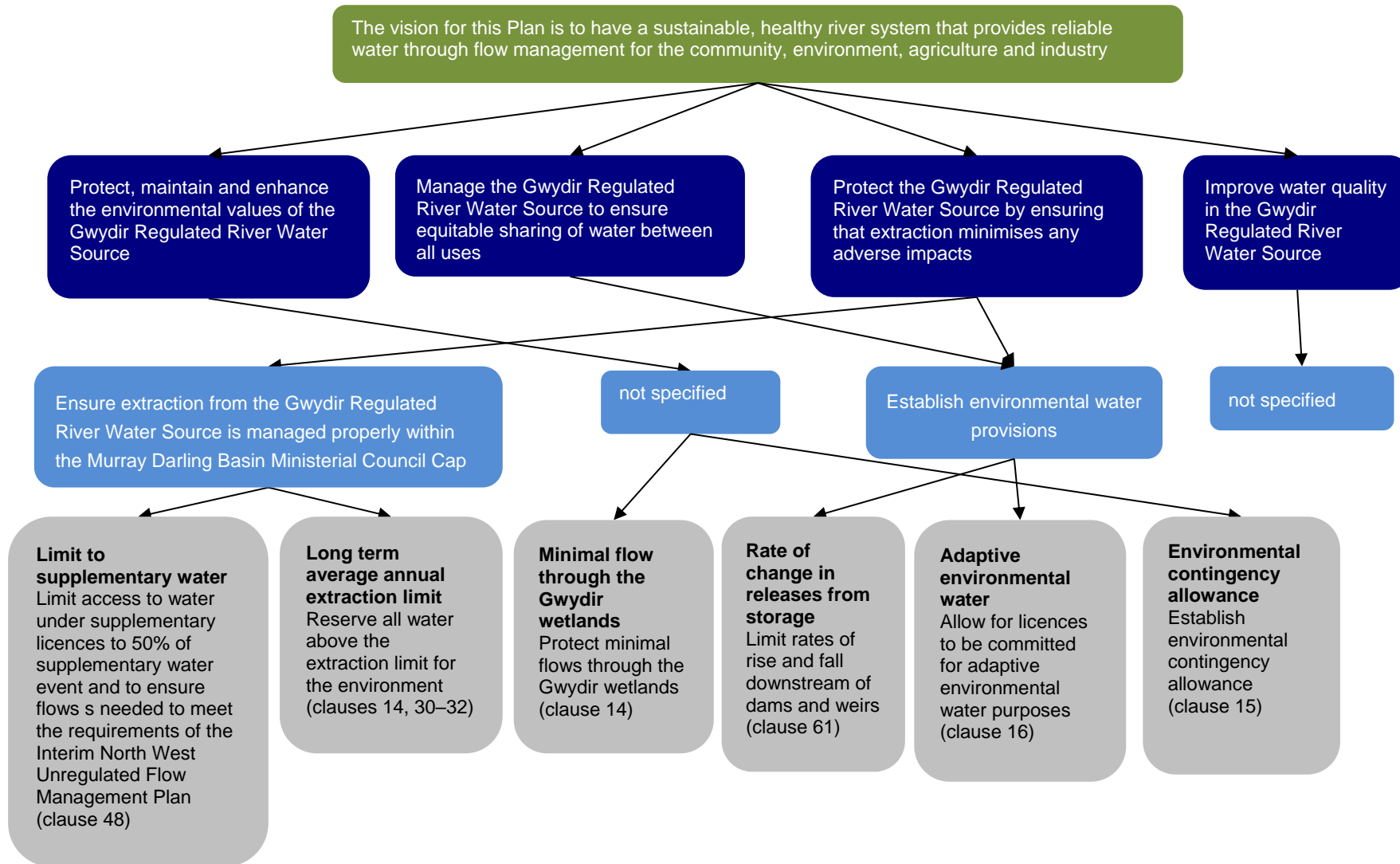












Figure 5: Environmental internal logic relationship diagram





Appendix 3 – Lachlan regulated river report cards and performance indicator summary




Table 5: Appropriateness Report Card



Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Plan scale	Is the scale of the Plan appropriate for water management?	Extent to which scale is appropriate for water sharing management	The geographic scale of the water source in the Plan is considered appropriate for water sharing management.			
Plan scope	Is the scope of the Plan appropriate for water management?	Extent to which interactions with other water sources are addressed appropriately within the Plan or other water sharing plans	<p>Further opportunities have been identified to recognise the interactions with groundwater and other surface water types beyond those interactions noted below.</p> <p>For example, the CSIRO (2008) Sustainable Yield Report found that increased groundwater use by 2030 would result in 25% of current groundwater use being sourced directly from induced stream–flow leakage. Much of this impact has not been explicitly considered in the development of existing surface water sharing plans. For the Lachlan, total surface water loss to groundwater by 2030 is estimated to be up to 40GL per year.</p> <p>The Plan does prohibit the issue of licences within effluent rivers to stop trading leading to an increase in extractions from rivers feeding environmentally sensitive wetland</p>		Consider reviewing this and adjoining surface and groundwater plans to formally recognise connectivity between water sources and provide line of sight from related rules to Plan objectives.	High


Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>areas.</p> <p>In addition, licence transfers from unregulated rivers to the regulated river cannot occur</p> <p>The Plan also provides for replenishment flows to refill pools and water holes in effluent river systems downstream of the water source and to provide water for household and town use and stock.</p>			
Prioritisation	<p>Is the level of management required under the Plan appropriate for the risk to environmental, economic, or social and cultural values?</p>	<p>Extent of risk to dependent ecosystems, economic, and social and cultural values</p>	<p>The prioritisation of the Plan as high risk (DLWC 1998) is considered appropriate.</p> <p>The level of management applied is considered appropriate based on high levels of pre-Plan water allocation.</p>			
		<p>Extent to which risk is addressed</p>	<p>Risk is addressed through the application of the LTAAEL, water sharing arrangements that respond to variations in water availability and associated water market.</p>			
		<p>Identified future risks, including climate change, change in industry base, etc.</p>	<p>Future risks are partially addressed through the application of the LTAAEL, water sharing arrangements that respond to variations in water availability and a flexible water market.</p> <p>The calculation of the LTAAEL uses the drought of record at the time the Plan was developed (which at that time was the early 1900s “federation</p>		<p>Consider undertaking analysis of climate variability and change, as well as potential changes in industry base to</p>	<p>High</p>

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>drought”), which may not reflect future climate due to existing climate variability beyond the historic record and the impacts of climate change. During the Plan term, a new drought of record was created in the Lachlan (the “Millennium Drought”).</p> <p>In addition, changes to the industry base are not recognized.</p>		<p>assess the implications for future water availability and demand.</p>	
Internal logic	Is the vision appropriate for water management?	Whether the vision reflects what is intended for water sharing plans in the Act	The vision is considered appropriate as it is consistent with the Act’s intent for water sharing plans to achieve economic, social and environmental outcomes.			
	Are the objectives suitable for water management?	Whether the objectives align with the vision	The objectives align with the Plan vision.			
		Whether the objectives align with the principles and objects of the Act	The objectives align with the principles and objects of the Act.			
		Extent to which the objectives are clear and comprehensive enough to reflect what the Plan intended to achieve	The objectives are clear and comprehensive enough to reflect what the Plan intended to achieve.			
		Extent to which the Plan logic	The Plan logic establishes objectives that		Consider reviewing some	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
		establishes SMART objectives	are SMART for the most part.		objectives to ensure they align with SMART principles.	
	Are the strategies suitable for water management?	Whether all Plan rules are linked to a strategy	All Plan rules can be linked to a strategy.			
		Whether the strategies provide clear direction for the Plan rules	Strategies could be more specific to guide the intent of the Plan rules and to highlight the links with their intended outcomes.		Consider whether more appropriate, objective-linked strategies should be developed, to improve clarity of direction for Plan rules and to improve the ability to measure success	High
		Whether the strategies align with the objectives	Not all strategies align with the objectives. Current strategies describe Plan structure only and do not adequately show how the Plan’s objectives will be achieved. For example, strategy (a) of the Plan is to establish environmental provisions. No direction is provided by this strategy to guide Plan rule formation to meet the Plan objectives. This is important as the Act requires performance indicators (PI) be used to assess how Plan strategies achieve the objectives.			
	Are the PI suitable for water management?	Whether the PI align with the objectives and strategies	All PI align to the objectives, but do not align with the strategies. For example, PI (a) of the Plan is “Change in ecological condition of this water source and dependent ecosystems”. The PI is aligned with objective (a) in the Plan but there are		Consider reviewing alignment and relevance of PIs and measures against each objective and	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			no strategies that are either aligned by the Plan itself or that can be aligned to the PI.		strategy.	
		Extent to which PI are clear and comprehensive enough to measure what the Plan intended to achieve	Most PI are clear but not comprehensive. Some additional measures are available for many PI and have been included in this evaluation where possible.			
Quality of Supporting Documentation	Is documentation explaining the decisions underpinning the Plan available?	Adequacy of documentation supporting the Plan	The Plan has a comprehensive "Part A" document (DLWC 2001) supporting and explaining Plan development which is available internally. A range of documents are also available that support and explain Plan implementation.			
		Extent to which documentation is made available to the public	The "Part A" document was publicly available during the Plan's initial exhibition period but is no longer publicly available. General Purpose Accounting Reports and Plan Implementation Audit Reports are available on the DPIE website.		Consider improving availability of evidence sources supporting Plan development, implementation and monitoring, to support Plan implementation and communication to stakeholders and the water market.	Low

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Communication	Is the process for communication with stakeholders adequate?	Extent of communication and processes supporting Plan development	<p>Consultation was carried out during Plan development, with the Lachlan River Management Committee meeting to explore issues and develop management strategies. In addition to the expertise of the committee members, community consultation added significant value to the Committee’s deliberations and shaped the final recommendations of the draft Plan. The consultation took two forms: a community briefing meeting; and the Committee members’ discussions with their stakeholder groups and other members of community.</p> <p>Additionally, David Towney, an Aboriginal Natural Resource officer with DLWC, undertook Aboriginal consultation.</p> <p>The Plan was placed on public exhibition.</p>			
		Communication arrangements in place during Plan operation	<p>Communication has been appropriate; however recent community feedback suggests that a more formalised ongoing communication protocol is required.</p> <p>Generally, communication was on an ‘as needs’ basis. During drought periods, frequent discussions were held with water users, including an advisory committee.</p> <p>Since the Plan suspension was lifted, there have been ongoing discussions with the Customer Services</p>		Consider developing a communication Plan that serves the needs of the community and the water market during Plan operation. Under current institutional arrangements,	Medium

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>Committee and other water user groups.</p> <p>A series of annual General–Purpose Water Accounting Reports are available on the DPIE website, as well as audits of Plan implementation.</p>		<p>DPIE may consider whether the Operating Licence and/or Works Approval for WaterNSW should include a requirement to implement the Communications Plan, given WaterNSW has a key operational and communication role. (NOTE the Draft Operating Licence for WaterNSW will be proposed by IPART in May 2017.)</p>	
		<p>Arrangements for consideration at term review of Plan</p>	<p>Opportunity will be provided for communication during the Water Resource Plan development process.</p> <p>Consultation will involve opportunities to make submissions, and face to face meetings will be held with stakeholders.</p> <p>There are ongoing discussions with targeted groups who may be affected by amendments under consideration, or who have identified issues.</p>			









Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Alignment with state priorities for natural resource management Plans (S43A)	Is the Plan aligned with state priorities for natural resource management?	Extent of alignment of Plan with state priorities	The NSW water sharing plans were in place prior to the development of the state priorities for natural resource management and so full alignment is not expected. The NRC considered there is some alignment of priorities, however the lack of available monitoring, evaluation and reporting information at the time of assessment limited the NRC's findings (NRC 2013).		Consider reviewing alignment of Plan objectives with state priorities for natural resource management during the development of the Water Resource Plan	High

Table 6: Efficiency Report Card




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Environmental water provisions	planned environmental water	Was all water above the extraction limit protected?	Assessment of compliance with the LTAAEL has occurred after the Plan term, in 2016. This assessment indicated that the LTAAEL was not exceeded. However, the LTAAEL was not assessed on an annual basis as required by the Plan. (see Extraction Limit evaluation findings below).		See Extraction Limit below	High
	Translucent flows	Were translucent flows released from Wyangala and Brewster in accordance with the Plan s15	The Plan was suspended from 1 July 2004 – 16 September 2011, due to drought of record conditions. The trigger for translucent releases was not met between 2004 and 2010. The trigger was met in 2010–11, but as the Plan was suspended, no releases were made. Tributary inflows below the dam were allowed to flow past Brewster weir. Translucent releases began on 8 June 2012. From this date onwards they were released in accordance with the Plan		Consider reviewing translucency trigger rules and timeframes to optimise contribution to the Plan’s environmental objectives, while ensuring no impact on reliability.	High
		Was the translucency release trigger reviewed before end of year 5 as per s15(1)(j)?	The Plan was suspended from 1 July 2004 – 16 September 2011, due to drought of record conditions. The review had not been conducted by 2011 (year 7), because the Plan		As above	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			was suspended. Since the translucency rule had not operated, there was insufficient evidence to undertake the review. (It is understood the review is now underway).			
	Environmental contingency allowance (ECA)	Was the ECA account managed according to the Plan rules?	The Plan was suspended from 1 July 2004 – 16 September 2011, due to drought of record conditions. During this period no credit to ECA was made, since General Security (GS) available water determinations (AWD) were below the trigger (50%) provided for in Plan. ECA credited and managed as per Plan from 2010–2011 onwards.			
		Was an annual release program for the use of ECA water prepared and approved?	<p>The Plan required annual release procedures established by Minister. These were not prepared during the Plan suspension and not prepared once the Plan reinstated.</p> <p>However, note that Lachlan CMA established an advisory committee, even though not required by the Plan.</p> <p>In addition, the Plan ECA rules pre-date contemporary governance arrangements of environmental water (e.g. NSW government decision (2008) to appoint OEH as the lead agency on discretionary environmental water, tradeable water entitlements for the</p>		<p>Consider reviewing the Plan rules to consider providing for:</p> <ul style="list-style-type: none"> • An advisory committee for the ECA. • Clarity of governance arrangements for the ECA. 	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			environment (mainly acquired 2006–2014) and strategic and annual environmental water planning (mainly from 2012)).			
		To what extent was the ECA used for all Plan specified purposes?	<p>ECA may be released for ecological purposes, including, but not limited to, completion of waterbird breeding events, promotion of fish breeding, promotion of fish passage, wetland watering and increasing flow variability.</p> <p>In 2010–2011, the ECA was used to partially offset operational losses incurred by a decision not to completely fill Lake Brewster, in order to enable completion of a pelican breeding event. The operational losses were incurred jointly between the ECA, the WQA and forgone GS AWDs. (ref Office of Water 2011 GPWAR).</p> <p>In 2011–12, 2012–13 and 2013–14, the ECA was credited 20,000ML each year, which was unused and so forfeited at the end of the water year. OEH environmental outcomes reports since 2010 (when crediting of ECA commenced) report no use of ECA for targeted environmental outcomes (which were achieved with held environmental water).</p> <p>Lachlan ECA does not accrue until AWDs for GS accounts is greater than 50%. AWD increases lag the</p>		<p>Consider review of ECA rules to increase flexibility of ECA accrual and use, while avoiding net impacts on consumptive entitlement reliability.</p> <p>Note: Basin Plan provisions mean no net change in planned environmental water and no impact on reliability outcomes is required.</p>	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>changing conditions in the catchment. In addition, the single threshold means the ECA is either available or not – there is not a graduated increase. Therefore, the ECA is only available and useable for a specific “window” between medium and wet conditions of water availability.</p> <p>In conclusion, some objectives/purposes for the ECA don't match the way the ECA accrues and is able to be held in accounts. Lachlan ECA usage will always be lumpy given the conditions around accrual and use. (However, the Plan modelling assumes 56% use of ECA (Driver et al 2004)).</p> <p>(Note that Lachlan does not have supplementary access and so flow freshes are generally available for the environment).</p>			
	Water Quality Allowance	Was the WQA account established and managed according to the Plan rules	<p>Prior to 2010, the WQA was not credited because the Plan was suspended, and the triggers also did not occur.</p> <p>In 2010–2011, the WQA was used to partially offset operational losses incurred by a decision not to completely fill Lake Brewster, in order to enable completion of a pelican breeding event. The operational losses were incurred</p>		<p>Consider amending WaterNSW works approval to provide more transparent procedures and accounting for WQA.</p> <p>DPIE endeavour to provide for transparent accounting of the WQA in the GPWAR.</p>	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>jointly between the ECA, the WQA and forgone GS AWDs. (ref Office of Water 2011 GPWAR)</p> <p>In 2011–12, 2012–13 and 2013–14, the WQA was credited 20,000ML each year. The audit and accounts record this as unused and so forfeited at the end of the water year. It is not clear why it was unused. (ref NSW Office of Water / DPI Water GPWAR for these 3 water years).</p> <p>However, it is understood that the WQA is in fact debited by WaterNSW adjusting releases on a daily real-time basis, to allow shandyng of water to meet BGA dilution rates and/or substitute for BGA-contaminated Lake Brewster water; evaporation losses and additional transmission losses from Wyangala. This use is consistent with the Plan. It is not clear why this does not appear in the GPWAR or the audit report.</p> <p>The Plan provides for the Minister to establish procedures determining the volume and timing of releases of water credited to the WQA account. Conditions relating to WQA releases are listed on the WaterNSW works approval.</p> <p>The Minister’s procedures determining the volume and timing of releases were not established.</p>		<p>Whilst the WQA provision has since 2016, been amended with a requirement to consult with the Environmental Water Advisory Group, DPIE may consider whether further amendments would improve transparency of governance of the WQA.</p>	







Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			Note that since 2016, this provision has been replaced with a requirement to consult with the Environmental Water Advisory Group.			
	Adaptive environmental water (AEW)	Is there a process for licences to be committed for adaptive environmental purposes?	<p>All necessary systems are in place to apply and manage AEW conditions should they be requested.</p> <p>Note: Additional water is held for environmental purposes by other access licences in this water source (CEWO and OEH) but these licences have not been conditioned as AEW.</p>			
		Were AEW Use Plans developed?	<p>OEH developed AEW use plans and committed licences to AEW.</p> <p>Note that CEWH chooses not to commit its licences to AEW status, but continues to apply its licences for environmental outcomes, for which it operates a planning process.</p>		Consider whether AEW provisions still provide the appropriate balance of water security for the environment with operational flexibility, given contemporary environmental water management governance, planning and reporting arrangements.	Low
		Were there additional licences created and AEW conditioned as a result of water savings	<p>Yes, several AEW licences were created from efficiency projects. The two largest were:</p> <ul style="list-style-type: none"> Lake Brewster has been re-engineered to provide for inflow 		As above	Low

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		within the water source?	<p>and outflow wetlands with a storage cell at the 'back' of the Lake. This was to achieve water quality benefits in a reduction of blue-green algae BGA discharged from the Lake to the river. The associated water savings led to creation of a 12GL AEW licence, with principle objectives to support ecological objectives in (1) Lake Brewster (2) elsewhere.</p> <ul style="list-style-type: none"> The piping of stock and domestic water for the Noonamah scheme formerly supplied by a 130km open channel. 1200ML S&D made into 725 ML high security AEW. <p>Note that the Commonwealth (CEWH) chooses not to commit its licences (including those recovered from water savings measures) to AEW status, but continues to apply its licences to environmental outcomes, for which it operates a planning process.</p>			
Basic Landholder Rights (BLR)	Domestic and Stock	Were domestic and stock BLR provided for within the Plan?	<p>The Plan provides for domestic and stock BLR.</p> <p>During the drought years 2004–2010 (and Plan suspension), BLR flows were only available intermittently, due to the extremely dry conditions and difficulty in transmitting the water considerable distances.</p>		Consider reviewing the Plan with a view to specifying more clearly the limits to availability of BLR, i.e. that this depends on ability to convey water volumes to the nominated access points.	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			Since 2011, BLR flows have been provided.			
		Is domestic and stock BLR growth provided for within the Plan?	Procedures are in place to allow for growth in domestic and stock BLR.			
		Was the water supply managed to ensure sufficient reserves for domestic and stock BLR were maintained?	During the drought years 2004–2010 (and Plan suspension), BLR reserves were available, but could only be delivered intermittently, due to the extremely dry conditions and difficult in transmitting the water considerable distances.		Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of: <ul style="list-style-type: none"> • Whether and in what circumstances the Plan is suspended; • Practical constraints on ability to delivery BLR during drought, due to transmission losses, including losses to groundwater; • Governance and criteria for decisions on BLR availability, during drought and/or when the Plan is suspended 	High
		Were domestic and stock BLR provided for	BLR is delivered as a volume on top of operational delivery flows.		See above	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		in water delivery operating protocols?	During the drought years 2004–2010 (and Plan suspension), BLR flows were only available intermittently, due to the extremely dry conditions and difficulty in transmitting the water considerable distances. Since 2011, BLR flows have been provided.			
		Were replenishment flows delivered when required to satisfy domestic and stock needs, subject to water availability?	<p>From 2004–2010 (while the Plan was suspended) irregular deliveries of annual replenishment flows were delivered based on availability of surplus flows. This varied considerably across the creeks nominated in the Plan. Some went without replenishment flows for up to four years.</p> <p>In hindsight, the Plan commits to supply water that it is now known cannot be supplied under certain conditions.</p> <p>Booberoi Creek (Plan requirement <12,500 ML/yr)</p> <p>2004–05: 7,510 ML; 2005–06: 8,435 ML; 2006–07: 6,918 ML; 2007–08: 3,311 ML; 2010–11: 13,182 ML; 2011–12: 12,390 ML (net replenishment delivery minus returns); 2012–13: 18,022 ML (net replenishment delivery minus returns; gate kept open during translucency & airspace operation); 2013–14: 11,293ML (net</p>		<p>Consider reviewing the Plan with an aim of specifying more clearly the limits to availability of replenishment flows, i.e. that this depends on ability to convey water volumes to the nominated effluent creeks.</p> <p>Consider specifying more clearly the net accounting approach to Booberoi Creek.</p>	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>replenishment delivery minus returns); 2014–15: 12,012 ML (net replenishment delivery minus returns)</p> <p>Torrigan, Muggabah and Merrimajeel</p> <p>Creeks Trust District (Plan requirement <9000 ML/yr)</p> <p>2004–05: zero ML; 2005–06: 7,030 ML; 2006–07: zero ML; 2007–08: 5,446 ML; 2007–08, 2008–09, 2009–10 all zero; 2010–11 9,336 ML; 2011–12: 484 ML; 2012–13: 6,561 ML; 2013–14: 1,542 ML; 2014–15: 5,227 ML.</p> <p>Willandra Creek (Plan requirement <12,000ML)</p> <p>2004–05: 13,800 ML; 2005–06: 10,170 ML; 2006–07, 2007–08, 2008–09, 2009–10 all zero ML; 2010–11 21,987 ML; 2011–12: zero due to natural flood flows; 2012–13: 1,021 ML; 2013–14: 16,360 ML (2 events start and end of water year); 2014–15: 0ML; and subsequently – as per Plan <12,000ML;</p> <p>Merrowie Creek (Plan requirement <9,000ML)</p> <p>2005–06: 8,520 ML; 2006–07, 2007–08, 2008–09, 2009–10 all zero ML; 2010–11: 11,112 ML; 2011–12: 300 ML, top up to natural flows; 2012–13: 300 ML; 2013–14: 8,834 ML; 2014–15: 7,818 ML</p>			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Are domestic and stock BLR consistent with reasonable use guidelines?	Reasonable use guidelines (made under s.52 of the Act and provided for in the Plan) have not been made by the Minister.		Endeavour to finalise and publish the reasonable use guidelines.	Low
	Native title	Were native title BLR provided for within the Plan?	Procedures are in place to provide access if native title rights for water are granted in the water source covered by this Plan. <i>Note: No native title rights for water have been established in this Plan area.</i>			
		Is growth in native title BLR protected within the Plan?	Procedures are in place to allow for growth in native title BLR.			
Rules for granting access licences	Granting new access licences	Were Plan rules followed for the granting of access licences?	All access licences granted were in line with the Plan provisions. The Water Management (General) Regulations 2004 and 2011 set out the specific purpose access licences and application conditions.			
Limits to the availability of water	Extraction limits	Was an extraction limit established?	A long-term average annual extraction limit (LTAAEL) was established for this water source.			
		Was the long-term average annual extraction assessed against the LTAAEL at the end of each water year?	Assessment of compliance with the LTAAEL has not occurred annually as specified in the Plan due to the unavailability of annually updated water use development data.		Consider reviewing the Plan to achieve an approach that: <ul style="list-style-type: none"> can be practically, cost-effectively and reliably implemented 	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>However, assessment and model update has occurred after the Plan term in 2016.</p> <p>Amendment of the Plan is recommended to achieve an approach that can be practically implemented, while enabling timely identification of any risk of growth in use.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of</p>		<ul style="list-style-type: none"> enable timely identification of any risk of growth in use (e.g. a 5–yearly assessment, unless there are other compliance/growth alerts). <p>Endeavour to resolve the process for the collection of water use development data so the IQQM model can be updated at an appropriate frequency.</p> <p>Endeavour to implement NSW Plan limit compliance assessment as routine business, alongside “Permitted take” (SDL) assessment under Basin Plan.</p> <p>High priority due to risks for NSW and for water access licence holders if “growth in use” not identified and addressed early.</p>	



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>compliance to take place. Water use development data is not volatile on an annual basis but is more appropriately assessed at the 3–5year frequency.</p> <p>However, the Plan implies that they will be updated, and the model must be run on an annual basis.</p> <p>It is recommended that this approach be reviewed and amended at Plan term review, given that this has proven to be impractical over the 10–year implementation of the Plan.</p> <p>Furthermore, the amended Plans will need to reflect Basin Plan requirements for application and compliance with the SDL.</p>			
	Variation of extraction limits	Were extraction limits varied?	<p>No changes to extraction limits have been required.</p> <p>(Note that the Basin Plan “Sustainable Diversion Limit” (SDL) is not implemented through the Plans until 2019 and effectively builds on existing NSW limits).</p>			
	LTADEL compliance	Was LTADEL exceeded?	<p>Assessment of LTADEL compliance has occurred after the Plan term in 2016 but has shown that LTADEL was not exceeded.</p> <p>Assessment of compliance with the LTADEL did not occur annually as specified in the Plan due to the</p>		<p>See above recommendations concerning Plan term review of LTADEL rules and implementation.</p> <p>Endeavour to make available on its website</p>	HIGH





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			unavailability of updated water use development data. LTAAEL compliance is not readily identifiable in publicly available information.		the ongoing LTAAEL compliance status.	
		Was extraction managed within LTAAEL?	AWD protocols include provisions to ensure the LTAAEL is not exceeded			
		Was a Compliance Assessment Advisory Committee established, if required, to advise on strategies to ensure the LTAAEL was not exceeded?	The audit reports (2005–09 and 2009–12) were ambiguous as to whether the committee had been established, but if it was, it was not continued.		Consider whether committee is required and whether it is necessary to write into Plan rules.	High
	AWDs	Were AWDs for all categories of licences calculated and announced in line with Plan provisions?	The Plan was suspended from July 2004 to September 2011, because of an extended drought of record. During this time arrangements prioritised critical needs. All licence categories AWDs were very low. General security was zero for significant periods. High security was as low as 0.3ML per share. Local water utilities were as low as 50%. In addition, priorities were not followed exactly as per the Plan during this period. For example, a GS AWD was declared before local water utilities allocation reached 100%, to distribute the limited available water through the		Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of: <ul style="list-style-type: none"> • Whether and in what circumstances the Plan is suspended; • Governance and criteria for decisions on AWDs, during drought and/or when Plan is suspended Consider reviewing rules for AWD	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			community (DPI Water 2013, Audit). Since the Plan was reinstated in September 2011, AWDs are understood to have been calculated and announced in line with Plan provisions.		announcements to balance the water needs of the whole community during dry times and triggers to move to these rules.	
Rules for managing access licences	Water allocation and account management	Were water accounts established for all licences?	Water accounts were established from the start of the Plan term, once tradeable water access licences were established.			
		Were accounts managed in accordance with the Plan rules?	From 2004–2011, the Plan was suspended due to drought of record. During this time, accounts were managed in accordance with Plan rules except where critical water needs measures required suspension of rules. For example, in some years, GS account holders were restricted to using 20% of their available account. Since 2011, accounts have been managed in line with Plan provisions.		Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of: <ul style="list-style-type: none"> • Whether and in what circumstances the Plan is suspended • Decision-making protocols for account management when the Plan is suspended 	High
	Carryover provisions	Was carryover managed in accordance with the Plan rules?	From 2004–2011, the Plan was suspended due to drought of record. During this time, carryover was managed in accordance with Plan rules except where critical water needs measures required suspension of rules. For example, limits were		Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of: <ul style="list-style-type: none"> • Whether and in what 	High





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>imposed on use of carryover in 2006–07, 2007–08 and 2009–10 (DPI Water 2013 Audit).</p> <p>Since 2011, carryover has been managed in line with Plan provisions.</p>		<p>circumstances the Plan is suspended</p> <ul style="list-style-type: none"> Decision–making protocols for carryover when the Plan is suspended 	
	Extraction conditions	Were the general priority of extraction conditions set out in the Plan complied with?	<p>From 2004–2011, the Plan was suspended due to drought of record conditions. During this time, priority was managed by critical water needs measures, which allowed discretion on priority of extraction.</p> <p>Since 2011, priority of extraction has been managed in line with Plan provisions.</p>		<p>Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of:</p> <ul style="list-style-type: none"> Whether and in what circumstances the Plan is suspended Decision–making protocols for priority of extraction when the Plan is suspended 	High
		Were numerically specified extraction components introduced by amending water access licences e.g. in relation to times, rates or circumstances that water may be taken?	<p>These were not required during the drought and Plan suspension period, since limited water availability meant that channel capacity was not exceeded.</p> <p>DPI Water’s (2013) implementation audit indicates that from 2011–12, channel capacity had begun to be exceeded and the need for these extraction components had begun to arise.</p>		<p>Consider establishing a state–wide policy for the establishment of numerical extraction conditions, with numerical extraction components.</p>	High






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Dealings	Minister's dealing principles	Were dealings in line with the Minister's dealing principles, the Act and the Plan?	<p>During Plan suspension (2004–2011), some dealings were carried out that were not otherwise permitted by the Minister's dealing principles. These were the assignment (transfer) of domestic and stock water between licences, the assignment (transfer) of Jemalong conveyance water and the assignment (transfer) of water between local water utility licences, but within the same utility. In all cases, these dealings were permitted in order to maximise flexibility and availability of water during extreme drought.</p> <p>All other dealings have been made in line with Minister's dealing principles.</p> <p><i>Note: Prohibited dealings in the Plan area include: interstate (transfer and assignment of allocation) and allocation assignments between water sources.</i></p>		<p>Consider reviewing the Plan and the Minister's dealing principles, to consider enabling flexible water availability for critical needs during extreme drought.</p> <p>(also relates to recommendations above, regarding clarity on circumstances for Plan suspension and decision-making protocols during Plan suspension and/or during drought of record).</p>	Medium
	Constraints within water source	Were dealings in line with rules relating to constraints within the water source?	All dealings were undertaken in line with Plan rules relating to constraints within the water source.			
	Change of water source	Were dealings in line with rules relating to change of water source?	Change of water source dealings are not possible as conversion factors have not been established.			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were conversion factors established when required?	<p>Conversion factors were not established.</p> <p>The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (released in Sept 2009 and March 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.</p> <p>Current NSW Regulations do not allow trade from an unregulated water source into a regulated water source. Trade is allowed from a regulated water source into an unregulated water source. However, given the principle of no impact on third parties from dealings, these trades rarely proceed.</p> <p>DPIE is reviewing trade between regulated systems including conversion factors with the introduction of the Basin Plan 2012.</p>		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water source?	<p>Conversion of access licence category dealings that do not require conversion factors are possible.</p> <p>Conversion of access licence category dealings are not possible where conversion factors are required as the factors have not been established.</p>		<i>see next</i>	<i>see next</i>

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were conversion factors established when required?	Conversion factors were not established. The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (released in Sept 2009 and March 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High
Mandatory conditions	Access licence conditions	Were mandatory conditions for access licences placed on licences?	Mandatory conditions required in the Act and in the Plan were placed on the licences during the conversion of licences from the WA to the WMA before the Plan commenced.			
	Water supply works approvals	Were mandatory conditions for works approvals placed on the works approvals?	Mandatory conditions required in the Act and in the Plan, were placed on the approval during the conversion of licences from the WA to the WMA before the Plans commenced.			
System Operation rules	Replenishment flows	Were replenishment flows provided in accordance with the Plan?	From 2004–2010 (while the Plan was suspended) irregular deliveries of annual replenishment flows were delivered based on availability of surplus flows. This varied considerably across the creeks nominated in the Plan. Some went without replenishment flows for up to four years.		Consider reviewing the Plan to specify more clearly the limits to availability of replenishment flows, and that this depends on the ability to convey water volumes to the nominated effluent creeks.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>In hindsight, the Plan commits to supply water that it is now known cannot be supplied under certain conditions.</p> <p>(See Basic Landholder Rights section above for full details of replenishment flows provided and not provided.)</p>		Consider specifying more clearly the net accounting approach to Booberoi Creek.	
		Was the water supply managed to ensure sufficient reserves for replenishment flows were maintained?	<p>From 2004–2010 (while the Plan was suspended), conditions did not allow regular deliveries of replenishment flows to effluent creeks. 2004–2010 operation was under drought contingency and reserves were managed via the drought contingency protocol with stakeholder consultation</p> <p>Since 2011–2012, it appears that the water supply has been managed to ensure sufficient reserves are maintained.</p>		Consider reviewing the Plan to specify more clearly how reserves are managed in a drought of record.	High
	Minimum flow levels	Was a visible flow maintained at the Lachlan River at Geramy?	<p>From 2004–2010 (while the Plan was suspended), conditions did not allow for maintenance of a continuous visible flow at Geramy.</p> <p>Since 2010 a visible flow has been maintained.</p> <p>There is evidence that Geramy is not a reliable gauge to use and that Four Mile Creek would be a better location (Driver et al 2011)</p>		Consider reviewing the Plan with a view to more clearly specifying how minimum flow levels are to be addressed during extreme drought.	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Water delivery and channel capacity constraints	Were initial estimates of maximum water delivery and operating channel capacity updated?	<p>No, these estimates were not updated.</p> <p>DPI Water Audits (2013) refer to an intention for State Water (now WaterNSW) to review these channel capacity estimates. However, no evidence could be found that the estimates had been reviewed.</p> <p>The 2013 Audit also makes a recommendation to consider if these constraints are appropriate to be included in Water Sharing Plans.</p>		Confirm whether or not channel capacity constraints are to be included in Plan. If they are to be included in Plan, DPIE may consider requiring WaterNSW to review and update the estimates.	Medium
	Rates of change to releases from storages	Was an operating protocol for the management of rates of change to releases from Wyangala Dam developed?	<p>No, an operating protocol was not developed (DPI Water Audit 2013).</p> <p>The 2013 Audit notes that the Dam works approval required the holder (SWC, now WaterNSW) to develop the protocol by June 2012.</p> <p>The 2013 Audit recommended DPI Water, DPI Fisheries, OEH and WaterNSW (agencies now within DPIE) to jointly developing an operating protocol for the implementation manual.</p>		Consider policy requirements – is the operating protocol required, given it hasn't been implemented during first 10-year term? If review considers a protocol is required, then DPIE may require compliance by holder of works approval.	Medium
	Dam operation during floods and spills	Were rules for operating Wyangala Dam in floods and spills followed?	Yes			
	Airspace operation rules	Was airspace operation in accordance with the	Yes			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		rules at s65 of the Plan?				
Plan Amendments	Changes to the water source	Were any changes to the water source required?	None required			
	Amendments relating to planned environmental water (made under s.8A of the WMA 2000)	Were any changes required to planned environmental water rules and if so, were they carried out consistent with s68 of the Plan?	Amendment is not mandatory and did not occur.		Consider whether discretionary amendment clauses under Part 12 of the Plan are still required.	
	Amendment of regulated river (conveyance) access licence rules	Were any changes to these rules required?	An amendment was made to these rules in 2013.		Consider whether any further amendments for conditions of Jemalong conveyance licence are required...	Low
	Amendment of rules relating to constraints within a water source	Was any review conducted and/or were changes made to rules at sections 51 of the Plan (constraints on trading/dealing)?	A limited review led to upward revision of the temporary trading limit from 31GL/year to 82GL/year that may be traded across Lake Cargelligo Weir. The Plan was amended 21 December 2012 to implement this change. DPIE is currently reviewing these rules for Water Resource Plan development and in light of the Basin Plan water trading rules.		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High
	Amendment of Plan relating to planned	Was any amendment made relating to	No further planned environmental water recovery and no amendment.		Review to consider whether this clause is still required, given	Medium




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	environmental water	planned environmental water recovery?	Note that considerable environmental water recovery has occurred since the Plan was made, by purchase or funded efficiency measures, and consistent with the Murray–Darling Basin Plan.		broader context of water recovery under Murray–Darling Basin Plan.	
	Amendments relating to floodplain harvesting	Were any changes made to water sources or Plan provisions to provide for floodplain harvesting?	No amendments made. DPIE website on “Healthy Floodplains” project does not identify Lachlan for attention.		Consider whether amendments required in the Lachlan.	Medium

Table 7: Effectiveness Report Card


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>Maintain or restore the key environmental features of the Lachlan River system by a river flow regime that, as much as possible, mimics natural conditions in order to make provision for the following outcomes:</p> <p>(i) diversity of natural in-stream and riparian habitat and biota,</p> <p>(ii) the restoration, by naturally triggered flooding, of the riverine floodplain to its previous rich mosaic of ecosystems,</p> <p>(iii) the improved health and function of wetlands as frequency and duration of inundation is restored,</p> <p>(iv) an abundance and diversity of native aquatic species,</p> <p>(v) an abundance and diversity of native water birds,</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p> <p>Change in water quality</p> <p><i>Additional PI identified</i> Change in surface water extraction relative to the long-term annual average extraction limit</p>	<p>Summary: Monitoring shows positive environmental outcomes. However, it is difficult to differentiate these from outcomes of environmental water reforms and change in approach to environmental water management by state and Commonwealth governments. It seems reasonable to conclude that the Plan has contributed to environmental outcomes, by preventing supplementary water access, the limited availability of the environmental contingency allowance (ECA) and the WQA.</p> <p>Ecological condition</p> <p>Analyses of the performance of the environmental flow rules over 100-year scenarios using IMEF wetland inundation models and the IQQM river model have continually shown that the Plan largely achieves its goals, with environmental water clearly showing benefits for wetland biota such as colonial nesting birds in Booligal Swamp (DPI Water 2012). Field observations of actual environmental flows support these modelling conclusions, especially in relation to post-drought responses (DPI Water 2012).</p> <p>While the Plan was suspended from July 2004 to September 2011, small environmental flow releases helped to support drought-affected vegetation in the</p>		Moderate	<p>Consider providing clearly defined PI and an associated performance monitoring programs that closely align with Plan objectives and strategies.</p> <p>consider whether to investigate further refinement of environmental rules and their operation to enhance environmental outcomes without impacting economic or social outcomes.</p>	High


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>(vi) the restoration of water quality that supports aquatic ecosystems, and</p> <p>(vii) the recovery of threatened species, communities and populations</p>		<p>nationally significant Booligal Wetland and the Great Cumbung Swamp.</p> <p>Throughout 2010/2011 to 2013/2014, environmental watering events, coinciding with natural events, led to the inundation of wetland, river and floodplain habitats. This resulted in multiple bird breeding events in Booligal wetlands, lake Brewster, and Murph's lake. Improvement in the condition of water-dependent vegetation, abundance of aquatic vegetation and abundance of frog species was also observed.</p> <p>There is limited information available regarding the condition or response of fish species in the Lachlan Regulated River.</p> <p>Change in flow regime</p> <p>The low flow regime generally met the baseline criteria, except for the 2009/2010 year where there were extended periods below the 'natural' 95th percentile flows. The moderate to high flow regime was only successfully implemented during years with large floods.</p> <p>Water quality</p> <p>The water quality allowance was not used to suppress algal blooms but was debited to offset non-release of Lake Brewster due to blue-green algal blooms there. Increased flows in 2010 successfully prevented water quality issues and potential fish kills. The waterway has generally poor water quality.</p>				

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>Due to the regulation of the Lachlan River, particularly with the construction of Wyangala Dam and associated river regulation structures downstream, significant water quality issues relating to thermal depression have occurred (DLWC 2000). NSW has developed a Cold Water Pollution Strategy to address these issues over the long-term (Cold Water Pollution Interagency Group (CWPIG) 2012).</p> <p>Although currently difficult to manage at the source due to structural constraints, the impacts of cold water releases can be somewhat mitigated with improved operation of the re-regulation weirs and storages. A review of existing arrangements, potential for adjustment and likely benefits or negatives or altered operations may lead to improved water quality outcomes.</p> <p>Until the NSW Cold Water Pollution Strategy is fully implemented and an effective cold water mitigating structure is constructed at Wyangala Dam, it is unlikely major improvements in this significant water quality issue will occur.</p> <p>Change in extraction relative to limit</p> <p>The Plan has been effective in preventing increase in extraction, extraction data shows compliance with the limit. However, note that there are many external factors that will also have contributed to this outcome, including the Millennium Drought, potentially more conservative use of water allocations by water entitlement holders and the significant</p>				

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		change in approach to environmental water management by State and Commonwealth for environmental use.				
<p>Make provisions for access for extraction by towns, riparian landholders, irrigation and other industry for the benefit of rural communities in the Lachlan River system by providing for the following outcomes:</p> <p>(i) a supply of water to provide for the needs of rural communities,</p> <p>(ii) the specification and provision of basic landholder rights,</p> <p>(iii) a water allocation system, which clarifies resource access, and enables flexibility and efficiency within climatic variability, and</p> <p>(iv) the maintenance and enhancement of recreational opportunities based on water features</p>	<p>Extent to which local water utility requirements have been met.</p> <p>Extent to which basic landholder rights have been met</p> <p><i>Additional PI component identified</i></p> <p>Extent to which licenced domestic and stock requirements have been met</p> <p>Change in economic benefits derived from water extraction and use</p> <p>Change in water quality</p>	<p>Summary: The Plan played a key role in establishing tradeable water access licences and building on earlier trading frameworks. Recent analyses suggest that enabling water trading has contributed to growth in economic outputs per ML of water extracted, as well as enabling water users to adjust to limited water availability during the Millennium drought, particularly through allocation trade. Other entitlement holders have been able to realise the asset value by selling part of all of their entitlement. However, there is difficulty in differentiating the economic impacts and benefits from other external factors, such as the drought, reforms and water buyback for the environment in the Murray–Darling Basin, as well as broader economic and social changes.</p> <p>Throughout the duration of the Plan, water was shared between all water uses, including the environment, according to the priority of access provided in the Plan.</p> <p>During the suspended period of the Plan (2004/2005 – 2010/2011, local water utilities received reduced water allocations in some</p>		Good	<p>Consider providing clearly defined PIs and associated performance monitoring programs that closely align with Plan objectives and strategies and meet SMART criteria.</p> <p>(See also recommendations under 'efficiency' with respect to arrangements during drought)</p>	Medium

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>years, varying from 50% to 100% across the seven-year period. For the final three years of the evaluation period, full AWD allocations were provided for in all water years (2011/2012, 2012/2013, 2013/2014).</p> <p>As no licences are required for extraction of water for BLR, it is difficult to assess accurately. Water to meet these needs is included in WaterNSW's operational protocols and is delivered on top of water ordered by licence holders. BLR were only partially met during some periods of drought conditions. Water was made available to meet critical human water needs, including BLR, during this time required the suspension of access to licensed water allocations carried over from previous years.</p> <p>During the first seven years of the evaluation period, the Plan was suspended due to drought of record conditions. During the suspended period, only two out of seven years have full AWD allocations for domestic and stock licences (29% of water years), with 2009/2010 only allocating 15% AWD. For the final three years of the evaluation period 2011/2012 – 2013/2014, full AWD allocations were provided for domestic and stock licences in all water years (100%).</p> <p><i>Economic outcomes</i></p> <p>Key drivers of annual changes in farm incomes include changing commodity prices, costs of farm inputs, and varying seasonal conditions and irrigation water availability ABARES (2015). The Plan has</p>				

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>almost no effect on most of these, except for being one factor in irrigation water availability.</p> <p>The introduction of the Plan, along with a range of other reforms, played a key role in enabling water trade (Aither 2017), as well as enabling water users to gain improved control over managing their exposure to risk around their water account and portfolio (e.g. through measures such as carryover and allocation (AWD) rules).</p> <p>However, these changes cannot be clearly differentiated in economic data from pre-existing water reforms in the 1980s and 1990s, as well as broader economic, social and climate factors.</p> <p>Therefore, while it can be reasonably concluded that the Plan contributed to economic benefits and a sustainable regional economy.</p> <p><i>Recreational opportunities</i></p> <p>There is no PI, nor data to assess effectiveness against the recreational sub-objective.</p>				
<p>Provide water to ensure that the social needs and amenity values of the Lachlan Valley community, that are reliant upon water, continue to be met by</p>	<p>Change in water quality in this water source</p> <p>Extent to which local water utility</p>	<p>During the suspended period of the Plan (2004/2005 – 2010/2011, local water utilities received reduced water allocations in some years, varying from 50% to 100% across the seven-year period. For the final three years of the evaluation period, full AWD</p>		<p>Moderate</p>	<p>Consider providing more clearly defined performance indicators and an associated performance monitoring programs that</p>	<p>High</p>

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>providing for the following outcomes:</p> <p>(i) supplies of water that deliver a range of recreational and amenity opportunities,</p> <p>(ii) that aesthetic values are maintained, and</p> <p>(iii) water management that recognises social impacts,</p>	<p>requirements have been met.</p> <p><i>Additional PI identified</i> Change in surface water extraction relative to the long term annual average extraction limit</p>	<p>allocations were provided for in all water years (2011/2012, 2012/2013, 2013/2014).</p> <p>The LTAAEL for the Lachlan Regulated River water source is 305 GL/year. Although the long-term average annual extraction was not assessed against the limit at the end of each water year as specified by the Plan, the annual diversion data is available. Only one year exceeded the value of 305 GL, while all other years is well below this figure. Therefore, it is assumed the LTAAEL has not been exceeded.</p> <p>There is no PI, nor data to directly assess effectiveness against amenity values.</p>			<p>closely align with Plan objectives and strategies.</p> <p>(see also efficiency recommendations regarding WQA use).</p>	
<p>Water management that recognises, respects and incorporates the spiritual, economic and aesthetic values of the water source to provide for the following outcomes:</p> <p>(i) the recognition and protection of the traditional rights of Aboriginal people,</p> <p>(ii) protection of sacred sites,</p> <p>(iii) the maintenance of traditional rights of access to birds, fish, crustacea</p>	<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p> <p>Extent to which native title rights requirements have been met</p> <p><i>Additional PI component identified</i> Extent to which licenced water has been made available and used</p>	<p>No native title rights have been granted within the water sources and no licences have been issued for Aboriginal cultural purposes.</p> <p>There are no specific strategies within the Plan that are directly related to the objective, although the Plan recognised environmental water provisions were likely to make some contribution towards the preservation of cultural and heritage values.</p> <p>There is little information available on the social impacts of the Plan on communities within the Plan area.</p> <p>The Plan has not provided cultural outcomes for Aboriginal communities with no real evidence of the Plan being able to influence</p>		Poor	<p>Endeavour to establish Aboriginal Social and Cultural objectives, strategies and PI that are directly linked to values of water for Aboriginal people</p> <p>DPIE consider the addition of a cultural /heritage use category for the EWA</p>	High

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>and other traditional foods, and</p> <p>(iv) the protection of the cultural, spiritual and identity aspects of rivers and wetlands.</p>	<p>for Aboriginal purposes.</p> <p>Change in water quality in this water source</p>	<p>outcomes relating Aboriginal spiritual, social and customary values.</p> <p>Given the potential linkages between cultural and heritage values and environmental assets the use of the EWA may support the achievement of this objective.</p>				

Table 8: Performance indicator results summary

Performance indicator	Related Plan objectives	Results	Strength of information
<p>Change in ecological condition of this water source and dependent ecosystems</p>	<p>(a) Maintain or restore the key environmental features of the Lachlan River system by a river flow regime that, as much as possible, mimics natural conditions in order to make provision for the following outcomes:</p> <p>(i) diversity of natural in-stream and riparian habitat and biota,</p> <p>(ii) the restoration, by naturally triggered flooding, of the riverine floodplain to its previous rich mosaic of ecosystems,</p> <p>(iii) the improved health and function of wetlands as frequency and duration of inundation is restored,</p> <p>(iv) an abundance and diversity of native aquatic species,</p> <p>(v) an abundance and diversity of native water birds,</p> <p>(vi) the restoration of water quality that supports aquatic ecosystems, and</p> <p>(vii) the recovery of threatened species, communities and populations</p>	<p>Monitoring of ecological response to changed flow regimes has occurred under the IMEF. For the Lachlan system, the following hypotheses were tested as part of the program</p> <ul style="list-style-type: none"> • Algal flushing and suppression (see water quality section below) • Wetland replenishment. • Rehabilitating fish communities <p><i>Wetlands</i></p> <p>Analyses of the performance of the environmental flow rules over 100-year scenarios using the IMEF wetland inundation models and the IQQM river model have continually shown that the Plan largely achieves its goals, with environmental water clearly showing benefits for wetland biota such as colonial nesting birds in Booligal Swamp (DPI Office of Water 2012). Field observations of actual environmental flows support these modelling conclusions, especially in relation to post-drought responses (DPI Office of Water 2012).</p> <p>Note that none of the NSW Water Sharing Plan objectives have been properly tested because this requires many decades of data (Driver et al .2013).</p> <p>Research in the mid-Lachlan billabongs found that fewer dry periods of ≥ 2 years tends to lead to higher plant species diversity (Chessman et al. 2003).</p> <p>Modelling at Booligal Swamp shows an overall drop in the nest number due to development. Note that the current river water management regime maintains the occurrence and duration of floods in Booligal Swamp partly by using translucent environmental flow rules (Hillman et al. 2003) which are designed largely to mimic the natural flood cycles. The effect would be more pronounced in absence of these environmental rules. (Chowdhury & Driver 2007)</p> <p>With such floods, especially within northern rivers and when temperature conditions are suitable, waterbirds produce more breeding pairs, especially</p>	<p>Moderate</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>after sustained drought (Driver et al. 2010; Lachlan). Post-drought recovery of deep-rooted plants is enabled by access to shallow groundwater systems such as the Coonambidgil Formation, especially if antecedent flow or rain conditions are sufficient (Driver et al. 2011; Lachlan River). Such floods need to occur more often than every 10 years and usually need to occur much more frequently, in order to maintain effective carbon cycling and invertebrate survival (Jenkins et al. 2012).</p> <p>In 2005, following substantial winter tributary flows in the upper Lachlan Catchment, replenishment flows were delivered to a number of distributaries and the lower Lachlan River, including Lake Brewster and the Great Cumbung Swamp. Success in terms of ecological response was mixed with enhanced waterbird recruitment within Lake Brewster and along Merrowie Creek (an effluent creek), whereas dry conditions greatly reduced water delivery efficiencies and desirable ecological responses within Merrimajeel Creek and the Great Cumbung Swamp (Driver 2007).</p> <p>There was no information available at the time of evaluation for the change in fish condition due to the water sharing Plan rules. In the Sustainable Rivers Audits (2004–2007 and 2008–2010), the Lachlan valley fish community was rated as Extremely Poor Condition for both audits. Loss of species richness, low abundance of native species and intrusions by alien species were apparent, especially in the Slopes and Upland Zones (MDBC 2008; MDBA 2012).</p> <p>However, it is now recognised that Booberoi Creek is an important refuge for native fish, especially eel-tailed catfish. This became especially pertinent after their population collapse post-drought and recognition of this creek as critical pool habitat containing <i>Tandanus tandanus</i>. (DPI Water officer pers comm)</p> <p><i>Summary of outcomes during the evaluation period</i></p> <p>From 2004/2005 to 2009/2010, the Plan was suspended due to drought of record conditions. By 2010, there was a loss of ecological character and flood dependent vegetation was observed to be stressed (DECCW 2010).</p> <p>During the drought, small environmental flow releases helped to support drought-affected vegetation including river red gums and deep-rooted plants</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>in the nationally significant Booligal Wetland and the Great Cumbung Swamp (Driver et al. 2011; DPI Office of Water 2012; NRC 2013).</p> <p>While there was no environmental water used, large tributary flows in 2009/2010 helped to connect isolated pools, improve connectivity with wetlands and allow fish movement (DECCW 2010).</p> <p>With the breaking of the drought in 2010/2011, aquatic plants and associated fauna were gradually returning in Booligal Swamp and the Great Cumbung Swamp (DPI Office of Water 2012). After the drought, Lachlan billabongs also benefited from floods and environmental flows, although with a slower recovery trajectory (DPI Office of Water 2012). In 2010/2011, environmental flow releases at Booligal Wetlands supported a major bird breeding event (OEH 2011; NRC 2013). Flows into Lake Brewster initiated a successful pelican breeding event (OEH 2011). Environmental water supported the improvement in water-dependent vegetation, with lignum in Booligal Wetlands and Merrowie Creek undergoing growth and active flowering, while the filling of Lake Tarwong restored drought-stressed river red gums event (OEH 2011). In addition, aquatic plants and several frog species were recorded (OEH 2011).</p> <p>The 2011/2012 water year built on the positive outcomes from the previous year with environmental water and flood inflows. Bird breeding occurred at Murphy's Lake, connectivity across floodplains was improved and water-dependent vegetation improved across the Merrowie creek, Merrimajeel and Muggabah floodplain region (OEH 2012).</p> <p>In early 2012/2013, rainfall triggered translucent flows releases from Wyangala Dam in accordance with the Plan, which provided a nearer to natural flow regime and inundated wetlands and effluent creeks on the lower Lachlan floodplain (OEH 2013; NRC 2013). Frog and waterbird responses to environmental water were observed at Burrawong Lagoon (OEH 2013).</p> <p>Below-average rainfall and above-average temperatures later in the 2012/2013 year caused many Lachlan wetlands to dry, leading to a significant environmental water release, providing flows to the Lachlan River below Lake Brewster (OEH 2013). This led to the inundation of 63,000 ha and was continued with additional environmental water in the 2013/2014</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>year. For the inundated areas, foliage growth, seedlings and juvenile tree regeneration was observed for river red gum and black box (OEH 2014). Over 20 species of waterbirds and the endangered southern bell frog were identified at some of the watered sites (OEH 2014).</p> <p>References:</p> <p>Chowdhury, S and Driver, P 2007, 'An ecohydrological model of waterbird nesting events to altered floodplain hydrology', in MODSIM 2007 International Congress on Modelling and Simulation, L Oxley and D Kulasiri (eds), Modelling and Simulation Society of Australia and New Zealand, December 2007, pp. 2896–2902</p> <p>Driver, P, Raine, A, Foster, ND and SA Williams (2013), <i>Ecological monitoring to support Water Sharing Plan evaluation and protect wetlands of inland New South Wales, Australia</i></p> <p>Driver, PD, Chowdhury, S, Hameed, T, O'Rourke, M and Shaikh, M (2010), <i>Ecosystem response models for lower Calare (Lachlan River) floodplain wetlands: managing wetland biota and climate change modelling</i>. In I Overton and N Saintilan, eds, <i>Ecosystem Response Modelling in the Murray–Darling Basin</i>, CSIRO Publishing, Melbourne, Victoria, pp. 183–196.</p> <p>Driver, PD, Barbour, EJ and Michener, K (2011), <i>An integrated surface water, groundwater and wetland plant model of drought recovery and response for environmental water management</i>. In Proceedings of MODSIM 2011 International Congress on Modelling and Simulation, Perth, Modelling and Simulation Society of Australia and New Zealand, December 2011. (http://www.mssanz.org.au/modsim2011/E15/driver.pdf)</p> <p>Driver, P. D. (2007). 2005 Environmental Water allocations to Lachlan wetlands. Compilation of unpublished LEFT and DNR documents for the Lachlan Customer Service Committee, May 2007. NSW Department of Water and Energy</p> <p>Murray Darling Basin Authority (2012), Sustainable Rivers Audit 2 The ecological health of rivers in the Murray– Darling Basin at the end of the Millennium Drought (2008–2010)</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>Murray Darling Basin Commission (2010) Sustainable Rivers Audit, SRA Report 1 A report on the ecological health of rivers in the Murray–Darling Basin, 2004–2007 Prepared by the Independent Sustainable Rivers Audit Group for the Murray–Darling Basin Ministerial Council</p> <p>Natural Resources Commission (2013), <i>Review of 2004 water sharing plans</i>, Document No. D13/1651.</p> <p>NSW Department of Environment, Climate Change and Water (2010), <i>Environmental water use in New South Wales Annual Report 2009–10</i></p> <p>NSW Department of Primary Industries, Office of Water (2012), <i>Environmental flow response and socio–economic monitoring Lachlan Valley – progress report 2011</i></p> <p>NSW Office of Environment and Heritage (2011), <i>Environmental water use in New South Wales Annual Report 2010–11</i></p> <p>NSW Office of Environment and Heritage (2012), <i>Environmental water use in New South Wales Annual Report 2011–12</i></p> <p>NSW Office of Environment and Heritage (2013), <i>Environmental water use in New South Wales Annual Report 2012–13</i></p>	
<p>Change in low flow regime</p>	<p>(a) Maintain or restore the key environmental features of the Lachlan River system by a river flow regime that, as much as possible, mimics natural conditions in order to make provision for the following outcomes:</p> <p>(i) diversity of natural in–stream and riparian habitat and biota,</p> <p>(ii) the restoration, by naturally triggered flooding, of the riverine floodplain to its previous rich mosaic of ecosystems,</p>	<p>As specified in the Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days below the natural 95th and 80th percentiles.</p> <p>The natural (without development) and Plan scenarios results were extracted from the IQQM models (BP 2012 Nov 2011 model R#844 – natural and R#845 – Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the criteria were not met in 2009/2010 at all stations. In addition, at the Corrong gauge (end of system site), the 80th percentile baseline was not met in water years 2004/2005, 2007/2008, and 2008/2009. The Plan was suspended during all of these water years.</p>	<p>Good</p>

Performance indicator	Related Plan objectives	Results				Strength of information
	<p>(iii) the improved health and function of wetlands as frequency and duration of inundation is restored,</p> <p>(iv) an abundance and diversity of native aquatic species,</p> <p>(v) an abundance and diversity of native water birds,</p> <p>(vi) the restoration of water quality that supports aquatic ecosystems, and</p> <p>(vii) the recovery of threatened species, communities and populations</p>	Comparison to modelled: Plan scenario for the number of days below the 95th percentile flow				
			412006 (Lachlan at Condobolin)	412005 (Lachlan at Booligal)	412045 (Lachlan at Corrong)	
		Natural 95 th percentile flow	5 ML/d	0 ML/d	0 ML/d	
		<i>the Plan scenario (baseline target)</i>	0	29	32	
		2004/2005	0	0	0	
		2005/2006	0	0	0	
		2006/2008	0	0	0	
		2007/2008	0	0	0	
		2008/2009	0	0	3	
		2009/2010	8	67	139	
		2010/2011	0	0	0	
		2011/2012	0	0	0	
		2012/2013	0	0	0	
		2013/2014	0	0	6	
		Comparison to modelled: Plan scenario for the number of days below the 80th percentile flow				
			412006 (Lachlan at Condobolin)	412005 (Lachlan at Booligal)	412045 (Lachlan at Corrong)	
		Natural 80 th percentile flow	47 ML/d	11 ML/d	9 ML/d	

Performance indicator	Related Plan objectives	Results				Strength of information
		<i>the Plan scenario (baseline target)</i>	1	33	33	
		2004/2005	0	14	135	
		2005/2006	0	0	0	
		2006/2008	0	6	33	
		2007/2008	0	9	74	
		2008/2009	0	4	81	
		2009/2010	78	144	214	
		2010/2011	0	0	0	
		2011/2012	0	3	0	
		2012/2013	0	0	0	
		2013/2014	0	1	12	
		<p>References:</p> <p>NSW Department of Primary Industries – Water (2017b), <i>Real Time Data – Rivers and Streams</i>, http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url</p>				
<p>Change in moderate to high flow regime</p>	<p>(a) Maintain or restore the key environmental features of the Lachlan River system by a river flow regime that, as much as possible, mimics natural conditions in order to make provision for the following outcomes:</p> <p>(i) diversity of natural in–stream and riparian habitat and biota,</p>	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days above the natural 30th, 15th and 5th percentiles.</p> <p>The natural (without development) and the Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the criteria were only met in the wet years of 20010/2011 to 2012/2013. This demonstrates that without large</p>				<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information																																																												
	<p>(ii) the restoration, by naturally triggered flooding, of the riverine floodplain to its previous rich mosaic of ecosystems,</p> <p>(iii) the improved health and function of wetlands as frequency and duration of inundation is restored,</p> <p>(iv) an abundance and diversity of native aquatic species,</p> <p>(v) an abundance and diversity of native water birds,</p> <p>(vi) the restoration of water quality that supports aquatic ecosystems, and</p> <p>(vii) the recovery of threatened species, communities and populations</p>	<p>floods, the Plan implementation has had limited success in mimicking 'natural' moderate and high flows.</p> <p>Comparison to modelled: Plan scenario for the number of days above the 30th percentile flow</p> <table border="1"> <thead> <tr> <th></th> <th>412006 (Lachlan at Condobolin)</th> <th>412005 (Lachlan at Booligal)</th> <th>412045 (Lachlan at Corrong)</th> </tr> </thead> <tbody> <tr> <td>Natural 30th percentile flow</td> <td>1,392 ML/d</td> <td>661 ML/d</td> <td>603 ML/d</td> </tr> <tr> <td><i>The Plan scenario (baseline target)</i></td> <td>113</td> <td>54</td> <td>58</td> </tr> <tr> <td>2004/2005</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>2005/2006</td> <td>45</td> <td>0</td> <td>8</td> </tr> <tr> <td>2006/2008</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>2007/2008</td> <td>3</td> <td>4</td> <td>0</td> </tr> <tr> <td>2008/2009</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>2009/2010</td> <td>14</td> <td>10</td> <td>10</td> </tr> <tr> <td>2010/2011</td> <td>107</td> <td>96</td> <td>79</td> </tr> <tr> <td>2011/2012</td> <td>140</td> <td>118</td> <td>110</td> </tr> <tr> <td>2012/2013</td> <td>138</td> <td>104</td> <td>117</td> </tr> <tr> <td>2013/2014</td> <td>40</td> <td>26</td> <td>37</td> </tr> </tbody> </table> <p>Comparison to modelled: Plan scenario for the number of days above the 15th percentile flow</p> <table border="1"> <thead> <tr> <th></th> <th>412006 (Lachlan at Condobolin)</th> <th>412005 (Lachlan at Booligal)</th> <th>412045 (Lachlan at Corrong)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		412006 (Lachlan at Condobolin)	412005 (Lachlan at Booligal)	412045 (Lachlan at Corrong)	Natural 30 th percentile flow	1,392 ML/d	661 ML/d	603 ML/d	<i>The Plan scenario (baseline target)</i>	113	54	58	2004/2005	0	0	0	2005/2006	45	0	8	2006/2008	0	0	0	2007/2008	3	4	0	2008/2009	0	0	0	2009/2010	14	10	10	2010/2011	107	96	79	2011/2012	140	118	110	2012/2013	138	104	117	2013/2014	40	26	37		412006 (Lachlan at Condobolin)	412005 (Lachlan at Booligal)	412045 (Lachlan at Corrong)					
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Performance indicator	Related Plan objectives	Results				Strength of information
		Natural 15 th percentile flow	4,792 ML/d	2,160 ML/d	1,176 ML/d	
		<i>The Plan scenario (baseline target)</i>	42	34	31	
		2004/2005	0	0	0	
		2005/2006	9	0	0	
		2006/2008	0	0	0	
		2007/2008	0	0	0	
		2008/2009	0	0	0	
		2009/2010	4	0	0	
		2010/2011	61	19	0	
		2011/2012	44	80	75	
		2012/2013	24	41	105	
		2013/2014	0	0	0	
		Comparison to modelled: Plan scenario for the number of days above the 5th percentile flow				
			412006 (Lachlan at Condobolin)	412005 (Lachlan at Booligal)	412045 (Lachlan at Corrong)	
		Natural 5 th percentile flow	11,685 ML/d	3,170 ML/d	1,643 ML/d	
		<i>The Plan scenario (baseline target)</i>	13	12	13	
		2004/2005	0	0	0	
		2005/2006	0	0	0	
		2006/2008	0	0	0	

Performance indicator	Related Plan objectives	Results				Strength of information
		2007/2008	0	0	0	
		2008/2009	0	0	0	
		2009/2010	0	0	0	
		2010/2011	7	0	0	
		2011/2012	21	0	13	
		2012/2013	0	0	81	
		2013/2014	0	0	0	
		<p>References:</p> <p>NSW Department of primary Industries, Office of Water (2017b), <i>Real Time Data – Rivers and Streams</i>, http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url</p>				
<p>Change in water quality in this water source</p>	<p>Maintain or restore the key environmental features of the Lachlan River system by a river flow regime that, as much as possible, mimics natural conditions in order to make provision for the following outcomes: (vi) the restoration of water quality that supports aquatic ecosystems,</p> <p>Make provisions for access for extraction by towns, riparian landholders, irrigation and other industry for the benefit of rural communities in the Lachlan River system by providing for the following outcomes: (iv) the maintenance and enhancement of recreational opportunities based on water features</p>	<p>The major water quality issues in the Lachlan Valley are increasing salinity, high nutrient levels, increasing frequency of algal blooms (an outcome of increasing nutrients) and high turbidity.</p> <p>As flows ceased through the drought, conditions refuge pools within in the Lachlan system were poor, with high surface temperatures and low oxygen levels (Pepper et al. 2010). In 2010, a fish kill was imminent; however, flow in February disrupted the stratifications.</p> <p>Prior to the commencement of the Plan, there were issues with algal blooms in the Lachlan River, which were attributed to algal contaminated water releases from Lake Brewster (DPW Water 2012; Driver et al. 2007). Algal counts reached moderately–high levels for recreation in the middle Lachlan reaches during 2008, although the species were considered to be non–toxic; this coincided with releases from Lake Brewster (DPI Office of Water 2012). Similarly, in 2012, high blue–green levels were reached, coinciding with releases from Lake Brewster.</p> <p>The Water Quality Allocation may be released for any water quality management purpose, in particular for reduction of salinity levels and</p>				<p>Poor</p>

Performance indicator	Related Plan objectives	Results	Strength of information																																			
	<p>Provide water to ensure that the social needs and amenity values of the Lachlan Valley community, that are reliant upon water, continue to be met by providing for the following outcomes:</p> <p>(i) supplies of water that deliver a range of recreational and amenity opportunities,</p> <p>(ii) that aesthetic values are maintained, and</p> <p>(iii) water management that recognises social impacts,</p> <p>Water management that recognises, respects and incorporates the spiritual, economic and aesthetic values of the water source to provide for the following outcomes:</p> <p>(i) the recognition and protection of the traditional rights of Aboriginal people,</p> <p>(ii) protection of sacred sites,</p> <p>(iii) the maintenance of traditional rights of access to birds, fish, crustacea and other traditional foods, and</p> <p>(iv) the protection of the cultural, spiritual and identity aspects of rivers and wetlands.</p>	<p>mitigation of blue–green algae impacts. This has not been implemented during the Plan operation.</p> <p>There is limited water quality data available for the Lachlan system over the evaluation period. The <i>Assessment of BP 2012 Water Quality targets in New South Wales</i> report provides some general information on water quality in the Lachlan system (Mawhinney & Muschal 2015). The ratings compared to basin targets are provided below based on median annual data from 2007 – 2012. There are some water quality issues at these sites with dissolved oxygen, Total Nitrogen, Total Phosphorous and Turbidity.</p> <table border="1"> <thead> <tr> <th colspan="7">Water quality index ratings by site for the Lachlan valley (Mawhinney & Muschal 2015)</th> </tr> <tr> <th>Station</th> <th>Turbidity (lab)</th> <th>Turbidity (field)</th> <th>Total phosphorus</th> <th>Total nitrogen</th> <th>pH</th> <th>Dissolved oxygen</th> </tr> </thead> <tbody> <tr> <td>412005 Lachlan River at Booligal</td> <td>Poor#</td> <td>Very Poor#</td> <td>Very Poor#</td> <td>Very Poor#</td> <td>Very Good</td> <td>Poor</td> </tr> <tr> <td>412039 Lachlan River at Hillston Weir</td> <td>Good</td> <td>Moderate</td> <td>Moderate</td> <td>Poor</td> <td>Very Good</td> <td>Very Poor</td> </tr> <tr> <td>412045 Lachlan River at Corrong</td> <td>Moderate</td> <td>Very Poor</td> <td>Very Poor</td> <td>Very Poor</td> <td>Very Good</td> <td>Very Poor</td> </tr> </tbody> </table> <p># Insufficient data (n<5) to assign a rating with confidence</p> <p>References:</p>	Water quality index ratings by site for the Lachlan valley (Mawhinney & Muschal 2015)							Station	Turbidity (lab)	Turbidity (field)	Total phosphorus	Total nitrogen	pH	Dissolved oxygen	412005 Lachlan River at Booligal	Poor#	Very Poor#	Very Poor#	Very Poor#	Very Good	Poor	412039 Lachlan River at Hillston Weir	Good	Moderate	Moderate	Poor	Very Good	Very Poor	412045 Lachlan River at Corrong	Moderate	Very Poor	Very Poor	Very Poor	Very Good	Very Poor	
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		<p>Driver, P, Mitrovic, S, Hardwick, L, Growns, I & Foster, N (2007) IMEF Technical Advisory Group (TAG) report on progress of the Integrated Monitoring Environmental Flows Program. Report for the Department of Water and Energy, State of new South Wales</p> <p>Mawhinney, W. and Muschal, M. 2015. Assessment of BP 2012 water quality targets in New South Wales; 2007 to 2012. New South Wales Department of Primary Industries, Water, Sydney. ISBN 978-1-74256-792-1</p> <p>NSW Department of primary Industries, Office of Water (2012), <i>Environmental flow response and socio-economic monitoring Lachlan Valley – progress report 2011</i></p> <p>Pepper, D, Dorani, F and Hardwick, L (2010), <i>Instream refugia in the Lachlan River during a no flow period</i>. Australian Society for Limnology Congress, Thredbo, New South Wales, 29 November – 3 December 2010</p>	
<p>Extent to which domestic and stock BLR requirements have been met</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced domestic and stock access requirements have been met</p>	<p>Make provisions for access for extraction by towns, riparian landholders, irrigation and other industry for the benefit of rural communities in the Lachlan River system by providing for the following outcomes:</p> <p>(ii) the specification and provision of BLR,</p> <p>(iii) a water allocation system, which clarifies resource access, and enables flexibility and efficiency within climatic variability, and</p> <p>(iv) the maintenance and enhancement of recreational opportunities based on water features</p>	<p>Provision for domestic and stock rights (a component of BLR) and domestic and stock access licences has been provided for in the Plan; estimated at Plan commencement to be 4,211 ML/year and 13,100 ML/year respectively. The Plan also provides for basic landholder rights or domestic and stock licences in some unregulated effluent creeks in the form of annual replenishment flows (section 60 in the Plan).</p> <p>As no licences are required for extraction of water for BLR, it is difficult to assess accurately. Water to meet these needs is included in the WaterNSW operational protocols and is delivered on top of water ordered by licence holders. During 2004 – 2008, water was provided for BLR in all regulated sections in the Lachlan (NSW Department of Water and Energy 2009). The drought conditions have meant, however, that this has required considerably more resources than would generally be the case. During 2009 – 2012, stock and domestic requirements were only partially met at times due to the extended dry conditions and resulting uncertainty in transmission losses and travel times (DPI Office of Water 2013). Water was made available to meet critical human water needs, including BLR, during this time required the suspension of access to licensed water allocations carried over from previous years.</p>	<p>Good</p>

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		<p>During the first seven years of the evaluation period, the Plan was suspended due to drought of record conditions. During the suspended period, only two out of seven years have full AWD allocations (29% of water years), with 2009/2010 only allocating 15% AWD.</p> <p>For the final three years of the evaluation period 2011/2012 – 2013/2014, full AWD allocations were provided for in all water years (100%).</p> <table border="1"> <thead> <tr> <th colspan="4">Domestic and Stock access licences within the Lachlan Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr><td>2004/2005</td><td>4,197</td><td>30%</td><td>2,241</td></tr> <tr><td>2005/2006</td><td>14,079</td><td>100%</td><td>7,968</td></tr> <tr><td>2006/2008</td><td>11,276</td><td>80%</td><td>7,067</td></tr> <tr><td>2007/2008</td><td>7,079</td><td>50%</td><td>4,624</td></tr> <tr><td>2008/2009</td><td>7,039</td><td>50%</td><td>3,992</td></tr> <tr><td>2009/2010</td><td>2,133</td><td>15%</td><td>494</td></tr> <tr><td>2010/2011</td><td>14,134</td><td>100%</td><td>3,558</td></tr> <tr><td>2011/2012</td><td>14,089</td><td>100%</td><td>2,702</td></tr> <tr><td>2012/2013</td><td>14,075</td><td>100%</td><td>4,293</td></tr> <tr><td>2013/2014</td><td>13,038</td><td>100%</td><td>4,281</td></tr> </tbody> </table> <p>References:</p> <p>NSW Department of primary Industries, Office of Water (2017c), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p> <p>NSW Department of primary Industries, Office of Water (2013), <i>Audit of implementation – Regulated river water sharing Plan audit report cards</i>, Prepared for the period between 1 July 2009 and 30 June 2012.</p>	Domestic and Stock access licences within the Lachlan Regulated River Water Source				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2004/2005	4,197	30%	2,241	2005/2006	14,079	100%	7,968	2006/2008	11,276	80%	7,067	2007/2008	7,079	50%	4,624	2008/2009	7,039	50%	3,992	2009/2010	2,133	15%	494	2010/2011	14,134	100%	3,558	2011/2012	14,089	100%	2,702	2012/2013	14,075	100%	4,293	2013/2014	13,038	100%	4,281	
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		NSW Department of primary Industries, Office of Water (2017c), <i>NSW Water Register</i> , http://www.water.nsw.gov.au/water-licensing/registers										
<p>Change in economic benefits derived from water extraction and use</p>	<p>Make provisions for access for extraction by towns, riparian landholders, irrigation and other industry for the benefit of rural communities in the Lachlan River system by providing for the following outcomes:</p> <p>(i) a supply of water to provide for the needs of rural communities,</p> <p>(ii) the specification and provision of basic landholder rights,</p> <p>(iii) a water allocation system, which clarifies resource access, and enables flexibility and efficiency within climatic variability, and</p> <p>(iv) the maintenance and enhancement of recreational opportunities based on water features</p>	<p>ABARES (2015) identifies there are many factors that impact on economic performance of the irrigation industry and few of these are affected by the Plan. Both ABARES (2015) and Aither (2017) identify that water trading has enabled irrigators and other water users to adapt to varying water availability, particularly during the Millennium drought. However, these are Murray–Darling Basin–wide conclusions.</p> <p><i>Water markets</i></p> <p>Aither (2017) found that “water markets are a fundamentally important tool for irrigated agricultural producers in New South Wales and are an increasingly important tool for regional urban water suppliers, environmental water managers, and investors as well. They are critical to driving improvements in productivity and efficiency in the NSW economy.”</p> <p>Aither (2017) summarised the water market in the Lachlan catchment since the Plan implementation: “Water in the Lachlan is unable to be traded with other systems due to a low degree of hydrological connectivity. As such, entitlements are infrequently traded. There is comparatively more activity in the allocation market, which shows good trade volumes and prices throughout most years.”</p> <p>A summary of water trades and their value summarised from the <i>NSW Water Register</i> is provided below. A more detailed analysis of this data is available in Aither (2017).</p> <p>The annual volume of water allocation assignments (i.e. temporary trades) varied during the Plan term but has in general increased substantially since the commencement of the Plan.</p> <table border="1"> <thead> <tr> <th colspan="3">Water allocation assignments traded within the Lachlan Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Share (units or ML)</th> <th>No. of dealings</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Water allocation assignments traded within the Lachlan Regulated River Water Source			Water year	Share (units or ML)	No. of dealings				<p>Market trading Good</p> <p>Economic benefits Poor</p> <p>Economic reports Not available</p>
Water allocation assignments traded within the Lachlan Regulated River Water Source												
Water year	Share (units or ML)	No. of dealings										

Performance indicator	Related Plan objectives	Results			Strength of information	
		2004/2005	4,531	129		
		2005/2006	35,838	328		
		2006/2008	21,342	328		
		2007/2008	9,569	228		
		2008/2009	8,241	198		
		2009/2010	4,382	87		
		2010/2011	68,164	156		
		2011/2012	130,292	232		
		2012/2013	274,400	462		
		2013/2014	268,158	479		
		<p>The volume of term transfers varied with peaks in the 2008/2009 and 2009/2010 water years. The average unit price of water transferred also varied through the evaluation period, with higher prices in 2010/2011.</p>				
		<p>Water term transfers within the Lachlan Regulated River Water Source</p>				
		Water year	Share (units or ML)	No. of dealings	Weighted average unit price (\$ per unit)	Total value of water traded #
		2004/2005	–	–	–	
		2005/2006	1,568	5	\$610	\$457,500
		2006/2008	1,233	3	\$650	\$316,400
		2007/2008	2,676	6	\$562	\$715,020
		2008/2009	21,282	28	\$668	\$13,906,336

Performance indicator	Related Plan objectives	Results					Strength of information
		2009/2010	69,269	28	\$755	\$52,284,545	
		2010/2011	1,716	3	\$1,271	\$2,180,600	
		2011/2012	4,873	12	\$655	\$2,680,533	
		2012/2013	2,071	7	\$485	\$1,004,320	
		2013/2014	2,938	18	\$463	\$1,218,828	
		<p>* Total value of water traded divided by number of shares traded (excluding shares traded for \$0). Data taken from <i>NSW Water Register</i>. There may be other factors that impact this value that were not considered in the analysis.</p>					
		<p># Total value of water traded determined by multiplying volume of water traded by unit cost of transaction for each transfer recorded in the <i>NSW Water Register</i>. This information is then summed for each year. No post-processing of the Water register data was undertaken. There may be other factors that impact this value that were not considered in the analysis.</p>					
		<p>Economic reports for the Lachlan Regulated River Water Source are not available. There are also many factors affecting economic status of a region, for example commodity prices, other sources of water (e.g. groundwater).</p>					
		<p>NSW Irrigators' Surveys provide the primary data for use in the socio-economic monitoring of the water sharing Plans in NSW. The Lachlan Regulated Water Source was included in the 2006, 2010 and 2013 survey. In all of the surveys, irrigators in the Lachlan catchment predominantly agreed that temporary water trading had been good for their area and that they had access to a lot of information about water trading (NSW Trade & investment 2015; DPI Office of Water 2011). These monitoring results are based on irrigator responses only and do not include comprehensive economic data.</p>					
		<p>The water use by irrigated enterprise is summarised from the survey reports below. Cotton, Hay and Wheat account for the majority of water usage in the Lachlan valley; however, during the evaluation period, the overall proportion of these crops of the overall water use has decreases (from 82% to 63%), suggesting the region has diversified its water use. Percentage of water use</p>					

Performance indicator	Related Plan objectives	Results	Strength of information																												
		<p>for cotton and hay has decreased over the evaluation period. Wheat peaked in the 2010 survey and has also increased over the evaluation period.</p> <table border="1"> <thead> <tr> <th colspan="4">Percentage water use for enterprise types from Irrigator's surveys</th> </tr> <tr> <th>Enterprise</th> <th>2006 survey</th> <th>2010 survey</th> <th>2013 survey</th> </tr> </thead> <tbody> <tr> <td>Cotton</td> <td>49%</td> <td>26%</td> <td>26.6%</td> </tr> <tr> <td>Hay</td> <td>27.1%</td> <td>11.6%</td> <td>22.7%</td> </tr> <tr> <td>Wheat</td> <td>5.8%</td> <td>24.4%</td> <td>13.6%</td> </tr> <tr> <td>Beef, sheep, and lamb</td> <td>5.7%</td> <td>9.5%</td> <td>6.8%</td> </tr> <tr> <td>Other</td> <td>12.4%</td> <td>28.5%</td> <td>30.3%</td> </tr> </tbody> </table> <p>This data reflects the results presented by Aither (2017) using Australian Bureau of statistics data from 2007/06 and 2014–15. Over 50,000 ML of water was applied for Cotton and pasture in 2014–15.</p> <p>References:</p> <p>ABARES (2015), Ashton, D & Oliver, M 2015, <i>Irrigated agriculture in the Murray–Darling Basin: an economic survey of irrigators, 2012–13 to 2014–15</i>, ABARES research report 15.13, Canberra, December.</p> <p>Aither (2017) <i>Water markets in New South Wales: market outcomes, trends and drivers</i>, Report prepared for NSW Department of Primary Industries, Water</p> <p>NSW Department of Trade and Investment, Regional Infrastructure and Services (2015) <i>Monitoring economic and social changes in NSW water sharing Plan areas Irrigators' Surveys 2009/2010 and 2013 – A state wide comparison</i></p> <p>NSW Department of Primary Industries, Office of Water (2011), <i>Monitoring economic and social changes in NSW water sharing Plan areas: A</i></p>	Percentage water use for enterprise types from Irrigator's surveys				Enterprise	2006 survey	2010 survey	2013 survey	Cotton	49%	26%	26.6%	Hay	27.1%	11.6%	22.7%	Wheat	5.8%	24.4%	13.6%	Beef, sheep, and lamb	5.7%	9.5%	6.8%	Other	12.4%	28.5%	30.3%	
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Performance indicator	Related Plan objectives	Results	Strength of information
		<p><i>comparison of irrigators' survey 2006 and 2010 – covering Plans commenced in 2004</i></p> <p>NSW Department of Primary Industries, Office of Water (2012), <i>Environmental flow response and socio-economic monitoring Lachlan Valley – progress report 2011</i></p> <p>NSW Department of Primary Industries, Office of Water (2017), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>	
<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p>	<p>Water management that recognises, respects and incorporates the spiritual, economic and aesthetic values of the water source to provide for the following outcomes:</p> <p>(i) the recognition and protection of the traditional rights of Aboriginal people,</p> <p>(ii) protection of sacred sites,</p> <p>(iii) the maintenance of traditional rights of access to birds, fish, crustacea and other traditional foods, and</p> <p>(iv) the protection of the cultural, spiritual and identity aspects of rivers and wetlands.</p>	<p>Water sharing plans currently provide various forms of protection and benefit for Aboriginal people's values and uses including specific purpose Aboriginal cultural access licences.</p> <p>There are many heritage sites recorded including scarred trees, campsites, burial sites, carved trees and quarry sites along the Lachlan River between Wyangala and Oxley. In addition to the Lachlan, Abercrombie, Boorowa, Belubula and Crookwell Rivers, the Lachlan Catchment has several wetlands that are important to Aboriginal people. Lake Cowal, the Booligal wetlands and the Great Cumbung Swamp are important cultural sites for the Aboriginal community in the Lachlan.</p> <p>Work to identify values has been undertaken in the Lachlan catchment through the <i>Recording Aboriginal Use & Values of the Lowbidgee & Lower Lachlan River Wetlands</i> project undertaken by DECCW 2010. Working with the Aboriginal community to ensure that the requirements of culturally significant wetlands are considered was seen as being very important – hence this sub-program. The study area included the lower Murrumbidgee River below Hay, and the lower Lachlan downstream of Booligal. The aim of the study was to document the link between today's Aboriginal community and the wetlands by recording physical artefacts, cultural landscapes and oral histories. This information will then be used to guide the management of environmental water allocations to these sites.</p> <p>The DPI Aboriginal Water Initiative program aims to improve aboriginal involvement and representation in water planning and management. The</p>	<p>Poor</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>Status and Issues Paper for the Lachlan Water Resource Plan includes a range of issues identified by Aboriginal communities (NSW DPI Water 2016)</p> <p>References:</p> <p>Jackson, S., Moggridge, B, and C.J. Robinson (2010) <i>Effects of changes in water availability on Indigenous people of the Murray – Darling Basin: a scoping study</i>, Report to the Murray Darling Basin Authority.</p> <p>Martin, S (2010), <i>Archaeological research, characterisation & predictive modelling project. Part of the recording of Aboriginal use & values on the Lowbidgee & Lower Lachlan Rivers wetlands under the NSW Rivers Environmental Restoration Program</i>, Department of Environment, Climate Change & Water</p> <p>NSW DPI – Water (2016), <i>Lachlan water resource Plan (surface water), status and issues paper</i>, Published by the NSW Department of Primary Industries</p>	
<p>Extent to which native title rights requirements have been met.</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced water has been made available and used for</p>	<p>Water management that recognises, respects and incorporates the spiritual, economic and aesthetic values of the water source to provide for the following outcomes:</p> <p>(i) the recognition and protection of the traditional rights of Aboriginal people,</p> <p>(ii) protection of sacred sites,</p> <p>(iii) the maintenance of traditional rights of access to birds, fish, crustacea and other traditional foods, and</p> <p>(iv) the protection of the cultural, spiritual and identity aspects of rivers and wetlands.</p>	<p>At the commencement of the Plan, there were no holders of native title rights in the water source and therefore native title rights were 0 ML/year.</p> <p>There are provisions in the Plan to provide access to water if native title rights over water are granted under the Commonwealth Native Titles Act 1993.</p> <p>No native title rights were established in the water source during the term of the Plan. Additionally, no Aboriginal Cultural Access licences have been issued within the Plan area.</p> <p>References:</p> <p>NSW Department of primary Industries, Office of Water (2017), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers</p> <p>Native Title Determinations (National Native Title Tribunal): http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/default.aspx</p>	<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information
Aboriginal purposes.			
<p><i>Additional PI identified:</i></p> <p>Change in surface water extraction relative to the long term annual average extraction limit</p>	<p>(a) Maintain or restore the key environmental features of the Lachlan River system by a river flow regime that, as much as possible, mimics natural conditions in order to make provision for the following outcomes:</p> <p>(i) diversity of natural in-stream and riparian habitat and biota,</p> <p>(ii) the restoration, by naturally triggered flooding, of the riverine floodplain to its previous rich mosaic of ecosystems,</p> <p>(iii) the improved health and function of wetlands as frequency and duration of inundation is restored,</p> <p>(iv) an abundance and diversity of native aquatic species,</p> <p>(v) an abundance and diversity of native water birds,</p> <p>(vi) the restoration of water quality that supports aquatic ecosystems, and</p> <p>(vii) the recovery of threatened species, communities and populations</p>	<p>The LTAAEL for the Lachlan Regulated River water source is 305 GL/year. This Plan Limit is the long-term average diversion, based on running the Plan Limit simulation model for the full period of simulation: 1st January 1890 to 30th June 2016. Note that the LTAAEL is approximately 15% below the long-term average MDB Cap; principally due to the additional environmental water created by the 1998 environmental flow rules and their adaptation for the Plan (e.g. the Plan ended previous supplementary water access in the Lachlan).</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate-adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. While these conditions do not vary on an annual basis, the Plan implies that they will be updated, and the model run on an annual basis. According to Office of Water (now DPIE) audit reports; this annual assessment did not occur during the Plan term, because development conditions were not updated in the model on an annual basis.</p> <p>Nevertheless, the cumulative assessment has since been carried out in 2015 (Hameed <i>et al</i> 2015). This assessment found that the Lachlan was under the LTAAEL.</p>	<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information																						
		<p>Annual diversion data is available from the NSW water register and is shown in the table below. However, as noted above, the figure cannot be used directly to assess LTAAEL compliance.</p> <table border="1"> <thead> <tr> <th>Water year</th> <th>Water usage (GL)</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>19</td> </tr> <tr> <td>2005/2006</td> <td>110</td> </tr> <tr> <td>2006/2008</td> <td>56</td> </tr> <tr> <td>2007/2008</td> <td>28</td> </tr> <tr> <td>2008/2009</td> <td>22</td> </tr> <tr> <td>2009/2010</td> <td>9</td> </tr> <tr> <td>2010/2011</td> <td>82</td> </tr> <tr> <td>2011/2012</td> <td>213</td> </tr> <tr> <td>2012/2013</td> <td>386</td> </tr> <tr> <td>2013/2014</td> <td>242</td> </tr> </tbody> </table> <p>References:</p> <p>NSW Department of primary Industries, Office of Water (2017), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers</p> <p>Hameed, T., Roberts, S and Patel, H. 2015, LACHLAN VALLEY CAP AND WATER SHARING PLAN AUDITING, 2014/15, DPI Water Modelling Unit internal report.</p>	Water year	Water usage (GL)	2004/2005	19	2005/2006	110	2006/2008	56	2007/2008	28	2008/2009	22	2009/2010	9	2010/2011	82	2011/2012	213	2012/2013	386	2013/2014	242	
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Appendix 4 – Lachlan regulated river internal logic diagrams

Relationship diagrams show the internal Plan logic supporting the delivery of each of the Plan's outcomes. One diagram has been created for each of the economic, social / cultural and environmental outcomes. The diagrams show linkages from the Plan vision (green box) through the broad objectives (navy boxes) to the targeted objectives (blue boxes) and the rules (grey boxes). Where gaps in the program logic have been identified, these are shown as 'not specified' in a box of the appropriate colour. Gaps have been identified at the targeted objectives level in this evaluation.

The vision for this Plan is to achieve a healthy Lachlan River that provides a dynamic and sustainable environment for native plants and animals, that is enjoyed and valued by the community and that is managed for the socio-economic interest of the people of the Lachlan catchment.

Make provisions for access for extraction by towns, riparian landholders, irrigation and other industry for the benefit of rural communities in the Lachlan River system by providing for the following outcomes:

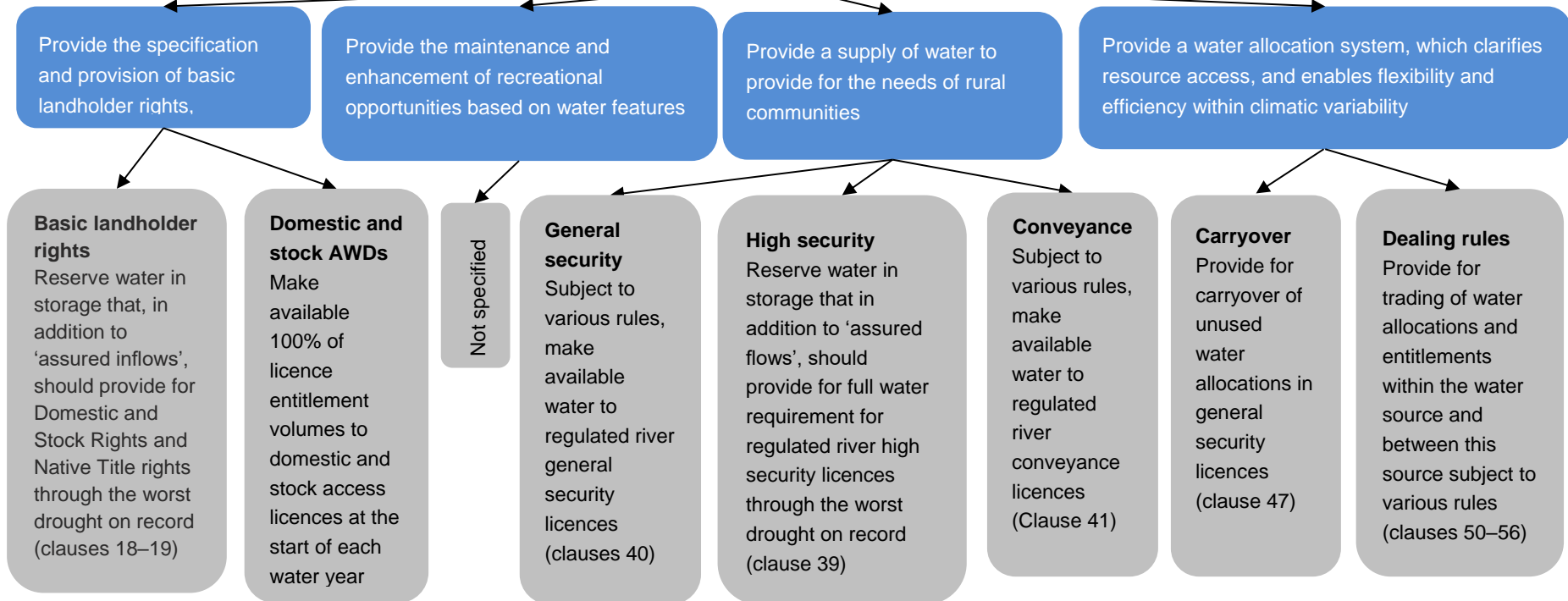


Figure 6: Economic internal logic relationship diagram

The vision for this Plan is to achieve a healthy Lachlan River that provides a dynamic and sustainable environment for native plants and animals, that is enjoyed and valued by the community and that is managed for the socio-economic interest of the people of the Lachlan catchment.

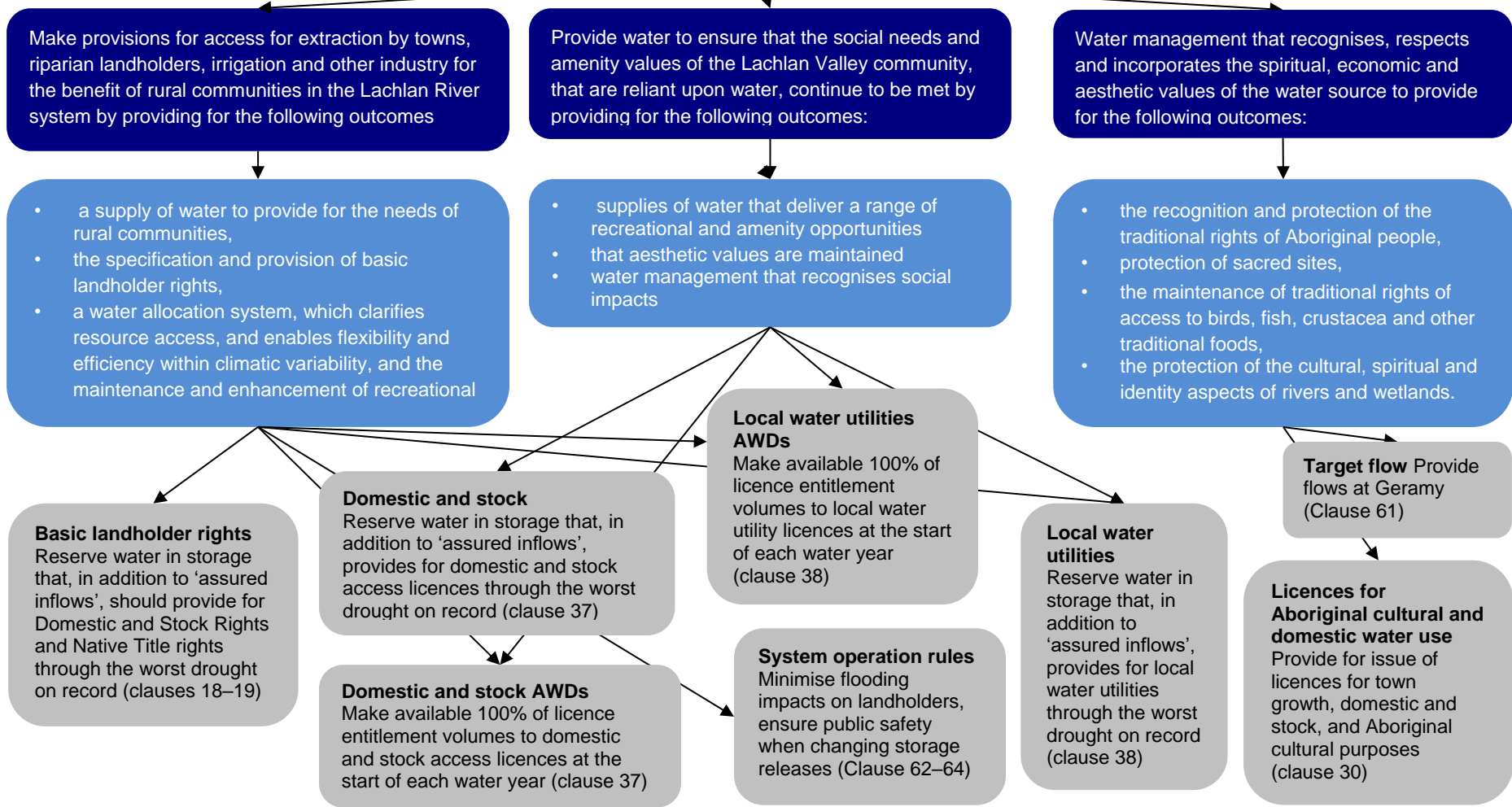


Figure 7: Social / Cultural internal logic relationship diagram

The vision for this Plan is to achieve a healthy Lachlan River that provides a dynamic and sustainable environment for native plants and animals, that is enjoyed and valued by the community and that is managed for the socio-economic interest of the people of the Lachlan catchment.

Maintain or restore the key environmental features of the Lachlan River system by a river flow regime that, as much as possible, mimics natural conditions in order to make provision for the following outcomes:

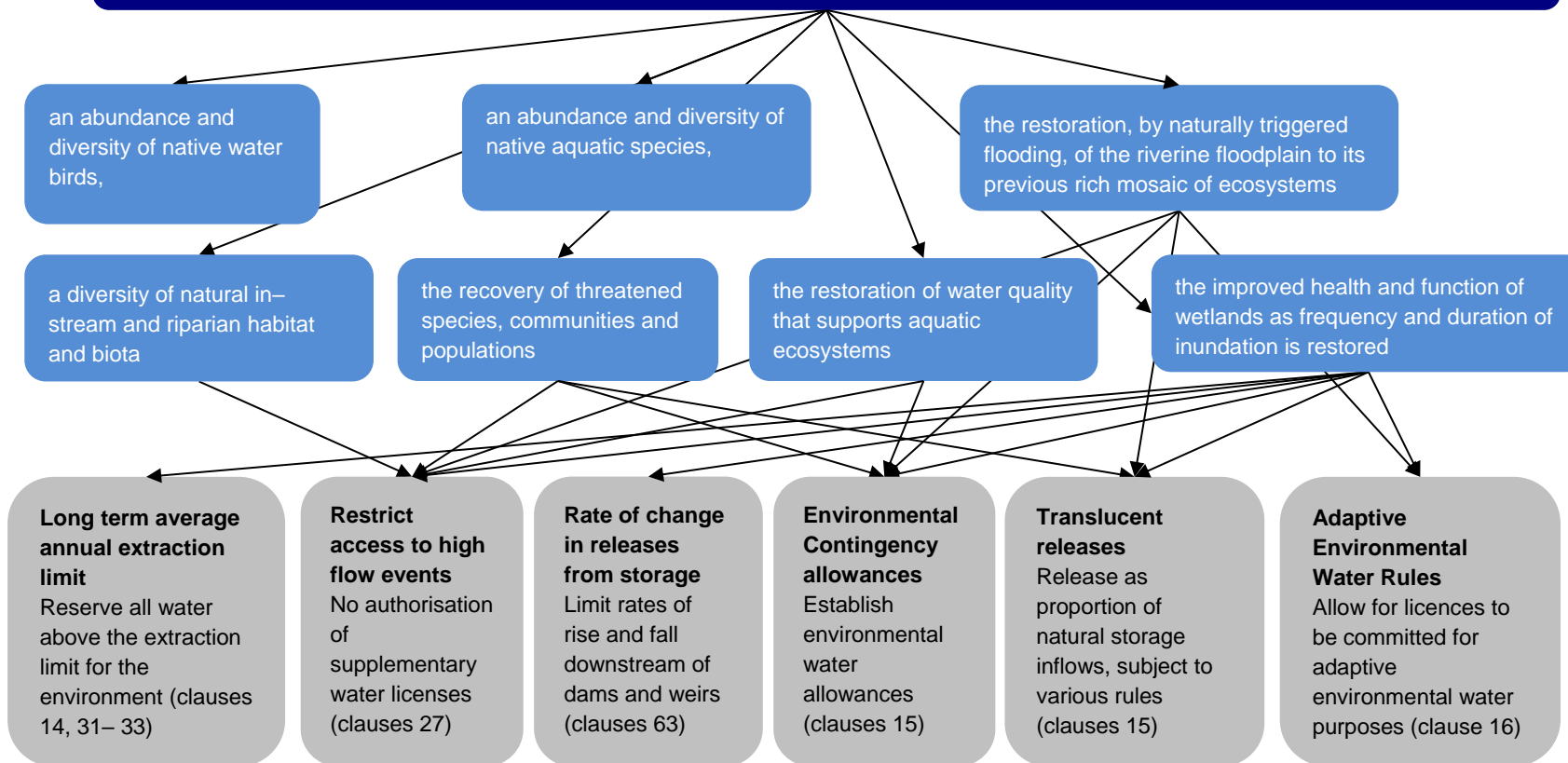











Figure 8: Environmental internal logic relationship diagram







Appendix 5 – Macquarie and Cudgegong regulated river report card and performance indicator summary





Table 9: Appropriateness Report Card



Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Plan scale	Is the scale of the Plan appropriate for water management?	Extent to which scale is appropriate for water sharing management	The geographic scale of the water source in the Plan is considered appropriate for water sharing management.			
Plan scope	Is the scope of the Plan appropriate for water management?	Extent to which interactions with other water sources are addressed appropriately within the Plan or other water sharing plans	<p>The Plan does not adequately recognise the interactions with groundwater or other surface water types beyond those interactions noted below.</p> <p>For example, the CSIRO (2008) Sustainable Yield Reports found that in some valleys increased groundwater use by 2030 would result in some of the current groundwater use being sourced directly from induced stream–flow leakage. Much of this impact has not been explicitly considered in the development of existing surface water sharing plans</p> <p>It does identify environmental flows from the regulated river into the Macquarie Marshes downstream of the water source and into other effluent streams</p> <p>It also provides specific replenishment flows into</p>		Consider reviewing this and adjoining surface and groundwater plans to formally recognise connectivity between water sources and provide line of sight from related rules to Plan objectives.	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			downstream unregulated areas for domestic and stock purposes.			
Prioritisation	Is the level of management required under the Plan appropriate for the risk to environmental, economic, or social and cultural values?	Extent of risk to dependent ecosystems, economic, and social and cultural values	The prioritisation of the Plan as high risk (DLWC 1998) is considered appropriate. The level of management applied is considered appropriate based on high levels of pre-Plan water allocation.			
		Extent to which risk is addressed	Risk is addressed through the application of the LTAAEL, water sharing arrangements that respond to variations in water availability and the associated water market.			
		Identified future risks, including climate change, change in industry base, etc.	Future risks are partially addressed through the application of the LTAAEL, water sharing arrangements that respond to variations in water availability and a flexible water market. The calculation of the limit uses the drought of record, which may not reflect future climate due to existing climate variability beyond the historic record and the impacts of climate change. In addition, changes to the industry base are not recognised.		Consider including analysis of climate variability and change, as well as potential changes in industry base to assess implications for water availability and water demands	High
Internal logic	Is the vision appropriate for	Whether the vision reflects what is intended for water sharing plans in the Act	The vision is considered appropriate as it is consistent			

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
	water management?		with the Act's intent for water sharing plans to achieve economic, social and environmental outcomes.			
	Are the objectives suitable for water management?	Whether the objectives align with the vision	The objectives align with the Plan vision.			
		Whether the objectives align with the principles and objects of the Act	The objectives align with the principles and objects of the Act.			
		Extent to which the objectives are clear and comprehensive enough to reflect what the Plan intended to achieve	<p>The objectives do not represent a full list of the Plan's intended outcomes.</p> <p>The objectives are broad and there are no targeted objectives.</p> <p>The objectives do not recognise the requirements of downstream wetlands. Water delivery to these systems is a primary function of the EWA and there are several Plan rules that address these requirements.</p>		<p>Consider whether additional targeted objectives should be developed to allow an effective evaluation of the Plan. Both clear broad and targeted objectives should be established to achieve specific economic, social and environmental outcomes.</p> <p>Consider reviewing objectives to capture the full intent of the Plan, for example delivery of flows to downstream wetlands.</p>	High



Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
		Extent to which the Plan logic establishes SMART objectives	The Plan logic fails to set objectives that can be evaluated using SMART criteria.		Consider whether the Plan logic should be reviewed to improve measurement of success.	High
Are the strategies suitable for water management?	Whether all Plan rules are linked to a strategy		All Plan rules can be linked to a strategy.		Consider whether more appropriate, objective–linked strategies should be developed, to improve clarity of direction for the Plan rules and to improve measurement of success (linked to recommendations regarding Plan objectives above).	High
	Whether the strategies provide clear direction for the Plan rules		Strategies could be more specific to guide the intent of the Plan rules and to highlight the links with their intended outcomes.			
	Whether the strategies align with the objectives		Not all strategies align with the objectives. Current strategies describe the Plan structure only and do not adequately show how the Plan’s objectives will be achieved. This is important as the Act requires performance indicators (PIs) to be used to assess how Plan strategies achieve the objectives.			
Are the PIs suitable for water management?	Whether the PIs align with the objectives and strategies.		All PIs align to the objectives, but do not align with the strategies.		Consider reviewing alignment and relevance of PIs and measures against each objective and strategy (linked to recommendations regarding Plan objectives above).	High
	Extent to which PIs are clear and comprehensive enough to measure what the Plan intended to achieve.		Most PIs are clear but not comprehensive. Some additional measures are available for many PIs and have been included in this evaluation where possible.			



Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Quality of Supporting Documentation	Is documentation explaining the decisions underpinning the Plan available?	Adequacy of documentation supporting the Plan	The Plan has a comprehensive "Part A" document (DLWC 2001) supporting and explaining Plan development which is available internally. A range of documents are also available that support and explain Plan implementation.			
		Extent to which documentation is made available to the public	The "Part A" document was publicly available during the Plan's initial exhibition period but is no longer publicly available. GPWAR and Plan Implementation Audit reports are available on the DPIE website.		Consider improving availability of evidence sources supporting Plan development, implementation and monitoring, to support Plan implementation and communication to stakeholders and the water market.	Low
Communication	Is the process for communication with stakeholders adequate?	Extent of communication and processes supporting Plan development.	Extensive consultation was carried out during Plan development, with the Macquarie and Cudgegong Regulated Rivers Management Committee meeting to explore issues and develop management strategies. The Plan was placed on public exhibition.			
		Communication arrangements in place during Plan operation	Communication has been appropriate; however recent community feedback suggests that a more formalised ongoing communication protocol is required.		Develop a communication Plan that serves the needs of the community and the water market during Plan	Medium

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>Generally, communication was on an as needs basis. During drought periods, frequent discussions were held with water users.</p> <p>A series of annual GPWAR are available on the DPIE website, as well as audits of Plan implementation.</p>		<p>operation. Under current institutional arrangements, WaterNSW has a key operational and communication role. DPIE to therefore consider whether the Operating Licence and/or Works Approval for WaterNSW should include a requirement to develop and implement a consistent communications Plan. (NOTE the Draft Operating Licence for WaterNSW will be proposed by IPART in May 2017.)</p>	
		<p>Arrangements for consideration at term review of Plan</p>	<p>Sufficient opportunity will be provided for communication during the water resource Plan development process.</p> <p>Consultation will involve opportunities to make submissions, and face to face meetings have been and will be held with stakeholders.</p>			
<p>Alignment with state priorities for natural</p>	<p>Is the Plan aligned with state priorities for</p>	<p>Extent of alignment of Plan with state priorities</p>	<p>The NSW water sharing plans were in place prior to the development of the state</p>		<p>Review alignment of Plan objectives with state priorities for</p>	<p>High</p>

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
resource management Plans (S43A)	natural resource management?		priorities for natural resource management and so full alignment is not expected. The NRC considered there is some alignment of priorities, however the lack of available monitoring, evaluation and reporting information at the time of assessment limited the NRC's findings (NRC 2013)		natural resource management during the development of the Water Resource Plan.	



Table 10 Efficiency Report Card


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Environmental water provisions	Planned environmental water	Was all water above the extraction limit protected?	<p>Assessment of compliance with the LTAAEL has occurred after the Plan term, in 2016. This assessment indicated that the LTAAEL was not exceeded.</p> <p>However, the LTAAEL was not assessed on an annual basis as required by the Plan. (see Extraction Limit evaluation findings below).</p>		See Extraction Limit below	High
		Was planned environmental water released from Windamere Dam?	<p>Planned environmental flows were released from Windamere Dam as per Plan rules when triggers were reached on most occasions throughout the Plan term, except where it was suspended to minimise the damage to private property and infrastructure due to flooding.</p> <p>Release triggers for Windamere Dam were reached in the following water years:</p> <ul style="list-style-type: none"> * 2005–2006, releases made in accordance with the Plan rules. * 2010–2011, releases were not made on advice from OEH and the EFRG to minimise flooding of private property and infrastructure along the Macquarie River below Burrendong Dam. * 2011–2012, releases generally made in accordance with the Plan 		<p>Consider the need for an additional clause allowing suspension of triggered planned environmental releases from Windamere Dam due to flooding.</p> <p>Consider the need for an additional clause to allow the ‘pay back’ of under releases of triggered planned environmental releases from Windamere Dam when they are suspended.</p> <p>Consider whether rules allowing the period of minimum flows and triggers to be changed in the Macquarie, are</p>	<p>Medium</p> <p>Medium</p> <p>Medium</p>

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>rules for the majority of the year. However, during March 2012 releases were suspended to minimise the damage to private property from flooding. Approximately 2.5 GL was not released from Windamere Dam. This was 'paid back' by increasing subsequent daily translucent releases by 25%.</p> <p>* 2013–2014, releases made in accordance with Plan rules.</p>		necessary for inclusion in the Plan.	
	Environmental water allowance (EWA), including translucency rules as a sub–component of the EWA	Were the accounts for the 2 sub–allowances of the EWA established?	<p>The 2 sub–allowances for the EWA were established. However, the account accrual and management rules were not always followed (see below).</p> <p>Although water was accrued into the EWA accounts, from September 2009 to July 2011 the decision was made to accrue all water into one of the sub accounts (the discretionary sub account) as part of the management strategy used during Plan suspension. After this period accounting returned to that stipulated by the Plan.</p> <p>Note: The EWA was not credited during the 2009–2010 water year as there were no AWDs announced for GS licences.</p>		<p>Consider reviewing the Plan to provide less complex accrual of EWA account(s).</p> <p>In addition, DPIE consider reviewing account management rules for improved flexibility of the EWA sub–allowances in the Macquarie to reflect experience and contemporary arrangements and operational methods for EWA releases</p>	High
		Were the EWA accounts managed	<p>Rules for releases from the sub–allowances were not followed.</p>		Consider reviewing the Plan to re–cast EWA rules to reflect more	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		according to the Plan rules?	<p>Difficulty in following the Plan EWA rules reflects:</p> <ol style="list-style-type: none"> 1. Drought conditions to 2012 2. WSP EWA rules are too prescriptive, and 3. WSP EWA rules pre-date contemporary governance arrangements of environmental water (eg NSW government decision (2008) to appoint OEH as lead agency on discretionary environmental water, Basin Plan reforms (2012), the development of environmental water portfolios (mainly 2006–2014) and strategic and annual environmental water planning (mainly from 2012)). <p>Decisions about release and accounting of the EWA have been made in full consultation with the Environmental Flows Reference Group (EFRG) and have been directed at the environmental objectives of the Plan. However, the rules were not followed due to their prescriptive and restrictive nature.</p> <p>It is clearly undesirable that the administrators of the Plan, the environmental water and the accounting are potentially in non-compliance despite being</p>		<p>contemporary environmental water management arrangements, include the Basin Plan-derived planning framework (ie long-term watering plans and annual priorities).</p> <p>Consider reviewing the Plan to re-cast rules to provide less complex accrual of EWA account(s), with operational release decisions then subject to OEH & EFRG, consistent with 5 year and annual plans, rather than prescribed in the Plan.</p> <p>Consider reviewing the Plan to consider rules which provide for the combined management of the EWA sub-allowances.</p> <p>Consider reviewing the Plan to provide for more transparent (but outcomes-based) governance and reporting of the EFRG.</p>	<p>High</p> <p>High</p>





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>consistent with environmental objectives.</p> <p>Therefore it is recommended that the rules are reviewed. This is understood to be underway.</p> <p>During the 2004–09 water years the account balances for the 2 sub–allowances were combined (this differed from the provisions in the Plan which required them to be managed separately). This approach was aimed at increasing the volume of environmental water available and maximising the delivery efficiency and benefits arising from the use of this water. During the period 2009–12 the delivery targets at Marebone Weir were specified by the EFRG and then the accounts were debited retrospectively. If the translucent triggers were met at this time, an amount was debited from the translucent sub account. Otherwise the full volume was debited from the active sub account.</p> <p>At the end of some water years, there has been water remaining in the translucent account and the EFRG requested that this water be released.</p> <p>Druring the period 2012–14 the rules for releases from the sub–allowances were also not followed.</p>			




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Orders were made in 2005 and 2015 to change the distribution of water between the two sub-accounts as required by the Plan rules.</p> <p>Total release from the EWA accounts were as follows; 2005–2006 (84 000 ML), 2007–2008 (21 000 ML), 2009–2010 (16 000 ML), 2010–2011 (139 101 ML), 2011–2012 (88 232 ML), 2012–2013 (128 119 ML) and 2013–2014 (43 671 ML).</p>			
		Was an annual release program for the use of EWA prepared and approved?	<p>During the period 2004–2009 release strategies for the use of the active sub-allowance was prepared for each year on an as needs basis rather than annually prior to each water year (as required by the Plan).</p> <p>During the period 2009–2014 release strategies for the use of the active sub-allowance were included annually in the environmental watering plan developed by OEH based on advice from the EWAG.</p>		Consider reviewing the Plan rules to reflect more contemporary environmental water management governance and planning arrangements.	Medium
		Was the Environmental Flow Reference Group (EFRG) established in 2004, and did it maintain an ongoing	<p>The EFRG required by the Plan was established in 2004 and has had an ongoing role in advising on the use of water from the EWA accounts since this time. The EFRG is managed by OEH with input and advice from other</p>		Consider reviewing the EFRG role and responsibilities to reflect to reflect more contemporary environmental water management	High






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		role in advising on the use of EWA water?	<p>agency staff and the community.</p> <p>During the Plan term the roles and responsibilities of NSW and federal government agencies in the management of environmental water changed substantially. Review of the EFRG is required.</p>		governance and planning arrangements. Consider standardising the environmental water advisory bodies.	
		To what extent was the EWA used for all Plan specified purposes?	<p>Rules for releases from the sub-allowances were not followed. Difficulty in following the Plan EWA rules reflects:</p> <ol style="list-style-type: none"> 4. Drought conditions to 2012 5. WSP EWA rules are too prescriptive, and 6. WSP EWA rules pre-date contemporary governance arrangements of environmental water (see detail above). <p>Over the duration of the Plan, EWA releases were utilised to target the most relevant specified purposes as outlined in the effectiveness evaluation report card.</p> <p>In general, it appears that the EWA was targeted to these purposes provided in section 22 of the Plan</p> <p>The Plan provides for two EWA accounts. EWA1 provides for translucency flows, EWA2 is used as a discretionary account</p>		See above recommendations regarding review of EWA rules and governance.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>by OEH (and its forerunners), on the advice of the EFRG. Accounts differentiating use of EWA1 & EWA2, are kept by WaterNSW.</p> <p>In 2005–2006, 84,000ML was released from EWA1 & EWA2 to support bird breeding. (DPI – Office of Water 2013a and 2013b). From 2007–2011, the Plan was suspended. Limited allocations were still made available to EWA2 and these were used to supplement translucent releases under EWA1. (DPI – Office of Water 2013a and 2013b). In 2007–08, 13,000ML of EWA2 carryover and 8,000ML of the 2007–08 allocation was released to support bird breeding. (DPI – Office of Water 2013a and 2013b). 2008–09: apparently, no usage (NSW Office of Water GPWAR (DPI Water 2017b). 2009–10: 16,000 ML EWA drought relief & habitat (OEH outcomes report 2010). 2010–11: 139,101 ML EWA vegetation and habitat, birds, fish (OEH outcomes report 2011). 2011–12: 88,229 ML EWA birds, drought relief & habitat maintenance of semi-permanent wetlands (OEH outcomes report 2012). 2012–13: 128,063 ML EWA drought relief & habitat maintenance of semi-permanent</p>			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			wetlands (OEH outcomes report 2013). 2013–14: 43,675 ML EWA birds, fish, drought relief & habitat maintenance of semi-permanent wetlands. 2014–15: 17,745 ML EWA birds, fish, drought relief & habitat maintenance of semi-permanent wetlands (OEH outcomes report 2015).			
	Adaptive environmental water (AEW)	Is there a process for licences to be committed for adaptive environmental purposes?	<p>All necessary systems are in place to apply and manage AEW conditions should they be requested.</p> <p>Note: Additional environmental water is held by other access licences in this water source (CEWO and OEH) but has not been conditioned as AEW.</p>			
		Were AEW Use Plans developed?	<p>AEW use plans approved.</p> <p>Five licences in this water source are conditioned as AEW and have an approved AEW use plan in place that commenced on 4/4/2007. There were no changes to the approved AEW use plans during the Plan term. (DWE 2009))</p> <p>Note: of these 5 licences, only 2 have share components and the other 3 have been cancelled.</p>		Consider whether the requirement for AEW use plans still provides the appropriate balance of water security for the environment with operational flexibility, given contemporary environmental water management governance, planning and reporting arrangements.	



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were there additional licences created and AEW conditioned as a result of water savings within the water source?	While AEW access licences were created during the Plan term, they were not the result of water savings within the water source.			
Basic Landholder Rights	Domestic and Stock	Were domestic and stock BLR provided for within the Plan?	The Plan identifies water requirements for domestic and stock BLR within the regulated river water source and provides for water to be supplied for these purposes. Additionally, some replenishment flows to downstream unregulated creeks are provided for within the Plan.			
		Is domestic and stock BLR growth provided for within the Plan?	Procedures are in place to allow for growth in domestic and stock BLR.			
		Was the water supply managed to ensure sufficient reserves for domestic and stock BLR were maintained?	The water resource assessment process incorporates calculations for BLR reserve requirements. At times during the period of Plan suspension, domestic and stock requirements were only partially met due to the extended dry conditions and resulting uncertainty in transmission losses and travel times.		Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of: <ul style="list-style-type: none"> • Whether and in what circumstances the Plan is suspended; • Practical constraints on ability to delivery BLR during drought, due to transmission losses; 	HIGH




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
					<ul style="list-style-type: none"> Governance and criteria for decisions on BLR availability, during drought and/or when the Plan is suspended. 	
		Were domestic and stock BLR provided for in water delivery operating protocols?	Domestic and stock rights were met at all times during this period, except during the period of suspension when domestic and stock requirements were only partially met due to the extended dry conditions and resulting uncertainty in transmission losses and travel times.		See above	HIGH
		Were replenishment flows delivered when required to satisfy domestic and stock needs, subject to water availability?	Replenishment flows were generally met when required and available, except during the period of suspension when domestic and stock requirements were only partially met due to drought conditions. Note: In this Plan, there are two sets of replenishment flow rules. One set is for uncontrolled flows to a number of downstream systems and the second is from the storages for Marra Ck and the lower Bogan River.		See above	HIGH
		Are domestic and stock BLR consistent with reasonable use guidelines?	Reasonable use guidelines (made under s.52 of the Act and provided for in the Plan) have not been made by the Minister.		Endeavour to finalise and publish the	Low



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
					reasonable use guidelines.	
	Native title	Were native title BLR provided for within the Plan?	<p>Procedures are in place to provide access if native title rights for water are granted in the water source covered by this Plan.</p> <p><i>Note: No native title rights for water have been established in this Plan area.</i></p>			
		Is growth in native title BLR protected within the Plan?	Procedures are in place to allow for growth in native title BLR.			
Rules for granting access licences	Granting new access licences	Were Plan rules followed for the granting of access licences?	<p>All access licences granted were in line with the Plan provisions.</p> <p>The Water Management (General) Regulations 2004 and 2011 set out the specific purpose access licences and application conditions.</p>			
Limits to the availability of water	Extraction limits	Was an extraction limit established?	An extraction limit was established for the water source.			
		Was the long-term average annual extraction assessed against LTAAEL at the end of each water year?	Assessment of compliance with the LTAAEL has not occurred annually as specified in the Plan due to the unavailability of annually updated water use development data.		<p>Consider reviewing the Plan to achieve an approach that:</p> <ul style="list-style-type: none"> • Can be practically, cost-effectively and reliably implemented 	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>However, assessment and model update has occurred after the Plan term in 2016.</p> <p>Amendment of the Plan is recommended to achieve an approach that can be practically implemented, while enabling timely identification of any risk of growth in use.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the WSP, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment</p>		<ul style="list-style-type: none"> • Enable timely identification of any risk of growth in use. Endeavour to resolve the process for the collection of water use development data so the IQQM model can be updated at an appropriate frequency. <p>Endeavour to implement NSW LTAAEL compliance assessment as routine business, alongside “Permitted take” (SDL) assessment under Basin Plan. High priority due to risks for NSW and for water rights holders if “growth in use” not identified and addressed early.</p>	



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>of compliance to take place. Water use development data is not volatile on an annual basis but is more appropriately assessed at the 3–5year frequency.</p> <p>However, the Plan implies that they will be updated, and the model must be run on an annual basis.</p> <p>It is recommended that this approach be reviewed and amended at Plan term review, given that this has proven to be impractical over the 10–year implementation of the Plan. Furthermore, the amended Plans will need to reflect Basin Plan requirements for application and compliance with the SDL.</p>			
	Variation of extraction limits	Were extraction limits varied?	<p>No changes to extraction limits have been required.</p> <p>(Note that the Basin Plan “Sustainable Diversion Limit” (SDL) is not implemented through WSPs until 2019 and effectively builds on existing NSW limits).</p>			
	LTADEL compliance	Was LTADEL exceeded?	<p>Assessment of LTADEL compliance has occurred after the Plan term in 2016 but has shown that LTADEL was not exceeded.</p> <p>Assessment of compliance with the LTADEL did not occur annually as specified in the Plan due to the</p>		<p>See above recommendations concerning Plan term review of LTADEL rules and implementation.</p> <p>Endeavour to make available on its website</p>	HIGH



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>unavailability of updated water use development data.</p> <p>LTAEL compliance is not readily identifiable in publicly available information.</p>		ongoing LTAEL compliance status.	
		Was a Compliance Assessment Advisory Committee established, if required, to advise on strategies to ensure the LTAEL was not exceeded?	<p>Triggers set to establish the CAAC has not been met. This was due to the extended dry conditions, no growth-in-use issues to be addressed and new approval processes required for appointment of such committees.</p>		Consider the necessity of the Compliance Assessment Advisory Committee for this water source.	Low
	AWDs	Were AWDs for all categories of licences calculated and announced in line with Plan provisions?	<p>AWDs for all categories of licences were calculated and announced in line with the Plan provisions for the nominated periods, except in 2007–2008 and the period 2010–2013.</p> <p>Note: The 2007–2008 exception was during the period of the Plan suspension from July 2007 until 16 September 2011 due to drought conditions. The period 2010–13 exception was the result of dam spilling and accounts were not refilled via an AWD.</p>		<p>Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of:</p> <ul style="list-style-type: none"> - Whether and in what circumstances the Plan is suspended; - Governance and criteria for decisions on AWDs during drought and/or when the Plan is suspended <p>Consider reviewing rules for AWD announcements to balance the water needs of the whole community during dry</p>	<p>High</p> <p>High</p> <p>Medium</p>




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
					<p>times and triggers to move to these rules.</p> <p>Consider changes to AWD announcement process to simplify the process of amending accounts in the Macquarie when Burrendong Dam spills whilst maintaining transparency in the process.</p>	
Rules for managing access licences	Water allocation and account management	Were water accounts established for all licences?	Water allocation accounts were established for all licence holders.			
		Were accounts managed in accordance with the Plan rules?	Accounts have been managed in line with the Plan rules.			
	Carryover provisions	Was carryover managed in accordance with the Plan rules?	<p>Rules relating to the carryover of balances in water allocation accounts from one year to the next were applied through the account management system for all years except during the period July 2007 – Jan 2008.</p> <p>During July 2007 – Jan 2008 whilst the Plan was suspended, limitations were placed on the use of balances in general security water accounts under the critical water planning process to</p>		<p>Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of:</p> <ul style="list-style-type: none"> - Whether and in what circumstances Plan suspended - Decision-making protocols for carryover when Plan suspended 	Medium





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			maximising water available for essential supplies. Between July 2007 and January 2008, general security licence holders were permitted to access only 25% of their carryover allocations in the Cudgegong and none in the Macquarie. Full access to carryover was reinstated in January 2008 following an improvement in the available water supplies in the water source.			
		Were the rules regarding the withdrawal of carryover when Windamere Dam spills and Burrendong water levels are in the flood mitigation zone (FMZ) complied with?	During the Plan term the criteria was only met in 2011–2012 and all HS and GS account balances were reset at 1.0 ML/unit share in April 2012.			
	Extraction conditions	Were the general priority of extraction conditions set out in the Plan complied with?	General priority of extraction conditions set out in the Plan was complied with at all times, except during the period 2009–2010. Under an approved process suspension of the Plan allowed for the limited resources available to be managed in a discretionary manner targeted to securing critical human water needs and environmental targets during the period 2009–2010.		See above, regarding overall recommendations on decisions during drought of record and Plan suspension and for managing AWDs during extremely dry times.	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were numerically specified extraction components introduced by amending water access licences e.g. in relation to times, rates or circumstances that water may be taken?	Numerically specified extraction components were not required to be introduced.		Consider establishing a state-wide policy for the establishment of numerical extraction conditions, including numerical extraction components where required.	Medium
	Supplementary water	Were supplementary water announcements made in accordance with Plan requirements?	Supplementary water announcements were made in accordance with Plan requirements in the Macquarie River. <i>Note: No supplementary event announcements have occurred in the Cudgegong River during the term of the Plan.</i>			
		Were individual supplementary events managed in accordance with Plan rules and targets?	Individual supplementary events were managed in accordance with Plan rules and targets. Each supplementary event is assessed on a case by case basis and as a result may or may not have restrictions placed on it. Events were managed in accordance with the Plan rules.			
		Did supplementary water users comply with Plan rules?	The DPIE website provides clear information about compliance activities and non-compliance consequences. The archive of successful compliance actions does not appear to include any			






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			convictions for non-compliance with supplementary access rules.			
Dealings	Minister's dealing principles	Were dealings in line with the Minister's dealing principles, the Act and the WSP?	<p>All dealings have been made in line with Minister's dealing principles.</p> <p><i>Note: Prohibited dealings in this Plan area include: interstate (transfer and assignment of allocation) and allocation assignments between water sources.</i></p>			
	Constraints within water source	Were dealings in line with rules relating to constraints within the water source?	<p>All dealings were undertaken in line with Plan rules relating to constraints within the water source except during the period July 2007 to June 2008.</p> <p>Assignment of allocations (temporary transfers) from the Cudgegong to the Macquarie River, allowed under the Plan, was suspended due to drought conditions. During this time, transfers were allowed only within the Cudgegong and Macquarie valleys. Between January and June 2008, trade of water allocation was limited to downstream trade (i.e. only trade from the Cudgegong to the Macquarie was allowed). Restrictions were introduced as a result of concerns about the ability to deliver purchased water efficiently. Normal dealing rules</p>		Consider dealing rules which consider water delivery constraints between the Cudgegong and Macquarie Rivers during dry conditions and a trigger for their operation.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			were reintroduced in January 2008.			
	Change of water source	Were dealings in line with rules relating to change of water source?	Change of water source dealings are not possible as conversion factors have not been established.			
		Were conversion factors established when required?	<p>Conversion factors were not established.</p> <p>The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (released in Sept 2009 and March 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.</p> <p>Change of water source dealings in this section of Plan relate to trade between regulated and unregulated water sources. Current NSW Regulations do not allow trade from an unregulated water source into a regulated water source. Trade is allowed from a regulated water source into an unregulated water source. However, the principle of no impact on third parties means that these trades rarely proceed.</p> <p>DPIE is reviewing trade between regulated systems including</p>		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			conversion factors for consistency with the Murray Darling Basin Plan Water Trade Rules.			
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water source?	Conversion of access licence category dealings that do not require conversion factors are possible. Conversion of access licence category dealings are not possible where conversion factors are required as the factors have not been established.		<i>see next</i>	<i>see next</i>
		Were conversion factors established when required?	Conversion factors were not established. The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (released in Sept 2009 and March 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High
Mandatory conditions	Access licence conditions	Were mandatory conditions for access licences placed on licences?	Mandatory conditions required in the Act and in the Plan were placed on the licences during the conversion of licences from the WA to the WMA before the plans commenced.			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Water supply works approvals	Were mandatory conditions for works approvals placed on the works approvals?	Mandatory conditions required in the Act and in the Plan were placed on the approval during the conversion of licences from the WA to the WMA before the plans commenced.			
System Operation rules	Replenishment flows	Were replenishment flows provided in accordance with the Plan?	Replenishment flows were generally met when required and available, except during the period of suspension when domestic and stock requirements were only partially met due to drought conditions. Note: In this Plan, there are two sets of replenishment flow rules. One set is for uncontrolled flows to a number of downstream systems and the second is from the storages for Marra Ck and the lower Bogan River.		Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of: <ul style="list-style-type: none"> - Whether and in what circumstances Plan suspended; - Governance and criteria for decisions on BLR availability, during drought and/or when Plan is suspended 	HIGH
		Was the water supply managed to ensure sufficient reserves for replenishment flows were maintained?	According to the Audit Report Card (NSW Office of Water 2013a and 2013b), reserves for replenishment flows were provided for.			
	Water delivery and channel capacity constraints	Were initial estimates of maximum water delivery and operating channel capacity updated?	The initial estimates of maximum water delivery or operating channel capacity included as notes in the Plans have not been updated. This is a common issue to all WSPs, according to the Audit Report Card (NSW Office of Water		Confirm whether or not channel capacity constraints are to be included in Plan. If they are to be included in Plan, DPIE to consider requiring WaterNSW to	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>2013a and 2013b). Dry conditions have meant that this has not been required or a priority. Rules operating during periods of constraint governing sharing of capacity between the EWA and water orders need clarification.</p>		review and update the estimates.	
	Rates of change to releases from storages	Was an operating protocol for the management of rates of change to releases developed?	<p>The Minister has not established procedures for setting rules for the development of protocols to minimise the effects of flow release from storages.</p>		<p>Consider the policy requirement – is the operating protocol required, given it hasn't been implemented during first 10-year term?</p> <p>If review considers protocol is required, then DPIE may consider requiring compliance by holder of the works approval.</p>	Medium
	Bulk water transfers between storages	Are systems in place to allow bulk water transfers?	<p>Bulk water transfers were managed in accordance with Plan rules.</p> <p>Note: Bulk water transfers were made in 2004–2005 in line with the Plan rules. Transfers were not required in any other years.</p> <p>Note: protocols for bulk transfers were introduced in 2015, documented and signed off by DPI Water and WaterNSW.</p>			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were rules for determining the pattern and volume of releases for the transfer of water from Windamere Dam to Burrendong Dam developed?	These had not been developed at the time of the Audit Report Card (NSW Office of Water 2013a and 2013b). Note: protocols for bulk transfers were introduced in 2015, documented and signed off by DPI Water and WaterNSW.		N/A – protocols have been introduced subsequent to 2004–2014 period evaluated here.	
	Dam operation during floods and spills	Were rules for operating Burrendong and Windamere Dams in floods and spills followed?	The Plan states dam safety rules must be followed but does not provide detailed rules as these are set and controlled by an external process. Provided these external rules are met, there are some operational rules that can be implemented if they are consistent with the existing safety rules.			
	Airspace operation	Were airspace rules implemented?	Operational rules for the Plan area have been included in the works approval issued to WaterNSW. Protocols were followed for airspace operations when required.			
Plan Amendments	Changes to the water source	Were any changes to the water source required?	No changes have been made to the water source.			
	Changes to planned environmental water	Were allowed Plan amendments to planned environmental water releases from Windamere Dam made?	None of the allowed changes to Plan rules for planned environmental water releases from Windamere Dam were required.		Consider whether these amendment provisions are still necessary.	LOW






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were allowed Plan amendments to EWAs made?	None of the changes to the EWA rules provided for in the Plan have been implemented. Note: the replacement Plan provides for Plan amendments similar to that in the 2003 Plan, but with greater flexibility in the minimum share of the sub-allowance. However, it has not changed the rules, only the amending provisions.		See above recommendations regarding amendments to environmental water rules.	HIGH
	Changes to supplementary access targets	Were permitted variations to flow targets at Warren (via Plan amendments) required?	There have been no changes to supplementary water as set out in the Plan.		Consider whether these amendment provisions are still necessary.	LOW
	Amendments relating to planned environmental water (made under s.8A of the WMA 2000)	Were any changes required to planned environmental water rules?	No changes allowed for in the Plan have been made to environmental water provisions.		See above recommendations regarding amendments to environmental water rules.	HIGH
	Amendments relating to floodplain harvesting	Were any changes made to water sources or Plan provisions to provide for floodplain harvesting?	No amendments made to date. The DPIE website on “Healthy Floodplains” project identifies the Macquarie as a priority catchment, including for Plan amendments.		Consider whether amendments are required in the Macquarie, consistent with the “Healthy Floodplains” project.	M

Table 11: Effectiveness Report Card

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>Maintain or enhance the ecological functions and values of riverine environments</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p> <p>Change in water quality in this water source</p> <p><i>Additional PI identified</i> Change in surface water extraction relative to the LTAAEL</p>	<p>Summary finding: The evaluation has been inconclusive in determining the effectiveness in achieving this objective over the 2004–2014 period. While some indicators showed positive environmental outcomes, others continue to show negative impacts.</p> <p>In addition, the evaluation found that effectiveness of Plan implementation could not be differentiated from pre-existing reforms in the Macquarie, the effects of the Millennium Drought, Plan suspension, EWA implementation not aligning with Plan rules and the development of environmental water portfolios. The latter was enabled but not intended by the Plan’s creation of fully tradeable water rights.</p> <p>The Plan was developed with an understanding that detrimental effects on the condition of water– dependent ecosystems and water quality in the Macquarie and Cudgegong Rivers and its terminal wetland systems had resulted from significant changes to the flow regime as a result of surface water development.</p> <p>Uniquely, in the Macquarie, water sharing arrangements had developed since the 1960s to attempt to protect the values of the Macquarie Marshes. Most relevant to the Plan in 1996, the revised Macquarie Marshes Water Management Plan implemented increased environmental allocations and limits to consumptive water use. The Plan essentially</p>		<p>Good</p>	<p>Consider providing clearly defined PIs and an associated performance monitoring programs that closely align with Plan objectives and strategies.</p> <p>Consider investigating further refinement of environmental rules and their operation to enhance environmental outcomes without impacting economic or social outcomes. (see efficiency recommendations)</p> <p>Design monitoring programs to attempt to clearly differentiate between Plan rules / implementation and other external factors.</p>	<p>High (all)</p>

implemented these requirements, with some adjustments. (Note that subsequent use of the EWA did not align with Plan rules – see efficiency evaluation.)

Monitoring of the outcomes of these changes encompassed both pre- and post-Plan periods.

Monitoring results show mixed responses to implementation of the WSP. However, these must be viewed in the context of both the historically unprecedented Millennium drought and the resulting suspension of the Plan between 2007 and 2011.

Ecological condition

Vegetation and invertebrates showed positive responses in some instances, but also showed sensitivity to the length of time between environmental flows and losses to transmission and lack of groundwater maintenance.

In summary, it can reasonably be concluded that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term, the management of the EWA not aligning with Plan rules and many other external factors. These external factors include the significant State and Commonwealth acquisition of water entitlements for environmental use, which was enabled by the Plan's creation of tradeable water rights, but was not an objective, strategy or rule of the Plan.

Change in flow regime

Analysis of flow regime shows that Plan performance indicator assessment criteria were


not achieved, compared to the baseline Plan target. This was the case for number of days below the 95th percentile and the 80th percentile, as well as number of days above the 30th, 15th and 5th percentiles. In all cases, the exceptions were the years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods.


This supports the finding that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term, the management of the EWA not aligning with Plan rules and many other external factors.


Water quality

Water quality in the Macquarie–Cudgegong has been found to be predominantly poor to very poor in the 2007–2012 period. However, with no pre–plan comparison available, it is not possible to make a finding as to the effectiveness of the Plan with respect to its water quality objectives.

Due to the regulation of the Macquarie and Cudgegong River, significant water quality issues particularly relating to thermal depression have occurred (DLWC 2000). NSW has developed a Cold Water Pollution Strategy to address these issues over the long–term (Cold Water Pollution Interagency Group (CWPIG) 2012). For Burrendong Dam cold water pollution has been somewhat mitigated with construction of a “curtain” in the dam, allowing selective withdrawal of water from warmer layers of the dam. A review of existing arrangements, potential for adjustment and likely benefits or negatives or altered

		<p>operations may lead to improved water quality outcomes.</p> <p>Change in extraction relative to limit</p> <p>The Plan has been effective in preventing increase in extraction, since extraction data shows compliance with the limit. However, note that there are many external factors that will also have contributed to this outcome, including the Millennium Drought, potentially more conservative use of water allocations by water entitlement holders and the development of environmental water portfolios.</p>			
Support a sustainable regional economy	Change in economic benefits derived from water extraction and use	<p>Summary: The Plan played a key role in establishing tradeable water rights and building on earlier trading frameworks. Recent analyses suggest that enabling water trading has contributed to growth in economic outputs per ML of water extracted, as well as enabling water users to adjust to limited water availability during the Millennium drought, particularly through allocation trade. Other entitlement holders have been able to realise the asset value by selling part of all of their entitlement. However, there is difficulty in differentiating the economic impacts and benefits from other external factors, such as the drought, reforms and water buyback for the environment in the Murray–Darling Basin, as well as broader economic and social changes.</p> <p>Key drivers of annual changes in farm incomes include changing commodity prices, costs of farm inputs, and varying seasonal conditions and irrigation water availability ABARES (2015). The Plan has almost no effect on most</p>		Moderate	Consider clearer identification of SMART objectives and PIs, related to the Plan rules and differentiated from external factors, to the extent possible.

		<p>of these, except for being one factor in irrigation water availability.</p> <p>The introduction of the Plan, along with a range of other reforms, played a key role in enabling water trade (Aither 2017), as well as enabling water users to gain improved control over managing their exposure to risk around their water account and portfolio (e.g. through measures such as carryover and allocation (AWD) rules).</p> <p>However, these changes cannot be clearly differentiated in economic data from pre-existing water reforms in the 1980s and 1990s, as well as broader economic, social and climate factors.</p> <p>Therefore, while it can be reasonably concluded that the Plan contributed to economic benefits and a sustainable regional economy.</p>				
<p>Protect the social values and benefits provided by the river system</p>	<p>Extent to which local water utility and major utility requirements (where major utilities are involved in urban water provision) have been met.</p> <p>Extent to which domestic and stock rights requirements have been met</p> <p><i>Additional PI component identified:</i> Extent to which licenced domestic and</p>	<p>Summary: The Plan and its implementation contributed to the social values and benefits provided by the river system. However, the Millennium Drought constrained the ability of the Plan and its implementation to make this contribution.</p> <p>Throughout the duration of the Plan, water was shared between all water uses, including the environment, according to the priority of access provided in the Plan (except when the Plan was suspended)</p> <p>Local water utilities and domestic and stock rights received 100% allocations since the commencement of the Plan, except in 2007–08, while the Plan was suspended during the drought.</p>		Good	<p>Endeavour to clearly identify the range of values of water to Aboriginal people to equitably share water between all uses.</p> <p>(Also see recommendation under efficiency with respect to clarity of arrangements and constraints in drought circumstances).</p>	Medium

	<p>stock requirements have been met</p> <p>Extent to which native title rights requirements have been met</p> <p>Extent to which licenced water has been made available and used for Aboriginal purposes.</p> <p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p> <p>Change in economic benefits derived from water extraction and use</p>	<p>Delivery of BLR for domestic and stock use, as well as domestic and stock access licences, occurred in most years. However, during Plan suspension and the Millennium Drought, some rights holders and licences did not receive full access and some replenishment flows were not able to be delivered. (see efficiency report card above).</p> <p>While no native title rights for water were established in the Plan area during the term of the Plan, the Plan makes provision for these requirements.</p> <p>The environmental water provisions for planned environmental water make some contribution towards the preservation of cultural and heritage values of water to Aboriginal people; however, there has been a lack of uptake of Aboriginal cultural specific purpose licences.</p>				
<p>Recognise and respect Aboriginal cultural responsibilities and obligations to the landscape</p>	<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p> <p>Extent to which native title rights requirements have been met</p> <p><i>Additional PI component identified</i> Extent to which</p>	<p>No native title rights have been granted within the water sources and no licences have been issued for Aboriginal cultural purposes.</p> <p>There are no specific strategies within the Plan that are directly related to the objective, although the Plan recognised environmental water provisions were likely to make some contribution towards the preservation of cultural and heritage values.</p> <p>There is little information available on the social impacts of the Plan on communities within the Plan area.</p>		Poor	<p>Endeavour to establish Aboriginal Social and Cultural objectives, strategies and PIs that are directly linked to values of water for Aboriginal people</p> <p>Consider the addition of a cultural /heritage use</p>	High

licenced water has been made available and used for Aboriginal purposes.

The Plan has not provided cultural outcomes for Aboriginal communities with no real evidence of the Plan being able to influence outcomes relating Aboriginal spiritual, social and customary values.

Given the potential linkages between cultural and heritage values and environmental assets the use of the EWA may support the achievement of this objective.

category for the EWA

Table 12: Performance indicator results summary

Performance indicator	Related Plan objectives	Results	Strength of information
<p>Change in ecological condition of this water source and dependent ecosystems</p>	<p>Maintain or enhance the ecological functions and values of riverine environments</p>	<p>Monitoring since 1999 shows positive responses of vegetation to environmental flows with an increase in the variety of vegetation species and an improvement in condition at sites wetted by the flows (DPI Water 2010). Monitoring of the 2009/2010 environmental flows show that a small maintenance flow (19,000 ML) can be used during drought to maintain core wetland plant communities within the Macquarie Marches and as the duration of the event increases more Plan species benefit from the environmental flows (DPI Water 2010; Michener & Driver 2010). For longer time scales, the effects of environmental flows are more nuanced, because specific flow regimes are required over time.</p> <p>Invertebrate monitoring and modelling were undertaken in the Macquarie Marshes (Jenkins et al. 2012). Taxon richness was higher in all creeks in years with EWA, particularly in 2005 when floodplains were inundated from August to November. Peaks in biodiversity were greater in 2005 than in 2003 (four weeks) and 2009 (eight weeks) when shorter environmental flows were released. The key goal of EWA releases must be to reduce the time between flood events, particularly during long dry periods. This will also increase flood frequency. This is important to sustain the dormant propagule bank for animals and seeds in the floodplain, which perish when dry periods extend from four years beyond 10 years. Jenkins et al. (2012) recommend gaps between floods of one to four years and to capitalise on unregulated flows in the system.</p> <p><i>Macquarie Marshes 2005/06 Environmental Flow. Responses of groundcover plants to environmental flow</i></p> <p>As a result of the delivery of approximately 84,000 ML of environmental flows into the Macquarie Marshes in 2005/06 (with 120–125 GL of total inflows, measured at Marebone weir), from October 2005 – January 2006, seven monitored wetland sites received a fill sufficient for sustained plant groundcover responses (Michener & Driver 2010). Sites were monitored as part of NSW Department of Natural Resources' Integrated Monitoring of Environmental Flows Program (IMEF). The 05/06 event reached fewer wetlands than were observed for similar flows during 2000–2004 largely because of greater transmission losses along streams and channels, and over the floodplain.</p>	<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>The primary benefit of environmental flows observed during this survey was the maintenance of groundcover wetland plant species, particularly those that are able to rapidly respond to inundation by producing additional plant biomass and storable energy in the form of seeds and rhizomes (Michener & Driver 2010).</p> <p>The study was not designed to directly measure the responses of River Red Gum health to water management. However, there was a complete loss of Common Reed (<i>Phragmites australis</i>) from monitored transects. Moreover, there was a dominance of plants adapted to relatively dry conditions (terrestrial dry and terrestrial damp functional groups) within monitoring transects. These patterns suggest that soil water and shallow groundwater are not being maintained. This lack of water is likely to negatively impact on river red gum health (Michener & Driver 2010).</p> <p><i>OEH Environmental Water Outcomes reports</i></p> <p>Since 2009, the Office of Environment and Heritage (OEH) has published annual environmental water outcomes reports (OEH 2010, 2011, 2012, 2013, 2014). These identify positive environmental outcomes from environmental watering, particularly following the end of the Millennium Drought, as there were significant flows into the Marshes in 2010, 2011 and 2012. Positive outcomes are reported for waterbirds, frogs and vegetation. However, these reports do not differentiate or identify specific outcomes from the EWA use under the Plan, as opposed to outcomes from delivery of state and Commonwealth held environmental water entitlements. In addition, it is not clear if the outcomes observed are anecdotal or from scientifically designed monitoring.</p> <p>There continue to be gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Macquarie and Cudgegong Regulated Rivers Water Source.</p> <p>References:</p> <p>Driver, P & Knight, C (2007) <i>Macquarie Marshes 2005/06 Environmental Flow. Responses of groundcover plants to environmental flow</i>. Report to the Macquarie Marshes Environmental Flow Reference Group</p> <p>Jenkins K., Kingsford R., Wolfenden B., Shiquan R., Driver P., (2012) <i>Invertebrate monitoring and modelling in the Macquarie Marshes</i>, NSW Department of Primary Industries, Sydney.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information									
		<p>Michener K. and Driver P. (2010) Vegetation responses to environmental flows in the Macquarie Marshes, 2009/2010. Report to the Environmental Flow Reference Group. Water Resource Evaluation, NSW Office of Water</p> <p>NSW Department of Primary Industries, Office of Water (2010), <i>Environmental flow response and socio-economic monitoring Macquarie Valley – progress report 2009</i></p>										
Change in low flow regime	Maintain or enhance the ecological functions and values of riverine environments	<p>As specified in the Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days below the natural 95th and 80th percentiles.</p> <p>The natural (without development) and Plan scenario results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – WSP). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that for the Carinda gauge (in the Macquarie Marshes), the flow is very low for the majority of the year and does not meet criteria based on the baseline WSP scenario for any year for the 95th percentile and only in 2010/2011 and 2011/2012 for the 80th percentile.</p> <p>For the Dubbo gauge, all years had all flows above the 95th percentile natural flow; however, the 80th percentile criterion was not met for most years. Over the evaluation period, the resulting low flow regime does not meet the modelled Plan scenario.</p> <table border="1"> <thead> <tr> <th>Comparison to modelled WSP scenario for the number of days below the 95th percentile flow</th> <th>421001 (Macquarie at Dubbo)</th> <th>421012 (Macquarie at Carinda)</th> </tr> </thead> <tbody> <tr> <td>Natural 95th percentile flow</td> <td>44 ML/d</td> <td>13 ML/d</td> </tr> <tr> <td><i>WSP scenario (baseline target)</i></td> <td>1</td> <td>4</td> </tr> </tbody> </table>	Comparison to modelled WSP scenario for the number of days below the 95th percentile flow	421001 (Macquarie at Dubbo)	421012 (Macquarie at Carinda)	Natural 95 th percentile flow	44 ML/d	13 ML/d	<i>WSP scenario (baseline target)</i>	1	4	Good
Comparison to modelled WSP scenario for the number of days below the 95th percentile flow	421001 (Macquarie at Dubbo)	421012 (Macquarie at Carinda)										
Natural 95 th percentile flow	44 ML/d	13 ML/d										
<i>WSP scenario (baseline target)</i>	1	4										

Performance indicator	Related Plan objectives	Results			Strength of information
		2004/2005	0	361	
		2005/2006	0	280	
		2006/2008	0	322	
		2007/2008	0	347	
		2008/2009	0	294	
		2009/2010	0	308	
		2010/2011	0	40	
		2011/2012	0	18	
		2012/2013	0	140	
		2013/2014	0	163	
		Comparison to modelled WSP scenario for the number of days below the 80 th percentile flow			
			421001 (Macquarie at Dubbo)	421012 (Macquarie at Carinda)	
		Natural 80 th percentile flow	158 ML/d	30 ML/d	
		<i>WSP scenario (baseline target)</i>	6	101	
		2004/2005	38	364	
		2005/2006	47	339	
		2006/2008	95	365	
		2007/2008	100	366	
		2008/2009	41	365	
		2009/2010	83	337	
		2010/2011	10	61	
		2011/2012	0	38	
		2012/2013	10	150	

Performance indicator	Related Plan objectives	Results			Strength of information
		2013/2014	28	245	
Change in moderate to high flow regime	Maintain or enhance the ecological functions and values of riverine environments	<p>As specified in the Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days above the natural 30th, 15th and 5th percentiles.</p> <p>The natural (without development) and WSP scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – WSP). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the criteria were only met in the wet years of 2010/2011 to 2012/2013, and in one case the 2013/2014 water year.</p> <p>This demonstrates that without large floods, the Plan implementation has had limited success in mimicking ‘natural’ moderate and high flows.</p>			Good
		<p>Comparison to modelled WSP scenario for the number of days above the 30th percentile flow</p>			
			<p>421001 (Macquarie at Dubbo)</p>	<p>421012 (Macquarie at Carinda)</p>	
		Natural 30 th percentile flow	1,711 ML/d	260 ML/d	
		<i>WSP scenario (baseline target)</i>	184	60	
		2004/2005	0	0	

Performance indicator	Related Plan objectives	Results			Strength of information
		2005/2006	115	0	
		2006/2008	46	0	
		2007/2008	3	0	
		2008/2009	1	0	
		2009/2010	0	1	
		2010/2011	207	190	
		2011/2012	230	171	
		2012/2013	223	119	
		2013/2014	120	0	
		Comparison to modelled WSP scenario for the number of days above the 15th percentile flow			
			421001 (Macquarie at Dubbo)	421012 (Macquarie at Carinda)	
		Natural 15 th percentile flow	4,325 ML/d	602 ML/d	
		<i>WSP scenario (baseline target)</i>	82	33	
		2004/2005	0	0	
		2005/2006	4	0	
		2006/2008	0	0	
		2007/2008	0	0	
		2008/2009	0	0	
		2009/2010	0	0	
		2010/2011	104	159	
		2011/2012	74	69	

Performance indicator	Related Plan objectives	Results			Strength of information
		2012/2013	135	81	
		2013/2014	0	0	
		Comparison to modelled WSP scenario for the number of days above the 5th percentile flow			
			421001 (Macquarie at Dubbo)	421012 (Macquarie at Carinda)	
		Natural 5 th percentile flow	13,608 ML/d	1,729 ML/d	
		<i>WSP scenario (baseline target)</i>	9	13	
		2004/2005	0	0	
		2005/2006	1	0	
		2006/2008	0	0	
		2007/2008	0	0	
		2008/2009	0	0	
		2009/2010	0	0	
		2010/2011	47	59	
		2011/2012	20	0	
		2012/2013	0	0	
		2013/2014	40	0	
		References:			
		NSW Department of Primary Industries – Water (2017c), <i>Real Time Data – Rivers and Streams</i> ,			

Performance indicator	Related Plan objectives	Results	Strength of information																																			
		http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url																																				
Change in water quality in this water source	Maintain or enhance the ecological functions and values of riverine environments	<p>The major water quality issues in the Macquarie–Cudgegong regulated River are increasing salinity, high nutrient levels, increasing frequency of algal blooms (an outcome of increasing nutrients) and high turbidity. Salinity is an issue in upper areas of the catchment from land–use changes. Turbidity and nutrients are often high, resulting in blue–green algal blooms in weir pools.</p> <p>There is limited water quality data available for the Macquarie–Cudgegong system over the evaluation period. The <i>Assessment of Basin Plan Water Quality targets in New South Wales</i> report provides some general information on water quality in the Macquarie system (Mawhinney & Muschal 2015). The ratings compared to basin targets are provided below based on median annual data from 2007 – 2012. There are some water quality issues at these sites with dissolved oxygen, Total Nitrogen, Total Phosphorous and Turbidity. Note that the report provides no “pre–Plan” comparison.</p> <table border="1"> <thead> <tr> <th colspan="7">Water quality index ratings by site for the Macquarie valley (Mawhinney & Muschal 2015)</th> </tr> <tr> <th>Station</th> <th>Turbidity (lab)</th> <th>Turbidity (field)</th> <th>Total phosphorus</th> <th>Total nitrogen</th> <th>pH</th> <th>Dissolved oxygen</th> </tr> </thead> <tbody> <tr> <td>421012 Macquarie River at Carinda</td> <td>Good#</td> <td>Very Poor#</td> <td>Very Poor#</td> <td>Very Poor#</td> <td>Very Good #</td> <td>ID</td> </tr> <tr> <td>421023 Bogan River at Gongolgon</td> <td>Very Poor#</td> <td>Very Poor#</td> <td>Very Poor#</td> <td>Very Poor#</td> <td>Very Good #</td> <td>ID</td> </tr> <tr> <td>421004 Macquarie</td> <td>Moderate</td> <td>Moderate</td> <td>Poor</td> <td>Moderate</td> <td>Very Good</td> <td>Very Poor#</td> </tr> </tbody> </table>	Water quality index ratings by site for the Macquarie valley (Mawhinney & Muschal 2015)							Station	Turbidity (lab)	Turbidity (field)	Total phosphorus	Total nitrogen	pH	Dissolved oxygen	421012 Macquarie River at Carinda	Good#	Very Poor#	Very Poor#	Very Poor#	Very Good #	ID	421023 Bogan River at Gongolgon	Very Poor#	Very Poor#	Very Poor#	Very Poor#	Very Good #	ID	421004 Macquarie	Moderate	Moderate	Poor	Moderate	Very Good	Very Poor#	Good
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421004 Macquarie	Moderate	Moderate	Poor	Moderate	Very Good	Very Poor#																																

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>River at Warren Weir</p> <p># Insufficient data (n<5) to assign a rating with confidence ID – Insufficient data to assign a rating</p> <p>References:</p> <p>Mawhinney, W. and Muschal, M. 2015. Assessment of Murray–Darling Basin Plan water quality targets in New South Wales; 2007 to 2012. New South Wales Department of Primary Industries, Water, Sydney. ISBN 978–1–74256–792–1</p> <p>Department of Water and Energy (DWE; 2009) <i>Water sharing in the Macquarie and Cudgegong Regulated Rivers Progress report 2004 to 2008</i></p>	
<p>Extent to which domestic and stock rights requirements have been met</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced domestic and stock access requirements have been met</p>	<p>Protect the social values and benefits provided by the river system</p>	<p>Provision for domestic and stock rights (a component of BLR) and domestic and stock access licences has been made in the Plan; estimated at Plan commencement to be 1,200 ML/year and 14,265 ML/year respectively.</p> <p>As no licences are required for extraction of water for BLR, it is difficult to assess accurately. Water to meet these needs is included in WaterNSW's operational protocols for delivery of water ordered by licence holders. The Plan also provides for BLR in some unregulated effluent creeks in the form of annual replenishment flows (s. 59 in the WSP).</p> <p>During 2004 – 2012, water was provided for BLR in all regulated sections in the Macquarie Cudgegong (NSW Department of Water and Energy 2009; DPI Water 2013). The drought conditions have meant, however, that this has required considerably more resources than would generally be the case.</p> <p>Irregular deliveries of annual replenishment flows were delivered based on availability of surplus flows. This varied considerably across the creeks nominated in the Plan. In 2004–05 BLR requirements of the creeks and lower Macquarie River were met in all but three of the nominated creeks. In each of the 2005/06 to 2007/2008, these requirements were met in all but two of the</p>	<p>Good All years</p>

Performance indicator	Related Plan objectives	Results	Strength of information																																																
		<p>nominated creeks (NSW Department of Water and Energy 2009). Replenishment flows were met when required for 2009 – 2012 (DPI Water 2013).</p> <p>For the evaluation period, full AWD allocations were provided for in all water years (100%).</p> <table border="1"> <thead> <tr> <th colspan="4">Domestic and Stock access licences within the Macquarie and Cudgong Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr><td>2004/2005</td><td>5,582</td><td>100%</td><td>1,652</td></tr> <tr><td>2005/2006</td><td>5,533</td><td>100%</td><td>1,463</td></tr> <tr><td>2006/2008</td><td>5,543</td><td>100%</td><td>2,157</td></tr> <tr><td>2007/2008</td><td>5,543</td><td>100%</td><td>2,157</td></tr> <tr><td>2008/2009</td><td>5,570</td><td>100%</td><td>1,889</td></tr> <tr><td>2009/2010</td><td>5,570</td><td>100%</td><td>1,483</td></tr> <tr><td>2010/2011</td><td>5,578</td><td>100%</td><td>940</td></tr> <tr><td>2011/2012</td><td>5,581</td><td>100%</td><td>1,273</td></tr> <tr><td>2012/2013</td><td>5,567</td><td>100%</td><td>2,030</td></tr> <tr><td>2013/2014</td><td>5,776</td><td>100%</td><td>2,027</td></tr> </tbody> </table> <p>References:</p> <p>NSW Department of Primary Industries – Water (2017d),, <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p> <p>NSW Department of Primary Industries, Office of Water (2013b), <i>Audit of implementation – Regulated river water sharing Plan audit report cards</i>, Prepared for the period between 1 July 2009 and 30 June 2012.</p>	Domestic and Stock access licences within the Macquarie and Cudgong Regulated River Water Source				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2004/2005	5,582	100%	1,652	2005/2006	5,533	100%	1,463	2006/2008	5,543	100%	2,157	2007/2008	5,543	100%	2,157	2008/2009	5,570	100%	1,889	2009/2010	5,570	100%	1,483	2010/2011	5,578	100%	940	2011/2012	5,581	100%	1,273	2012/2013	5,567	100%	2,030	2013/2014	5,776	100%	2,027	
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Extent to which local water utility requirements have been met.	Protect the social values and benefits provided by the river system	<p>Provision for local water utility requirements has been made in the Plan, estimated at Plan commencement to be 22,681 ML/year.</p> <p>There have been no restrictions on local water utility access since Plan commencement, with full AWD allocations (100%) provided for in all water years, except in 2007–08 while the Plan was suspended.</p> <table border="1"> <thead> <tr> <th colspan="4">Local Water Utility access licences within the Macquarie and Cudgong Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>18,145</td> <td>100%</td> <td>14,757</td> </tr> <tr> <td>2005/2006</td> <td>18,145</td> <td>100%</td> <td>15,008</td> </tr> <tr> <td>2006/2008</td> <td>18,145</td> <td>100%</td> <td>16,874</td> </tr> <tr> <td>2007/2008</td> <td>3,761</td> <td>20%</td> <td>11,797</td> </tr> <tr> <td>2008/2009</td> <td>18,805</td> <td>100%</td> <td>13,009</td> </tr> <tr> <td>2009/2010</td> <td>18,805</td> <td>100%</td> <td>10,218</td> </tr> <tr> <td>2010/2011</td> <td>18,805</td> <td>100%</td> <td>8,961</td> </tr> <tr> <td>2011/2012</td> <td>18,805</td> <td>100%</td> <td>9,277</td> </tr> <tr> <td>2012/2013</td> <td>18,805</td> <td>100%</td> <td>14,117</td> </tr> <tr> <td>2013/2014</td> <td>18,805</td> <td>100%</td> <td>12,499</td> </tr> </tbody> </table> <p>References:</p> <p>NSW Department of Primary Industries – Water (2017d), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>	Local Water Utility access licences within the Macquarie and Cudgong Regulated River Water Source				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2004/2005	18,145	100%	14,757	2005/2006	18,145	100%	15,008	2006/2008	18,145	100%	16,874	2007/2008	3,761	20%	11,797	2008/2009	18,805	100%	13,009	2009/2010	18,805	100%	10,218	2010/2011	18,805	100%	8,961	2011/2012	18,805	100%	9,277	2012/2013	18,805	100%	14,117	2013/2014	18,805	100%	12,499	Good All years
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Performance indicator	Related Plan objectives	Results	Strength of information			
<p>Change in economic benefits derived from water extraction and use</p>	<p>Support a sustainable regional economy</p>	<p>ABARES (2015) identifies there are many factors that impact on economic performance of the irrigation industry and few of these are affected by the Plan. Both ABARES (2015) and Aither (2017) identify that water trading has enabled irrigators and other water users to adapt to varying water availability, particularly during the Millennium drought. However, these are Murray–Darling Basin–wide conclusions.</p> <p><i>Water markets</i></p> <p>Aither (2017) found that “water markets are a fundamentally important tool for irrigated agricultural producers in New South Wales and are an increasingly important tool for regional urban water suppliers, environmental water managers, and investors as well. They are critical to driving improvements in productivity and efficiency in the NSW economy.”</p> <p>Aither (2017) summarised the water market in the Macquarie catchment since WSP implementation: “It is not possible to trade water in the Macquarie with other systems due to a lack of connectivity. Trade in the entitlement market is infrequent compared with other larger and more established markets in NSW. General Security is traded most frequently, while smaller amounts of High Security and Supplementary occur in some years. The allocations market is comparatively more active and mature than the entitlement market.”</p> <p>A summary of water trades and their value summarised from the <i>NSW Water Register</i> is provided below. A more detailed analysis of this data is available in Aither (2017).</p> <p>The annual volume of water allocation assignments (i.e. temporary trades) varied during the Plan term but has in general increased substantially since the commencement of the Plan.</p> <div style="background-color: #e0e0e0; padding: 5px;"> <p>Water Allocation Assignments and Volumes of Water traded within the Macquarie and Cudgegong Regulated Rivers Water Source</p> </div> <table border="1"> <thead> <tr> <th>Water year</th> <th>Share (units or ML)</th> <th>No. of Dealings</th> </tr> </thead> </table>	Water year	Share (units or ML)	No. of Dealings	<p>Market trading Good</p> <p>Economic benefits Poor</p> <p>Economic reports Not available</p>
Water year	Share (units or ML)	No. of Dealings				

Performance indicator	Related Plan objectives	Results				Strength of information
		2004/2005	10,231		164	
		2005/2006	49,210		271	
		2006/2008	40,806		324	
		2007/2008	6,280		112	
		2008/2009	16,305		149	
		2009/2010	31,444		193	
		2010/2011	106,236		219	
		2011/2012	202,302		224	
		2012/2013	296,862		498	
		2013/2014	106,658		391	
		<p>Similarly, the volume of term or permanent transfers varied (and peaked in 2010–2011 water year).</p>				
		<p>Water term transfers within the Macquarie and Cudgegong Regulated Rivers Water Source</p>				
		Water year	No of dealings	No of Shares	Weighted average (\$/per share) *	Total value of water traded #
		2004/2005	–	–	–	–
		2005/2006	10	19,598	\$1,433	\$86,000
		2006/2008	16	24,198	\$1,345	\$6,616,393
		2007/2008	12	6,237	\$1,231	\$7,396,695
		2008/2009	21	11,294	\$1,215	\$12,539,760
		2009/2010	49	68,000	\$1,315	\$88,600,240
		2010/2011	27	48,417	\$1,251	\$44,462,480

Performance indicator	Related Plan objectives	Results					Strength of information
		2011/2012	12	30,670	\$1,237	\$33,544,885	
		2012/2013	50	10,662	\$1,301	\$13,134,069	
		2013/2014	61	20,181	\$683	\$7,123,850	
		<p>* Total value of water traded divided by number of shares traded (excluding shares traded for \$0). Data taken from <i>NSW Water Register</i>. There may be other factors that impact this value that were not considered in the analysis.</p>					
		<p># Total value of water traded determined by multiplying volume of water traded by unit cost of transaction for each transfer recorded in the <i>NSW Water Register</i>. This information is then summed for each year. No post-processing of the Water register data was undertaken. There may be other factors that impact this value that were not considered in the analysis.</p>					
		<p>Aither (2017) identified an issue with users having small supplementary access licences without being set up properly to access their share during supplementary events. The licence holders have indicated they would like to sell these licences to other water users. While this is possible under the WSP, administrative challenges mean this does not occur in practice.</p>					
		<p><i>Irrigation industry</i></p>					
		<p>Economic reports specific to the Macquarie and Cudgegong Regulated Rivers Water Source are not available.</p>					
		<p>NSW Irrigators' Surveys provide the primary data for use in the socio-economic monitoring of the water sharing Plans in NSW. The Macquarie and Cudgegong Regulated Water Source was included in the 2006, 2010 and 2013 survey as the Central West catchment. In all the surveys, irrigators in the Central West catchment predominantly agreed that temporary water trading had been good for their area or 'both good and bad'; the proportion of irrigators believing that temporary trading was good for the area decreased over the evaluation period (NSW Trade & investment 2015; DPI Water 2011). These monitoring results are based on irrigator responses only and do not include comprehensive economic data.</p>					
		<p>The water use by irrigated enterprise is summarised from the survey reports below. Cotton accounts for the majority of water usage in the Central West; this</p>					

Performance indicator	Related Plan objectives	Results	Strength of information																												
		<p>amount decreased in 2010 during the drought period, and by the end of the evaluation period accounted for 92% of the water usage. Wheat increased to 30% in the 2010 survey then returned to a minimal amount by the 2013.</p> <table border="1"> <thead> <tr> <th colspan="4">Percentage water use for enterprise types from Irrigator's surveys</th> </tr> <tr> <th>Enterprise</th> <th>2006 survey</th> <th>2010 survey</th> <th>2013 survey</th> </tr> </thead> <tbody> <tr> <td>Cotton</td> <td>66.4%</td> <td>26.7%</td> <td>92.3%</td> </tr> <tr> <td>Hay</td> <td>9.1%</td> <td>0.8%</td> <td>0.2%</td> </tr> <tr> <td>Wheat</td> <td>10.9%</td> <td>29.9%</td> <td>0.2%</td> </tr> <tr> <td>Beef</td> <td>1.4%</td> <td>3.7%</td> <td>0.1%</td> </tr> <tr> <td>Other</td> <td>12.2%</td> <td>18.9%</td> <td>7.2%</td> </tr> </tbody> </table> <p>This data reflects the results presented by Aither (2017) using Australian Bureau of statistics data from 2007/08 and 2014–15. Volume of water applied for cotton increased from less than 10,000 ML in 2007/08 to almost 90, 000 ML in 2014/15.</p> <p>References:</p> <p>ABARES (2015), Ashton, D & Oliver, M 2015, <i>Irrigated agriculture in the Murray–Darling Basin: an economic survey of irrigators, 2012–13 to 2014–15</i>, ABARES research report 15.13, Canberra, December.</p> <p>Aither (2017) <i>Water markets in New South Wales: market outcomes, trends and drivers</i>, Report prepared for NSW Department of Primary Industries, Water NSW Department of Trade and Investment, Regional Infrastructure and Services (2015) <i>Monitoring economic and social changes in NSW water sharing plan areas Irrigators' Surveys 2009/2010 and 2013 – A state wide comparison</i></p> <p>NSW Department of Primary Industries, Office of Water (2011), <i>Monitoring economic and social changes in NSW water sharing plan areas: A comparison of irrigators' survey 2006 and 2010 – covering plans commenced in 2004</i></p>	Percentage water use for enterprise types from Irrigator's surveys				Enterprise	2006 survey	2010 survey	2013 survey	Cotton	66.4%	26.7%	92.3%	Hay	9.1%	0.8%	0.2%	Wheat	10.9%	29.9%	0.2%	Beef	1.4%	3.7%	0.1%	Other	12.2%	18.9%	7.2%	
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Performance indicator	Related Plan objectives	Results	Strength of information
		<p>NSW Department of Primary Industries, Office of Water (2010), <i>Environmental flow response and socio-economic monitoring Macquarie Valley – progress report 2009</i></p> <p>NSW Department of Primary Industries – Water (2017d), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>	
<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p>	<p>Protect the social values and benefits provided by the river system</p> <p>Recognise and respect Aboriginal cultural responsibilities and obligations to the landscape</p>	<p>No native title rights were established in the water source during the term of the Plan. Additionally, no Aboriginal Cultural Access licences have been issued within the Plan area.</p> <p>It is noted that although there are no specific strategies within the Plan that are directly related to the PI, the environmental water provisions make some contribution towards the preservation of cultural and heritage values where they coincide with environmental assets; however, there is no monitoring data available to support this contribution. The EWA is currently used to address environmental goals. Review of the EWA use rules may result in the addition of an Aboriginal cultural use.</p> <p>The DPI Aboriginal Water Initiative Program aims to improve Aboriginal involvement and representation in water sharing.</p>	<p>Good</p>
<p>Extent to which native title rights requirements have been met.</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced water has been made available and used for Aboriginal purposes.</p>	<p>Protect the social values and benefits provided by the river system</p> <p>Recognise and respect Aboriginal cultural responsibilities and obligations to the landscape</p>	<p>There are provisions in the Plan to provide access to water if native title rights over water are granted under the Federal Native Title Act 2003. No native title rights were established in the water source during the term of the Plan. Additionally, no Aboriginal Cultural Access licences have been issued within the Plan area.</p> <p>References:</p> <p>Native Title Determinations (National Native Title Tribunal): http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/default.aspx</p> <p>NSW DPI Water (2017d) – NSW Water Register: http://www.water.nsw.gov.au/water-licensing/registers</p>	<p>Good All years</p>

Performance indicator	Related Plan objectives	Results	Strength of information
<p><i>Additional PI identified:</i></p> <p>Change in surface water extraction relative to the long term annual average extraction limit (LTAAEL)</p>	<p>Maintain or enhance the ecological functions and values of riverine environments</p> <p>Support a sustainable regional economy</p> <p>Protect the social values and benefits provided by the river system</p> <p>Recognise and respect Aboriginal cultural responsibilities and obligations to the landscape</p>	<p>The LTAAEL for the Macquarie and Cudgegong Regulated Rivers is 392 GL/yr. This Plan Limit is the long-term average diversion, based on running the Plan Limit simulation model for the full period of simulation: 1st January 1890 to 30th June 2016. Note that the LTAAEL is approximately 9.5% below the long-term average MDB Cap, principally due to the additional environmental water created by the 1996 MMWMP.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the WSP, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate-adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. While these conditions do not vary on an annual basis, the Plan implies that they will be updated, and the model will be run on an annual basis. According to the implementation audit reports (DPI – Office of Water 2013a and 2013b), this annual assessment did not occur during the Plan term, because development conditions were not updated in the model on an annual basis.</p> <p>Nevertheless, the cumulative assessment has since been carried out in 2016 (Roberts and Hameed 2016). This assessment found that the Macquarie was under the LTAAEL.</p> <p>Annual diversion data is available from the NSW water register and is shown in the table below. However, as noted above, the figure cannot be used directly to assess LTAAEL compliance.</p>	<p>Good All years</p>

Performance indicator	Related Plan objectives	Results		Strength of information
		Water Year	Diversion (GL)	
		2004–2005	64	
		2005–2006	181	
		2006–2007	205	
		2007–2008	31	
		2008–2009	65	
		2009–2010	73	
		2010–2011	203	
		2011–2012	297	
		2012–2013	559	
		2013–2014	269	
		References:		
		NSW Department of Primary Industries – Water (2017d), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers		
		Roberts, S and Hameed, T. 2016, MACQUARIE VALLEY CAP AND WATER SHARING PLAN AUDITING, 2015/16, DPI Water Modelling Unit internal report.		

Appendix 6 – Macquarie and Cudgegong regulated river internal logic diagrams

Relationship diagrams show the internal Plan logic supporting the delivery of each of the Plan's outcomes. One diagram has been created for each of the economic, social / cultural and environmental outcomes. The diagrams show linkages from the Plan vision (green box) through the broad objectives (navy boxes) to the targeted objectives (blue boxes) and the rules (grey boxes). Where gaps in the program logic have been identified, these are shown as 'not specified' in a box of the appropriate colour. Gaps have been identified at the targeted objectives level in this evaluation.

The vision for this Plan is to provide water management in the Macquarie and Cudgegong Regulated Rivers Water Source that supports a healthy environment and a prosperous community

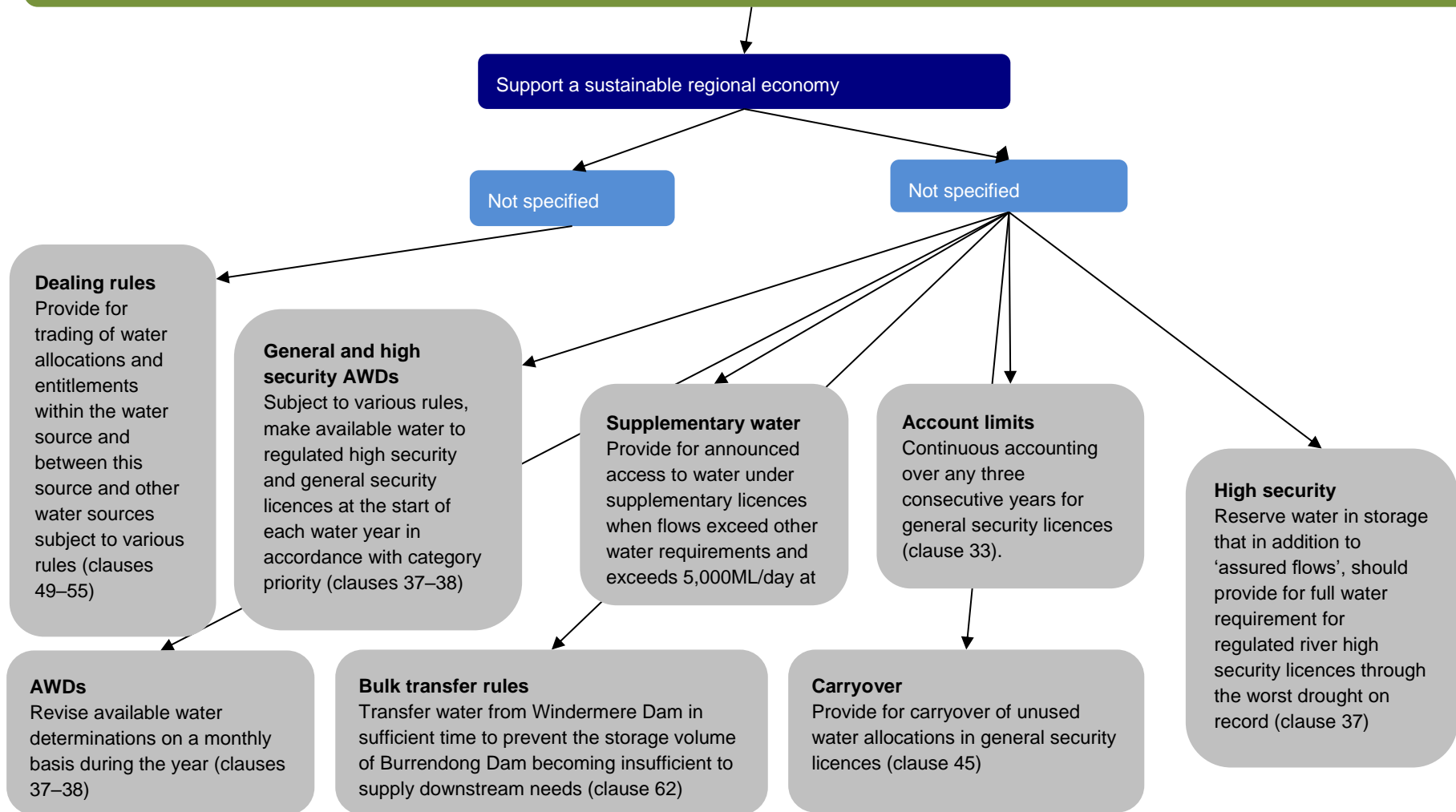


Figure 9: Economic internal logic relationship diagram

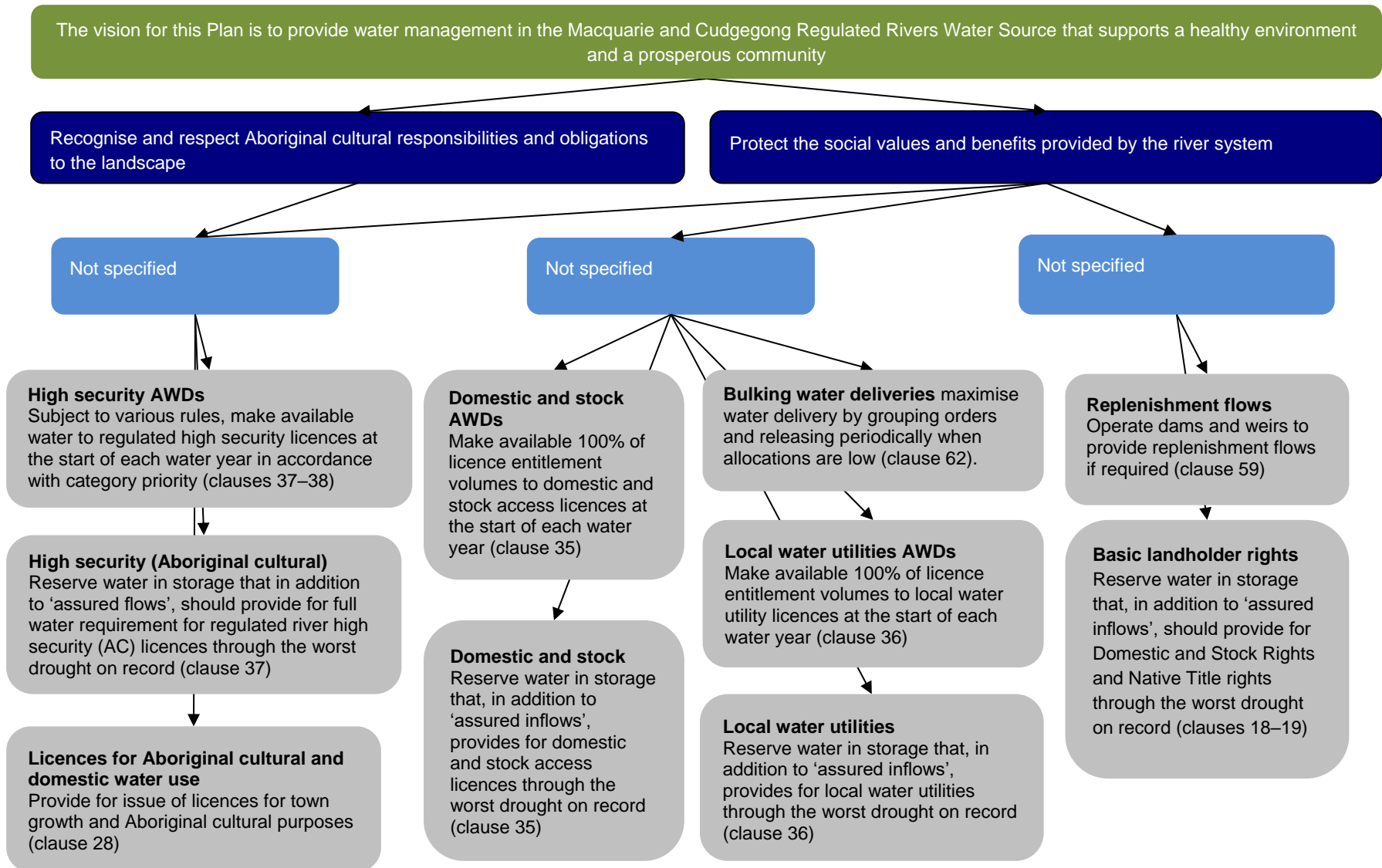


Figure 10: Social / Cultural internal logic relationship diagram

The vision for this Plan is to provide water management in the Macquarie and Cudgegong Regulated Rivers Water Source that supports a healthy environment and a prosperous community

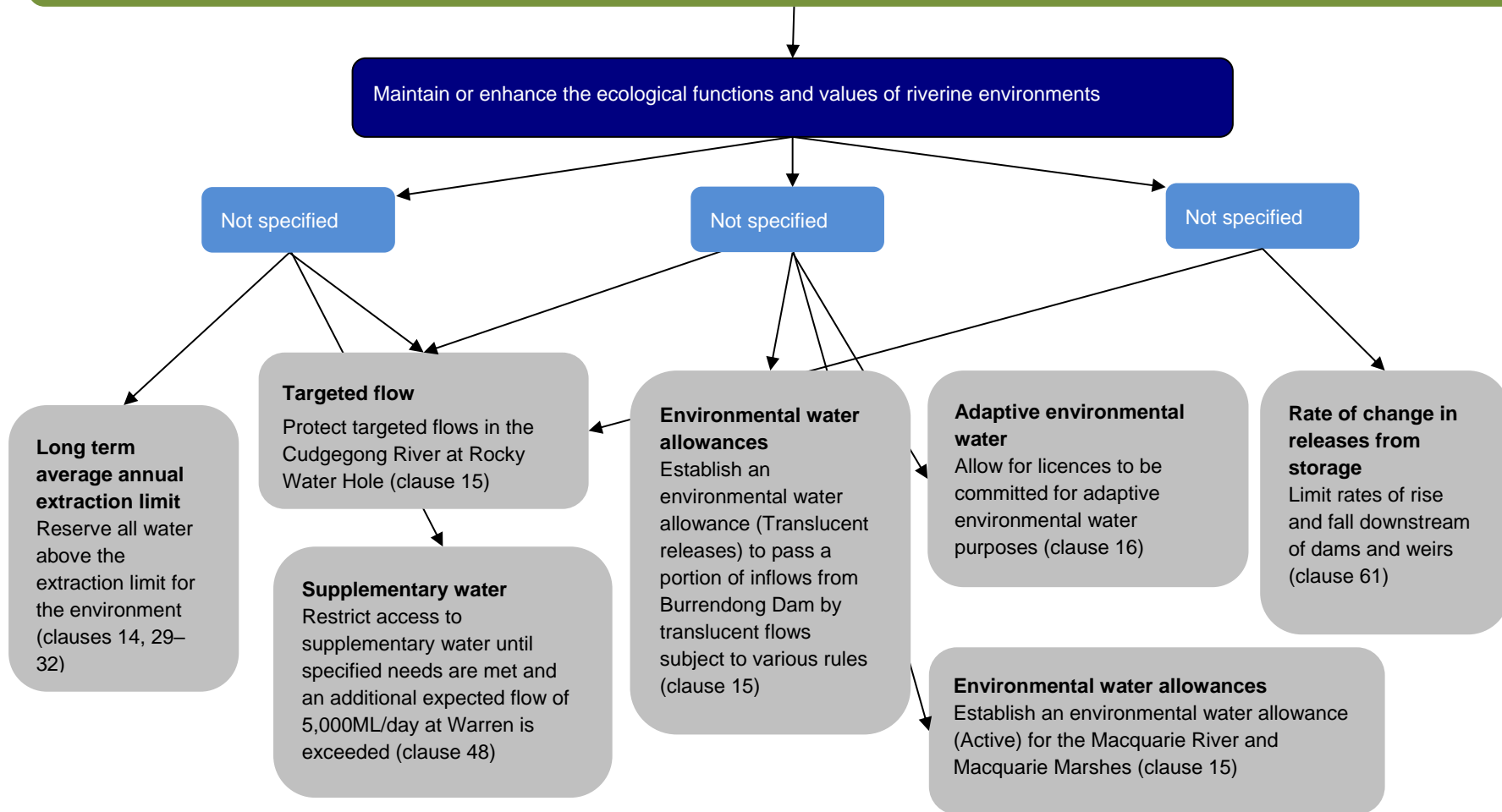








Figure 11: Environmental internal logic relationship diagram





Appendix 7 – NSW Border Rivers regulated river report card and performance indicator summary






Table 13: Appropriateness Report Card




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Plan scale	Is the scale of the Plan appropriate for water management?	Extent to which scale is appropriate for water sharing management	The geographic scale of the water source in the Plan is considered appropriate for water sharing management			
Plan scope	Is the scope of the Plan appropriate for water management?	Extent to which interactions with other water sources are addressed appropriately within the Plan or other water sharing plans	<p>The Plan's scope is considered appropriate.</p> <p>The Plan may benefit from a note indicating its interaction with relevant unregulated and groundwater water sharing plans.</p> <p>The Plan's scope is considered appropriate as interactions with connected water sources have been adequately addressed in the Plan or other relevant water sharing plans.</p> <p>The Plan clearly indicates how it relates to interstate water sharing and operational agreements with Queensland, for the Border Rivers, as well as the Interim North–West Unregulated Flow Management Plan that provides requirements for the downstream Barwon–Darling River.</p> <p>Environmental releases provided by the Plan are protected by</p>		Consider whether the Plan would benefit from a note consolidating how the Plan addresses flows to and from connected water resources.	Medium




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>limiting access to off-river pools or dams in connected water sources while the flows are occurring.</p> <p>The requirements of placement and depth of new or replacement bores, for deep alluvial aquifers and fractured rock aquifers, are specified in the adjacent plans of the Border Rivers water source to protect the water in the regulated river water source.</p>			
Prioritisation	Is the level of management required under the Plan appropriate for the risk to environmental, economic, or social and cultural values?	Extent of risk to dependent ecosystems, economic, and social and cultural values	<p>The Technical Advisory Panel appointed to provide advice to the former Border Rivers Flow Management Plan process assessed the Border Rivers as being in generally good condition. However, from experience in other catchments where there is a longer history of development, there is a possibility that the current levels of extraction, in the absence of good management practices and effective monitoring, could result in:</p> <ol style="list-style-type: none"> 7. deterioration in the condition of the riverine ecosystem; 8. riparian vegetation decline; 9. damage to threatened species habitat; 10. possible water quality decline; and 11. reduction in reliability of supply for both domestic and 			

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>stock users and licensed water users.</p> <p>The Plan has addressed the risk of unsustainable extraction from the water source through a Long-term Annual Average Extraction Limit (LTAAEL) and the establishment of planned environmental water.</p>			
		Extent to which risk is addressed	<p>Future risks are partially addressed through the application of the LTAAEL, water sharing arrangements that respond to variations in water availability and a flexible water market.</p>			
		Identified future risks, including climate change, change in industry base, etc.	<p>Future risks are partially addressed through the application of the LTAAEL and a flexible water market.</p> <p>The calculation of the limit uses the drought of record, which may not reflect future climate due to the impacts of climate change. In addition, changes to the industry base are not recognised</p>		Consider including analysis of climate change and changes in industry base to assess implications for water availability and water demands.	High
Internal logic	Is the vision appropriate for water management?	Whether the vision reflects what is intended for water sharing plans in the Act	<p>The vision is considered appropriate, as it is consistent with the Act's intent for water sharing plans to achieve economic, social and environmental outcomes</p>			

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
	Are the objectives suitable for water management?	Whether the objectives align with the vision	The objectives align with the Plan vision			
		Whether the objectives align with the principles and objects of the Act	The objectives align with the principles and objects of the Act			
		Extent to which the objectives are clear and comprehensive enough to reflect what the Plan intended to achieve	<p>The objectives are not clear and comprehensive enough to reflect what the Plan intended to achieve</p> <p>The objectives are broad and not targeted enough to link adequately to the strategies and then to the rules in the Plan. Some objectives do not have linking strategies but are addressed partly in the Plan rules (for example there are no specific strategies that link to the Plans objectives regarding the protection of Aboriginal, cultural and heritage values though the environmental water provisions aim to help protect cultural and heritage values</p>		Consider reviewing the Plan objectives to capture the full suite of intended outcomes identified in the Act, Plan, "Part A" document and other published material (see Internal Logic diagrams).	High
		Extent to which the Plan logic establishes SMART (Specific, Measurable, Attainable, Realistic, Time-bound) objectives	<p>The Plan logic fails to set objectives that align with the SMART criteria</p> <p>The objectives in the Plan are too broad and do not meet the Specific or Measurable components of the SMART criteria</p>		Consider whether the Plan logic should be reviewed to improve measurement of success.	Medium




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
<i>Internal logic continued</i>	Are the strategies suitable for water management?	Whether all Plan rules are linked to a strategy	All Plan rules link to a strategy		Consider reviewing the Plan to align objectives, strategies and rules	High
		Whether the strategies provide clear direction for the Plan rules	The strategies need to provide clearer direction for the Plan rules. The Plan strategies are vague and do not provide a link between the strategies and the expected outcomes of the rules.			
		Whether the strategies align with the objectives	Not all strategies align with the objectives. Current strategies describe the Plan structure only and do not clearly align with the Plan objectives. This is important as the Act requires performance indicators (PIs) to be used to assess Plan strategies.			
	Are the performance indicators suitable for water management?	Whether the performance indicators align with the objectives and strategies	The PIs do not align with the Plans Objectives.		Consider reviewing the PIs to align with the Objectives of the Plan.	High
		Extent to which performance indicators are clear and comprehensive enough to measure what the Plan intended to achieve	All PIs are clear but not comprehensive. Additional information is needed in the PIs to evaluate the performance of the Plan (example: PI (a) is looking for a change in ecological condition of this water source and dependant ecosystems, additional information defining what a			


Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			change in ecological condition is, is necessary to evaluate the performance of the Plan)			
Quality of Supporting Documentation	Is documentation explaining the decisions underpinning the Plan available?	Adequacy of documentation supporting the Plan	<p>The Plan has a comprehensive “Part A” document supporting Plan development which is available internally. A similar background document dating from Plan commencement is available on the Department’s website.</p> <p>A range of documents are also available that support Plan implementation.</p>			
<i>Quality of Supporting Documentation continued</i>		Extent to which documentation is made available to the public	<p>The “Part A” document was available publicly during the Plan’s initial exhibition period but is no longer publicly available as it has since been updated. The updated background document dating from Plan commencement is available on the Department’s website.</p> <p>General Purpose Water Accounting Reports are available on the DPIE website.</p> <p>The Plan Implementation Audit report is not yet publicly available</p>		Consider making the Plan Implementation Audit Report publicly available once finalised.	Low
Communication	Is the process for communication with stakeholders adequate?	Extent of communication and processes supporting Plan development	<p>Extensive consultation was carried out during Plan development, with the Border Rivers Regulated River Management Committee</p>			

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			(BRRRMC) meeting to explore issues and develop management strategies. The Plan was placed on public exhibition.			
		Communication arrangements in place during Plan operation	<p>Communication has been appropriate; however recent community feedback suggests that a more formalised ongoing communication protocol is required.</p> <p>Generally, communication was on an as needs basis during drought periods, frequent discussions were held with water users. A series of annual General-Purpose Water Accounting Reports are available on the DPIE website (DPI Water 2017b).</p>		Consider developing a communication Plan that serves the needs of the community (with reference to the communication role of WaterNSW).	Medium
		Arrangements for consideration at term review of Plan	<p>Sufficient opportunity will be provided for communication during the water resource plan development process</p> <p>Consultation will involve opportunities to make submissions, and face to face meetings will be held with stakeholders.</p>			
Alignment with state priorities for natural resource management plans (S43A)	Is the Plan aligned with state priorities for natural resource management?	Extent of alignment of Plan with state priorities	The NRC will in 2017 review the extent to which the Border Rivers Regulated River Water Sharing Plan materially contributes towards the achievement of the State		Consider reviewing the alignment of the Plan objectives with state priorities for natural	High



Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>priorities for natural resources management (NRC 2017).</p> <p>It is recommended that DPIE review alignment of the Plan objectives with state priorities.</p>		<p>resource management during the development of the Water Resource Plan</p>	






Table 14: Efficiency Report Card







Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Environmental water provisions	Planned environmental water	Was all water above the extraction limit protected?	Water above the LTAAEL was protected except for in the 2009/2010 water year when a debit of 1 ML was carried forward for the general security A access licence category.			
		Were minimum daily flow requirements, of 10 ML from Pindari Dam met?	Minimum daily flow requirements were always met when required. 2010–2011 – minimum daily flows were not required. This rule was in place prior to the commencement of the Plan. Although the Pindari Dam work approval did not commence until November 2010, the rule was implemented during 2009/10.			
		Were translucency releases implemented according to the Plan rules?	Translucency releases were not always implemented according to the Plan rules (Cl. 12(d)&(e)). 2009–2010: Translucency release rules were partially implemented during the first year of the Plan. There were several occasions in the June – August and September – May periods where the translucent flow rules were not implemented, however the Pindari Dam work approval did not commence until November 2010, in the second year of the Plan.		Endeavour to discuss the implementation of translucent releases from Pindari Dam with WaterNSW with the view to ensuring consistency between operational practice, the Plan and the Work Approval.	High






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>There have been several small breaches of translucency release conditions each year usually in the June – October period. In June 2013 translucent releases were not made as the Plan indicates and WaterNSW reported this as non-compliance in their water supply work approval annual compliance report.</p> <p>Real time data was not available to aid in rule implementation and events where requirements were not met occurred in low flows, where the daily inflow calculation can be unnaturally sporadic. In these circumstances constantly changing the release rate in the dam to match the calculation is not practical.</p> <p>WaterNSW applies monthly averaging and an 80% target to translucency release rules, consistent with other WaterNSW works approvals in relation to delivery of environmental water. These are operational practice and not strictly consistent with the Plan.</p>			
		Were Stimulus Flows (SFs) released from Pindari Dam?	<p>SFs were released when required.</p> <p>Although the work approval for Pindari Dam did not commence until November 2010 in the second year of the Plan, the account for the SF</p>		Consider reviewing the Plan to align the Stimulus Flow account keeping rules with current accounting practice and establish an account limit of	Medium







Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>was established prior to Plan commencement.</p> <p>2009–2010: the SF was not released, due to wet conditions (4,000 ML was carried over to the 2010–2011 period).</p> <p>2010–2011: the SF was not released, due to wet conditions (8,000 ML was carried over to the 2011–2012 period).</p> <p>2011–2012: the SF was not released, due to wet conditions (8,000 ML was carried over to the 2012–2013 period).</p> <p>2012–2013: A SF release occurred on the 2nd of December 2012 (outside of the Plan commencement period). 8,000 ML was released from the SF account and was supplemented by 859 ML of Commonwealth held environmental water.</p> <p>The flow was delayed due to concerns regarding a platypus breeding event and to enable the SF volume to be combined with other environmental water.</p> <p>The Plan does not establish a formal environmental flows reference group as in other regulated plan areas. Decisions relating to SF releases are made by DPIE in consultation with WaterNSW.</p>		8,000 ML (limiting carryover).	




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>2013–2014: 4,000 ML was credited to the SF account at the beginning of the 2013 water year and was released in August 2013. The SF was supplemented by 4,000 ML of Commonwealth held environmental water.</p> <p>Although the Plan specified accounting rules have been implemented, they are not particularly clear and would benefit from amendment to align with current account keeping protocols. Specifically establishing an Account Limit of 8,000 ML (rather than an implied limit), allowing Unlimited Carryover, and allowing an Annual Stimulus Credit of up to 4,000 ML.</p>			
		Were SFs and translucent releases protected from extraction downstream of Pindari Dam to the confluence of the Severn River and Frazers Creek?	As minimal extraction occurs between Pindari Dam and Frazers Creek, no formal process has been required to implement this clause to date.			
		Was a minimum uncontrolled flow of 100 Megalitres per day protected downstream of the Plan at the Barwon River at Mungindi, as outlined	This minimum flow was protected between September and March of each water year as required by the WSP.			






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		in the NSW–Queensland IGA?				
	Adaptive environmental water	Is there a process for licences to be committed for adaptive environmental purposes?	The Plan has the necessary processes in place to commit licences for AEW.			
		Were AEW Use Plans developed?	There are no AEW conditioned access licences in the Plan area, but there is a management process available should it be required.			
		Were there additional licences created and AEW conditioned as a result of water savings within the water source?	<i>Same as above</i>			
Basic Landholder Rights	Domestic and Stock	Were domestic and stock basic landholder rights (BLR) provided for within the Plan?	The Plan identified the water requirements for domestic and stock BLR within the regulated Borders River and provides water to be supplied for these purposes through storage in Pindari and Glenlyon Dam.			
		Is domestic and stock BLR growth provided for within the Plan?	The Plan recognises that demand may increase and provides that AWDs cannot be made until BLR reserves are provided for.			




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Was the water supply managed to ensure sufficient reserves for domestic and stock BLR were maintained?	Water was managed to ensure sufficient reserves for domestic and stock BLR were maintained			
		Were domestic and stock BLR provided for in water delivery operating protocols?	Domestic and stock rights were provided for throughout the life of the Plan.			
		Were replenishment flows delivered when required to satisfy domestic and stock needs, subject to water availability?	Replenishment flow requirements were met when required. Replenishment flows were not required during 2010–2012			
		Are domestic and stock BLR consistent with Reasonable Use Guidelines?	BLR Reasonable Use Guidelines are available in draft form. There is no audit or monitoring information to assess whether use is consistent with these draft guidelines.		Endeavour to finalise and publish the BLR Reasonable Use Guidelines	Medium
	Native title	Were native title BLR provided for within the Plan?	Procedures are in place to provide access if native title rights are granted in the water source covered by this Plan. Note: No native title rights for water have been established in this Plan area.			
		Is growth in native title BLR protected within the Plan?	The Plan recognises that demand may increase and provides that AWDs cannot be made until BLR reserves are provided for.			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Rules for granting access licences	Granting new access licences	Were Plan rules followed for the granting of access licences?	All access licences granted were in line with the Plan provisions. The Water Management (General) Regulations 2004 and 2011 set out specific purpose access licences and application conditions.			
Limits to the availability of water	Extraction limits	Was an extraction limit established?	An extraction limit was established for this water source.			
		Was the long-term average annual extraction assessed against the long-term annual average extraction limit at the end of each water year?	The annual extraction has been assessed against the LTAAEL each year as required. Whilst the assessment process has been undertaken annually, not all model input data used in the assessment has been updated. However recent work for the Healthy Floodplains Project suggests the model remains applicable.		Consider reviewing the approved model to make sure input data is still applicable and to update input data as necessary.	High
	Variation of extraction limits	Were extraction limits varied?	No changes to the extraction limits have been required.			
	LTAAEL compliance	Was LTAAEL exceeded?	The GS 'A' licence category exceeded the allocation limits in 2009–2010 which carried forward a small debit of 1 ML. There were small numbers of overdrawn GS accounts each year. When assessed as an account type rather than at the individual account level, GS 'A' and 'B' are within allocated limits.		DPIE and WaterNSW to consider a review of accounting practise and tools.	Medium


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Was extraction managed within LTAAEL?	No adjustments to the maximum AWD limits set in the Plan have been needed.			
	AWDs	Were AWDs for all categories of licences calculated and announced in line with Plan provisions?	AWDs for all categories of licences were calculated and announced in line with the Plan provisions. Although the Plan does not establish GS licences, an AWD was issued in 2009–2011, so that an incorrectly created access licence of this licence category could access allocations. The anomalous licence has since been corrected, so GS AWDs are no longer required.			
Rules for managing access licences	Water allocation and account management	Were water accounts established for all licences?	Water allocation accounts were established for all licence holders.			
		Were accounts managed in accordance with the Plan rules?	Accounts have been managed in line with the Plan rules.			
	Carryover provisions	Was carryover managed in accordance with the Plan rules?	Rules relating to the carryover of balances in water allocation accounts from one year to the next were applied throughout the account system.			
	Extraction conditions	Were the general priority of extraction conditions set out in	General priorities of extraction conditions set out in the Plan were complied with at all times.			


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		the Plan complied with?				
		Were numerically specified extraction components introduced by amending water access licences e.g. in relation to times, rates or circumstances that water may be taken?	Numerically specified extraction components were not required to be introduced.		Consider establishing a state-wide policy for the establishment of numerical extraction components. Numerical extraction components to be implemented where required ensuring clearly specified water access licences.	Medium
	Supplementary water	Were supplementary water announcements made in accordance with Plan requirements?	Supplementary water announcements were made in accordance with the Plan requirements. However, rules relating to limits on extraction rates and direct water use were implemented via supplementary announcements. They were not applied as mandatory licence conditions as the Plan specifies		Further review of mandatory conditions on work approvals may be required to ensure they have all been correctly applied. Refer the issue to the NSW DPIE Condition Reform Project	High
		Were individual supplementary events managed in accordance with Plan rules and targets?	Individual supplementary events were managed in accordance with the Plan rules and targets.			






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Did supplementary water users comply with Plan rules?	Access to water by supplementary water users (when announced) complied with the Plan rules.			
Dealings	Minister's dealing principles	Were dealings in line with the Minister's dealing principles, the Act and the Plan?	All dealings have been in line with the Minister's dealing principles.			
	Constraints within water source	Were dealings in line with rules relating to constraints within the water source?	Trade constraints have been implemented as per Plan rules.			
	Change of water source	Were dealings in line with rules relating to change of water source?	The only change of water source permitted under the Plan and the Minister's dealing principles is from a regulated to an unregulated water source within the Border Rivers Water Management Area. These dealings are subject to a conversion factor that was not established by the Minister during the audit period.		<i>See below</i>	<i>See below</i>
		Were conversion factors established when required?	Conversion factors were not established. The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (ACCC 2009 and ACCC 2010) recommended that conversion factors not be established due to		Refer the issue to the DPIE Trade Review for resolution parallel with Murray–Darling Basin Plan, 2012 trade rules compliance.	High





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			the potential impact on reliability of other licences.			
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water source?	<p>Procedures are in place to convert access licence category should applications be received. However, a conversion factor has not been established.</p> <p>One D&S access licence was converted to a HS access licence as per Plan rules.</p>		See next	See next
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water source?	<p>Conversion of access licence category dealings that do not require conversion factors are possible.</p> <p>One D&S access licence was converted to a HS access licence as per Plan rules.</p> <p>Conversions of access licence category dealings are not possible where conversion factors are required as the factors have not been established.</p>		See next	See next
		Were conversion factors established when required?	<p>Although conversions of access licence category are permitted, a conversion factor was not established by the Minister during the audit period.</p> <p>The ACCC in their position paper on Water Trading Rules (ACCC 2009 and ACCC 2010) recommended that conversion factors not be established due to the potential</p>		Refer the issue to the DPIE Trade Review for resolution in parallel with Basin Plan 2012 trade rules compliance.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>impact on reliability of other licences. DPIE is reviewing trade between regulated systems including conversion factors with the introduction of the Basin Plan 2012</p>			
		Were Interstate trades in water allocation assignments allowed in line with Plan rules?	<p>Interstate trades in water allocation assignments have been allowed in line with Plan rules.</p> <p>Most assignments are from NSW to Queensland with very few in the reverse direction.</p> <p><i>Note: There are still some significant issues in trading between NSW and Queensland requiring resolution. In some circumstances Queensland deals with trade differently to NSW which results in inconsistencies in trade data.</i></p>		Endeavour to continue working with Queensland to improve trade compatibility and resolve issues and inconsistencies.	Medium
		Have interstate WSW nominations been allowed in line with Plan rules and accounted for by tagging entitlements to interstate extraction sites?	<p>Tagging of NSW access licences to QLD extraction points was implemented when tagging procedures became available during 2011 to 2012.</p> <p>Tagging of NSW access licences to QLD extraction points was not available for the first two years of the Plan because arrangements and procedures were being developed.</p> <p>Tagging procedures became available in 2011/2012 with most activity occurring during the</p>		Endeavour to continue to refine the Licensing system to capture all data	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>2011/2012 and 2012/2013 water years.</p> <p>Tagging of QLD water licences to NSW works approvals is administered through QLD processes, although some of this information is also recorded in the NSW Licensing system.</p> <p><i>Note: There are still some significant issues in trading between NSW and QLD requiring resolution. In some circumstances QLD deals with trade differently to NSW which results in inconsistencies in trade data</i></p>			
Mandatory conditions	Access licence conditions	Were mandatory conditions for access licences placed on licences?	<p>Most mandatory conditions required by the Plan were placed on access licences during the licence conversion process from the WA 1912 to the Act at Plan commencement.</p> <p>The audit process reviewed a small number of access licences of each category within the Plan area. During the audit process a number of anomalies were identified.</p> <p>GS 'A' and GS 'B' access licences are required to have a mandatory condition limiting the volume that can be taken in any water year to 1ML/unit share. This is also implemented in account limits. The licences sampled have a take limit of 1.25ML/unit share and are limited to 3ML/unit share in any</p>		Further review of mandatory conditions on access licences is required to ensure they have all been correctly applied. Refer the issue to the NSW DPIE Condition Reform Project	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>consecutive 3–year period. This resulted from rules relating to carry over limits being incorrectly included in the Plan when made. These rules were corrected via amendment in 2013 however the related mandatory licence conditions have not been updated.</p> <p>Licences specifying water supply works in QLD are required to have an extra mandatory condition (normally applied to NSW work approvals) which relates to the provision of data. The licences include a provision to supply water data, but not the extra data specified in the Plan.</p>			
	Water supply works approvals	Were mandatory conditions for works approvals placed on the works approvals?	<p>Most mandatory conditions required by the Plan were placed on work approvals during the licence conversion process from the WA 1912 to the Act at Plan commencement. One condition was not applied but was implemented through another mechanism.</p> <p>The audit process reviewed a small number of work approvals within the Plan area. During the audit, the following anomaly was identified.</p> <p>Work approvals associated with a small group of licences are required to have a mandatory condition specifying maximum extraction rates and direct water use. These</p>		Further review of mandatory conditions on work approvals may be required to ensure they have all been correctly applied. Refer the issue to the NSW DPIE Condition Reform Project	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			conditions have not been applied to the work approvals sampled. The conditions have been implemented through inclusion in supplementary announcements.			
System Operation rules	Replenishment flows	Were replenishment flows provided in accordance with the Plan?	Replenishment flows were provided when required.			
		Was the water supply managed to ensure sufficient reserves for replenishment flows were maintained?	The water resource assessment process incorporates calculations for replenishment flow requirements.			
	Water delivery and channel capacity constraints	Were initial estimates of maximum water delivery and operating channel capacity updated?	No maximum channel capacity or maximum regulated rate has been determined during the audit period.		Consider reviewing both the Plan and the Pindari Dam work approval to clarify the process for determining channel capacity constraint	Medium
	Rates of change to releases from storages	Was an operating protocol for the management of rates of change to releases from Pindari Dam developed?	A draft rate of change to releases operating protocol for Pindari Dam was put in place in Oct 2012. Further development of the rate of change to releases protocol is required to fully address the Plan provisions.		Endeavour to progress the development of the rate of change of releases operating protocol for Pindari Dam with WaterNSW.	Medium
	Supply of orders when remaining	Were water orders grouped for release	Allocations did not fall low enough to trigger these			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	allocations are low	when supplies were low?	provisions during the audit period. Procedures are in place should these provisions be required in the future.			
	Dam operation during floods and spills	Were rules for operating Pindari Dam and Glenlyon Dam in floods and spills followed?	Protocols were followed for Pindari Dam operations during flood and spill events. Pindari Dam spilled from Sept 2010 for most of the remainder of the water year and then again intermittently from August 2011 until March 2012. Glenlyon Dam spilled between Dec 2010 and Feb 2011 and again from Oct to Dec 2011. <i>Note: The Plan specifies both Pindari and Glenlyon Dams in this section. Glenlyon is located in QLD and not managed by NSW processes.</i>			
Plan Amendments	Changes to the water source	Were any changes to the water source required?	No changes have been made to the water source.			
	Other amendments (Supplementary water)	Were changes to supplementary water rules set out in the Plan required?	No changes have been made to supplementary water as set out in the Plan.			
	Amendments relating to planned environmental water (made	Were any changes required to planned environmental water rules?	No changes allowed for in this Plan have been made to the environmental water provisions.			






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	under s.8A of the WMA 2000)					
	Amendments relating to floodplain harvesting	Were any changes made to water sources or Plan provisions to provide for floodplain harvesting?	No changes to the water source or Plan provisions have been made to provide for floodplain harvesting licences			



Table 15: Effectiveness Report card

Plan objectives	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
Manage this water source to ensure equitable sharing of water between all uses	<p>Extent to which domestic and stock requirement have been met</p> <p>Extent to which local water utility and major utility requirements (where major utilities are involved in urban water provision) have been met.</p> <p>Extent to which native title rights have been met.</p>	<p>Throughout the duration of the Plan water was shared between all water uses, including the environment, according to the priority of access provided in the Plan.</p> <p>Local water utilities received 100% allocations since the commencement of the Plan.</p> <p>While no native title rights for water were established in the Plan area during the term of the Plan, the Plan makes provision for these requirements.</p>		Good	<i>See recommendation under efficiency with respect to clarity of arrangements and constraints in drought circumstances</i>	
Implement environmental flow rules that protect, maintain and enhance the environmental, cultural and heritage values of this water source	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in moderate to high flow regime,</p> <p>Change in water quality in this water source</p> <p><i>Additional PI identified</i></p> <p>Change in low flow regime</p> <p>Change in surface water extraction relative</p>	<p>The evaluation has been unable to find that the Plan has been effective, nor ineffective, in achieving this objective over the 2009–2016 period.</p> <p>The Plan was developed with an understanding that detrimental effects on the condition of water– dependent ecosystems and water quality in the Border Rivers had resulted from significant changes to the flow regime as a result of surface water development.</p> <p><i>Ecological condition</i></p> <p>There is limited monitoring information available to assess the changed in</p>		Moderate	<p>Endeavour to develop clearly defined PIs and an associated performance monitoring programs that closely align with the Plan objectives and strategies.</p> <p>Consider investigating further refinement of environmental rules and their operation</p>	High

Plan objectives	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	to the long term annual average extraction limit	<p>ecological condition of the water source and dependent ecosystems.</p> <p>Some Integrated Monitoring of Environmental Flows (IMEF) studies showed the potential for flows to improve fish spawning events and algae growth. The overall ecosystem condition of the catchment in the Sustainable Rivers Audit 2 (2008–2010) was rated as poor health. This includes poor ratings for fish and vegetation condition.</p> <p><i>Change in flow regime</i> Analysis of flow regime shows that the Plan PI assessment criteria were not achieved compared to the baseline the Plan target. This was the case for number of days below 95th percentile and 80th percentile, as well as number of days above 30th, 15th and 5th percentile. In all cases, the exceptions were the years 2010/11, 2011/12 and 2012/13, which were associated with drought breaking floods, and in some cases 2013/204 and 2015/2016.</p> <p><i>Water quality</i> Water quality in the Border Rivers has been found to be predominantly moderate to good in the 2007–2012 period. However, with no pre–Plan comparison available, it is not possible to make a finding as to the</p>			<p>to enhance environmental outcomes without impacting economic or social outcomes and in the context of contemporary environmental water governance. (see efficiency recommendations).</p> <p>Consider the design of monitoring programs to attempt to clearly differentiate between Plan rules / implementation and other external factors.</p>	

Plan objectives	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>effectiveness of the Plan with respect to its water quality objectives.</p> <p><i>Change in extraction relative to limit</i> The Plan has been effective in preventing increase in extraction, since extraction data shows compliance with the limit. However, note that there are many external factors that will also have contributed to this outcome, including the significant program of water access licence acquisition by State and Commonwealth for environmental use.</p> <p>It can reasonably be concluded that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because the many external factors influencing the condition of the Border Rivers water source. These external factors include the significant State and Commonwealth acquisition of water entitlements for environmental use, which was enabled by the Plan's creation of tradeable water access licences, but was not an objective, strategy or rule of the Plan.</p>				

Plan objectives	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
Maintain and where feasible improve the flow related water quality in this water source	<p>Change in ecological condition of this water source and dependent ecosystems,</p> <p>Change in moderate to high flow regime,</p> <p>Change in water quality in this water source</p>	<p>Water quality in the Border Rivers has been found to be predominantly moderate to good in the 2007–2012 period. Poor results compared to basin targets were identified for turbidity and nutrient loads in the upper reaches.</p> <p>However, with no pre–Plan comparison available, it is not possible to make a finding as to the effectiveness of the Plan with respect to its water quality objectives.</p> <p>IMEF studies found that environmental water can assist in suppressing toxic algal blooms.</p>		Moderate	<i>See above.</i>	–
Manage this water source to preserve and provide for basic landholder rights	<p>Extent to which BLR requirements have been met</p>	<p>BLR were provided at all times since the commencement of the Plan, with full access for BLR provided.</p> <p>Priority of access was managed such that the requirements of the Act were maintained, and the system managed in such a way to ensure maintenance of supply as required by the Plan.</p> <p>Domestic and stock access licences received 100% allocations since the commencement of the Plan.</p> <p>While no native title rights for water were established in the Plan area during the term of the Plan, the Plan makes provision for these requirements.</p>		Good	<i>See recommendation under efficiency with respect to clarity of arrangements and constraints in drought circumstances</i>	–

Plan objectives	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
Manage this water source to preserve and enhance cultural and heritage values	<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p> <p><i>Additional PI identified</i> Extent to which native title rights have been met.</p>	<p>No native title rights have been granted within the water sources and no licences have been issued for Aboriginal cultural purposes.</p> <p>There are no specific strategies within the Plan that are directly related to the objective, although the Plan recognised environmental water provisions were likely to make some contribution towards the preservation of cultural and heritage values.</p> <p>There is little information available on the social impacts of the Plan on communities within the Plan area.</p> <p>The Plan has not provided cultural outcomes for Aboriginal communities with no real evidence of the Plan being able to influence outcomes relating Aboriginal spiritual, social and customary values.</p> <p>Given the potential linkages between cultural and heritage values and environmental assets the use of the Stimulus Flow may support the achievement of this objective.</p>		Poor	Consider establishing Aboriginal Social and Cultural objectives and PIs that are directly linked to values of water to Aboriginal people.	High
Provide a market based trading of surface water entitlements in this water source	Change in economic benefits derived from water extraction and use	Key drivers of annual changes in farm incomes include changing commodity prices, costs of farm inputs, and varying seasonal conditions and irrigation water availability ABARES (2015). The Plan has almost no effect on most of these,		Good	Consider clearer identification of SMART objectives (using program logic) and PIs, related to the Plan	High

Plan objectives	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>except for being one factor in irrigation water availability.</p> <p>The introduction of the Plan, along with a range of other reforms, played a key role in enabling water trade (Aither 2017), as well as enabling water users to gain improved control over managing their exposure to risk around their water account and portfolio (e.g. through measures such as carryover and allocation (AWD) rules).</p> <p>The trading framework provided opportunities for ecologically sustainable market based trading of entitlements, demonstrated by the increase in number and volume of both water allocation and entitlement trades in the water source since the commencement of the Plan. The most significant value of water traded in a water year was during the breaking of the drought in 2011/2012. Since trading commenced in 2010/2011, the largest volume of water entitlements permanently traded occurred in 2015/2016, while allocation assignments peaked in 2010/2011 within the water source, and in 2013/2014 for assignment trades into and out of the water source.</p> <p>Over the evaluation period, there has been a significant growth in water use</p>			<p>rules and differentiated from external factors, to the extent possible.</p> <p>Consider establishing a fit for purpose monitoring, evaluation and reporting program based around the previous recommendation.</p>	

Plan objectives	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>by the cotton industry, demonstrating a move to higher value crops.</p> <p>While it can be reasonably concluded that the Plan contributed to provide a market based trading of surface water entitlements in this water source, these changes cannot be clearly differentiated in economic data from pre-existing water reforms in the 1980s and 1990s, as well as broader economic, social and climate factors.</p>				

Table 16: Performance indicator results summary

Performance indicator	Related Plan objectives	Results	Strength of information
<p>Change in ecological condition of this water source and dependent ecosystems</p>	<p>Implement environmental flow rules that protect, maintain and enhance the environmental, cultural and heritage values of this water source</p>	<p><i>Pindari fish monitoring projects</i></p> <p>Wilson & Ellison (2010) completed a four–year study on spatial and temporal patterns in the distribution of fish early life history stages between the Severn, Mole and Macintyre rivers from 2005 to 2009 when the draft Plan had been developed. Preliminary analyses of the fish monitoring project downstream of Pindari Dam suggest that flow management can have significant implications for fish spawning. Flow conditions appear critical to the structuring of larval assemblages, while chemical and/or benthic conditions appear to be more important for post–larval stages.</p> <p>A study by Grows (2008) focused on the use of river flows by two vulnerable native fish species, the Eel–tailed catfish and Murray Cod, as both species use flowing water in their juvenile stages to disperse from spawning areas. Results indicated that juveniles for both fish species drifted mainly in November in the Border Rivers with limited drift in December and January for catfish and in October for cod. Therefore, it was recommended that river flows need to be maintained from late spring through to summer to ensure adequate dispersal of juvenile fish.</p> <p>A 6000ML stimulus flow occurred in October 2015. Although DPI Fisheries monitored fish outcomes from this release (pre and post the watering event), the data has not been analysed yet and the results will be available after this evaluation report has been completed (Anthony Townsend pers. comm., DPI Fisheries, 26 May 2016). The outcomes of this monitoring will be used to inform plan evaluation at the end of its ten–year plan cycle.</p> <p><i>Pindari benthic algae monitoring project</i></p> <p>Flows from Pindari Dam provided by stimulus rules are unlikely to alter periphyton (algae attached to rocks) communities greatly at below 1,000 megalitres per day. However, if stimulus flows are increased (to above 2,000 megalitres per day) or are piggy– backed onto unregulated tributary flows, there is likely to be a positive change in periphyton communities towards early– successional–stage species. The impact of different drying times on periphyton</p>	<p>Poor</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>was assessed to determine whether drying of the river may be a suitable technique for periphyton resetting. (DPI Water 2011)</p> <p><i>Sustainable Rivers Audit</i></p> <p>The Sustainable Rivers Audits (SRA) in 2004–2007 and 2008–2010 (MDBC 2008; MDBA 2012) provide some information on the overall condition of the Border Rivers catchment; this assessment covers the whole catchment not just the NSW component.</p> <p>The Border Rivers river ecosystem was rated in poor health. The Fish community of the Border Rivers was rated in poor to moderate condition and macroinvertebrates were rated as moderate condition for both audits.</p> <p>Vegetation was only included in the Sustainable Rivers Audit 2 (2008–2010). The riverine Vegetation of the Border Rivers river system was rated in poor condition. Valley-wide abundance in both the near riparian and lowland floodplain domains shows a large difference from reference.</p> <p><i>Other studies</i></p> <p>During October 2012, an 8,000 ML stimulus flow did not appear to degrade stream bed and bank stability, although the influence of this flow on platypus breeding was unresolved (Foster 2013).</p> <p>There continue to be gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Border Rivers Regulated Rivers Water Source.</p> <p>References:</p> <p>DPI Office of Water (2011) <i>Environmental flow response and socio-economic monitoring. Border Rivers – progress report 2009</i>, Department of Environment, Climate Change and Water</p> <p>Foster, N. (2013) Pindari Dam Stimulus Flow – An Assessment of the December 2012 Release. NSW Department of Primary Industries, Office of Water, Sydney. Unpublished report.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information															
		<p>Growns, I. 2008 The influence of changes to river hydrology on freshwater fish in regulated rivers of the Murray–Darling basin. <i>Hydrobiologia</i>, 596, 203–211.</p> <p>Murray–Darling Basin Authority (2012), Sustainable Rivers Audit 2 The ecological health of rivers in the Murray– Darling Basin at the end of the Millennium Drought (2008–2010)</p> <p>Murray–Darling Basin Commission (2010) Sustainable Rivers Audit, SRA Report 1 A report on the ecological health of rivers in the Murray–Darling Basin, 2004–2007 Prepared by the Independent Sustainable Rivers Audit Group for the Murray–Darling Basin Ministerial Council</p> <p>Wilson, G.G. & Ellison, T.L. 2010. <i>Pindari Dam fish monitoring project</i>. Final report to the New South Wales Office of Water. University of New England, Armidale, New South Wales. 59pp</p>																
<p>Change in low flow regime</p>	<p>Implement environmental flow rules that protect, maintain and enhance the environmental, cultural and heritage values of this water source</p>	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days below the natural 95th and 80th percentiles.</p> <p>The natural (without development) and the Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the flow was very low for the majority of the evaluation period and does not meet criteria based on the baseline Plan scenario for all years except 2010/2011 to 2012/2013.</p> <table border="1"> <thead> <tr> <th colspan="3">Comparison to modelled Plan scenario for the number of days below the 95th percentile flow</th> </tr> <tr> <th></th> <th>416002 (Macintyre River at Boggabilla)</th> <th>416001 (Barwon River at Mungindi)</th> </tr> </thead> <tbody> <tr> <td>Natural 95th percentile flow</td> <td>22 ML/d</td> <td>1 ML/d</td> </tr> <tr> <td><i>Plan scenario (baseline target)</i></td> <td>19</td> <td>22</td> </tr> <tr> <td>2009/2010</td> <td>24</td> <td>87</td> </tr> </tbody> </table>	Comparison to modelled Plan scenario for the number of days below the 95th percentile flow				416002 (Macintyre River at Boggabilla)	416001 (Barwon River at Mungindi)	Natural 95 th percentile flow	22 ML/d	1 ML/d	<i>Plan scenario (baseline target)</i>	19	22	2009/2010	24	87	<p>Good</p>
Comparison to modelled Plan scenario for the number of days below the 95th percentile flow																		
	416002 (Macintyre River at Boggabilla)	416001 (Barwon River at Mungindi)																
Natural 95 th percentile flow	22 ML/d	1 ML/d																
<i>Plan scenario (baseline target)</i>	19	22																
2009/2010	24	87																

Performance indicator	Related Plan objectives	Results			Strength of information
		2010/2011	0	0	
		2011/2012	0	1	
		2012/2013	4	23	
		2013/2014	24	51	
		2014/2015	22	113	
		2015/2016	35	17	
Comparison to modelled Plan scenario for the number of days below the 80th percentile flow					
			416002 (Macintyre River at Boggabilla)	416001 (Barwon River at Mungindi)	
		Natural 80 th percentile flow	109 ML/d	57 ML/d	
		<i>Plan scenario (baseline target)</i>	63	89	
		2009/2010	131	174	
		2010/2011	0	4	
		2011/2012	12	18	
		2012/2013	46	71	
		2013/2014	248	162	
		2014/2015	139	185	
		2015/2016	94	147	
References: DPI Water (2017b), <i>Real Time Data – Rivers and Streams</i> , http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url					

Performance indicator	Related Plan objectives	Results	Strength of information																								
<p>Change in moderate to high flow regime</p>	<p>Implement environmental flow rules that protect, maintain and enhance the environmental, cultural and heritage values of this water source</p>	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days above the natural 30th, 15th and 5th percentiles.</p> <p>The natural (without development) and the Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the moderate to high flow criteria were met in the wet years of 2010/2011 to 2012/2013, and in two cases the 2013/2014 water year. In the other years of the evaluation period, there were less days above the natural 30th, 15th and 5th flow percentiles than the baseline Plan scenario.</p> <p>This demonstrates that without large floods, the Plan implementation has had limited success in mimicking ‘natural’ moderate and high flows.</p> <div style="background-color: #e0e0e0; padding: 5px;"> <p>Comparison to modelled Plan scenario for the number of days above the 30th percentile flow</p> </div> <table border="1"> <thead> <tr> <th></th> <th>416002 (Macintyre River at Boggabilla)</th> <th>416001 (Barwon River at Mungindi)</th> </tr> </thead> <tbody> <tr> <td>Natural 30th percentile flow</td> <td>1,142 ML/d</td> <td>1,138 ML/d</td> </tr> <tr> <td><i>The Plan scenario (baseline target)</i></td> <td>135</td> <td>64</td> </tr> <tr> <td>2009/2010</td> <td>35</td> <td>30</td> </tr> <tr> <td>2010/2011</td> <td>249</td> <td>191</td> </tr> <tr> <td>2011/2012</td> <td>328</td> <td>116</td> </tr> <tr> <td>2012/2013</td> <td>312</td> <td>67</td> </tr> <tr> <td>2013/2014</td> <td>222</td> <td>5</td> </tr> </tbody> </table>		416002 (Macintyre River at Boggabilla)	416001 (Barwon River at Mungindi)	Natural 30 th percentile flow	1,142 ML/d	1,138 ML/d	<i>The Plan scenario (baseline target)</i>	135	64	2009/2010	35	30	2010/2011	249	191	2011/2012	328	116	2012/2013	312	67	2013/2014	222	5	<p>Good</p>
	416002 (Macintyre River at Boggabilla)	416001 (Barwon River at Mungindi)																									
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Performance indicator	Related Plan objectives	Results			Strength of information
		2014/2015	42	26	
		2015/2016	59	0	
		Comparison to modelled Plan scenario for the number of days above the 15th percentile flow			
			416002 (Macintyre River at Boggabilla)	416001 (Barwon River at Mungindi)	
		Natural 15 th percentile flow	2,902 ML/d	3,165 ML/d	
		<i>The Plan scenario (baseline target)</i>	50	24	
		2009/2010	7	20	
		2010/2011	162	141	
		2011/2012	156	65	
		2012/2013	146	42	
		2013/2014	70	0	
		2014/2015	17	0	
		2015/2016	20	0	
		Comparison to modelled Plan scenario for the number of days above the 5th percentile flow			
			416002 (Macintyre River at Boggabilla)	416001 (Barwon River at Mungindi)	
		Natural 5 th percentile flow	9,907 ML/d	6,409 ML/d	

Performance indicator	Related Plan objectives	Results							Strength of information																					
		<i>Plan scenario (baseline target)</i>	14	9																										
		2009/2010	2	17																										
		2010/2011	74	95																										
		2011/2012	34	53																										
		2012/2013	24	28																										
		2013/2014	0	0																										
		2014/2015	3	0																										
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Change in water quality in this water source	Maintain and where feasible improve the flow related water quality in this water source.	<p>There is limited water quality data available for the Border Rivers system over the evaluation period. The <i>Assessment of Basin Plan Water Quality targets in New South Wales</i> report provides some general information on water quality in the Border Rivers system (Mawhinney & Muschal 2015). The ratings compared to basin targets are provided below based on median annual data from 2007 – 2012. The water quality is generally in good condition in the downstream reaches (Macintyre, Barwon Rivers). Some of the upstream gauges have poor results for turbidity and nutrient loads. Note that the report provides no “pre-Plan” comparison.</p> <table border="1"> <thead> <tr> <th colspan="7">Water quality index ratings by site for the Border Rivers water source (Mawhinney & Muschal 2015)</th> </tr> <tr> <th>Station</th> <th>Turbidity (lab)</th> <th>Turbidity (field)</th> <th>Total phosphorus</th> <th>Total nitrogen</th> <th>pH</th> <th>Dissolved oxygen</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>							Water quality index ratings by site for the Border Rivers water source (Mawhinney & Muschal 2015)							Station	Turbidity (lab)	Turbidity (field)	Total phosphorus	Total nitrogen	pH	Dissolved oxygen								Moderate
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Station	Turbidity (lab)	Turbidity (field)	Total phosphorus	Total nitrogen	pH	Dissolved oxygen																								

Performance indicator	Related Plan objectives	Results							Strength of information
		416001 Barwon River at Mungindi	Very Good	Very Good#	Very Good	Good	Very Good	ID	
		416048 Macintyre River at Kanowna	Very Good	Very Good#	Very Good	Very Good	Very Good	ID	
		41610044 Macintyre River at Salisbury Bridge (Boggabilla)	Good	Good#	Moderate	Good	Good	ID	
		416040 Dumaresq River at Glenarbon Weir	Very Good	Poor#	Very Good	Good	Very Good	ID	
		416010 Macintyre River at Wallangra	Moderate	Poor#	Very Poor	Poor	Very Good	ID	
		<p># Insufficient data (n<5) to assign a rating with confidence ID – Insufficient data to assign a rating</p> <p>The impact of supplementary access flow rules on toxic algal blooms at Boggabilla, Goondiwindi and Mungindi was assessed in an IMEF project (DPI Water 2011). The project identified critical discharges and established that environmental water can assist in suppressing Anabaena blooms (Ryan & Royal 2007).</p> <p>References:</p>							

Performance indicator	Related Plan objectives	Results	Strength of information																																
		<p>Mawhinney, W. and Muschal, M. 2015. Assessment of the BP 2012 water quality targets in New South Wales; 2007 to 2012. New South Wales Department of Primary Industries, Water, Sydney. ISBN 978-1-74256-792-1</p> <p>DPI Office of Water (2011) <i>Environmental flow response and socio-economic monitoring. Border Rivers – progress report 2009</i>, Department of Environment, Climate Change and Water</p> <p>Ryan, N & Royal, M (2007), <i>NSW Regulated Water Sharing Plan Performance Monitoring Requirements Matching environmental performance monitoring to Plan objectives and performance indicators: Discussion Paper</i>, Draft report for Department of Water and Energy.</p>																																	
<p>Extent to which basic landholder rights requirements have been met</p>	<p>Manage this water source to preserve and provide for BLR</p>	<p>Provision for domestic and stock rights (a component of BLR) and domestic and stock access licences has been provided for in the Plan; estimated at Plan commencement to be 8,000 ML / year and 1,205 ML / year, respectively.</p> <p>As no licences are required for extraction of water for BLR, it is difficult to assess accurately. Water to meet these needs is included in the WaterNSW' operational protocols for delivery of water ordered by licence holders.</p> <p>Domestic and Stock requirements have not been restricted during the Plan term with full access and entitlements available (i.e. AWDs of 100%).</p> <table border="1"> <thead> <tr> <th colspan="4">Domestic and Stock access licences within the NSW Border Rivers Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr> <td>2009/2010</td> <td>1,280</td> <td>100%</td> <td>733</td> </tr> <tr> <td>2010/2011</td> <td>1,013</td> <td>100%</td> <td>345</td> </tr> <tr> <td>2011/2012</td> <td>1,002</td> <td>100%</td> <td>425</td> </tr> <tr> <td>2012/2013</td> <td>1,002</td> <td>100%</td> <td>646</td> </tr> <tr> <td>2013/2014</td> <td>1,002</td> <td>100%</td> <td>754</td> </tr> <tr> <td>2014/2015</td> <td>1,002</td> <td>100%</td> <td>733</td> </tr> </tbody> </table>	Domestic and Stock access licences within the NSW Border Rivers Regulated River Water Source				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2009/2010	1,280	100%	733	2010/2011	1,013	100%	345	2011/2012	1,002	100%	425	2012/2013	1,002	100%	646	2013/2014	1,002	100%	754	2014/2015	1,002	100%	733	<p>Good</p>
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		2015/2016	1,002	100%	961																																					
<p>Extent to which local water utility and major utility requirements (where major utilities are involved in urban water provision) have been met.</p>	<p>Manage this water source to ensure equitable sharing of water between all uses</p>	<p>Provision for local water utility requirements has been made in the Plan, estimated at Plan commencement to be 620 ML/year in the NSW Border Rivers. There have been no restrictions on local water utility access since the Plan commencement, with full AWD allocations (100%) provided for in all water years.</p> <table border="1"> <thead> <tr> <th colspan="4">Local water utility access licences within the NSW Border Rivers Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr> <td>2009/2010</td> <td>620</td> <td>100%</td> <td>597</td> </tr> <tr> <td>2010/2011</td> <td>620</td> <td>100%</td> <td>398</td> </tr> <tr> <td>2011/2012</td> <td>620</td> <td>100%</td> <td>445</td> </tr> <tr> <td>2012/2013</td> <td>620</td> <td>100%</td> <td>537</td> </tr> <tr> <td>2013/2014</td> <td>620</td> <td>100%</td> <td>580</td> </tr> <tr> <td>2014/2015</td> <td>620</td> <td>100%</td> <td>506</td> </tr> <tr> <td>2015/2016</td> <td>620</td> <td>100%</td> <td>562</td> </tr> </tbody> </table> <p>References: NSW Department of Primary Industries – Water (2017), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>				Local water utility access licences within the NSW Border Rivers Regulated River Water Source				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2009/2010	620	100%	597	2010/2011	620	100%	398	2011/2012	620	100%	445	2012/2013	620	100%	537	2013/2014	620	100%	580	2014/2015	620	100%	506	2015/2016	620	100%	562	<p>Good</p>
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Performance indicator	Related Plan objectives	Results	Strength of information
<p>Change in economic benefits derived from water extraction and use</p>	<p>Provide a market based trading of surface water entitlements in this water source</p>	<p>ABARES (2015) identifies there are many factors that impact on economic performance of the irrigation industry and few of these are affected by the Plan. Both ABARES (2015) and Aither (2017) identify that water trading has enabled irrigators and other water users to adapt to varying water availability, particularly during the Millennium drought. However, these are Murray–Darling Basin–wide conclusions.</p> <p><i>Water markets</i></p> <p>Aither (2017) found that “water markets are a fundamentally important tool for irrigated agricultural producers in New South Wales and are an increasingly important tool for regional urban water suppliers, environmental water managers, and investors as well. They are critical to driving improvements in productivity and efficiency in the NSW economy.”</p> <p>Aither (2017) summarised the water market in the Border Rivers Regulated water source since the Plan implementation: “Trade is not possible between the Border Rivers and other surface water systems in New South Wales; however, ‘tagged trade’ for entitlements occurs between New South Wales and Queensland Border Rivers. Both entitlement and allocation water markets in the Border Rivers are modest compared to other systems.”</p> <p>A summary of water trades and their value summarised from the <i>NSW Water Register</i> is provided below. A more detailed analysis of this data is available in Aither (2017).</p> <p>The annual volume of water allocation assignments (i.e. temporary trades) within the NSW Border Rivers water source varied during the Plan term, with the lowest volume of water allocation assignments occurring in 2011–2012 and the highest occurring in 2010–2011. The annual volume of water allocation assignments into and out of the NSW Border Rivers water source (to / from Queensland water source) also varied across the evaluation period, with the great volume both in and out occurring in 2013/2014.</p>	<p>Moderate</p>

Performance indicator	Related Plan objectives	Results					Strength of information
		Water allocation assignments and volumes of water traded within the NSW Border Rivers Regulated River Water Source					
		Water year	Share (units or ML)	No. of dealings			
		2009/2010	20,434	111			
		2010/2011	24,380	71			
		2011/2012	7,226	28			
		2012/2013	19,962	62			
		2013/2014	19,718	92			
		2014/2015	18,754	121			
		2015/2016	22,044	116			
		Water allocation assignments and volumes of water traded within the Border Rivers Regulated River Water Source					
			Water traded OUT		Water traded IN		
		Water year	Share (units or ML)	No. of dealings	Share (units or ML)	No. of dealings	
		2009/2010	9,541	33	965	4	
		2010/2011	23,300	47	–	–	
		2011/2012	26,112	41	–	–	
		2012/2013	22,827	48	500	1	
		2013/2014	28,028	54	2,450	3	
		2014/2015	1,102	13	–	–	
		2015/2016	8,826	43	65	1	
		The volume of water share assignments traded varied and peaked in the 2015/2016 water year, followed by the 2011/2012 water year. The weighted average unit price of water transferred also varied through the evaluation					

Performance indicator	Related Plan objectives	Results	Strength of information																																													
		<p>period, with highest prices in 2012/2013. The largest overall value of water traded occurred in 2011/2012.</p> <table border="1"> <thead> <tr> <th colspan="5">Water share assignments traded within the NSW Border Rivers Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Share (units or ML)</th> <th>No. of dealings</th> <th>Weighted average (\$/per share) *</th> <th>Total value of water traded #</th> </tr> </thead> <tbody> <tr> <td>2009/2010</td> <td>–</td> <td>–</td> <td>–</td> <td></td> </tr> <tr> <td>2010/2011</td> <td>291</td> <td>5</td> <td>\$1,950</td> <td>\$524,550</td> </tr> <tr> <td>2011/2012</td> <td>5,692</td> <td>6</td> <td>\$1,872</td> <td>\$10,540,950</td> </tr> <tr> <td>2012/2013</td> <td>289</td> <td>7</td> <td>\$2,541</td> <td>\$472,650</td> </tr> <tr> <td>2013/2014</td> <td>713</td> <td>4</td> <td>\$1,000</td> <td>\$469,000</td> </tr> <tr> <td>2014/2015</td> <td>2,725</td> <td>6</td> <td>\$1,700</td> <td>\$2,507,808</td> </tr> <tr> <td>2015/2016</td> <td>16,913</td> <td>17</td> <td>\$1,787</td> <td>\$4,376,908</td> </tr> </tbody> </table> <p>* Total value of water traded divided by number of shares traded (excluding shares traded for \$0). Data taken from <i>NSW Water Register</i>. There may be other factors that impact this value that were not considered in the analysis.</p> <p># Total value of water traded determined by multiplying volume of water traded by unit cost of transaction for each transfer recorded in the <i>NSW Water Register</i>. This information is then summed for each year. No post-processing of the Water register data was undertaken. There may be other factors that impact this value that were not considered in the analysis.</p> <p>Aither (2017) identified an issue with the complexity of accounting mechanisms and rules governing trade between New South Wales and Queensland water holders in the Border Rivers. Uncertainty given the complexity of trade may act as a barrier to trade.</p> <p><i>Irrigation industry</i></p>	Water share assignments traded within the NSW Border Rivers Regulated River Water Source					Water year	Share (units or ML)	No. of dealings	Weighted average (\$/per share) *	Total value of water traded #	2009/2010	–	–	–		2010/2011	291	5	\$1,950	\$524,550	2011/2012	5,692	6	\$1,872	\$10,540,950	2012/2013	289	7	\$2,541	\$472,650	2013/2014	713	4	\$1,000	\$469,000	2014/2015	2,725	6	\$1,700	\$2,507,808	2015/2016	16,913	17	\$1,787	\$4,376,908	
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Performance indicator	Related Plan objectives	Results	Strength of information															
		<p>Economic reports specific to the NSW Border Rivers Regulated Rivers Water Source are not available.</p> <p>NSW Irrigators' Surveys provide the primary data for use in the socio-economic monitoring of the water sharing plans in NSW. The NSW Border Rivers Regulated Water Source was included in the 2010 and 2013 survey combined with the Gwydir catchment. In the both surveys, irrigators in this area predominantly agreed that temporary water trading had been good for their area (NSW Trade & investment 2015). On the other hand, in both surveys, irrigators predominantly agreed that temporary water trading had been both good and bad for their area.</p> <p>Throughout the evaluation period, around 30% of irrigators were using their water title as security for a loan. This indicates that landholders are gaining benefits for utilising the flexibility offered by having a water title separate to the land title to manage their financial circumstances.</p> <p>These monitoring results are based on irrigator responses only and do not include comprehensive economic data.</p> <p>The water use by irrigated enterprise is summarised from the survey reports below. Cotton accounts for the majority of water usage in the Border Rivers region; this amount decreased in 2010 during the drought period, and by 2013 accounted for 92% of the water usage. Wheat increased to 30% in the 2010 survey then returned to a minimal amount by the 2013 survey.</p> <table border="1"> <thead> <tr> <th colspan="3">Percentage water use for enterprise types from Irrigator's surveys #</th> </tr> <tr> <th>Enterprise</th> <th>2010 survey</th> <th>2013 survey</th> </tr> </thead> <tbody> <tr> <td>Cotton</td> <td>46.7%</td> <td>92.3%</td> </tr> <tr> <td>Wheat</td> <td>29.9%</td> <td>0.2%</td> </tr> <tr> <td>Other</td> <td>23.4%</td> <td>7.5%</td> </tr> </tbody> </table> <p>#Note that the 2010 and 2013 surveys cover both Border Rivers and Gwydir.</p>	Percentage water use for enterprise types from Irrigator's surveys #			Enterprise	2010 survey	2013 survey	Cotton	46.7%	92.3%	Wheat	29.9%	0.2%	Other	23.4%	7.5%	
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Performance indicator	Related Plan objectives	Results	Strength of information
		<p>This data reflects the results presented by Aither (2017) using Australian Bureau of statistics data from 2007/08 and 2014–15. Volume of water applied for cotton increased from 60,000 ML in 2007/08 to over 160,000 ML in 2014/15.</p> <p>References:</p> <p>ABARES (2015), Ashton, D & Oliver, M 2015, <i>Irrigated agriculture in the Murray–Darling Basin: an economic survey of irrigators, 2012–13 to 2014–15</i>, ABARES research report 15.13, Canberra, December.</p> <p>Aither (2017) <i>Water markets in New South Wales: market outcomes, trends and drivers</i>, Report prepared for NSW Department of Primary Industries, Water NSW Department of Trade and Investment, Regional Infrastructure and Services (2015) <i>Monitoring economic and social changes in NSW water sharing plan areas Irrigators’ Surveys 2009/2010 and 2013 – A state–wide comparison</i></p> <p>DPI Office of Water (2011), <i>Environmental flow response and socio–economic monitoring Border Rivers Valley – progress report 2009</i>, Department of Environment, Climate Change and Water</p> <p>NSW Department of Primary Industries – Water (2017c), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water–licensing/registers</p>	
<p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p>	<p>Manage this water source to preserve and enhance cultural and heritage values</p>	<p>No native title rights were established in the water source during the term of the Plan. Additionally, no Aboriginal Cultural Access licences have been issued within the Plan area.</p> <p>It is noted that although there are no specific strategies within the Plan that are directly related to the PI, the environmental water provisions make some contribution towards the preservation of cultural and heritage values where they coincide with environmental assets; however, there is no monitoring data available to support this contribution. The stimulus flows are currently used to address environmental goals. Review of the stimulus flow rules may result in the addition of an Aboriginal cultural use.</p> <p>The DPI Aboriginal Water Initiative Program aims to improve Aboriginal involvement and representation in water sharing and has commenced engagement with the Aboriginal communities in the NSW, Border Rivers water</p>	<p>Moderate</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>resource plan (WRP) area. The community's objectives and outcomes for the management of the water resources of the water resources of the WRP area are founded in a number of traditional owner groups' obligations to the whole river system and associated river communities as an indivisible group. These groups include the Kamilaroi, Kambuwal, Githabul, Bigambul, Kwiambul and Ngarabal. Achieving their objectives requires consideration of values and uses that may extend across multiple WRP areas. Consultation to date has shown that these Aboriginal communities have a multi-faceted relationship with access to and use of water. This relationship ranges from a spiritual and cultural association, to an economic focus, to location of special places. Communities welcome the engagement and are interested in further discussions to improve opportunities to provide for Aboriginal values and uses. While consultation makes clear that Aboriginal values and uses across the landscape should be considered in a holistic, connected sense, some important values and uses at specific locations have been identified.</p> <p>References:</p> <p>DPI Water (2017d) NSW Border Rivers (SW16) Water Resource Plan (surface water) Status and Issues Paper http://www.water.nsw.gov.au/water-management/water-resource-plans/border-rivers-sw16</p>	
<p>Extent to which native title rights have been met.</p>	<p>Manage this water source to preserve and provide for BLR Manage this water source to ensure equitable sharing of water between all uses</p>	<p>There are provisions in the Plan to provide access to water if native title rights over water are granted under the Federal Native Title Act 2003. No native title rights were established in the Border Rivers Regulated River during the term of the Plan. Additionally, no Aboriginal cultural access licences have been issued in the Plan area.</p> <p>References:</p> <p>Native Title Determinations (National Native Title Tribunal): http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/default.aspx</p> <p>DPI Water (2017c) – NSW Water Register: http://www.water.nsw.gov.au/water-licensing/registers</p>	<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information								
<p><i>Additional PI identified:</i></p> <p>Change in surface water extraction relative to the long term annual average extraction limit</p>	<p>Implement environmental flow rules that protect, maintain and enhance the environmental, cultural and heritage values of this water source</p>	<p>The LTAAEL for the NSW Border Rivers is 399 GL/yr to be shared between NSW and Queensland. This Plan Limit is the long-term average diversion, based on running the Plan Limit simulation model for the full period of simulation: 1st January 1890 to 30th June 2016.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate-adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires updating of development conditions in the model from time to time to enable the assessment of compliance to take place. While these conditions do not vary on an annual basis, the Plan implies that they will be updated, and the model run on an annual basis. According to DPI Water’s audit reports, this annual assessment did not occur during the Plan term, because development conditions were not updated in the model on an annual basis.</p> <p>Nevertheless, the cumulative assessment has since been carried out in 2016 (Ching and Sivkova 2016). This assessment found that Border Rivers was under the LTAAEL.</p> <p>Annual diversion data is available from the NSW water register and is shown in the table below. However, as noted above, the figure cannot be used directly to assess LTAAEL compliance.</p> <table border="1"> <thead> <tr> <th>Water Year</th> <th>Diversion (GL)</th> </tr> </thead> <tbody> <tr> <td>2009/2010</td> <td>101</td> </tr> <tr> <td>2010/2011</td> <td>164</td> </tr> <tr> <td>2011/2012</td> <td>134</td> </tr> </tbody> </table>	Water Year	Diversion (GL)	2009/2010	101	2010/2011	164	2011/2012	134	
Water Year	Diversion (GL)										
2009/2010	101										
2010/2011	164										
2011/2012	134										

Performance indicator	Related Plan objectives	Results		Strength of information
		2012/2013	198	
		2013/2014	169	
		2014/2015	40	
		2015/2016	92	
		2009/2010	101	
		References:		
		DPI Water (2017c), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers		
		Ching, MF and Sivkova, M (2016), <i>Border Rivers VALLEY CAP AND WATER SHARING PLAN AUDITING 2014/15</i> , DPI Water Modelling Unit internal report.		

Appendix 8 – NSW Border Rivers regulated river internal logic relationship diagrams

Relationship diagrams show the internal Plan logic supporting the delivery of each of the Plan's outcomes. One diagram has been created for each of the economic, social / cultural and environmental outcomes. The diagrams show linkages from the Plan vision (green box) through the broad objectives (navy box) to the targeted objectives (blue box) and the rules (grey boxes). Where gaps in the program logic have been identified, these are shown as question marks in an appropriate coloured box. Gaps have been identified at the targeted and broad objectives levels in this evaluation.

The vision for this Plan is to have a sustainable, healthy working river system that meets community, environmental, agricultural and industrial needs.

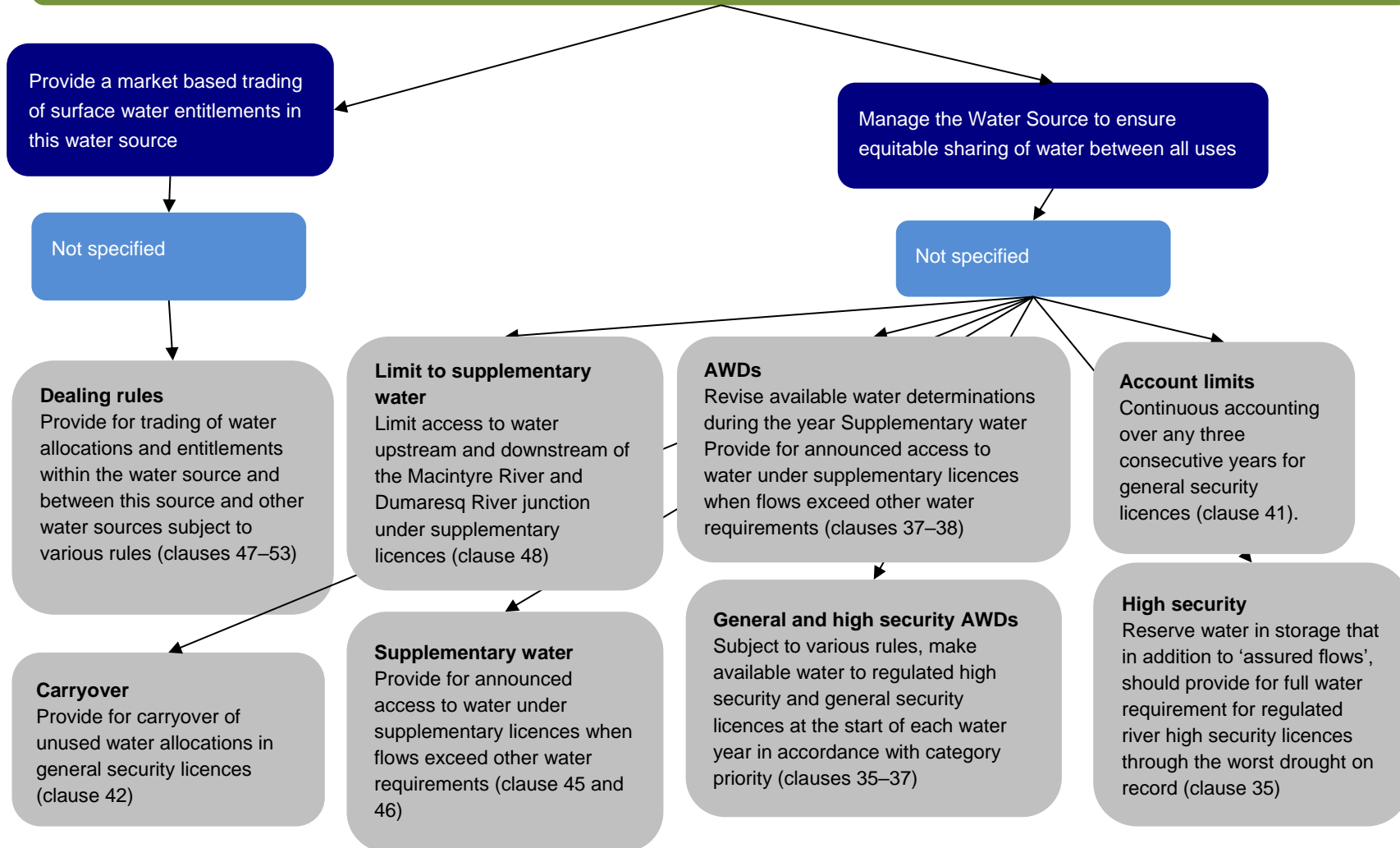


Figure 12: Economic internal logic relationship diagram

The vision for this Plan is to have a sustainable, healthy working river system that meets community, environmental, agricultural and industrial needs.

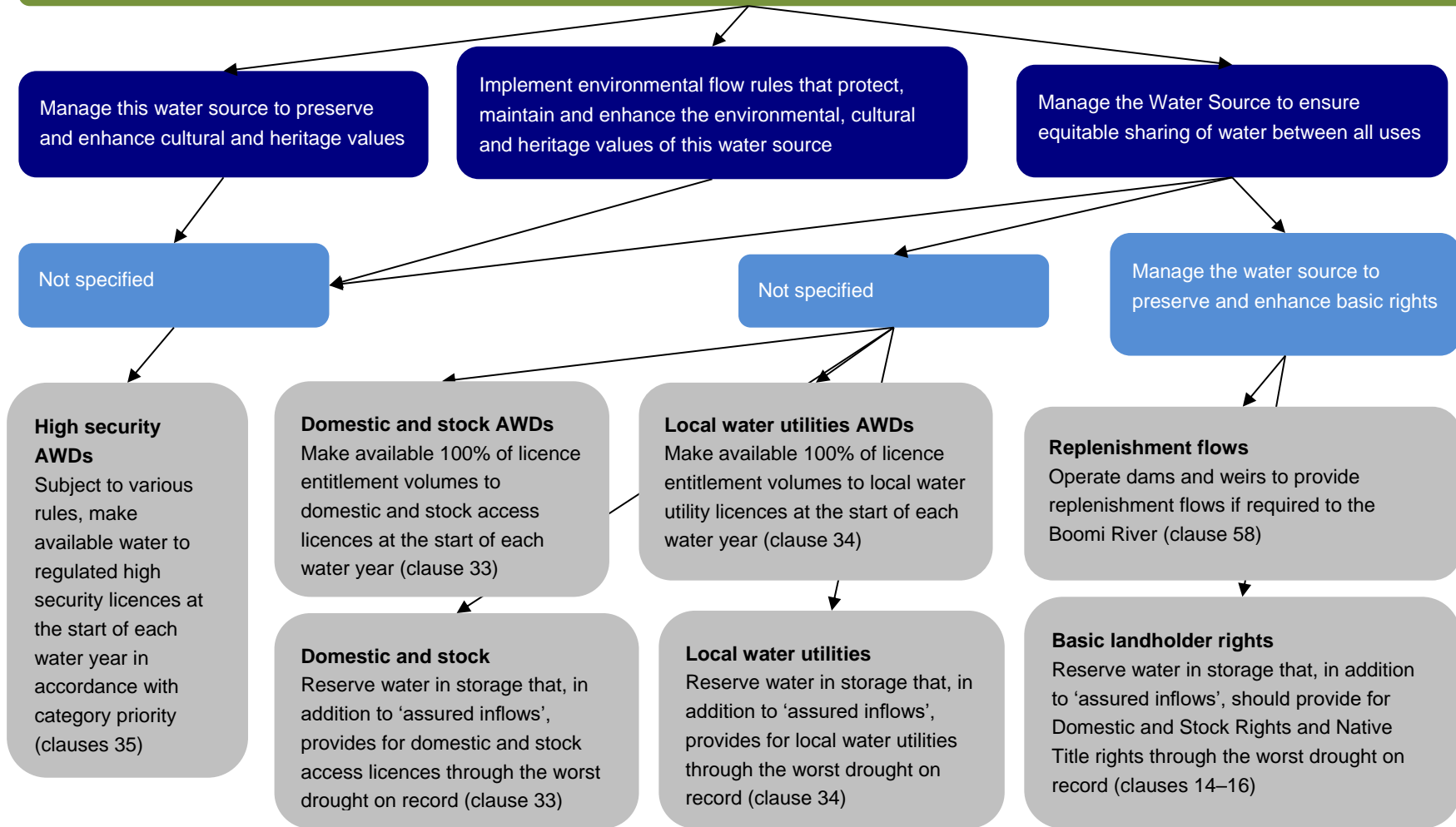


Figure 13: Social / Cultural internal logic relationship diagram

The vision for this Plan is to have a sustainable, healthy working river system that meets community, environmental, agricultural and industrial needs.

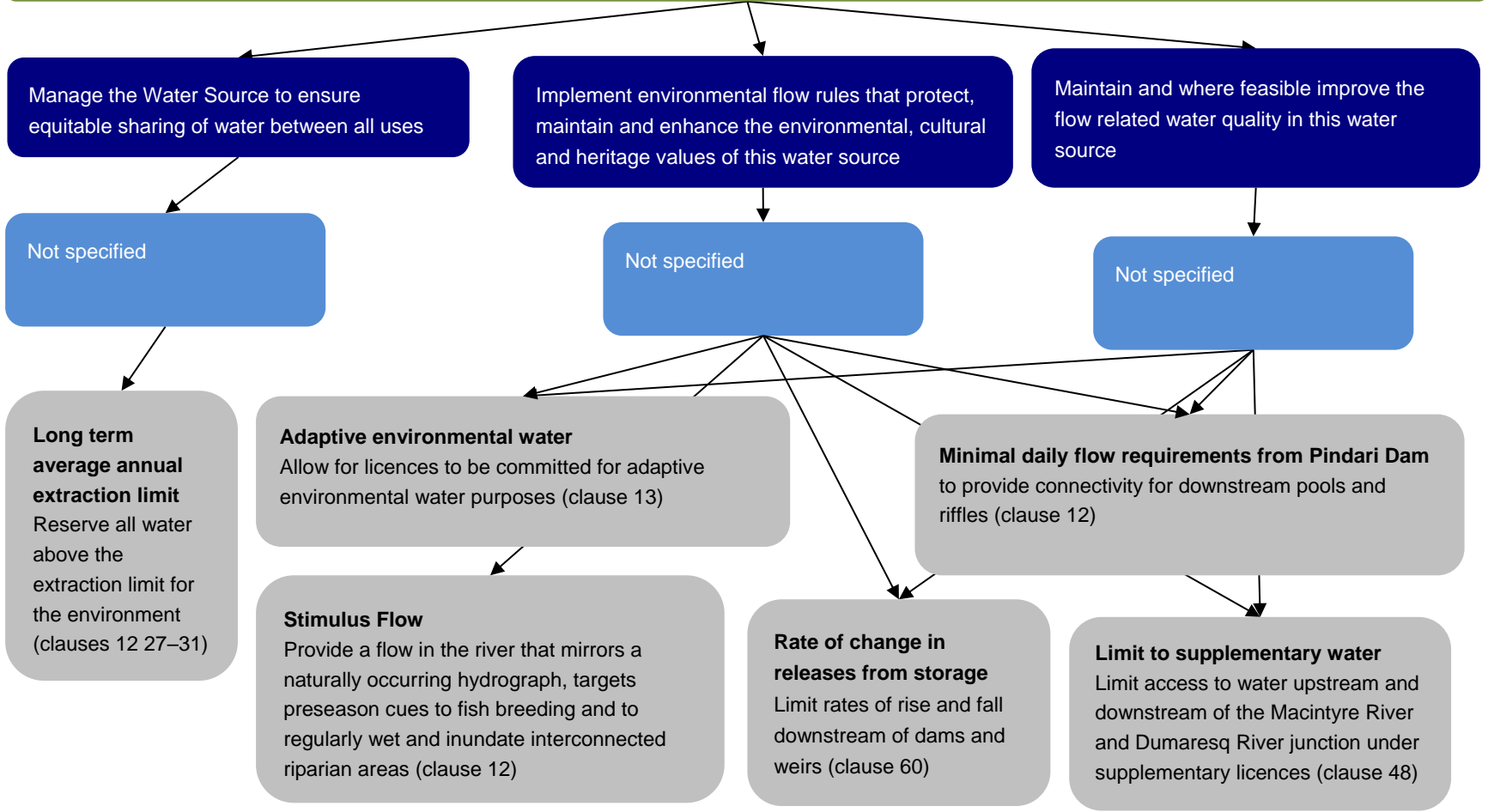











Figure 14: Environmental internal logic relationship diagram





Appendix 9 – Upper and Lower Namoi regulated river report cards and performance indicator summary





Table 17: Appropriateness Report Card




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Plan scale	Is the scale of the Plan appropriate for water management?	Extent to which scale is appropriate for water sharing management	The geographic scale of the water sources in the Plan is considered appropriate for water sharing management			
Plan scope	Is the scope of the Plan appropriate for water management?	Extent to which interactions with other water sources are addressed appropriately within the Plan or other water sharing plans	The Plan's scope is considered appropriate. However, the Plan would benefit from a note consolidating how the Plan addressed flows to and from connected water resources. Planned environmental releases provided by the Plan are protected by limiting access to off-river pools or dams in connected water sources while the flows are occurring. The Plan also provides for flows to the Barwon–Darling, by referencing the Interim North–West Unregulated Flow Management Plan. The requirements of placement and depth of new or replacement bores, for deep alluvial aquifers and fractured rock aquifers, are specified in the adjacent plans of the Namoi valley to protect the		Consider whether the Plan would benefit from a note consolidating how the Plan addressed flows to and from connected water resources.	Medium

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>water in the regulated river water sources.</p> <p>The CSIRO (2008) Sustainable Yield Reports found that in some valleys increased groundwater use by 2030 would result in some of the current groundwater use being sourced directly from induced stream–flow leakage. Much of this impact has not been explicitly considered in the development of existing surface water sharing plans.</p>			
Prioritisation	Is the level of management required under the Plan appropriate for the risk to environmental, economic, or social and cultural values?	Extent of risk to dependent ecosystems, economic, and social and cultural values	<p>The prioritisation of the Plan as high risk (DLWC 1998) is considered appropriate.</p> <p>The level of management applied is considered appropriate based on high levels of pre–Plan water allocation.</p>			
		Extent to which risk is addressed	<p>Risk is addressed through the application of the Long term average annual extraction limit (LTAAEL), water sharing arrangements that respond to variations in water availability and associated water market.</p>			
		Identified future risks, including climate change, change in industry base, etc.	<p>Future risks are partially addressed through the application of the LTAAEL and a flexible water market.</p> <p>The calculation of LTAAEL uses the drought of record, which may</p>		Consider including analysis of climate change and changes in industry base to assess	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>not reflect future climate due to the impacts of climate change. In addition, changes to the industry base are not recognised.</p> <p>The industry base is already changing with a large growth in coal energy production and likely future growth in coal and gas energy production.</p>		implications for water availability and water demands	
Internal logic	Is the vision appropriate for water management?	Whether the vision reflects what is intended for water sharing plans in the Act	The vision is considered appropriate , as it is consistent with the Act's intent for water sharing plans to achieve economic, social and environmental outcomes			
	Are the objectives suitable for water management?	Whether the objectives align with the vision	The objectives align with the Plan vision			
		Whether the objectives align with the principles and objects of the Act	The objectives align with the principles and objects of the Act			
		Extent to which the objectives are clear and comprehensive enough to reflect what the Plan intended to achieve	<p>The objectives are not clear and comprehensive enough to reflect what the Plan intended to achieve</p> <p>The objectives are broad and not targeted enough to link adequately to the strategies and then to the rules in the Plan. Some objectives do not have linking strategies but are addressed partly in the Plan rules (for example there are no specific strategies that link to the Plan</p>		Consider reviewing the Plan's objectives and developing more targeted objectives that better outline what the Plan intends to achieve and that link clearly through the strategies to the rules of the Plan	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			objective regarding the maintenance of water quality to rules regarding supplementary water access licences and long-term extraction limits that partly address this objective).			
		Extent to which the Plan logic establishes SMART (Specific, Measurable, Attainable, Realistic, Time-bound) objectives	<p>The Plan logic does not set objectives that align with the SMART criteria</p> <p>The objectives in the Plan are too broad and do not meet the Specific or Measurable components of the SMART criteria</p>		Consider whether Plan logic should be reviewed to improve measurement of success.	Medium
<i>Internal logic continued</i>	Are the strategies suitable for water management?	Whether all Plan rules are linked to a strategy	All Plan rules link to a strategy		Consider whether the strategies should be more targeted to address the Plan objectives and provide direction for the Plan rules.	High
		Whether the strategies provide clear direction for the Plan rules	<p>The strategies need to provide clearer direction for the Plan rules.</p> <p>The Plan strategies are vague and do not provide a link between the strategies and the expected outcomes of the rules.</p>			
		Whether the strategies align with the objectives	<p>Not all strategies align with the objectives.</p> <p>Current strategies describe the Plan structure only and do not clearly align with the Plan objectives. This is important as the Act requires performance</p>			

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			indicators to be used to assess Plan strategies.			
	Are the performance indicators (PIs) suitable for water management?	Whether the PIs align with the objectives and strategies	All PIs align with the objectives but not with the Plans strategies		Consider better defining PIs to be able to evaluate the Plan outcomes.	High
		Extent to which PIs are clear and comprehensive enough to measure what the Plan intended to achieve	All PIs are clear but not comprehensive. Additional information is needed in the PIs to evaluate performance of the Plan (example: PI (a) is looking for a change in ecological condition. Additional information defining what a change in ecological condition is, is necessary to evaluate the performance of the Plan).		Determining new targeted strategies or targeted objectives will address this issue with the PIs not aligning with the strategies.	
Quality of Supporting Documentation	Is documentation explaining the decisions underpinning the Plan available?	Adequacy of documentation supporting the Plan	The Plan has a comprehensive “Part A” document (NRRMC undated) supporting Plan development which is available internally. A range of documents are also available that support Plan implementation.			
<i>Quality of Supporting Documentation continued</i>		Extent to which documentation is made available to the public	The “Part A” document was available publicly during the Plan’s initial exhibition period but is no longer publicly available. General Purpose Water Accounting Reports (GPWAR;		Endeavour to improve availability of evidence sources supporting Plan implementation and monitoring.	Low

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			DPI Water 2017b), Gazetted Implementation Plan (Office of Water 2009) and Plan Implementation Reviews (DPI – Office of Water 2013a and 2013b) are available on the DPIE website.			
Communication	Is the process for communication with stakeholders adequate?	Extent of communication and processes supporting Plan development	Extensive consultation was carried out during Plan development , with the NRRMC meeting to explore issues, and develop management strategies. The Plan was placed on public exhibition.			
		Communication arrangements in place during Plan operation	Communication has been appropriate; however recent community feedback suggests that a more formalised ongoing communication protocol is required. Generally, communication was on an as needs basis during drought periods, frequent discussions were held with water users. A series of annual GPWAR are available on the DPIE website (DPI Water 2017b).		Endeavour to develop a communication Plan that serves the needs of the community (with reference to the communication role of WaterNSW).	Medium
		Arrangements for consideration at term review of Plan and WRP development	The Plan was reviewed, amended and replaced, in consultation with stakeholders in 2016 (DPI Water 2016). Sufficient opportunity will be provided for communication			













Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>during the WRP development process</p> <p>Consultation will involve opportunities to make submissions, and face to face meetings will be held with stakeholders.</p>			
Alignment with state priorities for natural resource management plans (S43A)	Is the Plan aligned with state priorities for natural resource management?	Extent of alignment of Plan with state priorities	The NRC (NRC, 2013) reviewed the water sharing plans and found that there is some lack of priorities, however, the lack of available monitoring, evaluation and reporting information at the time of the assessment limited to the NRC's findings (NRC 2013).		Consider reviewing the alignment of Plan objectives with state priorities for natural resource management during the development of the Namoi water resource plan.	High






Table 18: Efficiency Report Card

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Environmental water provisions	Planned environmental water	Was all water above the extraction limit protected?	<p>Assessment of compliance with the LTAAEL is underway in 2017. The LTAAEL was not assessed on an annual basis as required by the Plan. (see Extraction Limit evaluation findings below).</p> <p>However, it is likely that water above the extraction limit was protected, since AWD rules in the Plan are designed to implement the extraction limit.</p>			
		Were minimum daily flows maintained in June, July and August, at Walgett?	<p>Minimum daily flows were maintained periodically from 2004–2012 and were not always released when required by the Plan.</p> <p>2004–2005: No flows were delivered, even when required.</p> <p>The former Department of Water Resources set aside these provisions because of travel time during the drought, between Keepit Dam and Walgett. Because of travel time water released during the commencement dates of the Plan were unable to meet Plan targets.</p> <p>2005–2012 (Excluding 2010): Flows were delivered, when required.</p>		<p>Consider reviewing the end of system flow rules to take into consideration travel times between the storage and the end of system.</p> <p>Consider developing and documenting a governance arrangement for suspension of the end of system flows in periods of water shortage.</p>	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Flows were released prior to the June commencement dates but still arrived late to meet the Plan targets.</p> <p>2010 onwards: Minimum daily flows were periodically suspended.</p> <p>Although, total dam volume exceeded 120,000 ML in the key months (June, July and August) in 2010, it was determined that release of flow to meet the daily minimum requirements would cause total dam volume to fall below 120,000 ML.</p>			
	Adaptive environmental water	Is there a process for licences to be committed for adaptive environmental purposes?	The Plan and the Implementation Plan (Office of Water 2009) has the necessary processes in place to commit licences for AEW.			
		Were AEW Use Plans developed?	<p>No licences have been nominated as AEW in the water sources of the Plan.</p> <p>OEH develops annual plans for the use of AEW, alongside planned environmental water.</p> <p>(The CEWH chooses not to commit its water licences to AEW, but operates a range of planning processes, which are consistent with AEW Use Plans.)</p>			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were there additional licences created and AEW conditioned as a result of water savings within the water sources?	No licences have been nominated as AEW in the water sources of the Plan.			
Basic Landholder Rights	Domestic and Stock	Were domestic and stock BLR provided for within the Plan?	The Plan identified the water requirements for domestic and stock BLR within the upper and lower Namoi regulated river water sources and provides water to be supplied for these purposes through storage in Split Rock Dam and Keepit Lake.			
		Is domestic and stock BLR growth provided for within the Plan?	The Plan recognises that demand may increase and provides that AWDs cannot be made until BLR reserves are provided for through a drought of record.			
		Was the water supply managed to ensure sufficient reserves for domestic and stock BLR were maintained?	Domestic and Stock BLR were provided for throughout the life of the Plan.			
		Were domestic and stock BLR provided for in water delivery operating protocols?	Domestic and Stock rights are delivered on top of water orders by WaterNSW and are provided for as part of their operating protocols.			






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Domestic and stock rights were at times provided intermittently, due to drought conditions.</p> <p>During periods of water shortage BLR water was at times provided in accordance with a group release strategy managed by WaterNSW.</p>			
		Were replenishment flows delivered when required to satisfy domestic and stock needs, subject to water availability?	<p>Replenishment flows were delivered when water was available, and the flows were required.</p> <p>Note that delivery is not required when surplus flows have provided the required water.</p> <p><i>Note that information in the first 6 years of the Plan clearly publicly available, but in later years is available in the GPWAR (DPI Water 2017b)</i></p>			
		Are domestic and stock BLR consistent with Reasonable Use Guidelines?	<p>BLR Reasonable Use Guidelines (made under s.52 of the Act and provided for in the Plan) have not been made by the Minister. The guideline is currently in draft form.</p> <p>There is no audit or monitoring information to assess whether use is consistent.</p>		Endeavour to finalise and publish BLR and Domestic and Stock Reasonable Use Guidelines.	Medium




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Native title	Were native title BLR provided for within the Plan?	Procedures are in place to provide access if native title rights are granted in the water sources covered by the Plan. Note: No native title rights for water have been established in the Plan area.			
		Is growth in native title BLR protected within the Plan?	The Plan provides for provision of native title BLR before AWDs can be made.			
Rules for granting access licences	Granting new access licences	Were Plan rules followed for the granting of access licences?	All access licences granted were in line with the Plan provisions. The Water Management (General) Regulations 2004 and 2011 set out specific purpose access licences and application conditions.			
Limits to the availability of water	Extraction limits	Was an extraction limit established?	An extraction limit was established for these water sources.			
		Was the long-term average annual extraction assessed against the long-term annual average extraction limit at the end of each water year?	Assessment of compliance with the LTAAEL has not occurred annually as specified in the Plan due to the unavailability of annually updated water use development data.		Consider reviewing the Plan to achieve an approach that Can be practically, cost-effectively and reliably implemented.	High





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>However, assessment and model update are currently underway in 2017.</p> <p>Amendment of the Plan is recommended to achieve an approach that can be practically implemented, while enabling timely identification of any risk of growth in use.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p>		<p>Enable timely identification of any risk of growth in use.</p> <p>Endeavour to resolve the process for the collection of water use development data so the IQQM model can be updated at an appropriate frequency.</p> <p>Endeavour to implement NSW LTAAEL compliance assessment as routine business, alongside “permitted take” (SDL) assessment under Basin Plan.</p>	





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. Water use development data is not volatile on an annual basis but is more appropriately assessed at the 3–5-year frequency.</p> <p>However, the Plan implies that they will be updated, and the model must be run on an annual basis.</p> <p>It is recommended that this approach be reviewed and amended at Plan term review, given that this has proven to be impractical over the 10–year implementation of the Plan. Furthermore, the amended Plans will need to reflect Basin Plan requirements for application and compliance with the SDL.</p>			
	Variation of extraction limits	Were extraction limits varied?	No changes to the extraction limits have been required.			
	LTAAEL compliance	Was LTAAEL exceeded?	Assessment of compliance with the LTAAEL has not occurred annually as specified in the Plan due to the unavailability of annually updated water use development data.		See above for operational and Plan review recommendations.	




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			However, assessment and model update are currently underway in 2017.		Review and confirm the outcome of the LTAAEL assessment.	
		Was extraction managed within LTAAEL?	No adjustments to the maximum AWD limits set in the Plan have been needed.			
		Was the annual assessment of growth in extraction by the City of Tamworth assessed in accordance with the Plan?	<p>The annual assessment of growth in extraction by Tamworth City Council is required by the Plan but has not been implemented.</p> <p>Growth-in-use assessment procedures for Tamworth City Council have been developed as part of the Water Sharing Plan for the Peel River which commenced 1st of July 2010.</p> <p><i>Note: The assessment of growth in use by the City of Tamworth requires a model to model comparison similar to that required for LTAAEL compliance assessments. As such, similar issues as stated above have affected the ability to conduct this assessment annually.</i></p>		Consider reviewing the Plan and / or assessment procedures to allow for consistency between the two.	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	AWDs	Were AWDs for all categories of licences calculated and announced in line with Plan provisions?	AWDs for all categories of licences were calculated and announced in line with the Plan provisions.			
Rules for managing access licences	Water allocation and account management	Were water accounts established for all licences?	Water allocation accounts were established for all licence holders.			
		Were accounts managed in accordance with the Plan rules?	Accounts have been managed in line with the Plan rules.			
	Carryover provisions	Was carryover managed in accordance with the Plan rules?	Rules relating to the carryover of balances in water allocation accounts from one year to the next were applied through the accounting system.			
	Extraction conditions	Were the general priority of extraction conditions set out in the Plan complied with?	General priorities of extraction conditions set out in the Plan were complied with at all times.			





Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were numerically specified extraction components introduced by amending water access licences e.g. in relation to times, rates or circumstances that water may be taken?	Numerically specified extraction components were not required to be introduced. Note: In the Plan, this is required as soon as possible after the commencement of the Plan however, no deadline is set.		Endeavour establish a state-wide policy for the establishment of numerical extraction components, and to implement numerical extraction components where required.	Medium
	Supplementary water	Were supplementary water announcements made in accordance with Plan requirements?	Supplementary water announcements were made in accordance with the Plan requirements.			
		Were individual supplementary events managed in accordance with Plan rules and targets?	The supplementary water access triggers, in the Lower Namoi set by the Plan have proved difficult to implement in a real-world scenario and it is recommended that they are reviewed During a number of flow events, the required flow levels at Narrabri were not met at both the beginning and end of the event. Two issues were identified: There are supplementary users between the start and finish flow reference points, which may alter the flow.		Consider reviewing the appropriateness and practical feasibility for implementation of start and finish flow requirements for supplementary water events in the Lower Namoi.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			There are timing conflicts with respect to flows, between when DPIE permits the extraction of supplementary water and when the event is officially announced.			
		Did supplementary water users comply with Plan rules?	Access to water by supplementary water users (when announced) complied with the Plan rules.			
Dealings	Minister's dealing principles	Were dealings in line with the Minister's dealing principles, the Act and the Plan?	All dealings have been made in line with the Ministers dealing principles.			
	Constraints within water sources	Were dealings in line with rules relating to constraints within the water sources?	All dealings were undertaken in line with the Plan rules relating to the constraints within the water sources.			
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water sources?	<p>Conversion of access licence category dealings that do not require conversion factors are possible.</p> <p>Conversions of access licence category dealings are not possible where conversion factors are required as the factors have not been established.</p>		See next	See next

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Were conversion factors established when required?	<p>Conversion factors were not established.</p> <p>The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (ACCC 2009 and ACCC 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.</p>		Refer the issue to the DPIE Trade Review for resolution parallel with Murray–Darling Basin Plan trade rules compliance.	High
Mandatory conditions	Access licence conditions	Were mandatory conditions for access licences placed on licences?	Mandatory conditions required in the Act and in the Plan were placed on the licences during the conversion from the Water Act 1912 to WMA 2000.			
	Water supply works approvals	Were mandatory conditions for works approvals placed on the works approvals?	Mandatory conditions required in the Act and in the Plan were placed on the approval during the conversion from the Water Act 1912 to WMA 2000.			
System Operation rules	Replenishment flows	Were replenishment flows provided in accordance with the Plan?	<p>Replenishment flows were delivered when water was available, and the flows were required.</p> <p>Note that delivery is not required when surplus flows have provided the required water.</p>			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<i>Note that information in the first 6 years of the Plan is not clearly publicly available, but in later years is available in the GPWAR (DPI Water 2017b)</i>			
		Was the water supply managed to ensure sufficient reserves for replenishment flows were maintained?	The water supply was managed to ensure sufficient reserves for replenishment flows when required.			
	Water delivery and channel capacity constraints	Were initial estimates of maximum water delivery and operating channel capacity updated?	The initial estimates of maximum water delivery or operating channels capacity which were included as notes in the Plans have not been updated. Dry conditions have meant that this has not been required or a priority.		Endeavour to review the application and effectiveness of channel capacity and constraint rules.	Medium
	Rates of change to releases from storages	Was an operating protocol for the management of rates of change to releases from Keepit and Split Rock Dam developed?	No, an operating protocol was not developed (DPIW Audit 2013). However, storage releases are made according to a long-established draft protocol. The 2013 Audit notes that the Dam works approval required the holder (State Water, now WaterNSW) to develop the protocol by June 2012. The 2013 Audit recommended DPIW, DPI Fisheries, OEH and		Consider the policy requirement; i.e. is the operating protocol required, given it hasn't been implemented during first 10-year term? If the review considers the protocol is required, then DPIE may require compliance by the	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			WaterNSW to jointly developing operating protocol for the implementation manual (DPI Office of Water 2013b).		holder of the works approval.	
	Bulk water transfers between storages	Are systems in place to allow bulk water transfers?	<p>Bulk water transfers were managed in accordance with the Plan rules.</p> <p>Note: Bulk transfers were made in 2006–2007, 2007–2008 and 2013–14, in line with the Plan rules. Transfers were not required in any other years.</p> <p>A protocol for bulk water transfers was agreed in 2009.</p>			
	Supply of orders when remaining allocations are low	Were water orders grouped for release when supplies were low?	<p>Water orders were grouped in line with the Plan provisions.</p> <p>Water orders were grouped in several water years in line with the Plan rules to maximise efficiency of water delivery in the Lower Namoi in consultation with Namoi Valley Customer Service Committee and other relevant stakeholders. This is the only valley where these provisions were required to be implemented in the 1st 5 years of the Plan (in all other valleys systems are in place to implement these rules when necessary).</p>			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Dam operation during floods and spills	Were rules for operating Keepit Dam in floods and spills followed?	The Plan states dam safety protocols must be followed but does not provide detailed rules as these are set and controlled by external processes. Provided these external rules are met, there are some operational rules that can be implemented if they are consistent with existing safety rules.			
Plan Amendments	Changes to the water sources	Were any changes to the water sources required?	No changes have been made to the water sources.			
	Other amendments (Water storage capacity volumes)	Were changes to the rules set out in the Plan required for water storage capacity volumes, relating to available water determinations, for regulated river general security access licences?	There have been no changes to water storage capacity volumes as set out in the Plan.			
	Other amendments (Water extraction authorisation)	Were changes to the rules set out in the Plan required for water extraction authorisation, in respect to flow exceedances, for	There have been no changes to water extraction authorisation as set out in the Plan.			








Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		regulated river general security access licences				
	Other amendments (Supplementary water)	Were changes to supplementary water rules set out in the Plan required?	There have been no changes to supplementary water set out in the Plan.			
	Amendments relating to planned environmental water (made under s.8A of the WMA 2000)	Were any changes required to planned environmental water rules?	No changes allowed for in the Plan have been made to environmental water provisions.			
	Amendments relating to floodplain harvesting	Were any changes made to water sources or Plan provisions to provide for floodplain harvesting?	No changes to water sources or Plan provisions have been made to provide for floodplain harvesting licences. It is understood this may occur as part of the Healthy Floodplains program.		Consider whether Plan amendments are required for floodplain harvesting.	

Table 19: Effectiveness Report Card

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>Protect, preserve, maintain or enhance the important river flow dependant environmental features and Aboriginal, cultural and heritage values of the Namoi Regulated River Water Source</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p> <p>Change in water quality in this water source</p> <p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p>	<p>Summary: Monitoring shows some positive environmental outcomes for organic carbon loads, and mixed responses for fish populations and wetland replenishment. However, it is difficult to differentiate these from outcomes of environmental water reforms and the development of environmental water portfolios by state and Commonwealth governments.</p> <p>The Plan establishes a planned environmental water rule which contribute to: protecting important rises in water levels, maintaining wetland and floodplain inundation and maintaining natural flow variability</p> <p>Owing to the continued drought, only limited environmental monitoring of surface waters has been undertaken to assess the Plan. Furthermore, there continues to be gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Upper Namoi and Lower Namoi Regulated River Water Sources.</p> <p>The ecological benefits arising from a supplementary water event were partially assessed when dissolved organic carbon (DOC) was sampled during a flood event at Bugilbone. Even a minor flood event in the Lower Namoi River can mobilise increased concentrations of organic carbon from adjacent benches and banks. The mobilisation of DOC</p>		<p>Good</p>	<p>Consider providing clearly defined PIs and associated performance monitoring programs that closely align with the Plan objectives and rules regarding changes to flow regime.</p> <p>Consider investigating further refinement of environmental rules and their operation to enhance environmental outcomes (in particular native fish recruitment), without impacting economic or social incomes.</p> <p>Consider including appropriate social and cultural strategies and performance</p>	<p>High</p>

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>results in a basal food web dominated by heterotrophic bacteria (Westhorpe et al. 2010). This leads to a significant increase zooplankton numbers. Zooplankton are particularly important in lowland rivers as they are key organisms for the transfer of carbon to higher trophic levels (e.g., fish). Thus, supporting the importance of delivering varied flows (e.g., freshes) and subsequent wetting of lowland sections of regulated rivers (Mitrovic et al. 2014). The increased concentrations of organic carbon in the system then improve aquatic food webs and supresses phytoplankton blooms (DWE 2008).</p> <p>On-ground monitoring at wetland sites of the Namoi has indicated that the Plan environmental flow rules have improved wetland diversity and function.</p> <p>The Sustainable River Audits (SRA) released in 2004 and 2012, found the Namoi Valley fish community to be in Poor Condition. Rolls et al. (2013) found that for the northern rivers and when temperature conditions are suitable, large floods have been shown to enhance native fish recruitment.</p> <p><i>Change in flow regime</i></p> <p>Analysis of flow regime shows that Plan PI assessment criteria were not achieved compared to the baseline Plan target. This was the case for number of days below 95th</p>			<p>indicators when reviewing the Plan.</p> <p>Consider establishing Aboriginal Social and Cultural objectives during review of the Plan (using the program logic approach) that directly act to protect or enhance the important values and specific locations identified by the Aboriginal Water Initiative Program.</p>	Medium

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>percentile and 80th percentile, as well as number of days above 30th, 15th and 5th percentile. In all cases, the exceptions were the years 2010/11, 2011/12 and 2012/13, which were associated with drought breaking floods.</p> <p>This supports the finding that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term, and many other external factors.</p> <p><i>Recognition of spiritual, social and customary values of water to Aboriginal people</i></p> <p>The limits placed on the taking of water under supplementary water access licences and the long-term extraction limit provisions may provide some protection or enhancement of Aboriginal cultural and heritage values. However, there has been a lack of uptake of Aboriginal cultural specific purpose licences.</p>				
Manage the Namoi Regulated River Water Source to ensure equitable sharing of water between all uses	<p>Extent to which local water utility requirements have been met.</p> <p>Extent to which native title rights have been met.</p> <p>Extent to which domestic and stock</p>	<p>Throughout the duration of the Plan, water was shared between all water uses, including the environment, according to the priority of access provided in the Plan.</p> <p>Local water utilities received 100% allocations since the commencement of the Plan.</p> <p>While no native title rights for water were established in the Plan area during the term of</p>		Good		

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	rights requirements have been met	the Plan, the Plan makes provision for these requirements.				
Protect basic landholder rights of owners of land	<p>Extent to which basic landholder rights requirements have been met.</p> <p>Extent to which native title rights have been met.</p>	<p>Domestic and stock rights were at times provided intermittently, due to drought conditions.</p> <p>During periods of water shortage BLR water was at times provided in accordance with a group release strategy managed by WaterNSW. Priority of access was managed such that the requirements of the Act were maintained. The system was managed in such a way to ensure maintenance of supply as required by the Plan.</p> <p>Domestic and stock rights received 100% allocations since the commencement of the Plan.</p> <p>While no native title rights for water were established in the Plan area during the term of the Plan, the Plan makes provision for these requirements.</p>		Good		
Provide opportunities for market based trading of regulated water entitlement within sustainability and system constraints	Change in economic benefits derived from water extraction and use.	Key drivers of annual changes in farm incomes include changing commodity prices, costs of farm inputs, and varying seasonal conditions and irrigation water availability ABARES (2015). These factors are external to the Plan, except for the Plan being one factor in irrigation water availability.		Good	Consider revising the economic objectives (using the program logic approach) and define performance indicators that can measure the effectiveness of the Plan in achieving	High

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>The introduction of the Plan, along with a range of other reforms, played a key role in enabling water trade (Aither 2017), as well as enabling water users to gain improved control over managing their exposure to risk around their water account and portfolio (e.g. through measures such as carryover and allocation (AWD) rules).</p> <p>The Plan was developed with an understanding that the pre-Plan entitlement and extraction levels were environmentally unsustainable. Plan rules established a long-term extraction limit and clearly defined water entitlements and accounting rules with a range of dealing options for the transfer of water and entitlements. The trading framework provided opportunities for ecologically sustainable market based trading of entitlements, demonstrated by the increase in number and volume of both water allocation and entitlement trades in the water sources since the commencement of the Plan. The weighted average unit price of water transferred also varied through the evaluation period, with higher prices in 2008/2009 and 2009/2010.</p> <p>Over the evaluation period, there has been a significant growth in water use by the cotton industry, demonstrating a move to higher value crops.</p> <p>However, these changes cannot be clearly differentiated in economic data from pre-</p>			<p>these revised economic objectives.</p> <p>Consider establishing a fit for purpose monitoring, evaluation and reporting program based around the previous recommendation</p>	


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		existing water reforms in the 1980s and 1990s, as well as broader economic, social and climate factors.				
Provide sufficient flexibility in water account management to encourage responsible use of available water	Change in economic benefits derived from water extraction and use.	<i>See above</i>			–	–
Contribute to the maintenance of water quality	Change in water quality in this water source	<p>Water quality in the Namoi was found to be predominantly good in the 2004–2012 period.</p> <p>Mawhinney & Muschal 2015 found that the water quality rating is very good across all parameters for the Namoi River at Bugilbone in the lower Namoi area. Upstream at the Namoi River at Gunnedah, the water quality is generally in good condition compared to the basin plan targets, except for total phosphorus, which was rated as very poor.</p> <p>However, with no pre–Plan comparison available, it is not possible to make a finding as to the effectiveness of the Plan with respect to its water quality objectives</p>		Moderate	<i>See above (First objective)</i>	–

Table 20: Performance Indicator results summary

Performance indicator	Related Plan objectives	Results	Strength of information
Change in ecological condition of this water source and dependent ecosystems	Protect, preserve, maintain or enhance the important river flow dependent environmental features and Aboriginal, cultural and heritage values of these water sources.	<p>The PI is assessed through the monitoring of ecological response to changed flow regimes, under the Integrated Monitoring of Environmental Flows program (<i>IMEF</i>). <i>IMEF</i> tests a number of hypotheses to indicate how elements of river ecology respond to different aspects of the flow regime (including environmental flow rules, irrigation flows, and floods and wetland connectivity).</p> <p>Hypotheses in the Namoi</p> <ul style="list-style-type: none"> Algal bloom flushing and suppression Wetland replenishment Rehabilitating fish communities Wetting of terrestrial organic matter Resetting lowland biofilms Improve low flow habitat <p>The <i>IMEF</i> carbon hypothesis focuses on the role that wetting of riparian litter may play in stimulating riverine food webs. It proposes that flow rules that protect a proportion of freshes and high flows will result in more frequent wetting of river banks, benches and in some cases flood plains, then would otherwise occur. The ecological benefits arising from a 50 per cent sharing of supplementary water between irrigators and the environment were able to be partially assessed when dissolved organic carbon (DOC) was sampled during a flood event at Bugilbone. The two months before the flood were characterised by extremely low flows. DOC data revealed that even a minor flood event in the Lower Namoi River can mobilise increased concentrations of DOC from adjacent benches and banks, well above mean ambient DOC concentrations detected in long-term low flow monitoring. The positive relationship obtained between DOC concentrations and discharge provided for the development of DOC loads under different modelled scenarios (with and without environmental</p>	Moderate

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>flows and simulated natural – low development flows). Modelling indicated that environmental flows should increase the amount of DOC transported within the river in years with moderate and large flow events, thus supporting the need to protect small and medium sized flow events that have been partially dampened by regulation (Westhorpe & Mitrovic, 2012). More detailed studies in previous years have shown that DOC derived from common riparian vegetation (e.g. red gums and willows) stimulates heterotrophic bacteria to out-compete phytoplankton for inorganic nutrients, creating a system driven by organic matter derived from outside the ecosystem that results in heterotrophic dominance for some time after an event (DWE 2008; Westhorpe et al. 2010). This heterotrophic dominance driven by bacteria has been shown to significantly increase zooplankton density. Zooplankton are particularly important in lowland rivers as they are key organisms for the transfer of carbon to higher trophic levels (e.g., fish). Thus, supporting the importance of delivering varied flows (e.g., freshes) and subsequent wetting of lowland sections of regulated rivers (Mitrovic et al. 2014). The increased concentrations of organic carbon in the system then improve aquatic food webs and suppresses phytoplankton blooms.</p> <p>Preliminary findings from the wetland replenishment IMEF studies suggest that there was a lack of aquatic plant species present. This may be due to the quick rise and fall in water levels on anabranches and flood runners; the steep sides of the waterholes at the monitoring sites could reduce the sensitivity of vegetation to water level fluctuations (Driver et al. 2007).</p> <p>Government-funded flow response monitoring and modelling programmes (flow science) have supported water resource management since 1997. On-ground monitoring at wetland sites has largely ceased but the flow science done so far indicates that the environmental flow rules written into Water Sharing Plans improve wetland diversity and function (Driver, 2013).</p> <p>The Sustainable River Audit (SRA; MDBA 2012) released in 2004, found the Namoi Valley fish community to be in Poor Condition. Most predicted native species were found, but five alien species were abundant. Alien species were</p>	

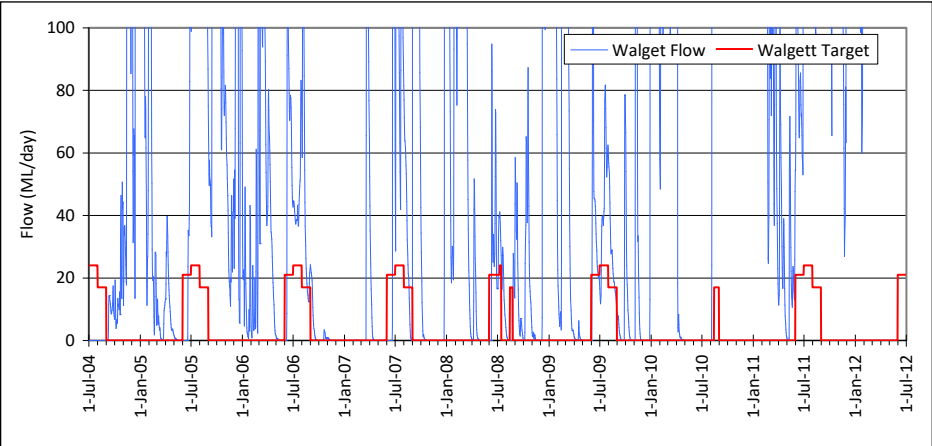
Performance indicator	Related Plan objectives	Results	Strength of information
		<p>61% of total biomass and 37% of total abundance. The SRA2 (MDBA 2012), again found the Namoi Valley fish community was characterised by a poor score for expected native fish species and for nativeness, and a very poor score for native fish recruitment. The Montane zone in particular had few fish and lacked three out of six predicted native species. The valley had reduced native species richness and alien species contributed over 67% of the biomass in samples.</p> <p>A Phase 1 IMEF project on fish passage and breeding failed to establish clear links between fish assemblages and river hydrology and the strongest relationship between flows and fish community structure may be mainly related to recruitment success of individual fish species (Driver et al. 2007). Rolls et al. (2013) found that for the northern rivers and when temperature conditions are suitable, large floods have been shown to enhance native fish recruitment. A study by Gowns (2008) focused on the use of river flows by two vulnerable native fish species, the eel-tailed catfish and Murray Cod, as both species use flowing water in their juvenile stages to disperse from spawning areas. Results indicated that juveniles drifted mainly in October and November. Therefore, it was recommended that river flows need to be maintained from late winter through to summer to ensure adequate dispersal of juvenile fish.</p> <p>There continue to be gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Upper Namoi and Lower Namoi Regulated Rivers Water Sources.</p> <p>References:</p> <p>NSW Department of Water and Energy (DWE, 2008) Integrated Monitoring of Environmental Flows Wetting terrestrial organic matter: IMEF Phase 1, 1998–2005</p> <p>Murray–Darling Basin Authority (MDBA; 2012) Sustainable Rivers Audit 2: The ecological health of rivers in the Murray–Darling Basin at the end of the Millennium Drought (2008–2010). Summary.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>Driver, P, Mitrovic, S, Hardwick, L, Growsns, I & Foster, N (2007) IMEF Technical Advisory Group (TAG) report on progress of the Integrated Monitoring Environmental Flows Program. Report for the Department of Water and Energy, State of new South Wales</p> <p>Driver, P.D., Raine, A., Foster, N.D. and Williams, S.A., 2013. Ecological monitoring to support Water Sharing Plan evaluation and protect wetlands of inland New South Walers, Australia. <i>Ecological Management & Restoration</i>, 14 (3), pp. 187–193.</p> <p>Growsns I. (2008). The influence of changes to river hydrology on freshwater fish in regulated rivers of the Murray–Darling basin. <i>Hydrobiologia</i>, 596, 203–211.</p> <p>Mitrovic S.M., Westhorpe D.P., Kobayashi T., Baldwin D.S., Ryan D. and Hitchcock J.N. (2014). Short–term changes in zooplankton density and community structure in response to different sources of dissolved organic carbon in an unconstrained lowland river: evidence for food web support. <i>Journal of Plankton Research</i>. 36(6), 1488–1500.</p> <p>NSW Office of Environment and Heritage (2011), <i>Environmental water use in New South Wales Annual Report 2010–11</i></p> <p>NSW Office of Environment and Heritage (2012), <i>Environmental water use in New South Wales Annual Report 2011–12</i></p> <p>NSW Office of Environment and Heritage (2013), <i>Environmental water use in New South Wales Annual Report 2012–13</i></p> <p>NSW Office of Environment and Heritage (2014), <i>Environmental water use in New South Wales Outcomes 2013–14</i></p> <p>Rolls R. J., Growsns I. O., Khan T. A. et al. (2013) <i>Fish recruitment in rivers with modified discharge depends on the interacting effects of flow and thermal regimes</i>. <i>Freshwater Biology</i> 58, 1804–1819.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information												
		<p><i>Westhorpe D.P., Mitrovic S.M., Ryan D. and Kobayashi T. (2010). Limitation of lowland river bacterioplankton by dissolved organic carbon and inorganic nutrients. Hydrobiologia. 652, 101–117.</i></p> <p><i>Westhorpe D.P. and Mitrovic S.M. (2012). Dissolved organic carbon mobilisation in relation to variable discharge and environmental flows in a highly regulated river. Marine and Freshwater Research. 63, 1218–1230.</i></p>													
Change in low flow regime	Protect, preserve, maintain or enhance the important river flow dependent environmental features and Aboriginal, cultural and heritage values of these water sources.	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days below the natural 95th and 80th percentiles. The natural (without development) and Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below for both the 95th and 80th percentile show that the only year the baseline target was met at all stations was 2011/12. During the drought period, there were a significant number of days in each year that the flow was below the 95th percentile natural flow and also the 80th percentile flow. The Office of Water suspended the minimum flow targets from 2004/05 until 2009/10 (DPI Water 2013).</p> <table border="1"> <thead> <tr> <th colspan="4">Comparison to modelled Plan scenario for the number of days below the 95th percentile flow</th> </tr> <tr> <th></th> <th>419001 (Namoi at Gunnedah)</th> <th>419039 (Namoi at Mollee)</th> <th>419057 /419091 (Namoi at Walgett)</th> </tr> </thead> <tbody> <tr> <td>Natural 95th percentile flow</td> <td>4 ML/d</td> <td>16 ML/d</td> <td>0 ML/d</td> </tr> </tbody> </table>	Comparison to modelled Plan scenario for the number of days below the 95th percentile flow					419001 (Namoi at Gunnedah)	419039 (Namoi at Mollee)	419057 /419091 (Namoi at Walgett)	Natural 95 th percentile flow	4 ML/d	16 ML/d	0 ML/d	Good
Comparison to modelled Plan scenario for the number of days below the 95th percentile flow															
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Natural 95 th percentile flow	4 ML/d	16 ML/d	0 ML/d												

Performance indicator	Related Plan objectives	Results				Strength of information
		<i>Plan scenario (baseline target)</i>	1	2	45	
		2004/2005	42	39	106	
		2005/2006	27	10	29	
		2006/2008	126	131	218	
		2007/2008	120	128	113	
		2008/2009	9	112	83	
		2009/2010	51	132	121	
		2010/2011	0	22	37	
		2011/2012	0	0	0	
		2012/2013	0	3	1	
		2013/2014	2	60	4	
		Comparison to modelled Plan scenario for the number of days below the 80 th percentile flow				
			419001 (Namoi at Gunnedah)	419039 (Namoi at Mollee)	419057 /419091 (Namoi at Walgett)	
		Natural 80 th percentile flow	112 ML/d	141 ML/d	97 ML/d	

Performance indicator	Related Plan objectives	Results			Strength of information	
		<i>Plan scenario (baseline target)</i>	52	50	185	
		2004/2005	129	160	297	
		2005/2006	120	128	223	
		2006/2008	219	250	344	
		2007/2008	197	218	257	
		2008/2009	173	194	286	
		2009/2010	221	234	265	
		2010/2011	43	66	136	
		2011/2012	0	2	15	
		2012/2013	83	68	207	
		2013/2014	122	111	322	
		<p>There are end of system flow targets on the Namoi and other Northern basin rivers to ensure connectivity with the Darling River. In the Namoi, this is a minimum daily flow at Walgett from June to August. The chart below shows that, with some minor exceptions, the flow targets were met throughout the period, achieving a satisfactory performance.</p>				

Performance indicator	Related Plan objectives	Results	Strength of information
		 <p>Monitoring information is not available to evaluate the environmental outcomes from this rule.</p> <p>References:</p> <p>NSW Department of Primary Industries Water (2017c), <i>Real Time Data – Rivers and Streams</i>, http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskr_url</p> <p>NSW Department of Primary Industries Office of Water (2013b), <i>Audit of implementation – Regulated river water sharing plan audit report cards</i>, Prepared for the period between 1 July 2009 and 30 June 2012.</p>	
Change in moderate to high flow regime	Protect, preserve, maintain or enhance the important river flow dependent environmental features and Aboriginal, cultural and heritage values of these water sources.	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled Plan scenario was completed for the metrics number of days above the natural 30th, 15th and 5th percentiles.</p> <p>The natural (without development) and Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and</p>	Good

Performance indicator	Related Plan objectives	Results			Strength of information																								
		<p>R#845 – Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the criteria were only met in the wet years of 20010/2011 to 2012/2013. This demonstrates that without large floods, the Plan implementation has had limited success in mimicking ‘natural’ moderate and high flows.</p> <p>The high flow regime (15th and 5th percentile flows) was more successfully implemented for the Mollee and Walgett (end of system) gauges, suggesting that while the upper catchment and dam releases may not create high flow events at Gunnedah, by the end of the system, with further contribution from the lower catchment, a high flow regime closer to natural conditions is provided (except for drought years).</p>																											
		<p>Comparison to modelled Plan scenario for the number of days above the 30th percentile flow</p> <table border="1"> <thead> <tr> <th></th> <th>419001 (Namoi at Gunnedah)</th> <th>419039 (Namoi at Mollee)</th> <th>419057 /419091 (Namoi at Walgett)</th> </tr> </thead> <tbody> <tr> <td>Natural 30th percentile flow</td> <td>1,008 ML/d</td> <td>1,170 ML/d</td> <td>899 ML/d</td> </tr> <tr> <td><i>Plan scenario (baseline target)</i></td> <td><i>144</i></td> <td><i>132</i></td> <td><i>74</i></td> </tr> <tr> <td>2004/2005</td> <td>37</td> <td>26</td> <td>27</td> </tr> <tr> <td>2005/2006</td> <td>66</td> <td>68</td> <td>27</td> </tr> <tr> <td>2006/2008</td> <td>57</td> <td>19</td> <td>0</td> </tr> </tbody> </table>				419001 (Namoi at Gunnedah)	419039 (Namoi at Mollee)	419057 /419091 (Namoi at Walgett)	Natural 30 th percentile flow	1,008 ML/d	1,170 ML/d	899 ML/d	<i>Plan scenario (baseline target)</i>	<i>144</i>	<i>132</i>	<i>74</i>	2004/2005	37	26	27	2005/2006	66	68	27	2006/2008	57	19	0	
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Performance indicator	Related Plan objectives	Results			Strength of information	
		2007/2008	22	15	27	
		2008/2009	30	21	25	
		2009/2010	28	22	47	
		2010/2011	164	160	196	
		2011/2012	129	133	126	
		2012/2013	128	129	97	
		2013/2014	143	109	6	
Comparison to modelled Plan scenario for the number of days above the 15th percentile flow						
			419001 (Namoi at Gunnedah)	419039 (Namoi at Mollee)	419057 /419091 (Namoi at Walgett)	
		Natural 15 th percentile flow	4,792 ML/d	2,160 ML/d	1,176 ML/d	
		<i>Plan scenario (baseline target)</i>	55	45	39	
		2004/2005	5	12	25	
		2005/2006	1	38	24	

Performance indicator	Related Plan objectives	Results			Strength of information	
		2006/2008	2	2	0	
		2007/2008	5	10	23	
		2008/2009	9	15	23	
		2009/2010	2	10	44	
		2010/2011	51	110	196	
		2011/2012	39	82	115	
		2012/2013	15	81	74	
		2013/2014	2	58	5	
Comparison to modelled Plan scenario for the number of days above the 5th percentile flow						
			419001 (Namoi at Gunnedah)	419039 (Namoi at Mollee)	419057 /419091 (Namoi at Walgett)	
		Natural 5 th percentile flow	11,685 ML/d	3,170 ML/d	1,643 ML/d	
		<i>Plan scenario (baseline target)</i>	13	15	15	
		2004/2005	1	10	23	

Performance indicator	Related Plan objectives	Results				Strength of information
		2005/2006	0	8	21	
		2006/2008	0	2	0	
		2007/2008	1	7	18	
		2008/2009	6	10	20	
		2009/2010	0	9	42	
		2010/2011	20	89	194	
		2011/2012	13	69	107	
		2012/2013	7	54	72	
		2013/2014	0	37	4	
		References: NSW Department of primary Industries – Water (2017c), <i>Real Time Data – Rivers and Streams</i> , http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url				
Change in water quality in this water source	Protect, preserve, maintain or enhance the important river flow dependent environmental features and Aboriginal, cultural and heritage values of these water sources.	Water quality data for the beginning of the evaluation period is available in the <i>Namoi Water Quality Project 2002–2007 – Final report</i> (Mawhinney 2011). From 2002 – 2007, the Namoi River at Goangra contributed total annual salt loads below the NSW Salinity Strategy end of valley target. This was attributed to low flows in the Namoi River during the sampling period. Phosphorus and nitrogen concentrations were generally not limiting to algal growth in the Namoi Catchment. Results from algal monitoring programs show				Moderate

Performance indicator	Related Plan objectives	Results	Strength of information																					
	Contribute to the maintenance of water quality.	<p>that high blue–green algae biovolumes did not eventuate in the rivers during periods of high nutrient levels and low flow, indicating that other factors such as flow, turbidity and light availability were limiting factors.</p> <p>The <i>Assessment of Basin Plan Water Quality targets in New South Wales</i> report provides some general information on water quality in the Namoi system (Mawhinney & Muschal 2015). The ratings compared to basin targets are provided below based on median annual data from 2007 – 2012.</p> <p>The water quality rating is very good across all parameters for the Namoi River at Bugilbone in the lower Namoi area. Upstream at the Namoi River at Gunnedah, the water quality is generally in good condition compared to the basin plan targets, except for total phosphorus, which was rated as very poor.</p> <div style="background-color: #e0e0e0; padding: 5px;"> <p>Water quality index ratings by site for the Namoi valley (Mawhinney & Muschal 2015)</p> </div> <table border="1"> <thead> <tr> <th>Station</th> <th>Turbidity (lab)</th> <th>Turbidity (field)</th> <th>Total phosphorus</th> <th>Total nitrogen</th> <th>pH</th> <th>Dissolved oxygen</th> </tr> </thead> <tbody> <tr> <td>419021 Namoi River at Bugilbone (Riverview)</td> <td>Very Good</td> <td>Very Good#</td> <td>Very Good</td> <td>Very Good</td> <td>Very Good</td> <td>ID</td> </tr> <tr> <td>419001 Namoi River at Gunnedah</td> <td>Good</td> <td>Very Good</td> <td>Very Poor</td> <td>Moderate</td> <td>Very Good</td> <td>ID</td> </tr> </tbody> </table>	Station	Turbidity (lab)	Turbidity (field)	Total phosphorus	Total nitrogen	pH	Dissolved oxygen	419021 Namoi River at Bugilbone (Riverview)	Very Good	Very Good#	Very Good	Very Good	Very Good	ID	419001 Namoi River at Gunnedah	Good	Very Good	Very Poor	Moderate	Very Good	ID	
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419001 Namoi River at Gunnedah	Good	Very Good	Very Poor	Moderate	Very Good	ID																		

Performance indicator	Related Plan objectives	Results	Strength of information
		<p># Insufficient data (n<5) to assign a rating with confidence ID – Insufficient data to assign a rating</p> <p>References:</p> <p>Driver, P, Mitrovic, S, Hardwick, L, Growns, I & Foster, N (2007) IMEF Technical Advisory Group (TAG) report on progress of the Integrated Monitoring Environmental Flows Program. Report for the Department of Water and Energy, State of new South Wales</p> <p>Mawhinney, W. (2011), <i>Namoi Water Quality Project 2002–2007 – Final report</i>, NSW Office of Water, Sydney</p> <p>Mawhinney, W. and Muschal, M. (2015). <i>Assessment of Murray–Darling Basin Plan water quality targets in New South Wales; 2007 to 2012</i>. New South Wales Department of Primary Industries, Water, Sydney. ISBN 978–1–74256–792–1</p>	
Extent to which BLR requirements have been met.	Protect basic landholder rights of owners of land.	<p>Provision for domestic and stock rights (a component of BLR) and have been provided for in the Plan; estimated at Plan commencement to be 160 ML/year in the Upper Namoi and 1,776 ML/year in the Lower Namoi.</p> <p>As no licences are required for extraction of water for basic rights, it is difficult to assess accurately. Water to meet these needs is included in the WaterNSW operational protocols and is delivered on top of water ordered by licence holders and via a replenishment flow down Pian Creek. During 2004 – 2008, dry conditions meant that water for basic rights holders was curtailed and at times flows ceased for short periods (NSW Department of Water and Energy 2009). Domestic and Stock rights were maintained during 2009 – 2012 (DPI Water 2013).</p> <p>Provision for domestic and stock access licences has been provided for in the Plan; estimated at Plan commencement to be 46 ML/year in the Upper Namoi and 1,967 ML/year in the Lower Namoi respectively. Domestic and Stock</p>	Poor

Performance indicator	Related Plan objectives	Results				Strength of information																																																							
		<p>requirements have not been restricted during the Plan term with full access and entitlements available (i.e. AWDs of 100%).</p> <p>While no native title rights for water were established in the Plan area during the term of the Plan, the Plan makes provision for these requirements.</p>																																																											
		<p>Local Water Utility access licences within the Lower Namoi Regulated River Water Source</p> <table border="1"> <thead> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th colspan="2">Water usage (ML)</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>2,056</td> <td>100%</td> <td colspan="2">570</td> </tr> <tr> <td>2005/2006</td> <td>2,030</td> <td>100%</td> <td colspan="2">946</td> </tr> <tr> <td>2006/2008</td> <td>2,030</td> <td>100%</td> <td colspan="2">1,065</td> </tr> <tr> <td>2007/2008</td> <td>2,030</td> <td>100%</td> <td colspan="2">1,180</td> </tr> <tr> <td>2008/2009</td> <td>2,030</td> <td>100%</td> <td colspan="2">873</td> </tr> <tr> <td>2009/2010</td> <td>1,974</td> <td>100%</td> <td colspan="2">658</td> </tr> <tr> <td>2010/2011</td> <td>2,019</td> <td>100%</td> <td colspan="2">788</td> </tr> <tr> <td>2011/2012</td> <td>2,019</td> <td>100%</td> <td colspan="2">488</td> </tr> <tr> <td>2012/2013</td> <td>2,019</td> <td>100%</td> <td colspan="2">709</td> </tr> <tr> <td>2013/2014</td> <td>2,019</td> <td>100%</td> <td colspan="2">1,137</td> </tr> </tbody> </table>				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)		2004/2005	2,056	100%	570		2005/2006	2,030	100%	946		2006/2008	2,030	100%	1,065		2007/2008	2,030	100%	1,180		2008/2009	2,030	100%	873		2009/2010	1,974	100%	658		2010/2011	2,019	100%	788		2011/2012	2,019	100%	488		2012/2013	2,019	100%	709		2013/2014	2,019	100%	1,137		
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Performance indicator	Related Plan objectives	Results				Strength of information
		Domestic and Stock access licences within the Upper Namoi Regulated River Water Source				
		Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	
		2004/2005	92	100%	8	
		2005/2006	92	100%	3	
		2006/2008	92	100%	8	
		2007/2008	92	100%	5	
		2008/2009	92	100%	8	
		2009/2010	92	100%	6	
		2010/2011	92	100%	6	
		2011/2012	92	100%	7	
		2012/2013	92	100%	6	
		2013/2014	92	100%	9	
		<p>References:</p> <p>NSW Department of Water and Energy (2009), <i>Water sharing in the Upper and Lower Namoi Regulated Rivers: Progress report 2004 to 2008</i></p> <p>NSW Department of Primary Industries – Water (2017), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>				

Performance indicator	Related Plan objectives	Results	Strength of information																																								
		NSW Department of Primary Industries, Office of Water (2013), <i>Audit of implementation – Regulated river water sharing plan audit report cards</i> , Prepared for the period between 1 July 2009 and 30 June 2012.																																									
Extent to which local water utility requirements have been met.	Manage these water sources to ensure equitable sharing between all users	<p>Provision for local water utility requirements has been made in the Plan, estimated at Plan commencement to be 150 ML/year in the Upper Namoi and 2,271 ML/year in the Lower Namoi. There have been no restrictions on local water utility access since the Plan commencement, with full AWD allocations (100%) provided for in all water years.</p> <table border="1"> <thead> <tr> <th colspan="4">Local Water Utility access licences within the Lower Namoi Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>2,271</td> <td>100%</td> <td>1,144</td> </tr> <tr> <td>2005/2006</td> <td>2,271</td> <td>100%</td> <td>1,087</td> </tr> <tr> <td>2006/2008</td> <td>2,271</td> <td>100%</td> <td>762</td> </tr> <tr> <td>2007/2008</td> <td>2,271</td> <td>100%</td> <td>440</td> </tr> <tr> <td>2008/2009</td> <td>2,271</td> <td>100%</td> <td>770</td> </tr> <tr> <td>2009/2010</td> <td>2,271</td> <td>100%</td> <td>847</td> </tr> <tr> <td>2010/2011</td> <td>2,271</td> <td>100%</td> <td>648</td> </tr> <tr> <td>2011/2012</td> <td>2,271</td> <td>100%</td> <td>599</td> </tr> </tbody> </table>	Local Water Utility access licences within the Lower Namoi Regulated River Water Source				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2004/2005	2,271	100%	1,144	2005/2006	2,271	100%	1,087	2006/2008	2,271	100%	762	2007/2008	2,271	100%	440	2008/2009	2,271	100%	770	2009/2010	2,271	100%	847	2010/2011	2,271	100%	648	2011/2012	2,271	100%	599	Good
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Performance indicator	Related Plan objectives	Results				Strength of information
		2012/2013	2,271	100%	931	
		2013/2014	2,271	100%	1,232	
		Local Water Utility access licences within the Upper Namoi Regulated River Water Source				
		Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	
		2004/2005	150	100%	3	
		2005/2006	150	100%	4	
		2006/2008	150	100%	27	
		2007/2008	150	100%	5	
		2008/2009	150	100%	5	
		2009/2010	150	100%	14	
		2010/2011	150	100%	1	
		2011/2012	515	100%	6	
		2012/2013	515	100%	9	
		2013/2014	515	100%	139	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>References:</p> <p><i>NSW Department of Primary Industries – Water (2017d), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers</i></p>	
<p>Change in economic benefits derived from water extraction and use</p>	<p>Provide opportunities for market based trading of regulated water entitlement within sustainability and systems constraints.</p> <p>Provide sufficient flexibility in water Account management to encourage responsible use of available water.</p>	<p>ABARES (2015) identified that there are many factors which impact on economic performance of the irrigation industry and few of these are affected by the Plan. Both ABARES (2015) and Aither (2017) identified that water trading has enabled irrigators and other water users to adapt to varying water availability, particularly during the Millennium drought. However, these are Murray–Darling Basin–wide conclusions.</p> <p><i>Water markets</i></p> <p>Aither (2017) found that “water markets are a fundamentally important tool for irrigated agricultural producers in New South Wales and are an increasingly important tool for regional urban water suppliers, environmental water managers, and investors as well. They are critical to driving improvements in productivity and efficiency in the NSW economy.”</p> <p>Aither (2017) summarised the water market in the Namoi catchment since Plan implementation:</p> <p>“Entitlement trade does occur in the Namoi River, although far less frequently than in other New South Wales systems. There were no recorded entitlement trades for High Security entitlements in the Namoi River over the study period. The allocation market in the Lower Namoi is more active than Namoi entitlements markets, with trade occurring in every year across the study period. The Upper Namoi has markedly less trade recorded.”</p> <p>A summary of water trades and their value summarised from the <i>NSW Water Register</i> is provided below. A more detailed analysis of this data is available in Aither (2017).</p>	<p>Moderate</p>

Performance indicator	Related Plan objectives	Results				Strength of information
		The annual volume of water allocation assignments (i.e. temporary trades) varied during the Plan term but has in general increased substantially since the commencement of the Plan.				
		Water allocation assignments within the Upper Namoi and Lower Namoi Regulated River Water Sources				
		Water year		Share (units or ML)	No. of dealings	
		2004/2005	Upper Lower	0 6,756	0 26	
		2005/2006	Upper Lower	8 20,888	1 70	
		2006/2007	Upper Lower	634 17,025	9 69	
		2007/2008	Upper Lower	533 5,600	12 33	
		2008/2009	Upper Lower	601 12,048	18 62	
		2009/2010	Upper Lower	1,113 11,600	11 54	
		2010/2011	Upper	581	4	

Performance indicator	Related Plan objectives	Results				Strength of information	
			Lower	10,672		23	
		2011/2012	Upper	581		4	
			Lower	20,178		41	
		2012/2013	Upper	1,038		11	
			Lower	36,046		119	
		2013/2014	Upper	1,046		13	
			Lower	36,625		141	
<p>The volume of water entitlement transfers (permanent transfers) varied and peaked in the 2012/2013 and 2013/2014 water years. The average unit price of water transferred also varied through the evaluation period, with higher prices in 2008/2009 and 2009/2010.</p>							
<p>Water share assignments within the Namoi Regulated River Water Sources</p>							
		Water year		Share (units or ML)	No. of dealings	Weighted average (\$/per share) *	Total value of water traded #
		2004/2005	Upper	–	–	–	–
			Lower	–	–	–	–
		2005/2006	Upper	–	–	–	–
			Lower	1,538	5	\$1,607	\$2,471,495

Performance indicator	Related Plan objectives	Results						Strength of information
		2006/2007	Upper	216	–	–	–	
			Lower		2	–	–	
		2007/2008	Upper	–	–	–		
			Lower	43	1	\$2,050	\$87,125	
		2008/2009	Upper	105	1	\$1,700	\$178,500	
			Lower	4,768	6	\$2,128	\$8,018,600	
		2009/2010	Upper	50	1	\$2,000	\$100,000	
			Lower	3,045	5	\$2,128	\$5,694,900	
		2010/2011	Upper	190	2	\$1,526	\$289,960	
			Lower	2,632	7	\$1,700	\$996,200	
		2011/2012	Upper	–	–	–	\$68,750	
			Lower	3,997	3	\$1,283	\$5,129,880	
		2012/2013	Upper	50	1	\$1,375		
			Lower	1,627	9	\$525	\$516,705	
		2013/2014	Upper	102	1	\$1,700	\$173,400	
			Lower	3,280	11	\$1,832	\$2,572,510	
		* Total value of water traded divided by number of shares traded (excluding shares traded for \$0). Data taken from <i>NSW Water Register</i> . There may be other factors that impact this value that were not considered in the analysis.						

Performance indicator	Related Plan objectives	Results	Strength of information
		<p># Total value of water traded determined by multiplying volume of water traded by unit cost of transaction for each transfer recorded in the <i>NSW Water Register</i>. This information is then summed for each year. No post-processing of the Water register data was undertaken. There may be other factors that impact this value that were not considered in the analysis.</p> <p>Economic reports for the Namoi Regulated River Water Source are not available. There are also many factors affecting economic status of a region, for example commodity prices, other sources of water (e.g. groundwater).</p> <p>NSW Irrigators' Surveys provide the primary data for use in the socio-economic monitoring of the water sharing plans in NSW. The Namoi was included in the 2006, 2010 and 2013 survey. For the 2006 survey, Namoi was combined with Gwydir and Border Rivers. Irrigators in the Namoi catchment predominantly agreed that temporary water trading had been good for their area, but this has decreased over the evaluation period (NSW Trade & investment 2015; DPI Water 2011). For permanent trading, the majority of irrigators rated it as 'both good and bad' for the area; the number of respondents that believe permanent trading is good for the area has also decreased over the evaluation period. These monitoring results are based on irrigator responses only and do not include comprehensive economic data.</p> <p>Aither (2017) summarises the water use by irrigated agricultural industry based on Australian Bureau of Statistics data from 2007/08 and 2014/15. Over the evaluation period, there has been a significant growth in water use by the cotton industry. Cotton is now the biggest water user in the Namoi, with around 160,000 ML in the 2014/15 year.</p> <p>References:</p> <p>ABARES (2015), Ashton, D & Oliver, M 2015, <i>Irrigated agriculture in the Murray-Darling Basin: an economic survey of irrigators, 2012-13 to 2014-15</i>, ABARES research report 15.13, Canberra, December.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>Aither (2017) <i>Water markets in New South Wales: market outcomes, trends and drivers</i>, Report prepared for NSW Department of Primary Industries, Water NSW Department of Trade and Investment, Regional Infrastructure and Services (2015) <i>Monitoring economic and social changes in NSW water sharing plan areas Irrigators' Surveys 2009/2010 and 2013 – A state wide comparison</i></p> <p>NSW Department of Primary Industries, Office of Water (2011), <i>Monitoring economic and social changes in NSW water sharing plan areas: A comparison of irrigators' survey 2006 and 2010 – covering plans commenced in 2004</i></p> <p>NSW Department of Primary Industries – Water (2017), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>	
Extent of recognition of spiritual, social and customary values of water to Aboriginal people	Protect, preserve, maintain or enhance the important river flow dependent environmental features and Aboriginal, cultural and heritage values of these water sources.	<p>No native title rights were established in the Upper and Lower Namoi Regulated River Water Sources during the term of the Plan. Additionally, no Aboriginal cultural access licences have been issued in the Plan area.</p> <p>It is noted that although there are no specific strategies within the Plan that are directly related to the Plan, the limits placed on the taking of water under supplementary water access licences and the long-term extraction limit provisions may provide some protection or enhancement of Aboriginal cultural and heritage values. However, there is no monitoring data available that supports the protection or enhancement of these values.</p> <p>Review of the Plan rules may result in the addition of Aboriginal cultural use.</p> <p>The DPI Aboriginal Water Initiative Program aims to improve Aboriginal involvement and representation in water sharing and has commenced engagement with the Aboriginal communities in the NSW, Namoi WRP area. The community's objectives and outcomes for the management of the water resources of the water resources of the WRP area are founded in a number of traditional owner groups' obligations to the whole river system and associated river communities as an indivisible group. These groups include the Gomeroi, Kamilaroi, Gwambray and Weilwan (DPI – Water 2017). Achieving their</p>	Poor

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>objectives requires consideration of values and uses that may extend across multiple WRP areas. Consultation to date has shown that these Aboriginal communities have a multi-faceted relationship with access to and use of water. This relationship ranges from a spiritual and cultural association, to an economic focus, to location of special places. Communities welcome the engagement and are interested in further discussions to improve opportunities to provide for Aboriginal values and uses. While consultation makes clear that Aboriginal values and uses across the landscape should be considered in a holistic, connected sense, some important values and uses at specific locations have been identified.</p>	
<p>Extent to which native title rights requirements have been met.</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced water has been made available and used for Aboriginal purposes.</p>	<p>Manage these water sources to ensure equitable sharing between all users.</p>	<p>There are provisions in the Plan to provide access to water if native title rights over water are granted under the Federal Native Title Act 2003. No native title rights were established in the Upper and Lower Namoi Regulated River during the term of the Plan. Additionally, no Aboriginal cultural access licences have been issued in the Plan area.</p>	<p>Moderate</p>
<p><i>Additional PI identified:</i></p> <p>Change in surface water extraction relative to the long term annual average extraction limit</p>	<p>Protect, preserve, maintain or enhance the important river flow dependent environmental features and Aboriginal, cultural and heritage values of these water sources.</p>	<p>The LTAAEL for the Upper and Lower Namoi Regulated River water sources is 238 GL/year. This Plan Limit is the long-term average diversion, based on running the Plan Limit simulation model for the full period of simulation: 1893–2014. Note that the LTAAEL is approximately 18GL below the long-term average MDB Cap, principally due to the additional environmental water created by the 1998 environmental flow rules and their adaptation for the Plan.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with</p>	

Performance indicator	Related Plan objectives	Results	Strength of information																				
		<p>updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. While these conditions do not vary on an annual basis, the Plan implies that they will be updated, and the model run on an annual basis. According to Office of Water audit reports, this annual assessment did not occur during the Plan term, because development conditions were not updated in the model on an annual basis.</p> <p>Assessment of compliance with the LTAAEL is underway in 2017.</p> <p>Annual diversion data is available from the <i>NSW Water Register</i> and is shown in the table below. However, as noted above, the figure cannot be used directly to assess LTAAEL compliance.</p> <table border="1"> <thead> <tr> <th>Water Year</th> <th>Lower Namoi Diversion (GL)</th> <th>Upper Namoi Diversion (GL)</th> <th>Total (GL)</th> </tr> </thead> <tbody> <tr> <td>2004–2005</td> <td>91</td> <td>5</td> <td>97</td> </tr> <tr> <td>2005–2006</td> <td>138</td> <td>3</td> <td>141</td> </tr> <tr> <td>2006–2007</td> <td>61</td> <td>6</td> <td>67</td> </tr> <tr> <td>2007–2008</td> <td>49</td> <td>2</td> <td>51</td> </tr> </tbody> </table>	Water Year	Lower Namoi Diversion (GL)	Upper Namoi Diversion (GL)	Total (GL)	2004–2005	91	5	97	2005–2006	138	3	141	2006–2007	61	6	67	2007–2008	49	2	51	
Water Year	Lower Namoi Diversion (GL)	Upper Namoi Diversion (GL)	Total (GL)																				
2004–2005	91	5	97																				
2005–2006	138	3	141																				
2006–2007	61	6	67																				
2007–2008	49	2	51																				

Performance indicator	Related Plan objectives	Results				Strength of information
		2008–2009	94	3	98	
		2009–2010	71	4	75	
		2010–2011	147	3	150	
		2011–2012	126	3	128	
		2012–2013	277	4	281	
		2013–2014	267	5	272	
		References: NSW Department of Primary Industries – Water (2017), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers				

Appendix 10 – Upper and Lower Namoi regulated river internal logic relationship diagrams

Relationship diagrams show the internal Plan logic supporting the delivery of each of the Plan's outcomes. One diagram has been created for each of the economic, social / cultural and environmental outcomes. The diagrams show linkages from the Plan vision (green box) through the broad objectives (navy boxes) to the targeted objectives (blue boxes) and the Rules (grey boxes). Where gaps in the program logic have been identified, these are shown as question marks in the appropriate coloured box. Gaps have been identified at the targeted and broad objectives levels in this evaluation.

A sustainable, healthy river system that provides equitable water access for all uses and users through flow management

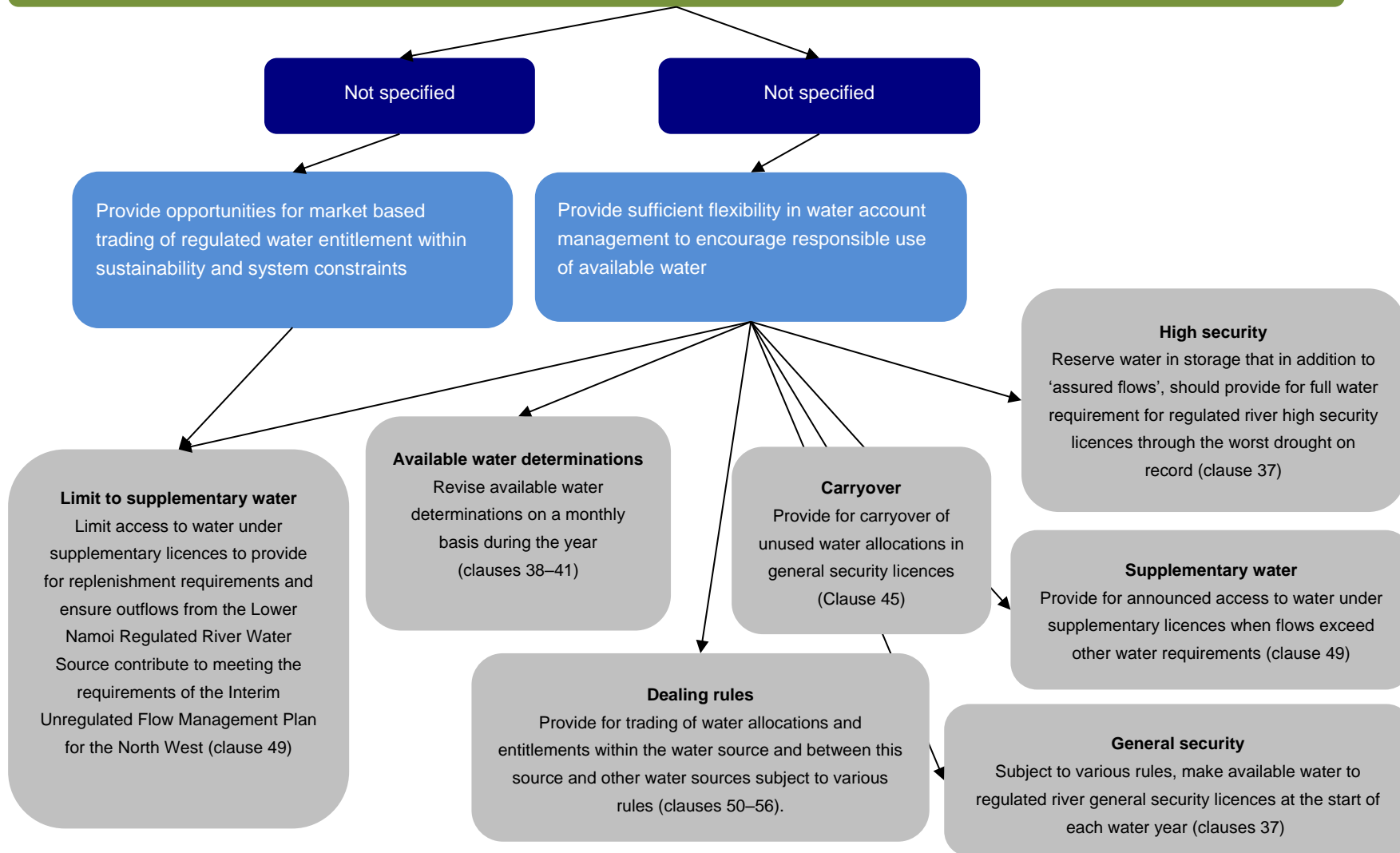


Figure 15: Relationship between Plan rules and economic outcomes

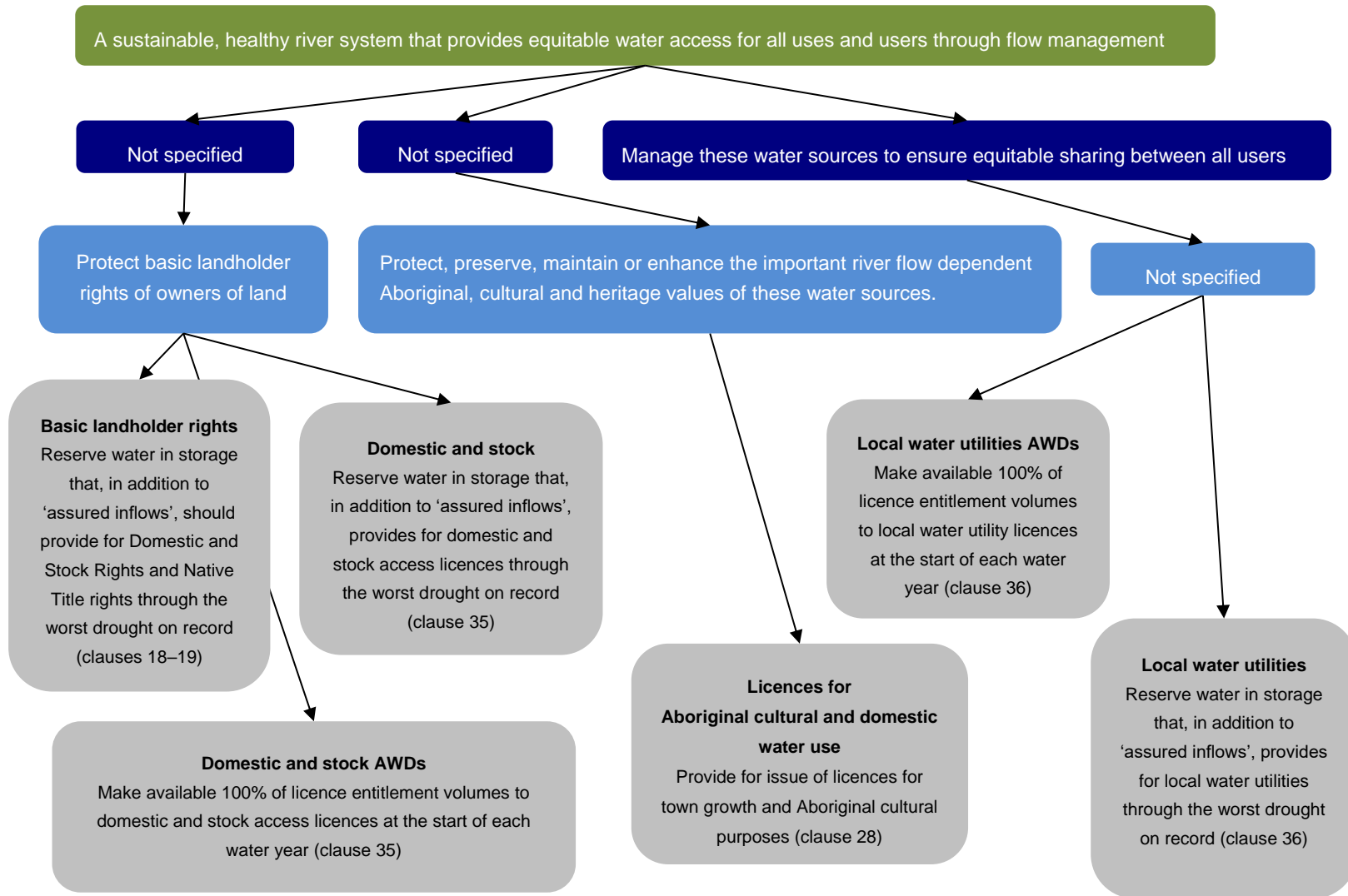


Figure 16: Relationship between Plan rules and social and cultural outcomes

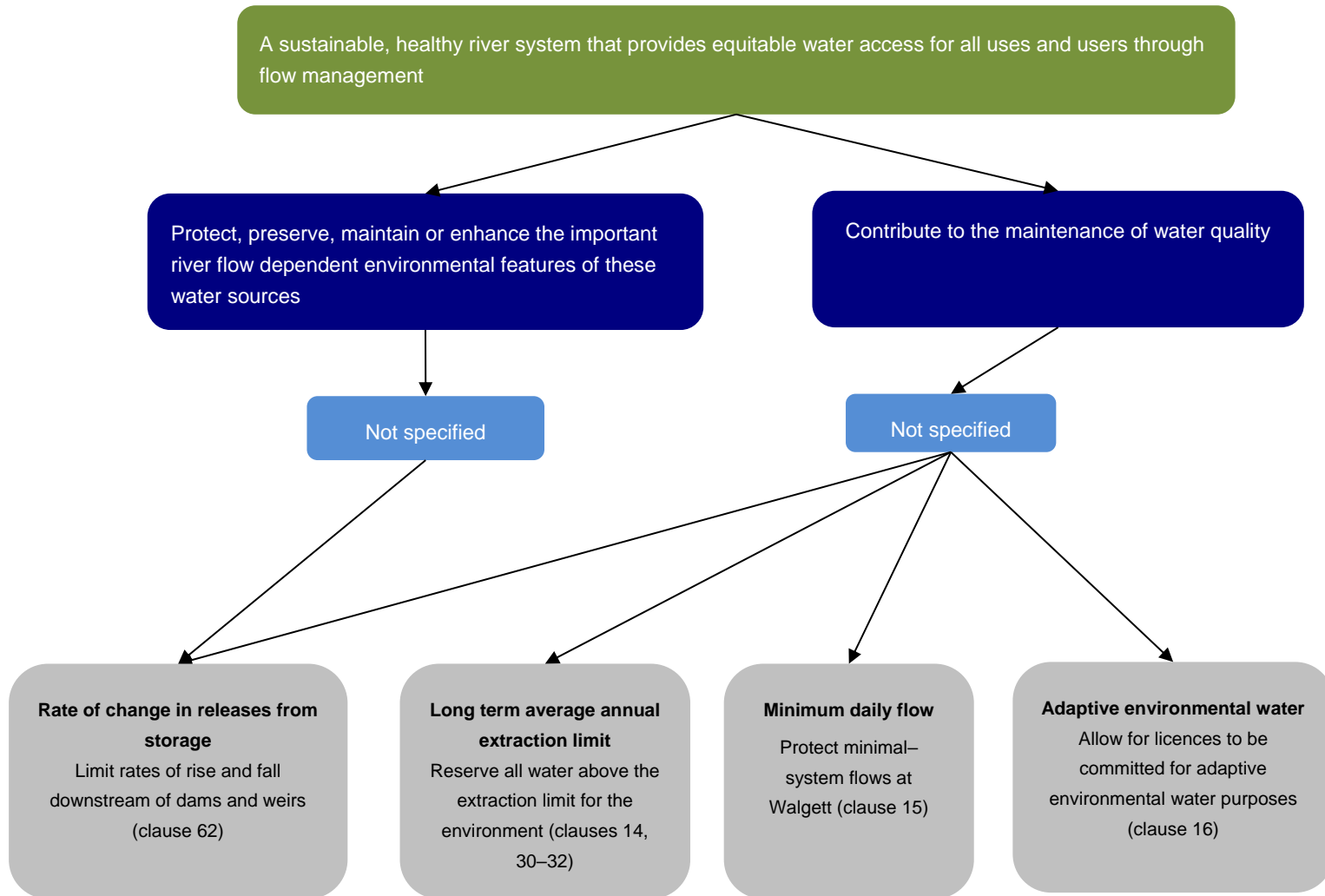












Figure 17: Relationship between Plan rules and environmental outcomes






Appendix 11 – NSW Murray and Lower Darling regulated river report cards and performance indicator summary




Table 21: Appropriateness Report Card




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Plan scale	Is the scale of the Plan appropriate for water management?	Extent to which scale is appropriate for water sharing management	The geographic scale of the water source in the Plan is considered appropriate for water sharing management			
Plan scope	Is the scope of the Plan appropriate for water management?	Extent to which interactions with other water sources are addressed appropriately within the Plan or other water sharing plans	<p>The Plan's scope is considered appropriate. The Plan clearly indicates how it relates to interstate water sharing and operational agreements for the River Murray and includes the Murray–Darling Basin Agreement system operation rules as an Appendix. The Plan may benefit from a note indicating its interaction with the relevant unregulated and groundwater water sharing plans.</p> <p>The CSIRO (2008) Sustainable Yield Reports found that in some valleys increased groundwater use by 2030 would result in some of the current groundwater use being sourced directly from induced stream–flow leakage. Much of this impact has not been explicitly considered in the development of existing surface water sharing plans.</p>		Consider whether the Plan should indicate its interaction with the unregulated and groundwater water sharing plans.	Medium

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>Planned environmental releases provided by the Plan are protected by limiting access to off-river pools or dams in connected water sources while the flows are occurring.</p> <p>The requirements of placement and depth of new or replacement bores, for deep alluvial aquifers and fractured rock aquifers, are specified in the adjacent plans of the Murray valley to protect the water in the regulated river water source.</p>			
Prioritisation	Is the level of management required under the Plan appropriate for the risk to environmental, economic, or social and cultural values?	Extent of risk to dependent ecosystems, economic, and social and cultural values	<p>The prioritisation of the Plan as high risk (DLWC 1998) is considered appropriate.</p> <p>The level of management applied is considered appropriate based on high levels of pre-Plan water allocation.</p>			
		Extent to which risk is addressed	<p>Risk is addressed through the application of the long term average annual extraction limit (LTAAEL), water sharing arrangements that respond to variations in water availability and associated water market.</p>			
		Identified future risks, including climate change, change in industry base, etc.	<p>Future risks are partially addressed through the application of the LTAAEL and a flexible water market.</p>		Consider including analysis of climate change and changes in	High

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			The calculation of the limit uses the drought of record, which may not reflect future climate due to the impacts of climate change. In addition, changes to the industry base are not recognised		industry base to assess implications for water availability and water demands	
Internal logic	Is the vision appropriate for water management?	Whether the vision reflects what is intended for water sharing plans in the Act	The vision is considered appropriate , as it is consistent with the Act's intent for water sharing plans to achieve economic, social and environmental outcomes			
	Are the objectives suitable for water management?	Whether the objectives align with the vision	The objectives align with the plan vision			
		Whether the objectives align with the principles and objects of the Act	The objectives align with the principles and objects of the Act			
		Extent to which the objectives are clear and comprehensive enough to reflect what the Plan intended to achieve	The objectives are clear and comprehensive and reflect what the Plan intended to achieve.			
		Extent to which the plan logic establishes SMART (Specific, Measurable, Attainable, Realistic, Time-bound) objectives	The plan logic establishes objectives that are SMART for the most part. Some of the objectives in the Plan are too broad and do not meet the Specific, Measurable or Time bound components of the SMART criteria			Medium


Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
<i>Internal logic continued</i>	Are the strategies suitable for water management?	Whether all plan rules are linked to a strategy	All plan rules link to a strategy		Consider reviewing the Plan's strategies to be more targeted to address the Plan objectives and provide direction for the Plan's rules, to outline the specific outcomes that are to be achieved by the Plan.	High
		Whether the strategies provide clear direction for the plan rules	The strategies need to provide clearer direction for the plan rules. The Plan strategies are unclear and do not provide a link between the strategies and the expected outcomes of the rules.			
		Whether the strategies align with the objectives	Not all strategies align with the objectives. Current strategies describe plan structure only and do not clearly align with the Plans objectives. This is important as the Act requires performance indicators to be used to assess plan strategies.			
Are the performance indicators suitable for water management?	Whether the performance indicators align with the objectives and strategies		All performance indicators align with the objectives but not with the Plan strategies		Determining new targeted strategies will address this issue with the performance indicators not aligning with the strategies Consider better defining the performance indicators to be	High
		Extent to which performance indicators are clear and comprehensive enough to measure what the Plan intended to achieve	All performance indicators are clear but not comprehensive. Additional information is needed in the performance indicators to evaluate performance of the Plan (example: performance indicator (a) is looking for a change in ecological condition of the water source and dependant			





Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			ecosystems, additional information defining what a change in ecological condition is, is necessary to evaluate the performance of the plan		able evaluate the Plan outcomes	
Quality of Supporting Documentation	Is documentation explaining the decisions underpinning the Plan available?	Adequacy of documentation supporting the Plan	<p>The 2002 “Part A” document provides a thorough explanation of the decisions between 1998 and 2002 that underpinned the original draft Plan.</p> <p>A range of documents are also available that support plan implementation.</p>			
<i>Quality of Supporting Documentation continued</i>		Extent to which documentation is made available to the public	<p>The “Part A” document was available publicly during the Plan’s initial exhibition period but is no longer publicly available.</p> <p>General Purpose Water Accounting Reports (GPWAR; DPI Water 2017b), an Implementation Plan (Office of Water 2009) and Plan Implementation Review reports (DPI Office of Water 2013a and 2013b) are available on DPIE’s website.</p>		Endeavour to improve availability of evidence sources supporting plan implementation and monitoring.	Low
Communication	Is the process for communication with stakeholders adequate?	Extent of communication and processes supporting plan development	<p>Extensive consultation was carried out during plan development, with the Murray Lower Darling Community Reference Committee meeting to explore issues and develop</p>			




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			management strategies. The Plan was placed on public exhibition.			
		Communication arrangements in place during plan operation	<p>Communication has been appropriate; however recent community feedback suggests that a more formalised ongoing communication protocol is required.</p> <p>Generally, communication was on an as needs basis during drought periods, frequent discussions were held with water users. A series of annual General-Purpose Water Accounting Reports are available on DPIE website.</p>		Endavour to develop a communication plan that serves the needs of the community (with reference to the communication role of WaterNSW).	Medium
		Arrangements for consideration at term review of Plan	<p>Plan term amendments were developed in consultation (DPI Water 2016).</p> <p>Sufficient opportunity will be provided for communication during the Water Resource Plan development process.</p> <p>Consultation will involve opportunities to make submissions, and face to face meetings will be held with stakeholders.</p>			
Alignment with state priorities for natural resource	Is the Plan aligned with state priorities for natural resource management?	Extent of alignment of Plan with state priorities	The NRC (NRC, 2013) reviewed the water sharing plans and found that there is some lack of priorities, however, the lack of available monitoring,		Consider reviewing alignment of Plan objectives with state priorities for	High




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
management plans (S43A)			evaluation and reporting information at the time of the assessment limited the NRC's findings (NRC 2013).		natural resource management during the development of the Water Resource Plan.	


Table 22: Efficiency Report Card



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Environmental water provisions	Planned environmental water	<p>Was the Barmah–Millewa Allowance (BMA) managed according to the rules laid out in the Plan?</p> <p><i>Note: The management of the Barmah–Millewa Allowance is a shared New South Wales and Victorian responsibility. The Plan rules outline the obligation of New South Wales in the management of the Barmah–Millewa Allowance.</i></p>	<p>The Barmah–Millewa Allowance was managed according to the Plan rules except during suspension of the Plan from October 2006 – September 2011. During the Plan suspension period other arrangements were followed that adhered to the intent of the Plan when possible.</p> <p>2005–2006: One release was made from the BMA of 256,000 ML.</p> <p>2006–2007 During the suspension of the Plan, water was borrowed from the EWA accounts and made available for consumptive use for the AWDs. (The borrowed water was repaid in 2010–11)</p> <p>2007–2008: Water was made available for environmental purposes under the critical water planning processes and was debited against the BMA account.</p> <p>2008–2009: No releases were made.</p> <p>From 2009–2010, and since the Plan suspension ceased the BMA was implemented according to the Plan rules.</p>		<p>Consider reviewing the Plan to clarify the arrangements for management of the BMA in the event of extreme drought and also repayment of water borrowed from the EWA accounts.</p> <p>Consider reviewing the Plan to simplify the planned environmental water rules.</p>	High






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Was the Barmah–Millewa Overdraw (BMO) managed according to the rules laid out in the Plan?	The BMO has not been required since commencement of the water sharing plan in 2004–05 (DPI Office of Water 2013a and 2013b, DPI Water 2017b).			
		Was the Barmah–Millewa Allowance Carryover managed according to the rules in the Plan?	Carryover for the BMA was managed according to the Plan rules while the Plan was in effect. Note: while the Plan was suspended no additional water was credited to the account. Once the Plan was once again in effect carryover rules recommenced.			
	Environmental contingency allowance	Was the management of the Lower Darling Environmental Contingency Allowance (<i>the Lower Darling ECA</i>) in the Lower Darling Water Source according to the Plan rules?	The Lower Darling ECA has been managed according to the Plan rules. However, no releases have been made during the Plan term (DPIW 2017b). Note: <i>no information was available in the 2004–2009 audit.</i>		Review whether these allowances are required and whether triggers are appropriate	Medium
		Was the management of the Murray Regulated River Water Source Additional Environmental Allowance (The Murray	The Murray AEA has been managed according to the Plan rules, however, no releases have been made. No AEA has been required to meet environmental requirements during		As above	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		AEA) according to the Plan rules?	the term of the Plan (DPI Water 2017b)			
	Adaptive environmental water	Is there a process for licences to be committed for adaptive environmental purposes?	The Plan has the necessary processes in place to commit licences for AEW.			
		Were AEW Use Plans developed?	OEH develops annual plans for the use of its AEW, alongside the Plan's planned environmental water. The Commonwealth Environmental Water Holder (CEWH) chooses not to condition its licences as AEW, but operates a range of planning processes, which are consistent with AEW Use Plans.			
		Were there additional licences created and AEW conditioned as a result of water savings within the water source?	Several AEW licences were created in the Murray and Lower-Darling Water Sources. Two AEW licences were created from water savings resulting from the corporatisation of Murray Irrigation Limited. In addition, two AEW licences were created in response to water savings from the replacement of replenishment flows with a pipeline in the Lower Darling water source.			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Basic Landholder Rights	Domestic and Stock	Were domestic and stock BLR provided for within the plan?	<p>The Plan identified the water requirements for domestic and stock BLR within the Murray and Lower Darling and provides water to be supplied for these purposes, through water set aside from the NSW share of assured inflows into each water source and in reserves held by NSW in water storages in each water source.</p> <p>The Plan provides for provision of domestic and stock BLR through a drought of record, before AWDs can be made.</p>			
		Is domestic and stock BLR growth provided for within the Plan?	<p>The plan recognises that demand may increase and provides for any growth, through the requirement to provide for BLR, prior to making available water determinations (AWDs).</p>			
		Was the water supply managed to ensure sufficient reserves for domestic and stock BLR were maintained?	<p>Domestic and stock BLR reserves were managed according to the Plan rules while the Plan was in effect. Note that, during the record drought years 2004–2010 (and WSP suspension), BLR reserves were available, but could only be delivered intermittently, due to the extremely dry conditions and difficulty in transmitting the water considerable distances.</p>		<p>Review the Plan to clarify what will happen under new drought of record, in terms of:</p> <ul style="list-style-type: none"> - Whether and in what circumstances the Plan is suspended; - Practical constraints on the ability to deliver BLR during 	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
					drought, due to transmission losses; - Governance and criteria for decisions on BLR availability, during drought and/or when the Plan is suspended	
		Were domestic and stock BLR provided for in water delivery operating protocols?	<p>Domestic and stock rights were only partially met due to the extended dry conditions and resulting uncertainty in transmission losses and travel times.</p> <p>2009–2010 and 2010–2011: Water made available to meet critical human water needs, including domestic and stock BLR, during this time required the suspension of access to licensed water allocations carried over from previous years. DPIE is developing guidelines for the take and use of water for domestic consumption and stock watering. These will set limits on extraction for domestic and stock purposes.</p> <p>2011–2012: Wet conditions meant that domestic and stock rights were met at all times during this water year.</p>		<i>As above</i>	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			Note: no information was available in the 2004–2009 audit, other than the Domestic and stock rights were provided for intermittently.			
		Were Great Darling Anabranh replenishment flows delivered when required to satisfy domestic and stock needs, subject to water availability?	<p>Replenishment flows to the Great Darling Anabranh are no longer needed in the Murray and Lower Darling water sources.</p> <p>In the Murray, a pipeline to meet domestic and stock requirements in the Great Darling Anabranh (the Lower Darling water source) is now operational and replenishment flows are no longer needed. The relevant clause in the Plan is now repealed.</p>			
		Are domestic and stock BLR consistent with Reasonable Use Guidelines?	<p>BLR Reasonable Use Guidelines are available in draft form.</p> <p>There is no audit or monitoring information to assess whether use is consistent.</p> <p>During Plan suspension, BLR users were required to comply with urban water user restrictions in force at the time.</p>		<p>Endeavour to publish finalised BLR Reasonable Use Guidelines, including clarification of triggers for requirement for alignment with urban water use restrictions.</p> <p>Consider as part of the Implementation Plan, to include a pilot audit of actual use, 3–5 years after the final guidelines are published.</p>	Medium


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Native title	Were native title BLR provided for within the Plan?	Procedures are in place to provide access if native title rights are granted in the water source covered by this plan. Note: No native title rights for water have been established in this plan area.			
		Is growth in native title BLR protected within the Plan?	The plan recognises that demand may increase and provides for any growth through the requirement to provide for BLR prior to making available water determinations (AWDs).			
Rules for granting access licences	Granting new access licences	Were plan rules followed for the granting of access licences?	All access licences granted were in line with the Plan provisions. The Water Management (General) Regulations 2004 and 2011 set out specific purpose access licences and application conditions.			
Limits to the availability of water	Extraction limits	Was an extraction limit established?	An extraction limit was established for this water source.			
		Was the long-term average annual extraction assessed against the long term average annual extraction limit at the end of each water year?	Assessment of compliance with the LTAAEL has not occurred annually as specified in the plan due to the unavailability of annually updated water use development data. For the Murray-Lower Darling, Cap compliance assessments are carried out by the MDBA, using the MSM-BIGMOD model. However, this differs from the		Consider reviewing the Plan to achieve an approach that <ul style="list-style-type: none"> - can be practically, cost-effectively and reliably implemented - enables timely identification of any risk of growth in use. 	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>LTAEL method for the NSW water sharing plan.</p> <p>Amendment of the Plan is recommended to achieve an approach that can be practically implemented, while enabling timely identification of any risk of growth in use.</p> <p>Compliance with the LTAEL is assessed by running a model to model comparison of development conditions at the start of the WSP, compared with updated development conditions. The LTAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. Water</p>		<p>Endeavour to resolve the process for the collection of water use development data so the IQQM model can be updated at an appropriate frequency.</p> <p>Endeavour to implement NSW Plan limit compliance assessment as routine business, alongside “Permitted take” (SDL) assessment under Basin Plan. This is high priority due to risks for NSW and for water rights holders if “growth in use” is not identified and addressed early.</p>	


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>use development data is not volatile on an annual basis but is more appropriately assessed at the 3–5year frequency.</p> <p>However, the Plan implies that they will be updated, and the model must be run on an annual basis.</p> <p>It is recommended that this approach be reviewed, given that this has proven to be impractical over the 10–year implementation of the Plan. Furthermore, the amended Plans will need to reflect Basin Plan requirements for application and compliance with the SDL.</p>			
	Variation of extraction limits	Were extraction limits varied?	No changes to the extraction limits have been required.			
	LTAEL compliance	Was LTAEL exceeded?	<p>While assessment has not occurred (see above), it is unlikely that LTAEL was exceeded.</p> <p>Assessment of compliance with the LTAEL did not occur annually as specified in the Plan. The Cap compliance approach carried out by the MDBA differs from the LTAEL approach in the Plan. In addition, updated water use development data was not available.</p> <p>LTAEL compliance is not readily identifiable in publicly available information.</p>		<p>See above recommendations concerning review of LTAEL rules and implementation.</p> <p>Endeavour to make available on its website annual LTAEL compliance status.</p>	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Was extraction managed within LTAAEL?	AWD protocols include provisions to ensure LTAAEL not exceeded			
	AWDs	Were AWDs for all categories of licences calculated and announced in line with Plan provisions?	<p>AWDs were calculated and announced according to the Plan rules while the Plan was in effect. It is noted that AWDs were only partially announced in line with the Plan provision in the years the WSP was suspended, due to extremely dry conditions that lead to suspension of the Plan.</p> <p>2004–2006: AWDs made however it is unclear whether there were access restrictions in place for the Lower Darling during this period.</p> <p>2006–2007: AWDs for general and high security differed from the Plan rules</p> <p>2007–2008: AWDS for all other category of licence were initially less than those required by the Plan in the NSW Murray and in the Lower–Darling.</p> <p>Under modified conditions licence holders were able to apply for survival allocations up to a maximum of 50% of allocation for permanent plantings in the Lower Darling and for immediate water needs such as intensive livestock, forestry and industry, abattoirs, wine processing, and non–</p>		<p>Consider reviewing the Plan to clarify what will happen under drought of record, in terms of:</p> <p>12. Whether and in what circumstances the Plan is suspended.</p> <p>13. Priorities and rules for setting AWDs when the Plan is suspended and / or under drought of record or worse.</p> <p>14. Governance and decision–making protocols under these circumstances.</p>	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>deciduous tree crops in the NSW Murray.</p> <p>2009–2011: Local water utility and domestic and stock licences received less than the AWDs provided for in the Plan due to extended dry conditions.</p> <p>As a response to the continued period of low water availability across the Murray–Lower–Darling, special water sharing arrangements between NSW, VIC and SA to share the River Murray resources were in place (these arrangements formally ceased in 2010).</p> <p>2011–2012, 2012–13 and 2013–14: AWDs for all licence categories were made according to the Plan rules.</p>			
Rules for managing access licences	Water allocation and account management	Were water accounts established for all licences?	Water allocation accounts were established for all licence holders.			
		Were accounts managed in accordance with the Plan rules?	<p>Access to account water by General and High security and conveyance licences was managed according to the Plan rules while the Plan was in effect.</p> <p>It is noted that while the Plan was suspended, from October 2006 – September 2011, due to the unprecedented drought other arrangements were followed, that adhered to the intent of the Plan when possible</p>		<p>Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of:</p> <p>15. Whether and in what circumstances the Plan is suspended.</p> <p>16. Priorities and rules for account</p>	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>2004–2006: Accounts were managed in accordance with the Plan rules.</p> <p>2006–2011: Access to account water by general and high security and conveyance licences were suspended in the NSW Murray. Changes to the account management made under the critical human water needs planning process were aimed at maximising water available for essential supplies.</p> <p>2011–2012: Full access was reinstated when Plan suspension was lifted in September 2011.</p>		<p>management when the Plan is suspended and / or under drought of record or worse.</p> <p>17. Governance and decision-making protocols under these circumstances.</p>	
	Carryover provisions	Was carryover in the Murray managed in accordance with the Plan rules?	<p>Carryover in the Murray was managed according to the Plan rules while the Plan was in effect. It is noted that while the Plan was suspended, from October 2006 – September 2011, due to the unprecedented drought carryover limits were relaxed to assist water users.</p> <p>2004–2006: Carryover occurred in line with the Plan provisions.</p> <p>2006–2011: While the Plan was suspended, limits on carryover of unused water account balances set out in the plan for general and high security and conveyance licence holders (NSW Murray water source only) were changed to allow carryover of up to 100% of the</p>		Consider reviewing carryover and account management rules for general security, high security and conveyance licences, to maximise the water available for critical water supplies during dry times, including triggers to move to these rules.	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>licensed entitlement in the Murray water source.</p> <p>No carryover for high security and only carryover of up to 50% entitlement for general security are provided for in the Plan.</p> <p>2011–2012: The Plan permits 0.5 ML/unit share of general security licence entitlements to be carried over to the next water year. As the water sharing Plans resumed during this water sharing year, there was uncertainty as to whether 100% carryover would be allowed as had been allowed during the previous years of Plan suspension. Out of 1,232 general security licences in the Murray, 914 accounts carried over more than the 0.5 ML / unit share provided for in the Plan.</p> <p>To remove uncertainty, it was publicly announced by the Commissioner of the then Office of Water that carryover of 100% would be allowed into the start of the 2012–2013 water year but that the rules as they stand in the Plan would apply the following water years.</p>			
		Was carryover in the Lower Darling managed in accordance with the Plan rules?	<p>Carryover in the Lower Darling was implemented and managed according to the Plan rules while the Plan was in effect. It is noted that while the Plan was suspended,</p>		As above	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>from October 2006 – September 2011, due to the unprecedented drought, carryover limits were relaxed to assist water users.</p> <p>2004–2006: Carryover occurred in line with the Plan provisions.</p> <p>2006–2009: While the Plan was suspended, limits on carryover of unused water account balances set out in the plan for general and high security licence holders were changed to allow carryover up to 100% of the licensed entitlement in the Lower Darling water source.</p> <p>Under Plan rules, no carryover is allowed for high security, and general security is allowed carryover of up to 50% entitlement plus on-farm dam airspace.</p>			
		<p>Were evaporation losses due to general security carryover managed according to the Plan rules?</p>	<p>Evaporation losses were applied to carryover accounts for general security in the Lower-Darling in accordance with Plan rules while the Plan was in effect. It is noted that while the Plan was suspended, this was not appropriate due to the severe water shortage and lack of water available. Note also that evaporate losses are not required in the Plan for general security carryover in the NSW Murray water source.</p>			




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Extraction conditions	Were the general priority of extraction conditions set out in the Plan complied with?	<p>General priorities of extraction conditions set out in the Plan were complied with while the Plan was in effect. It is noted that while the Plan was suspended, from October 2006 – September 2011, due to the unprecedented drought other arrangements were followed, that adhered to the intent of the Plan when possible.</p> <p>2004 to 2009: General priorities of extraction conditions set out in the Plan were complied with.</p> <p>2009–2010 and 2010–2011: General priorities of extraction conditions set out in the Plan were not complied with.</p> <p>The highest priority in the distribution of available water in NSW was to increase high security allocations and reserve water to provide a domestic and stock replenishment to the Wakool River systems.</p> <p>2011–2012, 2012–13 and 2013–14: General priorities of extraction conditions set out in the Plan were complied with.</p>		<p>Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of:</p> <p>18. Whether and in what circumstances the Plan is suspended.</p> <p>19. Priorities and rules when the Plan is suspended and / or under drought of record or worse.</p> <p>20. Governance and decision making protocols under these circumstances.</p>	
		Were numerically specified extraction components introduced by amending water access licences e.g. in relation to times, rates	<p>The Plan was suspended from October 2006 to September 2011.</p> <p>The numerical specification and amendment of water access licences was not carried out during the Plan term.</p>		Establish a state-wide policy for the establishment of numerical extraction components.	Medium



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		or circumstances that water may be taken?			Numerical extraction components to be implemented where required.	
	Supplementary water	Were supplementary water announcements made in accordance with plan requirements?	Supplementary water announcements were made in accordance with the Plan requirements. Dry conditions limited the number of times that access could be announced for this category of users.			
Dealings	Minister's dealing principles	Were dealings in line with the Minister's dealing principles, the Act and the WSP?	All dealings have been made in line with the Ministers dealing principles.			
	Constraints within water source	Were dealings in line with rules relating to constraints within the water source?	Dealings were in line with rules relating to constraints within the water source while the Plan was in effect. It is noted that while the Plan was suspended, deadlines for general and high security allocation assignments within the Murray were relaxed to increase the opportunity for licence holders to meet their water needs in the dry conditions, particularly in light of the low initial AWDs. However, the Plan contains dealing deadlines which should be further considered in the light		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance. Consider dealing rules which maximise water available to the market in dry times.	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>of Basin Plan Water Trading Rules.</p> <p>2004 to 2007: Dealings were in line with rules relating to constraints in the water source.</p> <p>2007 to 2011: Account water assignment across the Barmah choke in the NSW Murray was permitted during this period. Changes to the dealing rules made whilst the Plan was suspended were aimed at widening the water market as much as possible and giving licence holders greater flexibility in dealing with extremely limited water allocations (this was authorised by the MDBA).</p>			
	Change of water source	Trading across Barmah Choke	<p>Account water assignment across the Barmah Choke in the NSW Murray was implemented while the Plan was in effect. It is noted that while the Plan was suspended, changes were made to these dealing rules, with the aim to widen the water market as much as possible and give licence holders' greater flexibility in dealing with extremely limited water allocations. Note: This was authorised by the MDBA.</p> <p>Since the Plan was reinstated, trading across the Barmah Choke has followed the rules of the Plan and the Murray–Darling Basin Agreement.</p>		Continue to manage the NSW Murray and Lower Darling in conjunction with the MDBA when necessary	Medium



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water source?	Over 754 unit shares of entitlement were converted from general to high security licences from 2006 to 2008, however the dry conditions made it difficult to generate sufficient reserves in storage for the new high security licences. The conversion of general to high security licences was subsequently suspended in response to the recommendations of an Australian Competition and Consumer Commission paper on Water Trading Rules (ACCC 2009). The paper recommended that conversion of licence categories not occur due to the potential impact of such dealings on the reliability of allocations for general security licence holders.		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High
		Were conversion factors established when required?	Conversion factors were not established from 2009. The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (ACCC 2009 and ACCC 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences. Change of water source dealings in this section of the plan relate to trade between regulated and unregulated water sources. Current NSW Regulations do not allow		Refer the issue to DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>trade from an unregulated water source into a regulated water source. Trade is allowed from a regulated water source into an unregulated water source. However, the principle of no impact on third parties means that these trades rarely proceed</p> <p>NSW DPIE is reviewing trade between regulated systems including conversion factors with the introduction of the Murray Darling Basin Plan.</p> <p>Conversion factors were established and applied (0.6 shares in the Murray) in July 2006 to July 2008.</p> <p>From July 2008 to June 2009, conversion was suspended, due to dry conditions and difficulty in generating sufficient reserves in storage for the new high security licences was impacting on other general and high security licence holders.</p>			
		<p>Were dealings in line with the Plan rules for inter-valley and / or inter-state dealings?</p> <p>Note: Inter-state dealings are allowed only for the Murray-Lower Darling and Murrumbidgee plans.</p>	<p>Dealings were managed in line with Plan rules while the Plan was in effect. It is noted that while the Plan was suspended, additional restrictions were applied.</p> <p>2004-2006: Dealings were made in line with the Plan rules.</p> <p>2008-2011: Under the critical water planning process, restrictions on interstate and inter-valley dealings</p>		<p>Consider the operational constraints of inter-valley trades in the Murray in light of the experience in the Millennium drought.</p> <p>Refer the issue to DPIE Trade Review for resolution in parallel</p>	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>from the Murrumbidgee regulated river and the NSW Murray regulated river water source to the Lower Darling Regulated River Water Source were introduced.</p> <p>In 2009–2010: a moratorium on temporary trade from the Murrumbidgee to the Murray was introduced due to high transmission losses associated with such deliveries and the difficulty in physically delivering traded water.</p>		with Murray Darling Basin Plan trade rules compliance.	
Mandatory conditions	Access licence conditions	Were mandatory conditions for access licences placed on licences?	Mandatory conditions required in the Act and in the Plan, were placed on the licences during the conversion from WA to WMA before the Plan commenced.			
	Water supply works approvals	Were mandatory conditions for works approvals placed on the works approvals?	Mandatory conditions required in the Act and in the Plan, were placed on the approval during the conversion from WA to WMA before the plans commenced.			
System Operation rules	Replenishment flows	Were replenishment flows provided in accordance with the Plan?	<p>Replenishment flows are no longer needed in the Lower Darling water source.</p> <p>A pipeline to meet domestic and stock BLR requirements in the Great Darling Anabranche (the Lower Darling Water Source) is now operational. Replenishment flows are no longer needed and the relevant clause in the water sharing plan was repealed.</p>			


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		Was the water supply managed to ensure sufficient reserves for replenishment flows were maintained?	See above	See above		
	Water delivery and channel capacity constraints	Were initial estimates of maximum water delivery and operating channel capacity updated?	<p>The initial estimates of maximum water delivery or operating channels capacity included as notes in the plans have not been updated.</p> <p>For much of the Plan term dry conditions meant that this was not required or a priority.</p> <p>Rules operating during periods of constraint governing sharing of capacity between the ECA and water orders need clarification.</p>		Review the application and effectiveness of channel capacity and constraint rules.	Medium
	Rates of change to releases from storages	Was an operating protocol for the management of rates of change to releases from storages developed?	<p>No, an operating protocol was not developed, according to the Plan Implementation Review (DPI Office of Water 2013a and 2013b).</p> <p>However, storage releases are made according to a long-established draft protocol.</p> <p>The Plan Implementation Review notes that the Dam works approval required the holder (SWC, now WaterNSW) to develop the protocol by June 2012.</p> <p>The 2013 Audit recommended DPI Water, DPI Fisheries, Department of Planning, Industry & Environment - Environment, Energy & Science (agencies now within DPIE) and</p>		<p>Consider the policy requirement – is the operating protocol required given it hasn't been implemented during first 10-year term?</p> <p>If the review considers a protocol is required, then DPIE may require compliance by the holder of the works approval.</p>	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			WaterNSW jointly develop an operating protocol for the implementation manual.			
	Dam operation during floods and spills	Were rules for operating Dams in floods and spills followed?	<p>Protocols were followed for dam operations during floods and spills.</p> <p>The Plan requires that when the dam spills there should be a reduction in carryover in the BMA. Although, the Hume Dam spilt in 2010–2011, no reduction in carryover in the BMA was required. The water was protected by the Plan rules because previously borrowed water was repaid into the account.</p>			
Plan Amendments	Changes to the water source	Were any changes to the water source required?	<p>The Plan was amended in 2012 to make minor changes to the New South Wales Murray Regulated River water source to which the Plan applies.</p> <p>The amendments were:</p> <ul style="list-style-type: none"> • Include Waddy Creek and Merangatuk Creek (they were inadvertently omitted from the Plan). • Include the lower portion of Bullatale Creek and Aluminy Creek (water extracted from these watercourses is supplied from the regulated system). • Removed a short reach from the Rufus River (it is not supplied by water from the regulated system). 			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Amendments relating to planned environmental water (made under s.8A of the WMA 2000)	Were any changes required to planned environmental water rules?	<p>The volume of LTAAEL has been altered due to purchases of supplementary water under the Living Murray program, as the purchased volume was retired from the bulk access regime.</p> <p>Under “The Living Murray” initiative, 100,000 and 250,000 unit shares of supplementary water access licences were purchased in the Murray and Lower Darling, respectively. The associated volumes are intended to remain in channel for ecological benefits rather than be extracted for consumptive use</p> <p>The Murray Water Source LTAAEL has been reduced by 17,800 ML to reflect the long-term extraction associated with the 100,000 unit shares purchase.</p> <p>The Lower Darling LTAAEL has similarly been reduced by 35,500 ML to reflect the long-term extraction associated with the 250,000 unit share purchase.</p>			
	Amendments relating to floodplain harvesting	Were any changes made to water sources or Plan provisions to provide for floodplain harvesting?	<p>No changes to water sources or plan provisions have been made to provide for floodplain harvesting licences.</p>		Consider whether floodplain harvesting amendments are required for the Murray–Lower Darling and if not, whether the discretionary	



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
					amendment provision is required.	



Table 23: Effectiveness Report Card



Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>Improve opportunities for natural regeneration and breeding cycles and ecological processes reliant on seasonal patterns, in particular by reinstating more natural wetting and drying cycles</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p> <p><i>Additional PI identified</i></p> <p>Change in surface water extraction relative to the long term average annual extraction limit</p>	<p>Summary finding: The evaluation has been unable to find that the Plan has been effective, nor ineffective, in achieving this objective over the 2004–2014 period. While some indicators show positive environmental outcomes, others continue to show negative impacts.</p> <p>In addition, the evaluation found that effectiveness of Plan implementation could not be differentiated from pre-existing reforms in the Murray and Lower Darling, the effects of the Millennium Drought, Plan suspension, actions by other organisations that influence these regions and the development of environmental water portfolios. The latter was enabled but not intended by the Plan’s creation of fully tradeable water rights.</p> <p>The Plan was developed with an understanding that detrimental effects on the condition of water-dependent ecosystems and water quality in the Lower Darling and NSW Murray river and wetland systems had resulted from significant changes to the flow regime as a result of surface water development.</p> <p>Monitoring of the outcomes of these changes encompassed both pre- and post-Plan periods.</p> <p>Monitoring results show mixed responses to implementation of the Plan. However, these must be viewed in the context of both the historically unprecedented Millennium drought and the</p>		<p>Good</p>	<p>Provide clearly defined performance indicators and an associated performance monitoring programs that closely align with plan objectives and strategies.</p> <p>Investigate further refinement of environmental rules and their operation to enhance environmental outcomes without impacting economic or social outcomes. (see efficiency recommendations)</p> <p>Design of monitoring programs to attempt to clearly differentiate between Plan rules / implementation</p>	<p>High (all)</p>


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>resulting suspension of the Plan between 2006 and 2011.</p> <p>Ecological condition At some major sites in the NSW Murray area, vegetation condition was poor and limited waterbird breeding was recorded during the Millennium drought. Vegetation recovered through the natural flooding of 2010–12, with limited improvement since then.</p> <p>During the 2010/11 and 2011/12 years, EWA was used with other environmental water sources at Barmah Millewa, which lead to a breeding event considered to be the best in the valley for a decade.</p> <p>In summary, it can reasonably be concluded that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term, other holders of environmental water in the area, and many other external factors. These external factors include the significant State and Commonwealth development of environmental water portfolios, which was enabled by the Plan’s creation of tradeable water rights but was not an objective or strategy or rule of the Plan.</p> <p>Change in flow regime Analysis of flow regime shows that WSP Performance Indicator assessment criteria were not achieved compared to the baseline Plan target. This was the case for number of days below 95th</p>			and other external factors.	



Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>percentile and 80th percentile, as well as number of days above 30th, 15th and 5th percentile. In all cases, the exceptions were the years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods.</p> <p>This supports the finding that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term and many other external factors.</p> <p>Water quality</p> <p>Water quality in the Lower Darling has been found to be predominantly very poor in the 2007–2012 period. Water quality in the NSW Murray has been found to be predominantly good to very good in the 2007–2012 period.</p> <p>However, with no pre-plan comparison available, it is not possible to make a finding as to the effectiveness of the Plan with respect to its water quality objectives.</p> <p>While blackwater events have been a problem in the Murray and Lower Darling Valleys during the evaluation period, in some cases environmental water was successfully used to mitigate blackwater events and maintain water good quality.</p> <p>Change in extraction relative to limit</p> <p>Whilst assessment of compliance with the LTAAEL is not available, it is unlikely that the average annual extractions will have breached the LTAAEL</p>				


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>for this period, therefore it is assumed to have been protected.</p> <p>However, note that there are many external factors that will also have contributed to this outcome, including the Millennium Drought, potentially more conservative use of water allocations by water entitlement holders and the development of environmental water portfolios by State and Commonwealth for environmental use.</p>				
Increase the connectivity between the river and floodplain during spring and early summer	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in moderate to high flow regime</p>	<p>Analysis of flow regime shows that Plan Performance Indicator assessment criteria were not achieved, compared to the baseline Plan target. This was the case for number of days above 30th, 15th and 5th percentile. Some exceptions were the years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods.</p> <p>In particular, Murray at Wentworth (end of system site) performed poorly across most years for the 15th and 5th percentile flows.</p> <p>This supports the finding that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term and many other external factors.</p>		Good	See above	
Contribute to the maintenance or enhancement of the physical	Change in ecological condition of this water source and	<p>Analysis of flow regime shows that WSP Performance Indicator assessment criteria were not achieved, compared to the baseline Plan target. This was the case for number of days below 90th and 80th percentiles. In all cases, the exceptions</p>		Good	See above	

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
habitats of the river system	dependent ecosystems Change in low flow regime Change in moderate to high flow regime	were the years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods. This supports the finding that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought conditions through most of the Plan term and many other external factors.				
Improve the opportunities for breeding of native fish and other native organisms by encouraging the migration of native fish and allowing access to spawning sites, food sources and improved water quality, including correct thermal conditions	Change in ecological condition of this water source and dependent ecosystems Change in moderate to high flow regime	Successful fish spawning events occurred for golden perch in the Murray River Channel in 2013/14. The Barmah Forest fish community has shown little improvement over the evaluation period, despite an improvement in flow conditions in recent years. Environmental water was also used at Gunbower Forest to support the life cycle of native fish. Studies over the evaluation period found that periods of high fish growth coincided with environmental water delivery. Further monitoring is required to understand how the change in fish breeding and migration is influenced by the plan (opposed to other activities and conditions).		Good	See above	
Promote the recovery of threatened species, populations and	Change in ecological condition of this water source and	Watering at 'Nampoo' and 'Cliffhouse' stations enabled the recruitment of many frog species, including the southern bell frog, which is listed as vulnerable under Commonwealth legislation.		Poor	See above	

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
ecological communities	dependent ecosystems Change in low flow regime Change in moderate to high flow regime					
Contribute to expansion and diversification of river bank habitat	Change in ecological condition of this water source and dependent ecosystems Change in low flow regime Change in moderate to high flow regime	<p>Given the drought conditions for much of the evaluation period, efforts for riparian vegetation were focused on maintaining condition, diversity and extent rather than expansion and diversification.</p> <p>Flows down the Great Darling Anabranch improved the condition of riparian trees as well as increasing the diversity of understorey vegetation in 2013/14.</p> <p>In 2009/10 watering in the Murray enabled many sites to exhibit improved vegetation condition, especially in river red gum, lignum and black box communities.</p> <p>It is difficult to assess the effectiveness of the plan in this regard, given the drought conditions and multiple external factors influencing the riparian habitat outcomes.</p>		Moderate	See above	
Contribute to maintenance of bank stability	Change in moderate to high flow regime <i>Note: a more appropriate performance indicator</i>	<p>Change in flow regime</p> <p>Analysis of flow regime shows that WSP Performance Indicator assessment criteria were not achieved compared to the baseline WSP target. This was the case for number of days above 30th, 15th and 5th percentile. Some exceptions were the</p>		Good	See above	

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	<i>is required to be developed for this objective.</i>	<p>years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods.</p> <p>In particular, Murray at Wentworth (end of system site) performed poorly across most years for the 15th and 5th percentile flows.</p> <p>Other activities While not directly relevant to the Plan, work has been underway during the evaluation period to investigate appropriate rise and fall rates and increase conveyance capacity around the Barmah choke, to contribute to the objective of increased frequency of high flows and maintaining channel stability.</p> <p>It is difficult to assess the contribution of the flow regime to the maintenance of bank stability; however, given the poor performance of the moderate to high flow regime, it is likely that the plan has not contributed to the maintenance of bank stability.</p>				
Assist in maintenance of the ecological health of anabranches and billabongs, particularly for habitat that may	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in moderate to high flow regime</p>	<p>Analysis of flow regime shows that Plan Performance Indicator assessment criteria were not achieved compared to the baseline Plan target. This was the case for number of days above 30th, 15th and 5th percentile. Some exceptions were the years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods.</p> <p>In particular, Murray at Wentworth (end of system site) performed poorly across most years for the 15th and 5th percentile flows.</p>		Good	See above	

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
not be provided in the main river channel		While direct monitoring has not been undertaken, given the moderate to high flow regime was not implemented to align with the plan scenario, it is unlikely that the plan implementation has assisted the ecological health of floodplain features.				
Contribute to the maintenance or improvement of water quality to downstream water environments	Change in low flow regime Change in water quality	Water quality in the Lower Darling has been found to be predominantly very poor in the 2007–2012 period. Water quality in the NSW Murray has been found to be predominantly good to very good in the 2007–2012 period. An IMEF study showed that environmental water delivery can prevent algal blooms in the lower Darling. Environmental water was also used in the Murray in 2012 to prevent a blackwater event. However, with no pre–plan comparison available, it is not possible to make a finding as to the effectiveness of the Plan with respect to its water quality objectives.		Moderate	See above	
Protect basic landholder rights to access water	Extent to which basic landholder rights requirements have been met	Delivery of BLR for domestic and stock use, as well as domestic and stock access licences, occurred in all years in which the Plan was in effect. It is noted that during Plan suspension and the Millennium Drought, some rights holders and licences did not receive full access and some replenishment flows were not able to be delivered. (see efficiency report card above).		Good	Also see recommendation under efficiency with respect to clarity of arrangements and constraints in drought circumstances for Basic Landholder Rights, Domestic	Medium

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
					<i>and Stock licences and local water utility licences.</i>	
Enhance the viability, sustainability and security of primary and secondary, recreational and tourist industries, and the communities of the Murray–Lower Darling region.	<p>Extent to which local water utility and major utility requirements (where major utilities are involved in urban water provision) have been met</p> <p>Change in economic benefits derived from water extraction and use</p> <p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p> <p>Extent to which native title rights requirements have been met</p> <p><i>Additional PI component identified</i></p> <p>Extent to which licenced water has been made available</p>	<p>Throughout the duration of the Plan, water was shared between all water uses, including the environment, according to the priority of access provided in the Plan (except when the plan was suspended).</p> <p>Local water utilities Local water utilities received 100% allocations since the commencement of the Plan in the Lower Darling Regulated River Water Source, and in all years in the NSW Murray Regulated River Water Source except a few years while the Plan was suspended due to drought (2007/08, 2008/09 and 2009/10).</p> <p>Economic benefits The Plan played a key role in establishing tradeable water rights and building on earlier trading frameworks. Recent analyses suggest that enabling water trading has contributed to growth in economic outputs per ML of water extracted, as well as enabling water users to adjust to limited water availability during the Millennium drought, particularly through allocation trade. Other entitlement holders have been able to realise the asset value by selling part of all of their entitlement. However, there is difficulty in differentiating the economic impacts and benefits from other external factors, such as the drought, reforms and the</p>		Moderate	<p>Consider clearer identification of SMART objectives and performance indicators for changes in economic benefits, related to the Plan rules and differentiated from external factors, to the extent possible.</p> <p>Establish Aboriginal Social and Cultural objectives, strategies and PIs that are directly linked to values of water for Aboriginal people</p>	<p>High</p> <p>Medium</p>

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	<p>and used for Aboriginal purposes.</p> <p>Change in surface water extraction relative to the LTAAEL</p>	<p>development of environmental water portfolios in the Murray–Darling Basin, as well as broader economic and social changes.</p> <p>The introduction of the Plan, along with a range of other reforms, played a key role in enabling water trade (Aither 2017), as well as enabling water users to gain improved control over managing their exposure to risk around their water account and portfolio (e.g. through measures such as carryover and allocation (AWD) rules). However, these changes cannot be clearly differentiated in economic data from pre–existing water reforms in the 1980s and 1990s, as well as broader economic, social and climate factors.</p> <p>Therefore, while it can be reasonably concluded that the Plan contributed to economic benefits and a sustainable regional economy, it is recommended that clearer identification of SMART objectives and PIs, related to the Plan rules are developed.</p> <p>Water in the Murray and Lower Darling can be traded between the two water sources and with a number of connected systems (Murrumbidgee, Victoria and South Australia). While trading in the Lower darling is limited, there are substantial volumes of trade in the NSW Murray.</p> <p>Water trade prices peaked in the NSW Murray in 2009/2010 and in the lower Darling in 2008/2009.</p> <p>Native titles and spiritual, social and customary values of water to Aboriginal people</p> <p>No native title rights have been granted within the</p>				

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>water sources and no licences have been issued for Aboriginal cultural purposes.</p> <p>There are no specific strategies within the Plan that are directly related to the objective, although the Plan recognised environmental water provisions were likely to make some contribution towards the preservation of cultural and heritage values. There is little information available on the social impacts of the Plan on communities within the Plan area.</p> <p>The Plan has not provided cultural outcomes for Aboriginal communities with no real evidence of the Plan being able to influence outcomes relating Aboriginal spiritual, social and customary values.</p> <p>Given the potential linkages between cultural and heritage values and environmental assets the use of the EWA may support the achievement of this objective.</p>				

Table 24: Performance indicator results summary

Performance indicator	Related plan objectives	Results	Strength of information
<p>Change in ecological condition of this water source and dependent ecosystems</p>	<p>Improve opportunities for natural regeneration and breeding cycles and ecological processes reliant on seasonal patterns, in particular by reinstating more natural wetting and drying cycles</p> <p>Increase the connectivity between the river and floodplain during spring and early summer</p> <p>Contribute to the maintenance or enhancement of the physical habitats of the river system</p> <p>Improve the opportunities for breeding of native fish and other native organisms by encouraging the migration of native fish and allowing access to spawning sites, food sources and improved water quality, including correct thermal conditions</p> <p>Promote the recovery of threatened species, populations and ecological communities</p>	<p><i>The Living Murray</i></p> <p>The Living Murray is one of Australia's most significant river restoration programs. It aims to achieve a healthy working Murray River system for the benefit of all Australians. This includes returning water to the river's environment. The program issued 37 reports during the period 2006–07 to 2008–09 focusing on birds, fish and vegetation as ecological health objectives, and on general matters (DPI Water 2012). A summary provided by DPI Water (2012) provides an overview on some environmental outcomes during this period:</p> <p>Barmah Millewa environmental watering in 2006/07 produced successful waterbird breeding and healthy vegetation across the forest; however, in 2007/08, no waterbird breeding was recorded, and drought conditions led to a lack of understorey vegetation growth. In 2007/08 fish and turtle habitats were successfully maintained as well as suitable waterbird habitat.</p> <p>At Gunbower–Koondrook–Perricoota Forest, less than 20% of river red gum forests were in healthy condition and overall vegetation condition was declining with dry conditions in 2006/07 – 2007/08. Environmental water was used in 2008/09 to maintain responses.</p> <p>The focus for the River Murray Channel in 2006/07 to 208/09 was on fishway infrastructure and investigations to inform increased frequency of higher flows in spring. No watering activities occurred in 2008/09.</p> <p>2013–14 monitoring results at Barmah forest found vegetation response was greater than in the drought years of 2006 to 2009 and also an improvement on the wetter years of 2010 to 2013. Data collected over the past seven years indicates that the return to a seasonally appropriate wetting and drying regime is promoting an increasingly stronger response in diversity and cover of native wetland vegetation (MDBA 2016). Moira grass flowered at all monitored wetland sites in Barmah and achieved the growth and flowering expected in</p>	<p>Moderate</p>

Performance indicator	Related plan objectives	Results	Strength of information
	<p>Contribute to expansion and diversification of river bank habitat</p> <p>Assist in maintenance of the ecological health of anabranches and billabongs, particularly for habitat that may not be provided in the main river channel</p>	<p>response to environmental watering (Ward 2014). However, there was no evidence of germination from a seed-bank during the watering event. The reason for this is unclear and will require further research (MDBA 2016).</p> <p>While the first major spawning event of golden perch in the River Murray identified since 2006–07 occurred in 2013–14, the Barmah Forest fish community as a whole has shown little improvement since TLM monitoring commenced in 2006–07. This is despite an improvement in flow conditions in recent years (MDBA 2016).</p> <p>In 2013–14, the vegetation in Gunbower Forest continued to show limited signs of improved health following the large natural flooding of 2010–12. Vegetation continued to recover, although slowly, during water recession. Despite these results, no wetland sites and only a small number of red gum and box sites assessed were considered to support healthy species richness, and tree health was found to be generally low and / or declining.</p> <p>A key environmental watering action of 2013–14 comprised the delivery of environmental water through Gunbower Creek to support the lifecycle of native fish species, particularly the Murray cod. This water delivery played a key role in reducing the excessive short-term variation in water levels during the spawning season with winter flows a key contributor to the long-term survival of young of the year fish (Sharpe and Stuart I 2015).</p> <p>Other than the more common species such as ducks and cormorants, there was little bird breeding in Gunbower Forest as the area of suitable habitat for nesting and feeding was limited.</p> <p>Tonkin et al. (2014) analysed data collected between 1999 and 2014 to investigate links between flow regimes and the growth, recruitment and population responses of large bodied fish in the Yarrawonga to Tocomwal reach of the River Murray; the project found:</p> <p>Trout cod, Murray cod and golden perch grew more in years with high discharge and high flow variability that was predominantly in spring, summer</p>	

Performance indicator	Related plan objectives	Results	Strength of information
		<p>and autumn. The results also indicate that periods of high fish growth in the River Murray coincided with delivery of environmental water.</p> <p>Golden perch populations are largely driven by connectivity that facilitates adult migration. Increases in population size are associated with high flow events which enhance connectivity.</p> <p><i>OEH Environmental Water Outcomes reports</i></p> <p>Since 2009, the Office of Environment and Heritage (OEH) has published annual environmental water outcomes reports. These identify positive environmental outcomes from environmental watering, particularly following the end of the Millennium Drought. Positive outcomes are reported for waterbirds, fish frogs and vegetation. However, these reports do not differentiate or identify specific outcomes from the planned environmental water use under the Plan, as opposed to outcomes from delivery of state and Commonwealth held environmental water entitlements. In addition, it is not clear if the outcomes observed are anecdotal or from scientifically designed monitoring</p> <p>In both 2010/11 and 2011/12, the BMA was used at Barmah–Millewa Forest along with Living Murray, NSW AEW and Victorian Environmental Water Holder contributions. Barmah–Millewa Forest was inundated across approximately 80% of the forest for a substantial number of months, attracting approximately 7000–10,000 pairs of colonial nesting waterbirds and other species in a breeding event that was considered the best in the valley for over a decade</p> <p>This built on the ecological outcomes achieved from water delivered previously across Murray Lower Darling sites. OEH staff reported an increase in foliage cover on riparian trees such as river red gums, black box and understory lignum. Higher diversity and abundances of native wetland plants were also observed on most Murray and Lower Darling sites.</p>	

Performance indicator	Related plan objectives	Results	Strength of information
		<p>While the planned environmental water was not used in other years, positive outcomes reported include:</p> <p>Environmental flows down the Edward–Wakool river system provided a flow regime to benefit Murray cod habitats and provide opportunity for their recruitment in 2013/14</p> <p>Flows down the Darling Anabranh improved the condition of riparian trees as well as increasing the diversity of understorey vegetation in 2013/14</p> <p>Private wetlands were watered using Adaptive Environmental Water across the evaluation period.</p> <p>In 2013, OEH, in conjunction with the NSW Crown Lands Division, inundated approximately 460 hectares of black box floodplain, which is part of Bottle Bend Reserve. The floodplain had been dry for the previous 20 years and is the largest area of black box that has been actively watered in the Murray Valley.</p> <p>Watering at ‘Nampoo’ and ‘Cliffhouse’ stations enabled the recruitment of many frog species, including the southern bell frog, which is listed as vulnerable under Commonwealth legislation</p> <p>In 2009/10 watering in the Murray enabled many sites to exhibit improved vegetation condition, especially in river red gum, lignum and black box communities.</p> <p>There continue to be gaps in ecological response monitoring and water quality assessment in relation to impact of changed flow regime in the Murray and Lower Darling Regulated Rivers Water Source.</p> <p>References:</p> <p>Murray Darling Basin (MDBA) (2016) <i>The Living Murray Icon Sites Monitoring 2013–14</i>, Prepared by: Victor Hughes, Stuart Little and Gill Whiting, MDBA publication no.: 978–1–925221–45–9</p>	

Performance indicator	Related plan objectives	Results	Strength of information
		<p>NSW Department of Primary Industries, Office of Water (2012), <i>Environmental flow response and socio-economic monitoring Murray Valley and Lower Darling River – progress report 2011</i></p> <p>NSW Office of Environment and Heritage (2011), <i>Environmental water use in New South Wales Annual Report 2010–11</i></p> <p>NSW Office of Environment and Heritage (2012), <i>Environmental water use in New South Wales Annual Report 2011–12</i></p> <p>NSW Office of Environment and Heritage (2013), <i>Environmental water use in New South Wales Annual Report 2012–13</i></p> <p>NSW Office of Environment and Heritage (2014), <i>Environmental water use in New South Wales Outcomes 2013–14</i></p> <p>Stuart, I & Sharpe, C 2015, Golden perch tagging and potential for re-colonisation in the lower Gunbower Creek. Report prepared by CPS Environmental Research for the North Central Catchment Management Authority.</p> <p>Tonkin, Z, Lyon, J, Kitchingman, A, Kearns, J, O’Mahony, J, Bird, T, Nicol, S, Maloney, P & Hackett, G (2014), ‘<i>System Scale higher trophic order responses to environmental watering: Growth, recruitment and population responses of large-bodied native fish to flows in the mid River Murray</i>’, unpublished client report for Murray–Darling Basin Authority by the Arthur Rylah Institute for Environmental Research, Department of Environment and Primary Industries, Heidelberg, Victoria</p> <p>Ward, PA (2014), <i>Monitoring understorey vegetation response to flooding in Barmah Forest: 2013–14 – Final Report</i>, report prepared for Murray–Darling Basin Authority by the Victorian Department of Primary Industries & Environment, Melbourne, 252pp.</p>	

Performance indicator	Related plan objectives	Results	Strength of information								
Change in low flow regime	<p>Improve opportunities for natural regeneration and breeding cycles and ecological processes reliant on seasonal patterns, in particular by reinstating more natural wetting and drying cycles</p> <p>Contribute to the maintenance or enhancement of the physical habitats of the river system</p> <p>Promote the recovery of threatened species, populations and ecological communities</p> <p>Contribute to the maintenance or improvement of water quality to downstream water environments</p>	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled WSP scenario was completed for the metrics number of days below the natural 95th and 80th percentiles.</p> <p>The natural (without development) and WSP scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – WSP). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that for the Darling River at Burtundy, the baseline low flow requirement for the 95th percentile was met in wet years, and not met in the earlier drought years (2004/05 – 2007/08). The flow regime was better aligned with the baseline criteria for the 80th percentile flow, although criteria were still not met in 2004/05 – 2007/08.</p> <p>For the Murray River at Yarrawonga, the 95th percentile flow was generally met, with only 7 days over the evaluation period falling below 1,584 ML/d. Performance was not as good for the 80th percentile flows – the baseline of no more than 31 days below 3,626 ML/d was only achieved during the 2010/11 – 2012/13 wet years.</p> <p>Downstream at the Wentworth gauge, low flow performance was poor, only meeting the baseline criteria under wetter conditions.</p> <p>Over the evaluation period, the resulting low flow regime does not meet the modelled plan scenario</p> <p>.</p> <table border="1"> <thead> <tr> <th colspan="4">Comparison to modelled WSP scenario for the number of days below the 95th percentile flow</th> </tr> </thead> <tbody> <tr> <td>425007 (Darling at Burtundy)</td> <td>409025 (Murray at Yarrawonga)</td> <td>425010 (Murray at Wentworth)</td> <td></td> </tr> </tbody> </table>	Comparison to modelled WSP scenario for the number of days below the 95 th percentile flow				425007 (Darling at Burtundy)	409025 (Murray at Yarrawonga)	425010 (Murray at Wentworth)		Good
Comparison to modelled WSP scenario for the number of days below the 95 th percentile flow											
425007 (Darling at Burtundy)	409025 (Murray at Yarrawonga)	425010 (Murray at Wentworth)									

Performance indicator	Related plan objectives	Results				Strength of information
		Natural 95 th percentile flow	25 ML/d	1,584 ML/d	3,995 ML/d	
		<i>WSP scenario (baseline target)</i>	10	0	31	
		2004/2005	49	0	100	
		2005/2006	116	0	23	
		2006/2008	145	1	64	
		2007/2008	183	0	200	
		2008/2009	10	0	183	
		2009/2010	50	6	169	
		2010/2011	0	0	0	
		2011/2012	0	0	0	
		2012/2013	0	0	0	
		2013/2014	0	0	47	

Performance indicator	Related plan objectives	Results				Strength of information
		Comparison to modelled WSP scenario for the number of days below the 80th percentile flow				
			425007 (Darling at Burtundy)	409025 (Murray at Yarrawonga)	425010 (Murray at Wentworth)	
		Natural 80 th percentile flow	371 ML/d	3,626 ML/d	10,800 ML/d	
		<i>WSP scenario (baseline target)</i>	250	31	192	
		2004/2005	352	39	350	
		2005/2006	365	40	278	
		2006/2008	365	66	365	
		2007/2008	293	102	354	
		2008/2009	243	99	365	
		2009/2010	228	95	313	
		2010/2011	101	0	49	
		2011/2012	32	5	0	
		2012/2013	0	12	174	
		2013/2014	238	54	254	

Performance indicator	Related plan objectives	Results	Strength of information								
		<p>References:</p> <p>NSW Department of Primary Industries – Water (2017c), <i>Real Time Data – Rivers and Streams</i>, http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url</p>									
<p>Change in moderate to high flow regime</p>	<p>Improve opportunities for natural regeneration and breeding cycles and ecological processes reliant on seasonal patterns, in particular by reinstating more natural wetting and drying cycles</p> <p>Increase the connectivity between the river and floodplain during spring and early summer</p> <p>Contribute to the maintenance or enhancement of the physical habitats of the river system</p> <p>Improve the opportunities for breeding of native fish and other native organisms by encouraging the migration of native fish and allowing access to spawning sites, food sources and improved water quality, including correct thermal conditions</p>	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled WSP scenario was completed for the metrics number of days above the natural 30th, 15th and 5th percentiles.</p> <p>The natural (without development) and WSP scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – WSP). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the criteria were only met some cases during the wet period between 2010/11 and 2013/14. The end of system site, Murray at Wentworth performed poorly across most years for the 15th and 5th percentile flows.</p> <p>This demonstrates that without large floods, the plan implementation has had limited success in mimicking ‘natural’ moderate and high flows. In this WSP in particular, the flow at the end of system depends on many factors that cannot be controlled by the WSP.</p> <table border="1"> <thead> <tr> <th colspan="4">Comparison to modelled WSP scenario for the number of days above the 30th percentile flow</th> </tr> </thead> <tbody> <tr> <td>425007 (Darling at Burtundy)</td> <td>409025 (Murray at Yarrawonga)</td> <td>425010 (Murray at Wentworth)</td> <td></td> </tr> </tbody> </table>	Comparison to modelled WSP scenario for the number of days above the 30th percentile flow				425007 (Darling at Burtundy)	409025 (Murray at Yarrawonga)	425010 (Murray at Wentworth)		<p>Good</p>
Comparison to modelled WSP scenario for the number of days above the 30th percentile flow											
425007 (Darling at Burtundy)	409025 (Murray at Yarrawonga)	425010 (Murray at Wentworth)									

Performance indicator	Related plan objectives	Results				Strength of information
	Promote the recovery of threatened species, populations and ecological communities Contribute to expansion and diversification of river bank habitat Contribute to maintenance of bank stability Assist in maintenance of the ecological health of anabranches and billabongs, particularly for habitat that may not be provided in the main river channel	Natural 30 th percentile flow	7,833 ML/d	19,431 ML/d	43,020 ML/d	
		<i>WSP scenario (baseline target)</i>	45	53	39	
		2004/2005	0	11	0	
		2005/2006	0	35	0	
		2006/2008	0	0	0	
		2007/2008	0	0	0	
		2008/2009	0	0	0	
		2009/2010	36	0	0	
		2010/2011	202	154	165	
		2011/2012	166	69	137	
		2012/2013	0	75	59	
		2013/2014	0	60	0	

Performance indicator	Related plan objectives	Results			Strength of information	
		Comparison to modelled WSP scenario for the number of days above the 15th percentile flow				
			425007 (Darling at Burtundy)	409025 (Murray at Yarrawonga)	425010 (Murray at Wentworth)	
		Natural 15 th percentile flow	13,345 ML/d	32,762 ML/d	65,816 ML/d	
		<i>WSP scenario (baseline target)</i>	21	27	18	
		2004/2005	0	3	0	
		2005/2006	0	0	0	
		2006/2008	0	0	0	
		2007/2008	0	0	0	
		2008/2009	0	0	0	
		2009/2010	0	0	0	
		2010/2011	165	56	81	
		2011/2012	139	21	0	
		2012/2013	0	30	0	
		2013/2014	0	14	0	

Performance indicator	Related plan objectives	Results			Strength of information
		Comparison to modelled WSP scenario for the number of days above the 5th percentile flow			
			425007 (Darling at Burtundy)	409025 (Murray at Yarrawonga)	425010 (Murray at Wentworth)
		Natural 5 th percentile flow	17,374 ML/d	57,713 ML/d	110,631 ML/d
		<i>WSP scenario (baseline target)</i>	11	9	6
		2004/2005	0	0	0
		2005/2006	0	0	0
		2006/2008	0	0	0
		2007/2008	0	0	0
		2008/2009	0	0	0
		2009/2010	0	0	0
		2010/2011	94	11	0
		2011/2012	73	2	0
		2012/2013	0	0	0

Performance indicator	Related plan objectives	Results	Strength of information
		<p>2013/2014</p> <p style="text-align: center;">0 0 0</p> <p>References: NSW Department of Primary Industries – Water (2017c), <i>Real Time Data – Rivers and Streams</i>, http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url</p>	
Change in water quality in this water source	Contribute to the maintenance or improvement of water quality to downstream water environments	<p>Blackwater events have been a problem in the Murray and Lower Darling Valleys during the evaluation period. There was a significant blackwater event from mid–November 2010 to mid–March 2011. This led to a reduction in the abundance of small and large bodied fish, and the death of yabbies and shrimp (NSW OEH 2011).</p> <p>In April and May 2012, environmental water was used in the Murray and Edward–Wakool River systems to mitigate the blackwater that was entering the system (NSW OEH 2012). In both 2012/13 and 2013/14, good water quality was improved or maintained in mid Murray ephemeral creek systems using environmental water (NSW OEH 2013; NSW OEH 2014).</p> <p>An IMEF project was established to investigate algal bloom management in the Lower Darling River (DPI Water 2012). Flow releases were effective at mitigating cyanobacterial growth through either the suppression of persistent thermal stratification or through dilution and translocation of cells (Mitrovic, Hardwick, & Dorani 2011).</p> <p>There is limited water quality data available for the NSW Murray and Lower Darling systems over the evaluation period. The <i>Assessment of Basin Plan Water Quality targets in New South Wales</i> report provides some general information on water quality in the Murray–Lower Darling system (Mawhinney & Muschal 2015). The ratings compared to basin targets are provided below based on median annual data from 2007 – 2012. There are some nutrient and</p>	Moderate

Performance indicator	Related plan objectives	Results	Strength of information																												
		<p>turbidity water quality issues at the Lower Darling site with very poor results compared to targets. The Murray River sites on the other hand have good or very good scores compared to the targets for all parameters considered. Note that the report provides no pre-Plan comparison.</p> <p>Water quality index ratings by site for the Murray-Lower Darling valley (Mawhinney & Muschal 2015)</p> <table border="1"> <thead> <tr> <th>Station</th> <th>Turbidity (lab)</th> <th>Turbidity (field)</th> <th>Total phosphorus</th> <th>Total nitrogen</th> <th>pH</th> <th>Dissolved oxygen</th> </tr> </thead> <tbody> <tr> <td>425007 Darling River at Burtundy</td> <td>Very Poor</td> <td>Very Poor</td> <td>Very Poor</td> <td>Very Poor</td> <td>Good</td> <td>Moderate</td> </tr> <tr> <td>409025 Murray River downstream Yarrowong a Weir</td> <td>Good</td> <td>Very Good</td> <td>Good</td> <td>Good</td> <td>Very Good</td> <td>Very Good</td> </tr> <tr> <td>414206 Murray River at Merbein Pump Station</td> <td>Very Good</td> <td>Good</td> <td>Good</td> <td>Good</td> <td>Very Good</td> <td>Good</td> </tr> </tbody> </table>	Station	Turbidity (lab)	Turbidity (field)	Total phosphorus	Total nitrogen	pH	Dissolved oxygen	425007 Darling River at Burtundy	Very Poor	Very Poor	Very Poor	Very Poor	Good	Moderate	409025 Murray River downstream Yarrowong a Weir	Good	Very Good	Good	Good	Very Good	Very Good	414206 Murray River at Merbein Pump Station	Very Good	Good	Good	Good	Very Good	Good	
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414206 Murray River at Merbein Pump Station	Very Good	Good	Good	Good	Very Good	Good																									

Performance indicator	Related plan objectives	Results	Strength of information
		<p>References:</p> <p>Mawhinney, W. and Muschal, M. 2015. Assessment of Murray–Darling Basin Plan water quality targets in New South Wales; 2007 to 2012. New South Wales Department of Primary Industries, Water, Sydney. ISBN 978–1–74256–792–1</p> <p>Simon M. Mitrovic, Lorraine Hardwick, Forugh Dorani; (2011) <i>Use of flow management to mitigate cyanobacterial blooms in the Lower Darling River, Australia</i>. J Plankton Res 2011; 33 (2): 229–241. doi: 10.1093/plankt/fbq094</p> <p>NSW Department of Primary Industries, Office of Water (2012), <i>Environmental flow response and socio–economic monitoring Murray Valley and Lower Darling River – progress report 2011</i></p> <p>NSW Office of Environment and Heritage (2011), <i>Environmental water use in New South Wales Annual Report 2010–11</i></p> <p>NSW Office of Environment and Heritage (2012), <i>Environmental water use in New South Wales Annual Report 2011–12</i></p> <p>NSW Office of Environment and Heritage (2013), <i>Environmental water use in New South Wales Annual Report 2012–13</i></p> <p>NSW Office of Environment and Heritage (2014), <i>Environmental water use in New South Wales Outcomes 2013–14</i></p>	
<p>Extent to which domestic and stock rights requirements have been met</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced domestic</p>	<p>Protect basic landholder rights to access water</p>	<p>Provision for domestic and stock rights (a component of BLR) has been provided for in the plan; estimated at Plan commencement to be 2,118 ML/year for the Murray Regulated River Water Source and 3,727 ML/year for the Lower Darling Regulated River Water Source.</p> <p>As no licences are required for extraction of water for basic rights, it is difficult to assess accurately. Water to meet these needs is included in WaterNSW operational protocols and is delivered on top of water ordered by licence holders. During 2009 – 2012, stock and domestic requirements were only</p>	<p>Good</p>

Performance indicator	Related plan objectives	Results	Strength of information																																
and stock access requirements have been met		<p>partially met at times due to the extended dry conditions and resulting uncertainty in transmission losses and travel times (DPI Water 2013). Water made available to meet critical human water needs, including stock and domestic rights, during this time required the suspension of access to licensed water allocations carried over from previous years.</p> <p>Provision for domestic and stock access licences has been provided for in the plan; estimated at Plan commencement to be 14,518 ML/year and 601 ML/year for the Murray and Lower darling water sources respectively.</p> <p>Domestic and stock access licences had full allocations for the NSW Murray Regulated River Water Source in all years except 2007/2008 – 2009/2010, when the plan was suspended.</p> <table border="1"> <thead> <tr> <th colspan="4">Domestic and Stock access licences within the NSW Murray Regulated River Water Source</th> </tr> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>15,908</td> <td>100%</td> <td>12,434</td> </tr> <tr> <td>2005/2006</td> <td>15,897</td> <td>100%</td> <td>12,543</td> </tr> <tr> <td>2006/2008</td> <td>16,080</td> <td>100%</td> <td>12,219</td> </tr> <tr> <td>2007/2008</td> <td>12,783</td> <td>75%</td> <td>7,839</td> </tr> <tr> <td>2008/2009</td> <td>16,252</td> <td>95%</td> <td>9,782</td> </tr> <tr> <td>2009/2010</td> <td>16,668</td> <td>97%</td> <td>10,421</td> </tr> </tbody> </table>	Domestic and Stock access licences within the NSW Murray Regulated River Water Source				Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2004/2005	15,908	100%	12,434	2005/2006	15,897	100%	12,543	2006/2008	16,080	100%	12,219	2007/2008	12,783	75%	7,839	2008/2009	16,252	95%	9,782	2009/2010	16,668	97%	10,421	
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Performance indicator	Related plan objectives	Results				Strength of information
		2010/2011	17,216	100%	7,784	
		2011/2012	17,184	100%	9,627	
		2012/2013	17,181	100%	9,631	
		2013/2014	17,157	100%	9,762	
		Domestic and stock access licences had full allocations for the Lower Darling Regulated River Water Source in all years.				
		Domestic and Stock access licences within the Lower Darling Regulated River Water Source				
		Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	
		2004/2005	632	100%	200	
		2005/2006	638	100%	250	
		2006/2008	1,376	100%	287	
		2007/2008	1,381	100%	358	
		2008/2009	1,383	100%	507	
		2009/2010	1,383	100%	522	
		2010/2011	1,383	100%	463	

Performance indicator	Related plan objectives	Results				Strength of information
		2011/2012	1,376	100%	566	
		2012/2013	1,370	100%	750	
		2013/2014	1,370	100%	580	
		<p>References:</p> <p>NSW Department of Primary Industries – Water (2017d), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p> <p>NSW Department of Primary Industries, Office of Water (2013b), <i>Audit of implementation – Regulated river water sharing plan audit report cards</i>, Prepared for the period between 1 July 2009 and 30 June 2012.</p>				
Extent to which local water utility requirements have been met.	Enhance the viability, sustainability and security of primary and secondary, recreational and tourist industries, and the communities of the Murray–Lower Darling region	<p>Provision for local water utility requirements has been made in the Plan, for each of the Murray and lower Darling Regulated River Water Sources.</p> <p>The provision for water utility requirements estimated at plan commencement to be 33,336 ML/year for the Murray Regulated River Water Source.</p> <p>For seven years of the evaluation period, full AWD allocations were provided for. During the 2007/2008 to 2009/2010 water years, less than 100% allocations were provided. During this period, the WSP was suspended due to drought conditions.</p>				Good.
		<p>Local Water Utility access licences within the NSW Murray Regulated River Water Source</p>				
		Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	

Performance indicator	Related plan objectives	Results				Strength of information
		2004/2005	33,435	100%	19,942	
		2005/2006	33,497	100%	21,173	
		2006/2007	33,497	100%	20,538	
		2007/2008	16,749	50%	12,214	
		2008/2009	31,822	95%	15,107	
		2009/2010	32,492	97%	15,770	
		2010/2011	33,497	100%	16,460	
		2011/2012	33,497	100%	15,664	
		2012/2013	33,497	100%	18,518	
		2013/2014	33,497	100%	18,284	
		<p>Provision for local water utility requirements has been made in the Plan, estimated at plan commencement to be 10,160 ML/year for the Lower Darling Regulated River Water Source.</p> <p>For the evaluation period, full AWD allocations were provided for in all water years (100%). Water usage during this period was significantly less than the water made available.</p>				

Performance indicator	Related plan objectives	Results	Strength of information																																												
		<p>Local Water Utility access licences within the Lower Darling Regulated River Water Source</p> <table border="1"> <thead> <tr> <th>Water year</th> <th>Water made Available (ML)</th> <th>AWD allocations</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr><td>2004/2005</td><td>10,135</td><td>100%</td><td>6,322</td></tr> <tr><td>2005/2006</td><td>10,135</td><td>100%</td><td>6,151</td></tr> <tr><td>2006/2007</td><td>10,135</td><td>100%</td><td>4,050</td></tr> <tr><td>2007/2008</td><td>10,135</td><td>100%</td><td>3,566</td></tr> <tr><td>2008/2009</td><td>10,135</td><td>100%</td><td>1,716</td></tr> <tr><td>2009/2010</td><td>10,135</td><td>100%</td><td>3,998</td></tr> <tr><td>2010/2011</td><td>10,135</td><td>100%</td><td>961</td></tr> <tr><td>2011/2012</td><td>10,135</td><td>100%</td><td>1,106</td></tr> <tr><td>2012/2013</td><td>10,135</td><td>100%</td><td>1,200</td></tr> <tr><td>2013/2014</td><td>10,135</td><td>100%</td><td>4,979</td></tr> </tbody> </table> <p>References:</p> <p>NSW Department of Primary Industries – Water (2017d), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>	Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	2004/2005	10,135	100%	6,322	2005/2006	10,135	100%	6,151	2006/2007	10,135	100%	4,050	2007/2008	10,135	100%	3,566	2008/2009	10,135	100%	1,716	2009/2010	10,135	100%	3,998	2010/2011	10,135	100%	961	2011/2012	10,135	100%	1,106	2012/2013	10,135	100%	1,200	2013/2014	10,135	100%	4,979	
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Change in economic benefits derived from	Enhance the viability, sustainability and security of	ABARES (2015) identifies there are many factors that impact on economic performance of the irrigation industry and few of these are affected by the Plan.	Moderate																																												

Performance indicator	Related plan objectives	Results	Strength of information
water extraction and use	primary and secondary, recreational and tourist industries, and the communities of the Murray–Lower Darling region	<p>Both ABARES (2015) and Aither (2017) identify that water trading has enabled irrigators and other water users to adapt to varying water availability, particularly during the Millennium drought. However, these are Murray–Darling Basin–wide conclusions.</p> <p><i>Water markets</i></p> <p>Aither (2017) found that “water markets are a fundamentally important tool for irrigated agricultural producers in New South Wales and are an increasingly important tool for regional urban water suppliers, environmental water managers, and investors as well. They are critical to driving improvements in productivity and efficiency in the NSW economy.”</p> <p>Aither (2017) summarised the water market in the NSW Murray and Lower Darling catchment since WSP implementation:</p> <p>“Water in the Lower Darling can be traded with connected systems including the Murray, Murrumbidgee and Victoria and South Australia. Despite this, both High Security and General Security entitlements are infrequently traded. There is relatively more trade activity on the allocation market, especially in years when there is water available in the system to be traded.”</p> <p>“Water in the Murray is able to be traded with a number of connected systems (Murrumbidgee, Lower Darling, but also Victoria and South Australia). Entitlement trade has been occurring throughout the study period, and there is relatively more General Security trade. Allocation trade markets are deep – there are substantial volumes of trade in all years.”</p> <p>A summary of water trades and their value summarised from the <i>NSW Water Register</i> is provided below. A more detailed analysis of this data is available in Aither (2017).</p> <p>The annual volume of water allocation assignments (i.e. temporary trades) in the NSW Murray generally increased during the plan term, with the peak assignments occurring in 2012/2013.</p>	

Performance indicator	Related plan objectives	Results	Strength of information																																	
		<p>Water allocation assignments and volumes of water traded within the NSW Murray Regulated River Water Source</p> <table border="1"> <thead> <tr> <th>Water year</th> <th>Share (units or ML)</th> <th>No. of dealings</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>205,849</td> <td>1,055</td> </tr> <tr> <td>2005/2006</td> <td>277,594</td> <td>1,223</td> </tr> <tr> <td>2006/2007</td> <td>206,741</td> <td>2,148</td> </tr> <tr> <td>2007/2008</td> <td>149,282</td> <td>2,664</td> </tr> <tr> <td>2008/2009</td> <td>314,687</td> <td>3,335</td> </tr> <tr> <td>2009/2010</td> <td>536,091</td> <td>2,527</td> </tr> <tr> <td>2010/2011</td> <td>620,024</td> <td>820</td> </tr> <tr> <td>2011/2012</td> <td>795,924</td> <td>994</td> </tr> <tr> <td>2012/2013</td> <td>1,049,881</td> <td>2,089</td> </tr> <tr> <td>2013/2014</td> <td>934,963</td> <td>2,012</td> </tr> </tbody> </table> <p>The annual volume of water allocation assignments (i.e. temporary trades) in the lower Darling varied during the plan term, with low volumes assigned in in the first five years of the plan term and higher volumes in second half of the evaluation period, and a peak assignment volume in 2009/2010.</p>	Water year	Share (units or ML)	No. of dealings	2004/2005	205,849	1,055	2005/2006	277,594	1,223	2006/2007	206,741	2,148	2007/2008	149,282	2,664	2008/2009	314,687	3,335	2009/2010	536,091	2,527	2010/2011	620,024	820	2011/2012	795,924	994	2012/2013	1,049,881	2,089	2013/2014	934,963	2,012	
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Water year	Share (units or ML)	No. of dealings																																					
2004/2005	30,252	46																																					
2005/2006	21,892	37																																					
2006/2007	2,377	22																																					
2007/2008	17,284	49																																					
2008/2009	40,295	221																																					
2009/2010	861,898	169																																					
2010/2011	167,934	137																																					
2011/2012	126,500	151																																					
2012/2013	170,295	263																																					
2013/2014	149,024	169																																					

Performance indicator	Related plan objectives	Results					Strength of information
		Water allocation assignments and volumes of water traded within the NSW Murray Regulated River Water Source					
		Water year	Share (units or ML)	No. of dealings	Weighted average (\$/per share) *	Total value of water traded #	
		2004/2005	–	–	–		
		2005/2006	3,010	21	\$872	\$1,371,800	
		2006/2008	1,449	12	\$986	\$1,223,850	
		2007/2008	110,576	44	\$273	\$29,601,961	
		2008/2009	44,414	118	\$1,131	\$49,699,800	
		2009/2010	116,624	184	\$1,517	\$114,316,019	
		2010/2011	42,783	145	\$1,244	\$42,553,327	
		2011/2012	38,406	123	\$697	\$21,802,260	
		2012/2013	69,633	163	\$1,173	\$79,500,175	
		2013/2014	31,370	119	\$926	\$26,164,463	
		The volume of term or permanent transfer in the Lower Darling varied significantly across the evaluation period and peaked in the 2011/2012 and					

Performance indicator	Related plan objectives	Results				Strength of information
		2013/2014 water years. The average unit price of water transferred also varied through the evaluation period, with higher prices in 2011/2012 and 2013/2014.				
		Water allocation assignments and volumes of water traded within the Lower Darling Regulated River Water Source				
		Water year	Share (units or ML)	No. of dealings	Weighted average (\$/per share) *	Total value of water traded #
		2004/2005	–	–	–	–
		2005/2006	–	–	–	–
		2006/2008	–	–	–	–
		2007/2008	–	–	–	–
		2008/2009	525	2	\$2,298	\$1,206,250
		2009/2010	551	5	\$1,007	\$75,500
		2010/2011	567	3	\$610	\$300,120
		2011/2012	2,588	7	\$1,313	\$857,190
		2012/2013	12	1	\$1,200	\$14,400
		2013/2014	2,759	15	\$1,297	\$3,162,963

Performance indicator	Related plan objectives	Results	Strength of information
		<p>* Total value of water traded divided by number of shares traded (excluding shares traded for \$0). Data taken from <i>NSW Water Register</i>. There may be other factors that impact this value that were not considered in the analysis.</p> <p># Total value of water traded determined by multiplying volume of water traded by unit cost of transaction for each transfer recorded in the <i>NSW Water Register</i>. This information is then summed for each year. No post-processing of the Water register data was undertaken. There may be other factors that impact this value that were not considered in the analysis.</p> <p>The total volume of water transferred (both permanent trades and temporary assignments) in the Murray and Lower Darling catchment is significant compared to other catchments in NSW (NSW Trade & investment 2015).</p> <p>Economic reports for the Murray–Lower Darling Regulated River Water Source are not available. There are also many factors affecting economic status of a region, for example commodity prices, other sources of water (e.g. groundwater).</p> <p>NSW Irrigators' Surveys provide the primary data for use in the socio-economic monitoring of the water sharing plans in NSW. The NSW Murray and Lower Darling Water Sharing Plan was included in the 2006, 2010 and 2013 survey. In all the surveys, irrigators in the Murray and Lower Murray Darling catchment predominantly agreed that temporary water trading had been good for their area and that they had access to a lot of information about water trading (NSW Trade & investment 2015). These monitoring results are based on irrigator responses only and do not include comprehensive economic data.</p> <p>From the survey information, the percentage of water used for different crops varied across the plan term, with overall increases for rice and wheat, and decreases for beef and dairy. The 2010 survey results, during the drought, show a move towards water use for dairy and grapes and away from rice and wheat (NSW Trade & investment 2015; DPI Water 2011).</p>	

Performance indicator	Related plan objectives	Results	Strength of information
		<p>References:</p> <p>ABARES (2015), Ashton, D & Oliver, M 2015, <i>Irrigated agriculture in the Murray–Darling Basin: an economic survey of irrigators, 2012–13 to 2014–15</i>, ABARES research report 15.13, Canberra, December.</p> <p>Aither (2017) <i>Water markets in New South Wales: market outcomes, trends and drivers</i>, Report prepared for NSW Department of Primary Industries, Water NSW Department of Trade and Investment, Regional Infrastructure and Services (2015) <i>Monitoring economic and social changes in NSW water sharing plan areas Irrigators’ Surveys 2009/2010 and 2013 – A state wide comparison</i></p> <p>NSW Department of Primary Industries, Office of Water (2012), <i>Environmental flow response and socio–economic monitoring Murray Valley and Lower Darling River– progress report 2011</i></p> <p>NSW Department of Primary Industries – Water (2017), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water–licensing/registers</p> <p>NSW Department of Primary Industries, Office of Water (2011), <i>Monitoring economic and social changes in NSW water sharing plan areas: A comparison of irrigators’ survey 2006 and 2010 – covering plans commenced in 2004</i></p>	
Extent of recognition of spiritual, social and customary values of water to Aboriginal people	Enhance the viability, sustainability and security of primary and secondary, recreational and tourist industries, and the communities of the Murray–Lower Darling region	<p>Water sharing plans currently provide various forms of protection and benefit for Aboriginal people’s values and uses including specific purpose Aboriginal cultural access licences.</p> <p>Aboriginal Traditional Owner groups within the Murray and Lower Darling WRP area include Bangerang, Barkindji, Barapa Barapa, Maljangapa, Maraura, Muthi Muthi, Nyeri, Ngiyampaa, Tati Tati, Wadi Wadi, Wamba Wamba, Weki Weki and Wiradjuri.</p> <p>Engagement with Aboriginal communities across the Basin Plan area has provided an understanding that, at a landscape level, Aboriginal people’s objectives and outcomes for the management of the water resources are founded in traditional owner group’s obligations to the whole river system and</p>	Poor

Performance indicator	Related plan objectives	Results	Strength of information
		<p>associated river communities as an indivisible group. Aboriginal communities have a multi-faceted relationship with access to and use of water. This relationship ranges from a spiritual and cultural association, to an economic focus, to the location of special places.</p> <p>Through the development of the Murray and Lower Darling WRP, DPIE will provide opportunities for Aboriginal people's involvement in the process through the collection of social, spiritual and cultural data, including the identification of specific values and uses. Additional opportunities will be provided for Aboriginal communities and groups to provide submissions to DPIE to inform the development of the Murray and Lower Darling WRP.</p> <p>Historically the inclusion of issues and information relating to cultural values and uses of water by Aboriginal communities had proven difficult for DPIE due to a lack of data and an inability to adequately address cultural water requirements. It has been highlighted through the Aboriginal Water Initiative community engagement that this lack of cultural data has been one of the major risks to the long-term sustainability of cultural values, with significant consequences and threats to Aboriginal cultural heritage values and uses. These risks and associated management approaches are included in DPI Water Risk Assessment Report. (NSW DPI 2017)</p> <p>DPI Aboriginal Water Initiative program aims to improve aboriginal involvement and representation in water sharing. The Status and Issues Paper for the Murray-Lower Darling Water Resource Plan includes a range of issues identified by aboriginal communities (NSW DPI 2017).</p> <p>References:</p> <p>NSW Department of Primary Industries (2016), <i>New South Wales Murray and Lower Darling Water Resource Plan (Surface Water), Status and issues paper</i>, Published by the NSW Department of Primary Industries</p>	

Performance indicator	Related plan objectives	Results	Strength of information						
<p>Extent to which native title rights requirements have been met.</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced water has been made available and used for Aboriginal purposes.</p>	<p>Enhance the viability, sustainability and security of primary and secondary, recreational and tourist industries, and the communities of the Murray–Lower Darling region</p>	<p>At the commencement of the Plan, there were no holders of native title rights in the NSW Murray or Lower Darling water sources and therefore native title rights were 0 ML/year. There are provisions in the Plan to provide access to water if native title rights over water are granted under the Commonwealth Native Titles Act 1993.</p> <p>No native title rights were established in the water source during the term of the Plan. Additionally, no Aboriginal Cultural Access licences have been issued within the Plan area.</p> <p>References:</p> <p>NSW Department of primary Industries – Water (2017d), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers</p> <p>Native Title Determinations (National Native Title Tribunal): http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/default.aspx</p>							
<p><i>Additional PI identified:</i></p> <p>Change in surface water extraction relative to the long–term average annual extraction limit</p>	<p>Enhance the viability, sustainability and security of primary and secondary, recreational and tourist industries, and the communities of the Murray–Lower Darling region</p>	<p>The LTAAELs for the NSW Murray Regulated River are described in section 31 of the plan.</p> <p>Murray and Lower Darling estimates were produced by MDBA using MSM Bigmod for cap compliance purpose and hence there are no readily available year to year WSP equivalent simulation results.</p> <p>Although the long–term average annual extraction was not assessed against the limit at the end of each water year as specified by the Plan, the annual diversion data is available and is shown in the table below.</p> <table border="1"> <thead> <tr> <th>Water year</th> <th>NSW Murray Water usage (GL)</th> <th>Lower Darling Water usage (GL)</th> </tr> </thead> <tbody> <tr> <td>2004/2005</td> <td>1,224</td> <td>16</td> </tr> </tbody> </table>	Water year	NSW Murray Water usage (GL)	Lower Darling Water usage (GL)	2004/2005	1,224	16	Moderate
Water year	NSW Murray Water usage (GL)	Lower Darling Water usage (GL)							
2004/2005	1,224	16							

Performance indicator	Related plan objectives	Results			Strength of information
		2005/2006	1,603	16	
		2006/2008	543	12	
		2007/2008	215	11	
		2008/2009	293	9	
		2009/2010	404	11	
		2010/2011	745	28	
		2011/2012	1,602	67	
		2012/2013	2,031	95	
		2013/2014	1,564	157	
		<p>References: NSW Department of Primary Industries – Water (2017d), NSW Water Register, http://www.water.nsw.gov.au/water-licensing/registers</p>			

Appendix 12 – NSW Murray and Lower Darling regulated river internal relationship diagrams

Relationship diagrams show the internal Plan logic supporting the delivery of each of the Plan's outcomes. One diagram has been created for each of the economic, social / cultural and environmental outcomes. The diagrams show linkages from the Plan vision (green box) through the broad objectives (navy boxes) to the targeted objectives (blue boxes) and the rules (grey boxes). Gaps have been identified at the targeted and broad objectives levels in this evaluation.

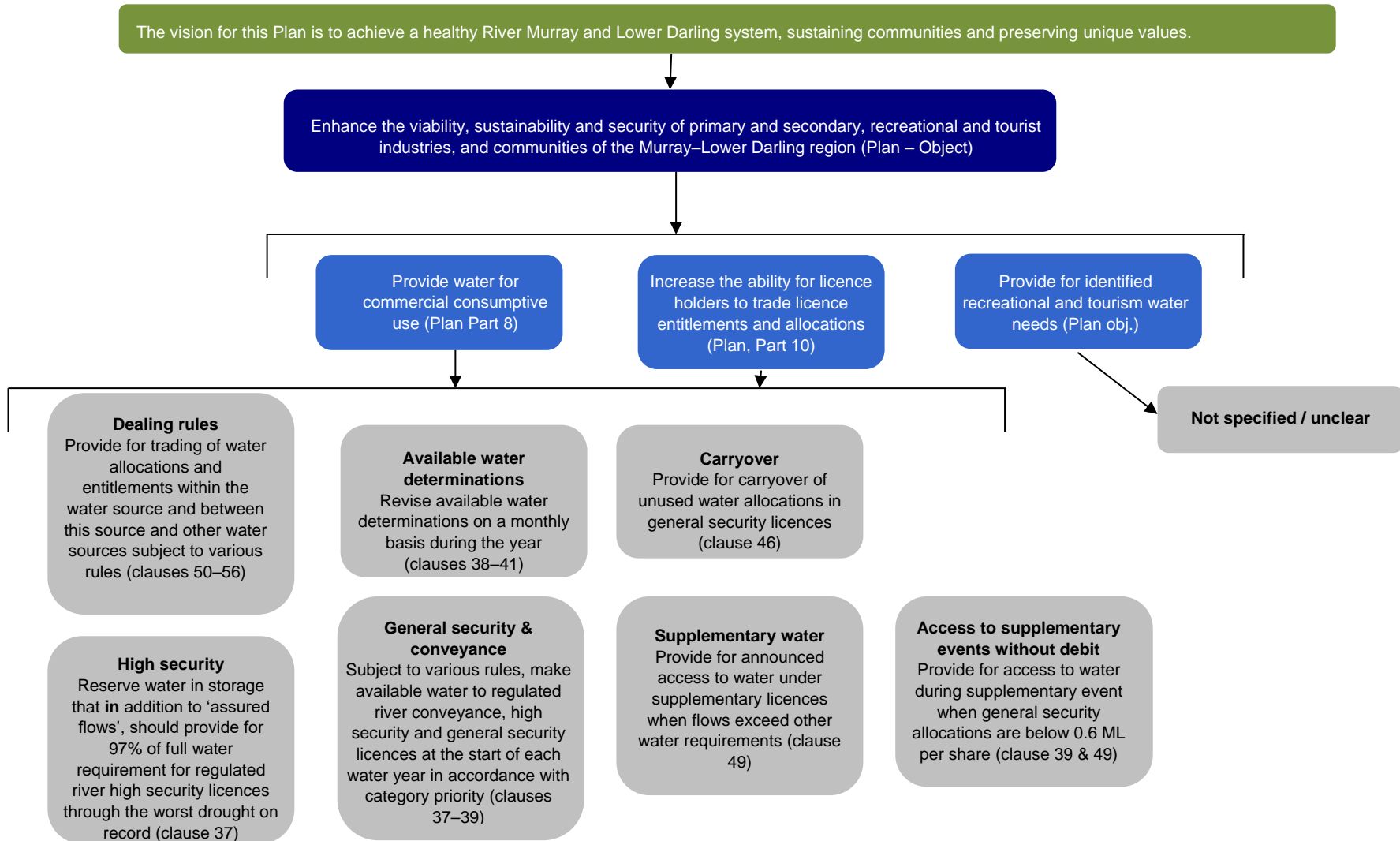


Figure 18: Relationship between Plan rules and economic outcomes

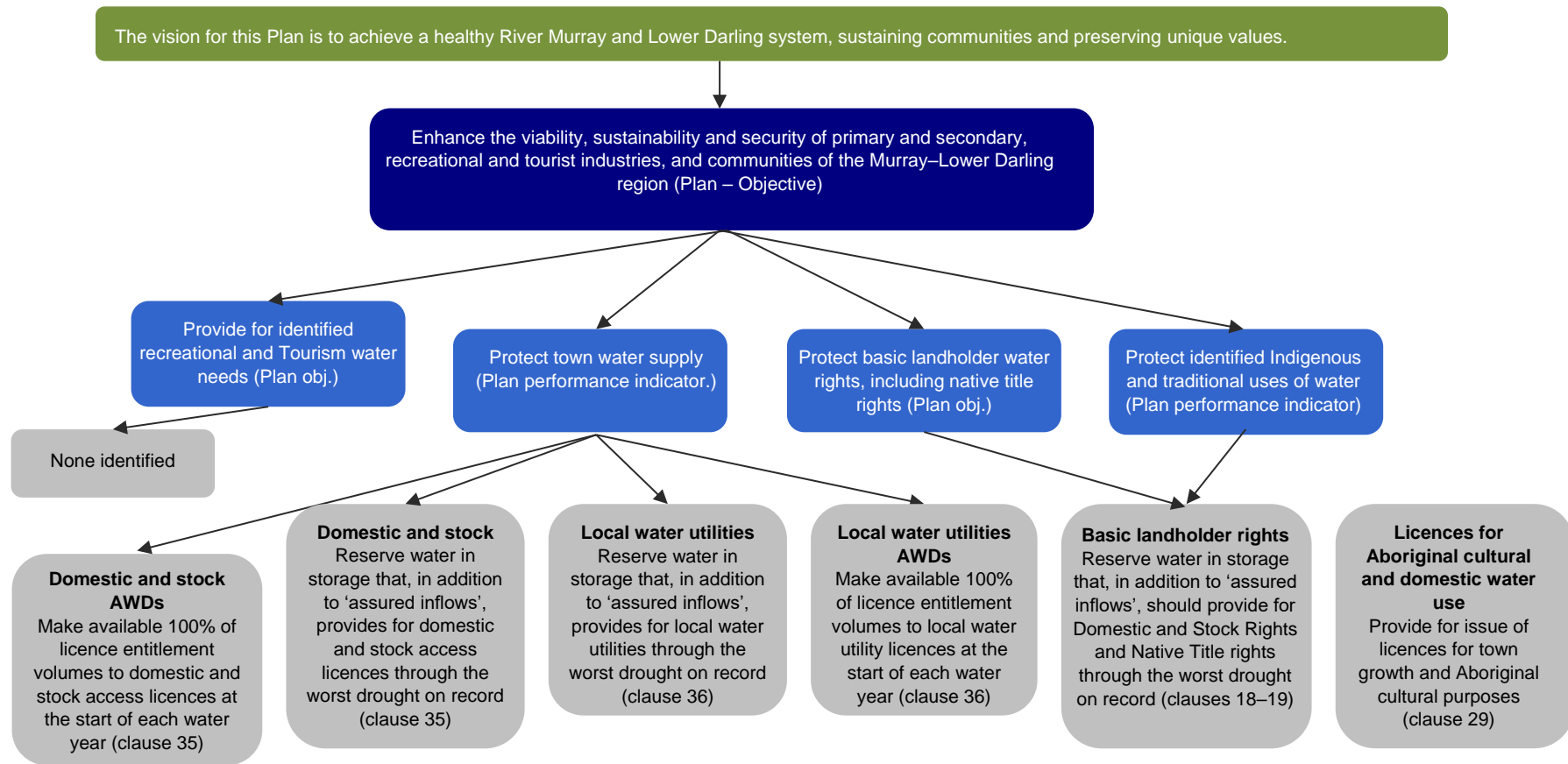


Figure 19: Social / Cultural internal logic relationship diagram

The vision for this Plan is to achieve a healthy River Murray and Lower Darling system, sustaining communities and preserving unique values

Improve opportunities for natural regeneration and breeding cycles and ecological processes reliant on seasonal patterns, in particular by reinstating more natural wetting and drying cycles

Assist in maintenance of the ecological health of anabranches and billabongs, particularly for habitat that may not be provided in the main river channel

Contribute to the maintenance or improvement of water quality to downstream water environments

Increase the connectivity between the river and floodplain during spring and early summer

Promote the recovery of threatened species, populations and ecological communities

Improve the opportunities for breeding of native fish and other native organisms by encouraging the migration of native fish and allowing access to spawning sites, food sources and improved water quality, including correct thermal conditions

Contribute to the maintenance or enhancement of the physical habitats of the river system

Contribute to maintenance of bank stability

Contribute to expansion and diversification of river bank habitat

Establish provisions that place limits on the availability of water

Establish environmental water provisions

• **Planned Environmental Water Rules (Section 3)**



Water shall not be taken in excess of the long term extraction limit under section 8 (Clauses 31 and 33) for any purpose.



- A maximum of 350,000 ML shall be available, for beneficial outcomes for the Barmah–Millewa forest, known as the Barmah–Millewa Allowance (BMA). A maximum of 50,000 ML/year shall also be available known as the Barmah–Millewa Overdraw, provided it doesn't constrain the available water determinations for any licence category. Both the Allowance and Overdraw are subject to conditions outlined in Clause 15 (Rules 1 – 7). Water from the BMA may be used for other environmental purposes provided it is not required to be released for beneficial outcomes for the Barmah–Millewa forest.
- Water shall be taken from the BMA and made available to the Regulated Murray Water Source access licences, whenever the sum of available water determinations for Murray Water Source regulated river (general security) access licences during the year is less than the total volume required to achieve the target water availability (the target water availability is defined in the plan (Clause 15 Rule 10) and are subject to the circumstances laid out in Clause 15 Rule 11.
- Water shall be released at a rate of 2,000 ML/day (May – October) and 5,000 ML/day (November – April) from the Lower Darling Environmental Contingency Allowance (ECA) to mitigate Blue green algal concerns during high alert. Release from the Lower Darling ECA is subject to conditions relating to the volume in Menindee Lakes outlined in the Plan Clause 15 Rule 17.
- Releases from the Murray Additional Environmental Water Allowance (the Murray AEA) can be used to meet any of the environmental objectives outlined in the plan, subject to the conditions outlined in Clause 15 Rules 20 – 25.






Figure 20: Environmental internal logic relationship diagram

Appendix 13 – Murrumbidgee regulated river report card and performance indicator summary




Table 25: Appropriateness Report Card




Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
Plan scale	Is the scale of the Plan appropriate for water management?	Extent to which scale is appropriate for water sharing management	The geographic scale of the Murrumbidgee Regulated River Water Source is considered appropriate , especially as the Lowbidgee was incorporated via a Plan amendment in October 2012.			
Plan scope	Is the scope of the Plan appropriate for water management?	Extent to which interactions with other water sources are addressed appropriately within the Plan or other water sharing plans	The Plan's scope is considered appropriate. However, the Plan would benefit from a note consolidating how the Plan addresses flows to and from connected water resources. The CSIRO (2008) Sustainable Yield Reports found that in some valleys increased groundwater use by 2030 would result in some of the current groundwater use being sourced directly from induced stream–flow leakage. Much of this impact has not been explicitly considered in the development of existing surface water sharing plans. Planned environmental releases provided by the Plan are protected by limiting access to off–river pools or dams in		Consider whether the Plan would benefit from a note consolidating how the Plan addressed flows to and from connected water resources.	Medium

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>connected water sources while the flows are occurring.</p> <p>The requirements of placement and depth of new or replacement bores, for deep alluvial aquifers and fractured rock aquifers, are specified in the adjacent plans of the Murrumbidgee water source to protect the water in the regulated river water source.</p> <p>Shallow alluvial aquifers recharged by the river are accounted for as part of the expected losses within the Murrumbidgee available water determination process and recharges are considered in transmission loss calculation as part of system operations.</p>			
Prioritisation	Is the level of management required under the Plan appropriate for the risk to environmental, economic, or social and cultural values?	Extent of risk to dependent ecosystems, economic, and social and cultural values	<p>The prioritisation of the water source as a high priority for management is also considered appropriate</p> <p>The level of management applied is considered appropriate due to the large volumes of water extracted and the potential for the environmental impact of storages.</p>			
		Extent to which risk is addressed	<p>Risk is addressed through the application of the Long-term average annual extraction limit (LTAAEL), water sharing arrangements that respond to</p>			

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			variations in water availability and associated water market.			
		Identified future risks, including climate change, change in industry base, etc.	Future risks are partially addressed through the application of the LTAAEL and a flexible water market. The calculation of the limit uses the drought of record, which may not reflect future climate due to the impacts of climate change. In addition, changes to the industry base are not recognised		Consider including analysis of climate change and changes in industry base to assess implications for water availability and water demands	High
Internal logic	Is the vision appropriate for water management?	Whether the vision reflects what is intended for water sharing plans in the NSW Water Management Act, 2000 (the Act)	The vision is considered appropriate as it is consistent with the Act's intent for water sharing plans to achieve economic, social and environmental outcomes.			
	Are the objectives suitable for water management?	Whether the objectives align with the vision	The objectives align with the Plan vision.			
		Whether the objectives align with the principles and objects of the Act	The objectives align with the principles and objects of the Act.			
		Extent to which the objectives are clear and comprehensive enough to reflect what the Plan intended to achieve	The objectives could be more specific – some are vague, and their intent is unclear. They contain a mixture of targeted and broad outcomes, with no clearly identifiable link between them. The objectives do not represent a full list of the Plan's intended outcomes. A more extensive list		Consider reviewing the Plan objectives to capture the full suite of intended outcomes in the Act, Plan, "Part A" document and	Medium



Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			has been identified however it does not cover all the Plan rules.		other published material	
		Extent to which the plan logic establishes SMART (Specific, Measurable, Attainable, Realistic, Time-bound) objectives	The Plan Objectives use ambiguous terms (“protect and restore”; “sustain and enhance”; “appropriate water regimes”), which require further interpretation to derive SMART objectives (and therefore performance indicators (PIs))		Consider reviewing the Plan to establish objectives that meet SMART criteria.	High
	Are the strategies suitable for water management?	Whether all Plan rules are linked to a strategy	Strategies could be more specific to guide the rules in the Plan and to highlight the links with their intended outcomes.		Consider reviewing the Plan to align objectives, strategies and rules.	Medium
		Whether the strategies provide clear direction for the Plan rules	Strategies could be more specific to guide the rules in the Plan and to highlight the links with their intended outcomes.			
		Whether the strategies align with the objectives	Strategies could be better aligned to objectives. (some align, while others do not clearly align).			
	Are the performance indicators suitable for water management?	Whether the PIs align with the objectives and strategies	Most PIs are too broadly specified to be able to align directly with objectives and strategies.		Consider reviewing the Plan to align objectives, strategies, rules and PIs	High
		Extent to which PIs are clear and comprehensive enough to measure what the Plan intended to achieve	There are a number of gaps in PIs and there is a weakness in relation to their capacity to answer evaluation questions. This has implications for the			


Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			completeness and quality of the evaluation.			
Quality of Supporting Documentation	Is documentation explaining the decisions underpinning the Plan available?	Adequacy of documentation supporting the Plan	The 2002 “Part A” document provides a thorough explanation of the decisions between 1998 and 2002 that underpinned the original draft Plan.			
		Extent to which documentation is made available to the public	The “Part A” document was available publicly during the Plan’s initial exhibition period but is no longer publicly available. General Purpose Water Accounting Reports (GPWAR; DPI Water 2017b), an Implementation Plan (Office of Water 2009) and Plan Implementation Review reports (DPI Office of Water 2013a and 2013b) are available on DPI Water’s website.		Consider improving availability of evidence sources supporting Plan implementation and monitoring.	Low
Communication	Is the process for communication with stakeholders adequate?	Extent of communication and processes supporting Plan development	Consultation was carried out during 2004 Plan development, with the Murrumbidgee Regulated River Management Committee (MRRMC) meeting to explore issues and develop management strategies. In addition to the expertise of the MRRMC members, community consultation added significant value to the MRRMC’s deliberations and shaped the final			

Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
			<p>recommendations of the draft Plan. The consultation took two forms: community briefing meetings; and the MRRMC members' discussions with their stakeholder groups and other members of community.</p> <p>The Plan was placed on public exhibition.</p>			
		Communication arrangements in place during Plan operation	<p>Communication has been appropriate; however, recent community feedback suggests that a more formalised ongoing communication protocol is required.</p> <p>Generally, communication was on an as needs basis. During drought periods, frequent discussions were held with water users. A series of annual GPWAR are available on the DPIE website.</p>		Consider developing a communication plan that serves the needs of the community (with reference to the communication role of WaterNSW).	Medium
		Arrangements for consideration at term review of Plan	<p>Sufficient opportunity will be provided for communication during the Water Resource Plan development process.</p> <p>Consultation will involve opportunities to make submissions, and face to face meetings will be held with stakeholders.</p>			
Alignment with state priorities	Is the Plan aligned with state	Extent of alignment of Plan with state priorities	The NSW water sharing plans were in place prior to the		Consider reviewing	High


Evaluation criteria	Evaluation question	Evaluation indicator	Appropriate evaluation findings	Performance	Recommendation	Priority
for natural resource management plans (S43A)	priorities for natural resource management?		development of the state priorities for natural resource management and so full alignment is not expected. The Natural Resources Commission (NRC) considered there is some alignment of priorities, however the lack of available monitoring, evaluation and reporting information at the time of assessment limited the NRC's findings (NRC 2013).		alignment of Plan objectives with state priorities for natural resource management during the development of the Water Resource Plan	

Table 26: Efficiency report Card


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Environmental water provisions	Planned environmental water	Was all water above the extraction limit (LTAAEL) protected?	<p>Assessment of compliance with the LTAAEL is underway in 2017. The LTAAEL was not assessed on an annual basis as required by the Plan. (see Extraction Limit evaluation findings below).</p> <p>However, it is likely that water above the extraction limit was protected, since AWD rules in the Plan are designed to implement the extraction limit.</p>		See Extraction Limit below	High
		Were minimum daily flows released?	<p>The Plan was suspended from 10 November 2006 to September 2011. Minimum daily flows at Balranald required by the Plan were maintained until June 2008, despite Plan suspension.</p> <p>From this date, minimum flows were only provided when irrigation orders provided sufficient conveyance ability and minimised losses. Minimum flows dropped as low as 41.5ML/day for 2 days. Shortfalls were monitored and were recouped when resources allowed, enabling total volume per year to be equivalent to Plan requirements.</p>		<p>Consider reviewing the Plan to more clearly specify the criteria for end of system flows during extended drought.</p> <p>Consider whether the operational criteria in the WaterNSW works approval should be included within the Plan.</p>	Medium


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Implementation of variable minimum flows (required by the Plan from July 2008) did not occur until the Plan was reinstated in September 2011. Since then these flows have been maintained except for brief non-compliance for short periods of a few days. This is permitted by the WaterNSW works approval.</p> <p>Due to the operational practicalities of delivering a fixed target at some distance from regulating structures, a set of compliance criteria were developed which allowed WaterNSW, in operating the river, to compensate for any short term under delivery. The criteria have been included within the WaterNSW works approval.</p>			
		<p>Were transparent releases made in accordance with the Plan</p>	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>Transparent releases were made from 2004 to 2006, but then discontinued for term of Plan suspension. Transparent releases recommenced from September 2011.</p> <p>However, several implementation issues arose:</p>		<p>Consider whether to review the Plan with a view to:</p> <p>Simplify the criteria for calculation of transparency and ensure they can be practically implemented.</p> <p>Clarify the procedure and decision-making</p>	<p>High</p>



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Trigger criteria could not be implemented because of the complexity of calculation associated with interaction with Snowy–Blowering bulk transfers. As a result, a flat rate release of the maximum transparency volume was implemented from Blowering.</p> <p>A misinterpretation of the rules initially resulted in under–delivery of transparency from Burrinjuck.</p> <p>Later an error was identified in the spreadsheet calculation of transparent release volumes resulting in over–delivery of this environmental water. This was corrected in the spreadsheet and then reconciled by debiting the over–delivery from Environmental Water Allowance 1(EWA1).</p> <p>While the Plan was suspended, but only from 1 July 2010, accounts were kept of transparency water not delivered. This was later delivered for environmental benefits consistent with the EWA.</p> <p>Plan rules for transparent environmental flow releases from Blowering Dam were not implemented at times due to extended drought conditions and</p>		<p>criteria and governance arrangements during drought, including drought of record and including transparency rules.</p> <p>Clarify the procedure for reconciliation and “repayment” of under or over delivery through either drought or errors.</p> <p>Review implementation arrangements, tools, accounting and audit arrangements before new Plan term commences.</p>	


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>because key information was not available when required.</p> <p>The transparent and translucent environmental flow releases from Burrinjuck Dam were also not implemented at times due to the extended drought, and errors arising from the complexity and misinterpretation of the Plan rules. This created uncertainties in the results and required a high level of resources to implement the rules. In future, the Plan could specify ways of rectifying any over or under releases if errors are identified.</p> <p>The evidence indicates that the Plan rules for the Burrinjuck EWA are complex, created errors and confusion, and were inefficient in implementation. The review of EWAs did not take place within the scheduled timeframe and remains outstanding.</p>			
		<p>Were translucent releases made in accordance with the Plan</p>	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>Releases from Burrinjuck Dam were delivered in line with the Plan provisions until June 2008. (There is no requirement in the Plan for</p>		<p>Refer to recommendation for transparent releases</p>	<p>High</p>




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>translucency releases from Blowering Dam.)</p> <p>Releases were not made under the critical water planning process, while the Plan was suspended. In 2009–2010 EWA and provisional storage volume accounting rules were suspended under the critical human water needs planning process.</p> <p>Water borrowed from the EWA accounts that were made available for consumptive use in previous years was fully repaid by 1 March 2010. During this period, “under delivery” of environmental water under translucency and transparency rules was made available for environmental purposes via the EWA accounts. This use of the EWA accounts is not provided for in the Plan.</p> <p>Routine compliance of river operations revealed that the calculation of environmental releases from Burrinjuck Dam had been in error since September 2010.</p>			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Environmental Water Allowance	Was the EWA account managed according to the Plan rules?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>Water borrowed from the EWA accounts that were made available for consumptive use in previous years was fully repaid by 1 March 2010. During this period, “under delivery” of environmental water under translucency and transparency rules was made available for environmental purposes via the EWA accounts. This use of the EWA accounts is not provided for in the Plan.</p> <p>Routine compliance of river operations revealed that the calculation of environmental releases from Burrinjuck Dam had been in error since September 2010.</p> <p>Plan rules for transparent environmental flow releases from Blowering Dam were not implemented at times due to extended drought conditions and because key information was not available when required.</p> <p>The transparent and translucent environmental flow releases from</p>		Refer to recommendation for transparent releases	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Burrinjuck Dam were also not implemented at times due to the extended drought, and errors arising from the complexity and misinterpretation of the Plan rules. This created uncertainties in the results and required a high level of resources to implement the rules. In future, the Plan could specify ways of rectifying any over or under releases if errors are identified.</p> <p>The evidence indicates that the Plan rules for Burrinjuck EWA are complex, created errors and confusion, and were inefficient to implement. The review of EWAs did not take place within the scheduled timeframe and remains outstanding.</p>			
		<p>Was an annual release program for the use of EWA water prepared and approved?</p>	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>In early 2007, the former Department of Environment Conservation and Climate Change (now Office of Environment and Heritage (OEH)) was nominated as the State's environmental water manager. Following these changes OEH is responsible for advising the Minister for the Environment on any</p>			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			discretionary elements of planned environmental water provisions in the WSPs. Although not required by the Plan, OEH produces an Annual Watering Plan for each regulated water source in which they have a decision-making role. This Watering Plan will cover use of EWAs and any Adaptive Environmental Water (AEW) licences.			
		Was the Environmental Water Allocation Reference Group (EWARG) established, and did it maintain an ongoing role in advising on the use of EWA water?	The EWARG was established and provided advice as envisaged, but as the volume of Commonwealth and State held environmental water increased, its role and scope changed.		Consider reviewing the Plan to reflect appropriately the role of the EWARG in the context of the Basin Plan, other reforms, changed governance and large volumes of Commonwealth and State held environmental water.	High
		To what extent was the EWA used for all Plan specified purposes?	The Plan was suspended from November 2006 to September 2011. The Plan requires that the EWA be released for maximum beneficial outcomes for water bird breeding, wetland inundation, fish passage and breeding and water quality.		Consider reviewing the Plan to clarify drought provisions, triggers for suspension of EWA, triggers for use of EWA to augment AWDs, "payback" provisions and governance during	High






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>EWA releases, both those made while the Plan was in place and those while Plan suspended, aligned with these purposes.</p> <p>However, while the Plan was suspended, the use of EWA in 2009/10 to augment AWDs for licensed entitlements, was not consistent with Plan specified purposes.</p>		Plan (or part Plan) suspension.	
	Adaptive environmental water	Is there a process for licences to be committed for AEW purposes?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>During the term of Plan suspension, DECCW (now OEH) acquired licensed entitlement and committed it to AEW. Despite the Plan suspension, the process operated as intended by the Plan.</p> <p>However, the Commonwealth, while it acquired and used licences for environmental purposes, chose not to commit its licences to AEW under the Plan. There is no legal requirement, nor policy reason, why the Commonwealth should commit its water as AEW and it is assumed the Commonwealth chose not to, in order to retain flexibility of operation. The Commonwealth Water Act</p>			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			provides a range of governance requirements that otherwise ensure the appropriate management, planning and use of its held environmental water.			
		Were AEW Use Plans developed?	<p>OEH develops annual plans for the use of its AEW, alongside the Plan's planned environmental water.</p> <p>As noted above, the Commonwealth Environmental Water Holder (CEWH) operates a range of planning processes, which are consistent with AEW Use Plans, but not required by the Water Sharing Plan,</p>			
		Were there additional licences created and AEW conditioned as a result of water savings within the water source?	Yes – AEW conditions were added to licences in the Murrumbidgee (NSW Office of Water 2013a).			
Basic Landholder Rights	Domestic and Stock	Were domestic and stock basic landholder rights (BLR) provided for within the Plan?	<p>The Plan provides for provision of domestic and stock BLR through a drought of record, before AWDs can be made.</p> <p>The Plan was suspended from November 2006 to September 2011.</p>		Consider reviewing the Plan to clarify governance, decision-making, thresholds for changes in delivery and other arrangements for BLR during drought,	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Water needs for BLR were only partially met for the first six years of the Plan due to the extended dry conditions and resulting uncertainty in transmission losses and travel times for their supply.</p> <p>BLR are delivered on top of water orders by WaterNSW and are provided for as part of the operating protocols. During this period BLR requirements were only partially met at times due to the extended dry conditions and resulting uncertainty in transmission losses and travel times. Water made available to meet critical human water needs, including BLR, during this time required the suspension of access to licensed water allocations carried over from previous years.</p>		<p>including drought of record or worse.</p> <p>(Note this may require Act amendment)</p>	
		Is domestic and stock BLR growth provided for within the Plan?	<p>Procedures are in place to allow for growth in domestic and stock BLR.</p> <p>The Plan provides for provision of native title BLR through a drought of record, before AWDs can be made.</p>			
		Was the water supply managed to ensure sufficient reserves for	<p>During the drought years 2004–2010 (and the Plan suspension), BLR reserves were available, but could only be delivered intermittently, due to the extremely</p>		<p>Consider whether to review the Plan to clarify what will happen under new</p>	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		domestic and stock BLR were maintained?	dry conditions and difficult in transmitting the water considerable distances.		<p>drought of record, in terms of:</p> <p>Whether and in what circumstances Plan suspended;</p> <p>Practical constraints on ability to delivery BLR during drought, due to transmission losses;</p> <p>Governance and criteria for decisions on BLR availability, during drought and/or when Plan is suspended</p>	
		Were domestic and stock BLR provided for in water delivery operating protocols?	<p>The Plan was suspended from November 2006 to September 2011. However, BLR continued to be provided for in water delivery protocols.</p> <p>BLR are delivered on top of water orders by WaterNSW and are provided for as part of the operating protocols. During this period stock and domestic requirements were only partially met at times due to the extended dry conditions and</p>		Consider reviewing the Plan to clarify governance, decision-making, thresholds for changes in delivery and other arrangements for BLR during drought, including drought of record or worse.	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			resulting uncertainty in transmission losses and travel times.			
		Were replenishment flows delivered when required to satisfy domestic and stock needs, subject to water availability?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>The minimum flow in Billabong Creek at Darlot was unable to be maintained at all times due to the extended drought conditions and the difficulty in maintaining a consistent flow due to long travel times (e.g. 74 days during 2009–10 water year).</p>		Consider whether compliance criteria specified in WaterNSW's works approval should be included in the Plan, or at a minimum an authorisation clause referring to the works approval.	Medium
		Are domestic and stock BLR consistent with Reasonable Use Guidelines?	<p>BLR Reasonable Use Guidelines are available in draft form.</p> <p>There is no audit or monitoring information to assess whether use is consistent.</p> <p>During Plan suspension, BLR users were required to comply with urban water user restrictions in force at the time.</p>		<p>Endeavour to publish finalised BLR Reasonable Use Guidelines, including clarification of triggers for requirement for alignment with urban water use restrictions.</p> <p>Consider whether an Implementation Plan could include a pilot audit of actual use, 3–5 years after final guidelines published.</p>	Medium



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Native title	Were native title BLR provided for within the Plan?	Yes – The Plan provides for provision of native title BLR through a drought of record, before AWDs can be made.			
		Is growth in native title BLR protected within the Plan?	Yes – The Plan provides for provision of native title BLR through a drought of record, before AWDs can be made.			
Rules for granting access licences	Granting new access licences	Were Plan rules followed for the granting of access licences?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>However, the Water Management (General) Regulation 2004 sets out the specific purpose access licences for which applications can be accepted in line with the plans.</p> <p>Licence applications have been processed according to the embargoes and other considerations set out in the Plan.</p>			
Limits to the availability of water	Extraction limits	Was an extraction limit established?	An extraction limit was established for this water source.			
		Was the long-term average annual extraction assessed against the long-term	Assessment of compliance with the LTAAEL has not occurred annually as specified in the Plan due to the		Consider reviewing the Plan to achieve an approach that	High



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		average annual extraction limit at the end of each water year?	<p>unavailability of annually updated water use development data.</p> <p>However, assessment and model update are currently underway in 2017.</p> <p>Review of the Plan is recommended to achieve an approach that can be practically implemented, while enabling timely identification of any risk of growth in use.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray–Darling Basin Cap, where a model run generates a climate–adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total</p>		<p>can be practically, cost–effectively and reliably implemented</p> <p>enable timely identification of any risk of growth in use.</p> <p>Endeavour to resolve the process for the collection of water use development data so the IQQM model can be updated at an appropriate frequency.</p> <p>Endeavour to implement NSW Plan limit compliance assessment as routine business. This is high priority due to risks for NSW and for water holders if “growth in use” not identified and addressed early.</p>	




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. Water use development data is not volatile on an annual basis but is more appropriately assessed at the 3–5year frequency.</p> <p>However, the Plan implies that they will be updated, and the model must be run on an annual basis.</p> <p>It is recommended that this approach be reviewed and amended at Plan term review, given that this has proven to be impractical over the 10–year implementation of the Plan. Furthermore, the amended Plans will need to reflect Basin Plan requirements for application and compliance with the SDL.</p>			
	Variation of extraction limits	Were extraction limits varied?	Extraction limit was increased when Plan was amended to add Lowbidgee.			
	LTAAEL compliance	Was LTAAEL exceeded?	Assessment of LTAAEL compliance is currently underway in 2017.		See above recommendations	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>Assessment of compliance with the LTAAEL did not occur annually as specified in the Plan due to the unavailability of updated water use development data.</p> <p>LTAAEL compliance is not readily identifiable in publicly available information.</p>		<p>concerning Plan term review of LTAAEL rules and implementation.</p> <p>Endeavour to make available on its website ongoing LTAAEL compliance status.</p>	
		Was extraction managed within LTAAEL?	AWD protocols include provisions to ensure LTAAEL not exceeded			
	available water determinations (AWDs)	Were AWDs for all categories of licences calculated and announced in line with Plan provisions?	The Plan was suspended from November 2006 to September 2011, because of an extended drought of record. During this time arrangements prioritised critical needs and sought to distribute the limited available water throughout the community.		<p>Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of:</p> <p>Whether and in what circumstances the Plan is suspended</p> <p>Priorities and rules for setting AWDs when the Plan is suspended and / or under drought of record or worse</p> <p>Governance and decision-making</p>	High


Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
					protocols under these circumstances	
Rules for managing access licences	Water allocation and account management	Were water accounts established for all licences?	Water accounts were established at commencement of the Plan			
		Were accounts managed in accordance with the Plan rules?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>Accounting errors occurred (identified by the 2013 Audit) including errors which led to some GS accounts being able to carry over more than the Plan permitted. These errors were later corrected.</p>		Consider implementing a process to audit and confirm WaterNSW accounting arrangements and tools prior to commencement of new plans.	High
	Carryover provisions	Was carryover managed in accordance with the Plan rules?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>During Plan suspension, HS accounts were permitted at times to carry over up to 30% of entitlement, whereas the Plan does not permit carryover for HS licences.</p> <p>Some GS accounts were permitted to carry over more than the limit in</p>		<p>Consider reviewing the Plan to clarify what will happen under new drought of record, in terms of:</p> <p>Whether and in what circumstances the Plan (or part thereof) is suspended</p> <p>Priorities and rules for carryover when the</p>	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			the Plan. This was later corrected through accounting measures.		Plan is suspended and / or under drought of record or worse Governance and decision-making protocols under these circumstances	
	Extraction conditions	Were the general priority of extraction conditions set out in the Plan complied with?	The Plan was suspended from November 2006 to September 2011. However, the general priority of extraction conditions was implemented.			
		Were numerically specified extraction components introduced by amending water access licences e.g. in relation to times, rates or circumstances that water may be taken?	The Plan was suspended from November 2006 to September 2011. The numerical specification and amendment of water access licences was not carried out.		Endeavour to establish a state-wide policy for the establishment of numerical extraction conditions. Consider whether necessary to implement numerical extraction components.	Medium




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Supplementary water	Were supplementary water announcements made in accordance with Plan requirements?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>Access to supplementary water is announced when tributary inflows into the Murrumbidgee Regulated River downstream of storages are more than required for environmental or other needs and what has been ordered by licence holders. These announcements are linked to water availability in the connected NSW Murray Regulated River Water Source.</p> <p>These announcements were made in accordance with Plan rules, including during Plan suspension.</p> <p>The Plan was amended in 2012 to add Supplementary (Lowbidgee) access licences.</p>			
		Did supplementary water users comply with Plan rules?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>No evidence was available to assess this question.</p>			



Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
Dealings	Minister's dealing principles	Were dealings in line with the Minister's dealing principles, the Act and the Plan?	All dealings were carried out consistent with the Minister's dealing principles.			
	Constraints within water source	Were dealings in line with rules relating to constraints within the water source?	<p>During Plan suspension, deadlines for general and high security allocation assignments within the Murrumbidgee were relaxed to increase the opportunity for licence holders to meet their water needs in the dry conditions, particularly in light of the low initial AWDs.</p> <p>However, the Plan contains dealing deadlines which may be inconsistent with the Basin Plan water trading rules and should be further considered.</p>		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High
	Change of water source	Were dealings in line with rules relating to change of water source?	<p>During Plan suspension, restrictions were placed on inter-valley allocation assignments allowed by the Plan as the trade imbalance between the Murrumbidgee and NSW Murray and the limited water availability in the Murrumbidgee meant that purchased water could not be physically delivered through the Murrumbidgee system.</p> <p>Trade was suspended and a ballot system that was not provided for</p>		Refer to DPIE Trade Review, to consider introducing clear triggers, rules, governance and market transparency for delivery during drought.	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			under the Plan was introduced for water allocations.			
		Were conversion factors established when required?	<p>Conversion factors were not established from 2009. The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (ACCC 2009 and 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.</p> <p>Change of water source dealings in this section of the Plan relate to trade between regulated and unregulated water sources. Current NSW Regulations do not allow trade from an unregulated water source into a regulated water source. Trade is allowed from a regulated water source into an unregulated water source. However, the principle of no impact on third parties means that these trades rarely proceed</p> <p>DPIE is reviewing trade between regulated systems including conversion factors with the</p>		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High




Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			<p>introduction of the Murray Darling Basin Plan.</p> <p>Conversion factors were established and applied (0.55 shares in the Murray) in July 2006 to July 2008.</p> <p>From July 2008 to June 2009, conversion was suspended due to dry conditions and difficulty in generating sufficient reserves in storage for the new high security licences impacting on other general and high security licence holders.</p>			
	Conversion of access licence category	Were dealings in line with rules relating to conversion of access licence category within the water source?	<p>Over 142,000 ML of entitlement was converted from general to high security licences from 2006 to 2008. However, the dry conditions made it difficult to generate sufficient reserves in storage for the new high security licences. The conversion of general to high security licences was subsequently suspended in response to the recommendations of an Australian Competition and Consumer Commission paper on Water Trading Rules (ACCC 2009 and 2010). The paper recommended that conversion of licence categories not occur due to the potential impact of such dealings on the reliability of</p>		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			allocations for general security licence holders.			
		Were conversion factors established when required?	Conversion factors were not established. The Australian Competition and Consumer Commission (ACCC) in their position paper and final advice on Water Trading Rules (ACCC 2009 and 2010) recommended that conversion factors not be established due to the potential impact on reliability of other licences.		Refer the issue to the DPIE Trade Review for resolution in parallel with Murray Darling Basin Plan trade rules compliance.	High
Mandatory conditions	Access licence conditions	Were mandatory conditions for access licences placed on licences?	Mandatory conditions required in the Act and in the Plan were placed on the licences during the conversion of licences from the WA to the WMA before the plans commenced.			
	Water supply works approvals	Were mandatory conditions for works approvals placed on the works approvals?	Mandatory conditions required in the Act and in the Plan were placed on the approval during the conversion of licences from the WA to the WMA before the plans commenced.			

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
System Operation rules	Provisional Storage Volume (PSV)	Was the PSV accrued, accounted and managed as required by the Plan.	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>Rules for account management of provisional storage volumes (PSVs) were not implemented at times during Plan suspension, largely due to extended drought conditions, and errors in the accruals in the EWA2 and EWA3 accounts on which the PSV accruals rely. During the Plan's implementation, there were issues with managing the EWA accounts which led to miscalculations of the amounts available (see above). This led to incorrect PSV account balances or the PSVs not being implemented.</p> <p>The scheduled review of the provisional storage volume rules did not occur within the 12-month timeframe set in the Plan.</p>		Consider reviewing the Plan to simplify PSV rules as part of simplifying planned environmental water rules, to ensure they can be practically and efficiently implemented and audited.	High
	Replenishment flows and minimum flows	Were replenishment flows provided in accordance with the Plan?	See BLR replenishment flows for Billabong Creek above.		See BLR recommendation for Billabong Creek above	
		Was the water supply managed to ensure sufficient reserves for	See BLR replenishment flows for Billabong Creek above.		See BLR recommendation for Billabong Creek above	

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
		replenishment flows were maintained?				
	Channel capacity constraints	Were initial estimates of maximum water delivery and operating channel capacity updated?	Initial estimates were not updated. Dry conditions meant that channel capacity constraints were not relevant until 2010. After this time capacity constraints estimated in the Plan were exceeded on occasion (including in 2010/11, 2011/12 and 2012/13). These exceedances were largely the result of airspace operations and high tributary inflows.		Consider if channel capacity constraints are appropriate to be included in water sharing plans and if so, review their effectiveness of operation within the plans.	Medium
	Rates of change to releases from storages	Was an operating protocol for the management of rates of change to releases from Copeton Dam developed?	No, an operating protocol was not developed (DPI Water Audit 2013). However, storage releases are made according to a long-established draft protocol. The 2013 Audit notes that the Dam works approval required the holder (SWC, now WaterNSW) to develop the protocol by June 2012. The 2013 Audit recommended DPI Water, DPI Fisheries, OEH (agencies now within DPIE) and WaterNSW to jointly develop operating protocol for the implementation manual.		Consider reviewing the policy requirement – is the operating protocol required, given it hasn't been implemented during first 10-year term? If review considers protocol is required, then DPIE may consider requiring compliance by holder of works approval.	Medium

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Flood and airspace operation rules	Were rules for operating Burrinjuck Dam and Blowering Dam during and after floods and spills followed?	Yes, these Plan rules were implemented in line with the Plan.			
Plan Amendments	Changes to the water source	Were any changes to the water source required?	The Plan was amended in 2012 to add the Lowbidgee Flood Control and Irrigation District and earlier amendments made minor changes.			
	Review of planned environmental water rules and provisional storage volume (PSV) rules.	Were the reviews carried out and if so, were they carried out as required and were amendments made?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>The environmental water rules and PSV rules have not been reviewed.</p> <p>The rules are complex, and several errors have occurred during implementation, leading at different times to under and over-crediting of the EWA. Evaluation by the former Office of Water found considerable resources were required to develop implementation tools and calculations.</p> <p>Given the problems with implementation, and the potential impacts on both environmental outcomes and reliability of water allocations, a review and</p>		Consider reviewing the Plan rules for environmental water and PSV accrual and accounting.	High

Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
			amendment are strongly recommended.			
	Review of access rules for supplementary water access licences and supplementary water (Lowbidgee) access licences	Were changes to supplementary water rules set out in the Plan required?	<p>The Plan was suspended from November 2006 to September 2011.</p> <p>No review or changes to the supplementary water access rules were carried out. The supplementary water (Lowbidgee) access licences were created by amendment of the Plan in 2012 to add the Lowbidgee Flood Control and Irrigation District to the Plan.</p>		Consider whether these provisions are still required in the Plan.	Medium
	Amendments relating to conveyance access licences	Were any changes required to conveyance access licences?	<p>In 2011, changes were made to AWDs for Murrumbidgee Irrigation (conveyance) access licences.</p> <p>Note: These changes build on an amendment of the same rules in 2006. The changes allow incremental increase in AWDs for the conveyance licences during the course of the water year.</p>			
	Amendment relating to recovery of planned environmental water	Was the amendment required?	No changes under s8A of the Act were required.			






Plan part	Plan rule groups	Evaluation question	Efficiency evaluation findings	Performance	Recommendation	Priority
	Amendments relating to floodplain harvesting	Were any changes made to water sources or Plan provisions to provide for floodplain harvesting?	Changes to floodplain harvesting are gradually being implemented but are only planned and prioritised for northern valleys in the Murray–Darling Basin.		Consider whether floodplain harvesting amendments are required for the Murrumbidgee	Medium



Table 27: Effectiveness Report Card



Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
<p>Protect and restore in–river and riparian habitats and ecological processes</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p> <p>Change in water quality in this water source</p> <p><i>Additional PI identified</i> Change in surface water extraction relative to the long–term average annual extraction limit</p>	<p>Returning natural flow variability to rehabilitate the Murrumbidgee River appears to be hindered by the overarching effects of unseasonal water delivery flows and water column nutrient dynamics. To provide maximum benefits of environmental flows to in–channel communities, multiple flow pulses may need to be delivered over a period of months to avoid long periods of relatively constant discharge. To optimise in stream benefits, it is recommended environmental releases are specifically aimed to restore key flow components that reflect the variability of a more natural hydrograph.</p> <p>Change in flow regime</p> <p>Analysis of flow regime shows that the Plan PIs assessment criteria were not achieved, compared to the baseline the Plan target. This was the case for number of days below 95th percentile and 80th percentile, as well as number of days above 30th, 15th and 5th percentile. In all cases, the exceptions were the years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods.</p> <p>This supports the finding that ecological condition is still at risk, but that it is difficult to make a finding on Plan effectiveness in this regard. This is because of the drought</p>		<p>Moderate</p>	<p>Consider providing clearly defined PIs and an associated performance monitoring programs that closely align with Plan objectives and strategies.</p> <p>Consider investigating further refinement of environmental rules and their operation to enhance environmental outcomes without impacting economic or social outcomes.</p> <p>Consider the design of monitoring programs, to attempt to clearly differentiate between Plan rules / implementation and other external factors.</p> <p><i>See efficiency recommendations on</i></p>	<p>High (all)</p>

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>conditions through most of the Plan term and many other external factors.</p> <p>Change in surface water extraction relative to the long-term average annual extraction limit</p> <p>The comparative model run assessment for Plan limit compliance is currently underway. The Plan is likely to have been effective in preventing increase in extraction, since extraction data and Murray–Darling Cap shows compliance. However, these are not direct surrogates for LTAAEL compliance (see discussion under PIs below). Note that there are many external factors that will also have contributed to this outcome, including the Millennium Drought and potentially more conservative use of water allocations by water entitlement holders.</p>			<p><i>environmental water rules and LTAAEL compliance assessment.</i></p>	
<p>Provide for appropriate watering regimes for wetlands</p>	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p> <p>Change in moderate to high flow regime</p>	<p>Wetlands studied were still in recovery after a significant period of drought. Both frogs and waterbirds appear to have benefited from wetland flooding, with a significant increase in the abundance of some species, and an increase in frog activity and the successful completion of some water bird breeding events. There was also a positive impact through dilution of organic carbon in wetlands, thus reducing the risk of blackwater events caused by low dissolved oxygen.</p> <p>There was an improvement of the health of River Red Gums, and a halt in the decline of</p>		<p>Moderate</p>	<p>Consider providing clearly defined PIs and an associated performance monitoring programs that closely align with Plan objectives and strategies.</p> <p>Consider investigating further refinement of environmental rules and their operation</p>	<p>High</p>

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>black box woodlands and associated wetlands, especially some areas not watered for a decade or more.</p> <p>Analysis of flow regime shows that the Plans PI assessment criteria were not achieved, compared to the baseline. This was the case for number of days below 95th percentile and 80th percentile, as well as number of days above 30th, 15th and 5th percentile. In all cases, the exceptions were the years 2010–11, 2011–12 and 2012–13, which were associated with drought breaking floods.</p> <p>The Plan provided water for wetlands, and releases were made under Plan rules using the EWAs. In addition, licences held by the State and Commonwealth Governments for environmental purposes were also used to make releases for wetlands.</p> <p>Integrated Monitoring of Environmental Flows (IMEF) studies carried out to investigate the provision of replenishment flows proposed that protecting and restoring high flows and freshes would replenish and restore wetlands.</p>			<p>to enhance environmental outcomes without impacting economic or social outcomes.</p> <p>Consider the design of monitoring programs, to attempt to clearly differentiate between Plan rules / implementation and other external factors.</p>	
Sustain and enhance population numbers and diversity of indigenous species	<p>Change in ecological condition of this water source and dependent ecosystems</p> <p>Change in low flow regime</p>	While hydrological change explained only a small amount of variation in fish assemblage structure, flooding regime management of wetlands were shown to be of benefit to a number of species.		Moderate	As above	High


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	<p>Change in moderate to high flow regime</p> <p>Change in water quality in this water source</p>	<p><i>Findings above for other environmental objectives are also relevant.</i></p>				
<p>Protect basic landholder rights, as specified in the <i>Water Management Act 2000</i>, including native title rights</p>	<p>Extent to which basic landholder rights requirements have been met</p>	<p>The Plan protected water for BLR except when the Plan was suspended. This includes for the provision of the 50 ML per day flow in Billabong Creek at Darlot which is understood to be provided for stock and domestic use, although this is not specified in the Plan or supporting documents.</p> <p>Indigenous use of water was largely protected through the Plan by provision for a high security (Aboriginal cultural) access licence. There is one high security (Aboriginal cultural) access licence which was provided up to the maximum limit of 2,150 ML during the evaluation period. Water was made available to this licence except when the Plan was suspended during the drought. Work is underway to increase understanding of Aboriginal water use in the Plan area.</p>		<p>Good</p>		


Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
Maximise early season general security allocations	Change in economic benefits derived from water extraction and use	<p>AWDs were quickly announced as soon as water was available. Carryover introduced by the Plan allowed general security water users greater control over the volume of account water they could hold at the commencement of the water year.</p> <p>During the period of the Plan's suspension, early season allocations were not able to be made due to the dry conditions. In addition, account water held by users was used for essential supplies.</p> <p>A suspension in the availability of account water for general security licences in 2006 resulted in significant impacts on general security licence holders, as decisions had been made based on the higher allocation levels announced earlier in the season.</p> <p>Tradeable water licences contributed to economic benefits.</p>		Good		
Protect town water supply	Extent to which local water utility requirements have been met.	The Plan protected town water supply, however the full requirement was not provided when the Plan was suspended.		Good	Consider rules that set aside volumes of water to maintain supply to towns and the potential for incorporating the provision of "critical human needs" in the Plan.	High

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
Protect end-of-system flows	Change in low flow regime	<p>For the first four years of the Plan, a minimum flow of between 200 and 300 megalitres (ML) per day was required to be maintained downstream of Balranald Weir to reintroduce a more natural flow pattern and to ensure connectivity throughout the river system and with connected water sources. After 1 July 2008, this minimum flow was to change to a variable flow targets to reflect a more natural flow pattern.</p> <p>When the Plan recommenced in 2011, the variable targets provided for in the Plan from 2008 were implemented.</p> <p>During the period when the Plan was not suspended, the Plan generally protected end-of-system flows.</p> <p>Note that the end of system flow targets are based on modelling developed prior to the start of the Plan, which does not include the Millennium Drought years. It is recommended that DPIE consider the impact of including the Millennium Drought in the model run.</p>		Good	Consider the impact of including the Millennium Drought in the model run for providing end of system flows.	
Provide for commercial consumptive use	<p>Change in economic benefits derived from water extraction and use</p> <p>Extent to which water requirements for high</p>	Overall, the evaluation found that the provision of water for commercial consumptive use was impacted during the extended drought when the Plan was suspended. During periods of reduced availability, and during the period of plan suspension, announcements were made		Good	Consider clearer identification of SMART objectives and performance indicators, related to the Plan rules and differentiated from	Medium

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	<p>security licences have been met</p> <p>Extent to which water provided for high security, general security and supplementary licences in that order of priority</p> <p>Provide sufficient water for irrigation corporation conveyance licences to allow delivery of water allocations</p> <p>Increase water supply to general security licences in dry years</p> <p>Increase water supply security to general security licences in the Murray in dry years</p>	<p>quickly in response to increased water availability.</p> <p>Economic modelling indicates a slight decrease in annual regional margin due to the Plan; however, this is within the model's standard error range, so it represents a negligible change. Impacts appear to be greatest during the driest years.</p> <p>The Plan made it possible for water access licence holders to trade their water independent of their land. The ability to buy and sell water independent of land has given farmers more flexibility to manage risks associated with changing conditions. Trading of water on this scale is new to NSW, and an assessment of the change in unit price of water transfers provides an indication as to whether the market has adjusted to this new system of trading. The weighted average price of allocation trades peaked in the period from 2006–2007 to 2008–2009 during the extended drought period.</p> <p>During the Plan, the watering of lower value crops reduced during drier periods while watering for higher value crops remained constant. This suggests that water has been shifted from lower value to higher value crops during this time.</p> <p>Survey findings indicate that licence holders are making use of the flexibility of having a</p>			<p>external factors, to the extent possible.</p> <p>Consider addressing Plan rules that are identified as being barriers to trade</p>	

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>separate water title to manage their financial circumstances.</p> <p>Available water determinations at the start of the year for high security licences were less than what was provided for in the Plan during the extended drought when the Plan was suspended. Otherwise, allocations achieved the 95% allocation target and the plan requirements were met.</p> <p>Maximum water was made available for regulated river high and general security licences, within the requirements of the plan to supply higher priority requirements. During the period of plan suspension, allocations were severely reduced, and a transparent communication process implemented to provide licence holders with information on the likelihood of receiving water. Supplementary events were announced when triggers in the plan were reached. This provided options for water access even when storage levels were low. Significant volumes of water were extracted under these conditions.</p> <p>The rules within the plan which allocate water for conveyance licences provide sufficient water to ensure delivery of allocated high and general security water</p> <p>General Security access to supplementary water without debit provisions have increased water supply to general security licence holders</p>				

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
		<p>in periods of allocation reduction. However, a lack of supplementary events during extremely dry conditions means that this rule is unable to provide assistance during these periods.</p> <p>Water was not delivered to increase water supply to General Security licence holders in the Murray, as there were no occasions when low allocation in the Murray coincided with high allocations in the Murrumbidgee</p> <p>Even though the Plan generally increased the ability for licence holders to trade licence entitlements and allocations, there is evidence that some trading rules are unnecessarily impeding trade. Rules regarding conversion of licence category have not been successful and have been suspended due to concerns about potential third party impacts.</p>				
Provide for identified recreational water needs	<i>None identified</i>	There are no rules which contribute to achieving this outcome, therefore this objective has not been assessed.	N/a	N/a	Consider including appropriate rules and PIs for this objective or removing objective from the Plan.	Low
Protect identified indigenous and traditional uses of water	<p>Extent to which native title rights requirements have been met</p> <p><i>Additional PI component identified</i></p>	At the commencement of the Plan, there were and still are no extractions in this water source for native title rights under the Commonwealth's Native Title Act 1993. During the evaluation period, there have been no applications for	<p>Cultural water use</p> 	Good	Endeavour to proceed with further work to identify spiritual, social and customary values of	High

Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
	<p>Extent to which licenced water has been made available and used for Aboriginal purposes.</p> <p>Extent of recognition of spiritual, social and customary values of water to Aboriginal people</p>	<p>native title rights, so this requirement has not come into effect.</p> <p>Indigenous use of water was largely protected through the Plan by provision for a high security (Aboriginal cultural) access licence. There is one high security (Aboriginal cultural) access licence which was provided up to the maximum limit of 2,150 ML during the evaluation period. Water was made available to this licence except when the Plan was suspended during the drought. Work is underway to increase understanding of Aboriginal water use in the Plan area.</p> <p>The licences appear to be used to the benefit of Aboriginal cultural purposes. However, the costs associated with obtaining and utilising cultural access licences are a barrier to effective use of these licences.</p> <p>Positive progress has been made in recognising the values of water to Aboriginal people, however considerably more work needs to occur.</p> <p>The Aboriginal Water Initiative will help to foster the values of water to Aboriginal people. This program was established at the end of the evaluation period, so there is no evidence available to assess this outcome.</p>	<p>Recognition of values</p> 		<p>water to Aboriginal people</p> <p>Consider how to address costs associated with cultural access licences to remove barrier to effective use of these licences.</p>	


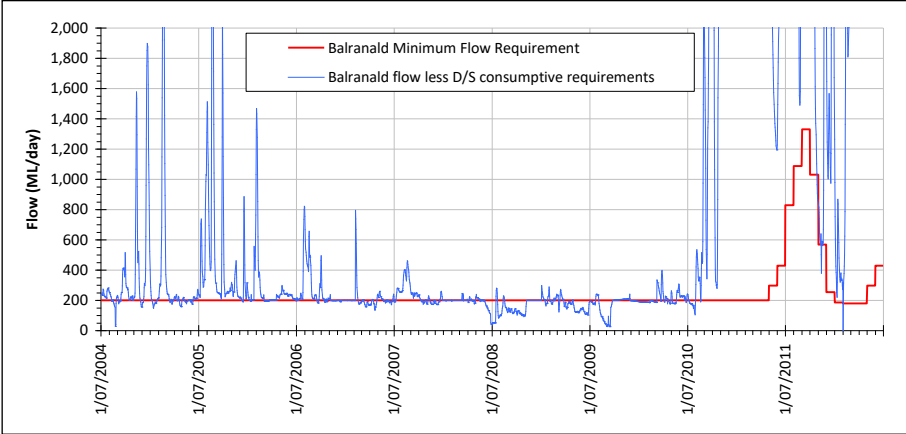
Plan objective	Performance indicators	Effectiveness evaluation finding	Performance	Strength	Recommendation	Priority
Within the ability of this Plan promote the recovery of known threatened species	<i>None identified</i>	<p>No studies have directly targeted the impacts of the Plan on threatened species, but some limited information on threatened species has been collected through other studies.</p> <p>Environmental watering in 2009–10 in the Lowbidgee wetlands provided some suitable breeding conditions for the Southern Bell frog. Environmental watering in 2010–11 enabled partial recovery of the populations of Southern Bell frogs in some wetlands, and it was rediscovered in several wetlands. Watering regime management needs to consider concurrent impacts on breeding of introduced fish such as Gambusia which predate on frog eggs and tadpoles.</p>		Poor	Consider including appropriate PIs for this objective or removing objective from the Plan.	Low

Table 28: Performance indicator results summary

Performance indicator	Related Plan objectives	Results	Strength of information									
Change in low flow regime	Protect and restore in-river and riparian habitats and ecological processes Provide for appropriate watering regimes for wetlands Sustain and enhance population numbers and diversity of indigenous species Protect end-of-system flows	<p><i>Protect or restore natural low flow variability</i></p> <p>The transparent rules for the dams aim to mitigate the impacts of storages on low flows, which is reflected in the significantly lower total volumes released under these rules. In contrast the translucency releases, which have much higher flow triggers and occur during the wetter months, are aimed at improving the high flow variability.</p> <p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled the Plan scenario was completed for the metrics number of days below the natural 95th and 80th percentiles. The natural (without development) and the Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – the Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database. The results provided below show that during the 2007/2008 and 2008/2009, the baseline 95th percentile flow targets were not met at either gauge. Similarly, from 2004/2005 to 2009/2010, the 80th percentile flow criterion was not met at either gauge. Over the evaluation period, the resulting low flow regime does not meet the modelled Plan scenario.</p>	Good									
		<p>Comparison to modelled: Plan scenario for the number of days below the 95th percentile flow</p> <table border="1"> <thead> <tr> <th></th> <th>410001 (Murrumbidgee at Wagga)</th> <th>410130 (Murrumbidgee at Balranald)</th> </tr> </thead> <tbody> <tr> <td>Natural 95th percentile flow</td> <td>585 ML/d</td> <td>158 ML/d</td> </tr> <tr> <td><i>The Plan scenario (baseline target)</i></td> <td>2</td> <td>3</td> </tr> <tr> <td>2004/2005</td> <td>0</td> <td>34</td> </tr> </tbody> </table>			410001 (Murrumbidgee at Wagga)	410130 (Murrumbidgee at Balranald)	Natural 95 th percentile flow	585 ML/d	158 ML/d	<i>The Plan scenario (baseline target)</i>	2	3
	410001 (Murrumbidgee at Wagga)	410130 (Murrumbidgee at Balranald)										
Natural 95 th percentile flow	585 ML/d	158 ML/d										
<i>The Plan scenario (baseline target)</i>	2	3										
2004/2005	0	34										

Performance indicator	Related Plan objectives	Results		Strength of information	
		2005/2006	0	0	
		2006/2008	0	0	
		2007/2008	7	15	
		2008/2009	7	134	
		2009/2010	0	41	
		2010/2011	0	0	
		2011/2012	0	0	
		2012/2013	0	10	
		2013/2014	0	0	
Comparison to modelled: Plan scenario for the number of days below the 80th percentile flow					
			410001 (Murrumbidgee at Wagga)	410130 (Murrumbidgee at Balranald)	
		Natural 80 th percentile flow	1,639 ML/d	1,173 ML/d	
		<i>The Plan scenario (baseline target)</i>	13	194	
		2004/2005	32	341	

Performance indicator	Related Plan objectives	Results			Strength of information
		2005/2006	28	340	
		2006/2008	124	349	
		2007/2008	146	330	
		2008/2009	101	346	
		2009/2010	67	335	
		2010/2011	10	79	
		2011/2012	0	73	
		2012/2013	0	167	
		2013/2014	0	241	
		<i>End of system flows</i>			
		<p>For the first four years of the Plan, a minimum flow of between 200 and 300 megalitres (ML) per day was required to be maintained downstream of Balranald Weir to reintroduce a more natural flow pattern and to ensure connectivity throughout the river system and with connected water sources. After 1 July 2008, this minimum flow was to change to a variable flow targets to reflect a more natural flow pattern.</p>			
		<p>Although the Plan rules provided for initial flow targets of between 200 and 300 ML per day, low general security allocations during this period up to 2008 meant that the target remained at the lower 200 ML per day. Targets were not met for extended periods when the Plan was suspended between October 2006 and September 2011. When the Plan recommenced in 2011, the variable targets provided for in the Plan from 2008 were implemented.</p>			

Performance indicator	Related Plan objectives	Results	Strength of information
		<p><i>Comparison of adjusted daily flows at Balranald with target end-of-system flow</i></p>  <p>References:</p> <p>NSW Department of primary Industries – Water (2017c), <i>Real Time Data – Rivers and Streams</i>, http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url</p>	
Change in moderate to high flow regime	<p>Protect and restore in-river and riparian habitats and ecological processes</p> <p>Provide for appropriate watering regimes for wetlands</p> <p>Sustain and enhance population numbers and</p>	<p>As specified in the Water Sharing Plan, an assessment of the gauge data compared to the modelled the Plan scenario was completed for the metrics number of days above the natural 30th, 15th and 5th percentiles.</p> <p>The natural (without development) and the Plan scenarios results were extracted from the IQQM models (Basin Plan Nov 2011 model R#844 – natural and R#845 – the Plan). Streamflow data for the evaluation period was taken from the Real Time Data – rivers and streams online database.</p> <p>The results provided below show that the criteria were only met in the wet years of 2010/2011 to 2012/2013. For the Murrumbidgee at Balranald gauge, no days in the evaluation period were above the 5th percentile natural flow.</p>	Good

Performance indicator	Related Plan objectives	Results			Strength of information	
	diversity of indigenous species	This demonstrates that without large floods, the Plan implementation has had limited success in mimicking 'natural' moderate and high flows.				
Comparison to modelled: Plan scenario for the number of days above the 30th percentile flow						
		410001 (Murrumbidgee at Wagga)	410130 (Murrumbidgee at Balranald)			
		Natural 30 th percentile flow	10,395 ML/d	9,076 ML/d		
		The Plan scenario (baseline target)	173	34		
		2004/2005	12	0		
		2005/2006	110	0		
		2006/2008	2	0		
		2007/2008	0	0		
		2008/2009	0	0		
		2009/2010	2	0		
		2010/2011	144	88		
		2011/2012	214	43		
		2012/2013	226	35		

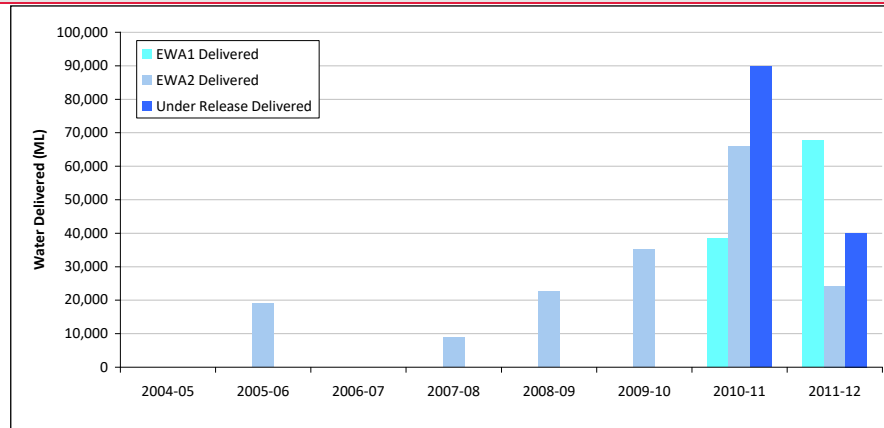
Performance indicator	Related Plan objectives	Results			Strength of information
		2013/2014	76	0	
		Comparison to modelled: Plan scenario for the number of days above the 15th percentile flow			
			410001 (Murrumbidgee at Wagga)	410130 (Murrumbidgee at Balranald)	
		Natural 15 th percentile flow	18,672 ML/d	14,796 ML/d	
		<i>The Plan scenario (baseline target)</i>	38	17	
		2004/2005	0	0	
		2005/2006	11	0	
		2006/2008	0	0	
		2007/2008	0	0	
		2008/2009	0	0	
		2009/2010	2	0	
		2010/2011	71	13	
		2011/2012	38	24	
		2012/2013	12	0	

Performance indicator	Related Plan objectives	Results			Strength of information
		2013/2014	0	0	
Comparison to modelled: Plan scenario for the number of days above the 5th percentile flow					
			410001 (Murrumbidgee at Wagga)	410130 (Murrumbidgee at Balranald)	
		Natural 5 th percentile flow	36,756 ML/d	24,644 ML/d	
		<i>The Plan scenario (baseline target)</i>	10	5	
		2004/2005	0	0	
		2005/2006	0	0	
		2006/2008	0	0	
		2007/2008	0	0	
		2008/2009	0	0	
		2009/2010	0	0	
		2010/2011	27	0	
		2011/2012	16	0	
		2012/2013	0	0	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>The Plan provides for Environmental Watering Allowances (EWA), transparency and translucency rules, and the ability for licences and account water to be purchased and used for environmental purposes. These licences can be either AEW or other licences held for environmental purposes, such as those held by CEWH and/or managed by OEH.</p> <p>Releases of environmental water have primarily provided watering to a targeted wetland site. Due to the significant volumes of water required to achieve overbank flooding, flow management to achieve general watering of floodplains has not been possible within the Plan rules.</p> <p>A significant body of work documented the ecological response of wetlands to flooding regimes. While this was one of the most studied aspects of changes to flow management, the results were complicated by the extended drought which necessitated a period of recovery for these habitats. This was particularly noted for aquatic vegetation by Wassens et al. (2011) who found less frequently flooded wetlands recovered more slowly. Since healthy vegetation is an important habitat state for many other species, a time lag exists between improving vegetation condition and improving the condition of dependent organisms, which may explain why results for fauna species were less conclusive.</p> <p>Despite this, both frogs and waterbirds appear to have benefited from wetland flooding, with a significant increase in the abundance of some species, and an increase in frog activity (Wassens et al. 2012) and the successful completion of some water bird breeding events (NSW Office of Environment and Heritage 2011). Wassens et al. (2012) also found a positive impact through dilution of organic carbon in wetlands, thus reducing the risk of blackwater events caused by low dissolved oxygen. They concluded that their findings suggest that wetlands studied were still in recovery after a significant period of drought.</p> <p>Hardwick and Maguire (draft) noted that the assessment of the impact of flow rules on wetland health was complicated by natural flows but concluded that the environmental flows established in 1998 had a positive effect on selected river fed billabongs.</p> <p>Annual reports for the 2009–10 and 2010–11 periods by NSW Department of Environment, Climate Change and Water noted the improvement of the health of River Red Gums, and a halt in the decline of black box woodlands and associated wetlands, especially some areas not watered for a decade or more. Suitable breeding conditions and partial recovery of populations</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>of Southern Bell frogs was also found. Thomas et al. (2011) found the Southern Bell frog had recolonised a number of formally occupied wetlands in the Lowbidgee wetland complex.</p> <p><i>Wetland watering regimes</i></p> <p>As little is known about the flow requirements of wetlands within the Plan area, ecological studies were undertaken under the IMEF program to determine the response of wetlands to flow events. The IMEF hypothesis for replenishing wetlands proposed that protecting or restoring a proportion of freshes and high flows, and otherwise maintaining natural flow variability, will replenish in channel and floodplain wetlands and restore their biodiversity.</p> <p>Both the EWA accounts and water access licences purchased by State and Commonwealth Governments for environmental purposes were used to provide water for wetlands. This water was used in line with an annual watering plan.</p> <p>Volumes credited to EWA accounts are linked to available water determinations for general security licences. Low volumes of water ordered in the early years of the Plan implementation reflect the limited water available from these accounts for environmental purposes. Similarly, the considerably higher volumes of EWA water used in 2010–11 and 2011–12 reflect the wetter conditions and larger volumes of water available in the EWA accounts.</p> <p>Figure below shows the total volumes of water delivered from the EWA1 and EWA2 account. No water was ordered from the EWA3 account during the eight years considered in this evaluation report.</p> <p><i>Total environmental water account releases from Burrinjuck Dam 2004–05 to 2011–12</i></p>	

Performance indicator	Related Plan objectives	Results	Strength of information
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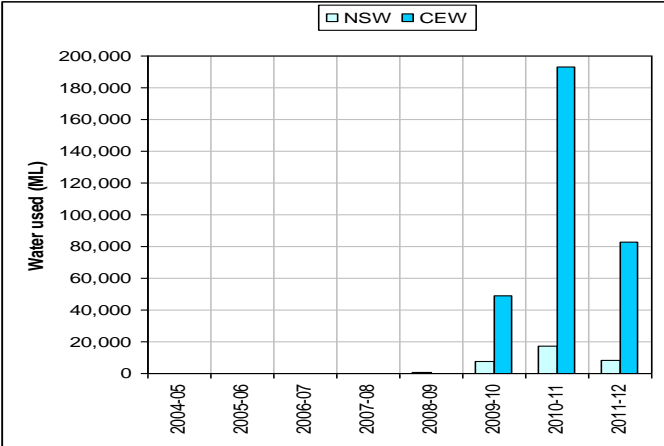


In addition to the EWA water, large volumes of entitlement have been purchased for environmental purposes by both the State and Commonwealth Governments. The volumes purchased have been summarised in Table 25.

Total licensed water holdings held for environmental purposes by program at 30 June 2012

	Entitlement (megalitres/share) by licence category			
Program	High security	General security	Conveyance	Supplementary access
NSW Government	0	22,507	0	5,679
Commonwealth Government	1,600	167,100	5,727	20,820

A range of potential environmental watering targets, which include both wetland complexes and in-stream habitat have been identified in the Murrumbidgee and water accruing to these licences delivered to these sites since 2008–09. Total volumes, duration and frequency of flow

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>events are dictated by the nature of the environmental site or system and its water requirements, volume and timing of available water, existing infrastructure and agreements with private landholders.</p> <p>Different areas within the Lowbidgee and connected National Parks estate have been most consistently watered since the Plan commenced. The use of this licensed water for in-stream river health benefits and on other smaller wetland complexes has largely been limited to the 2010–11 and 2011–12 water years, when water available under these licences increased dramatically.</p> <p><i>Total use of licensed water held for environmental purposes in the Murrumbidgee from 2004–05 to 2011–12</i></p>  <p><i>Sustain and enhance population numbers and diversity of indigenous species</i></p> <p>Before the Plan started, the relatively low and stable flows downstream of Burrinjuck Dam outside of the irrigation season are likely to have reduced the frequency of wetting of benches within the river channel and low lying areas of the adjacent floodplain (DIPNR 2004). Native fish populations are identified as having generally declined in association with the increased development of water resources (DIPNR 2004). Many other species of flora and fauna including rare, endangered or vulnerable species that rely on the aquatic environment, may</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>also be impacted by river regulation. In particular, native vegetation, bird and frog breeding are impacted by regulation, both within channel and on the floodplain and wetlands.</p> <p>The targeted outcome of increasing naturally occurring moderate and high flows through the system was expected to inundate benches and riparian zones, creating habitats suitable for the breeding of freshwater fish if temperatures are sufficiently high. It was considered that this may enhance the competitive advantage of native species in comparison to carp and other alien species.</p> <p>The IMEF study most closely aligned to this outcome was hypothesis 8 which targeted the rehabilitation of fish communities. Only one study was conducted under this hypothesis. It explored the relationship between hydrology and fish assemblage structures and abundancies and concluded that these were only weakly correlated with flow indicators (Growth 2008).</p> <p>Other studies about replenishing wetlands also inform this outcome as they used population numbers and diversity of species as a measure of wetland response to flooding regime management. Native vegetation, frogs and waterbirds were all found to benefit. While Wassens et al. (2012) concluded that the watering regime appeared to favour native over exotic species, Thomas et al. (2011) found a greatly increased abundance of the introduced fish <i>Gambusia</i>, highlighting the importance of wetland drying in the watering regime.</p> <p><i>Threatened species</i></p> <p>Alteration or modification of flow in a river system is listed under both the <i>Threatened Species Conservation Act 1995</i> and the <i>Fisheries Management Act</i> as a key threatening process.</p> <p>Promoting the recovery of known threatened species involves recognising individual species, as well as ecological communities which satisfy requirements for listing under various legislation, including those described as:</p> <p>extinct in the wild, critically endangered, endangered or vulnerable under the Commonwealth's <i>Environment Protection and Biodiversity Conservation Act 1999</i></p> <p>vulnerable, critically endangered or endangered species or ecological communities under the <i>NSW Threatened Species Conservation Act 1995</i></p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>threatened fish (including macroinvertebrates, crustaceans and others) and ecological communities protected under the NSW <i>Fisheries Management Act 1994</i>.</p> <p>The aquatic ecological community of the natural drainage system of the Lower Murray River catchment is a declared endangered ecological community under the <i>Fisheries Management Act 1994</i>. This includes “all natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murrumbidgee River downstream of Burrinjuck Dam, the Tumut River downstream of Blowering Dam and all their tributaries, branches and effluents including Billabong Creek, Yanco Creek and Columbo Creek in the Murrumbidgee water source”. In addition, the Murray Crayfish (<i>Euastacus armatus</i>) was added to the list of vulnerable species under the <i>Fisheries Management Act 1994</i> in July 2013.</p> <p>Altering or modifying flows under the Plan rules to achieve a more natural pattern of flows would generally be considered to be a move towards achieving this outcome. This includes implementing the transparency and translucency rules for Blowering and Burrinjuck Dams.</p> <p>No studies have directly targeted the impacts of the Plan on threatened species, but some limited information on threatened species has been collected through other studies. An increase in Southern Bell frog (listed as threatened under the NSW <i>Threatened Species Conservation Act 1995</i> and as vulnerable under the Commonwealth’s <i>Environment Protection and Biodiversity Conservation Act 1999</i>) numbers in some wetlands (NSW OEH 2011), and a re-colonisation of others (NSW OEH 2011) was found in response to wetland flooding. A flood event that resulted in the recolonisation by the Southern Bell frog in wetlands formerly known to have been frog habitats also resulted in a greatly increased abundance of <i>Gambusia</i>, an introduced species that feeds on frog eggs and tadpoles (Thomas et al. 2011).</p> <p>References:</p> <p>NSW Office of Environment and Heritage (OEH, 2011) Environmental water use in New South Wales, Annual Report 2010–11</p> <p>Thomas, R., Spencer, J.A., Wassens, S., Lu, Y., Wen, L., Hunter, S., Iles, J. and Kobayashi, Y. (2011), Environmental flow monitoring in the Lowbidgee wetlands and Macquarie Marshes in 2010–11. Testing wetland resilience: monitoring the response of iconic wetlands to reflooding following historic drought project. Progress report for the NSW Catchment Action Program,</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>Office Environment and Heritage, Sydney and Charles Sturt University, Wagga Wagga, March 2011.</p> <p>Growns, I (2008) <i>The influence of changes to river hydrology on freshwater fish in regulated rivers of the Murray–Darling Basin</i>. <i>Hydrobiologia</i> 596: 203–211.</p> <p>Hardwick, L & Maguire, J 1999, Integrated Monitoring of Environmental Flows – Murrumbidgee Region 1998 flow year – Technical Report 1 (draft)</p> <p>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 on periphyton communities in the Murrumbidgee catchment</p> <p>NSW Office of Environment and Heritage (2011) Environmental water use in New South Wales, Annual Report 2010–11</p> <p>NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) 2004, <i>A guide to the Water Sharing Plan for the Murrumbidgee Regulated River Water</i>, http://www.water.nsw.gov.au/__data/assets/pdf_file/0010/547705/murrumbidgee-reg-guide.pdf</p> <p>NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) (2003), IMEF Operations Manual – Murrumbidgee Valley, NSW Government</p> <p>Thomas, R., Spencer, J.A., Wassens, S., Lu, Y., Wen, L., Hunter, S., Iles, J. and Kobayashi, Y. (2011), Environmental flow monitoring in the Lowbidgee wetlands and Macquarie Marshes in 2010–11. Testing wetland resilience: monitoring the response of iconic wetlands to reflooding following historic drought project. Progress report for the NSW Catchment Action Program, Office Environment and Heritage, Sydney and Charles Sturt University, Wagga Wagga, March 2011.</p> <p>Wassens, S, Watts, R J, Howitt, J, Spencer, J, Zandera, A and Andrew Halla, (2011), Monitoring of ecosystem responses to the delivery of environmental water in the Murrumbidgee system, Institute of Land, Water and Society, Report 1, December 2011</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		Wassens, S, Watts, RJ, Spencer, JA, Howitt, J, McCasker, NA, Griese, V, Burns, A, Croft, R, Zander, A, Amos, C and Hall, A (2012), Monitoring of ecosystem responses to the delivery of environmental water in the Murrumbidgee system, Institute of Land, Water and Society, Report 2, May 2012	
Change in water quality in this water source	<p>Protect and restore in-river and riparian habitats and ecological processes</p> <p>Sustain and enhance population numbers and diversity of indigenous species</p>	<p>The Murrumbidgee River experiences a range of water quality issues, including blackwater events and cold water pollution from dams. The Plan acknowledges that any changes to general water quality due to changed flow regimes will be a long-term outcome, and that there are many external factors that affect water quality. Flow management techniques can however, be used to mitigate specific water quality threats – specifically, blue green algae blooms, cold water pollution and blackwater events. NSW OEH (2011) reported that a natural blackwater event, where dissolved oxygen levels in the water plummet due to the decomposition of organic matter, was mitigated to a limited extent by dam water releases.</p> <p>There is minimal information available in relation to this outcome. While differences in water quality were found between regulated and unregulated sections of the Murrumbidgee River (Hardwick et al. 2012), and a trend of increasing turbidity was found in the Murrumbidgee region (McGeoch & Muschal 2009), both studies noted that external influences, in particular land management, were likely to be much more important drivers of general water quality than changes in flow management.</p> <p>An assessment of the impact of translucent releases below Burrinjuck Dam concluded that water quality in the regulated rivers differed substantially from unregulated rivers, and water released from Burrinjuck Dam in particular was affected by upstream catchment development as well as the influence of the dam itself (Hardwick et al 2012). It was proposed that these effects were likely to mitigate any environmental improvement expected to result from flow restoration in the Murrumbidgee downstream of Burrinjuck Dam.</p> <p>There is limited water quality data available for the Murrumbidgee system over the evaluation period. The <i>Assessment of Basin Plan Water Quality targets in New South Wales</i> report provides some general information on water quality in the Murrumbidgee system (Mawhinney & Muschal 2015). The ratings compared to basin targets are provided below based on median annual data from 2007 – 2012. The ratings are general good, with some ‘moderate’ ratings for turbidity, nutrients, and dissolved oxygen. The water quality ratings are better at the upstream</p>	Moderate

Performance indicator	Related Plan objectives	Results	Strength of information																																			
		<p>sites and the condition declines for the downstream sites. Note that the report provides no “pre-Plan” comparison.</p> <p>Water quality index ratings by site for the Murrumbidgee valley (Mawhinney & Muschal 2015)</p> <table border="1"> <thead> <tr> <th>Station</th> <th>Turbidity (lab)</th> <th>Turbidity (field)</th> <th>Total phosphorus</th> <th>Total nitrogen</th> <th>pH</th> <th>Dissolved oxygen</th> </tr> </thead> <tbody> <tr> <td>41010395 Murrumbidgee River downstream Wagga at Roach Rd</td> <td>Good</td> <td>Good</td> <td>Good</td> <td>Good</td> <td>Very Good</td> <td>Very Good</td> </tr> <tr> <td>410136 Murrumbidgee River downstream Hay Weir</td> <td>Good</td> <td>Good</td> <td>Moderate</td> <td>Very Good</td> <td>Very Good</td> <td>Very Good</td> </tr> <tr> <td>410040 Murrumbidgee River downstream Maude Weir</td> <td>Good</td> <td>Moderate</td> <td>Moderate</td> <td>Good</td> <td>Very Good</td> <td>Very Good</td> </tr> <tr> <td>41010901 Murrumbidgee River at Balranald Weir Storage Gauge</td> <td>Good</td> <td>Moderate</td> <td>Moderate</td> <td>Moderate</td> <td>Very Good</td> <td>Moderate</td> </tr> </tbody> </table> <p>References:</p>	Station	Turbidity (lab)	Turbidity (field)	Total phosphorus	Total nitrogen	pH	Dissolved oxygen	41010395 Murrumbidgee River downstream Wagga at Roach Rd	Good	Good	Good	Good	Very Good	Very Good	410136 Murrumbidgee River downstream Hay Weir	Good	Good	Moderate	Very Good	Very Good	Very Good	410040 Murrumbidgee River downstream Maude Weir	Good	Moderate	Moderate	Good	Very Good	Very Good	41010901 Murrumbidgee River at Balranald Weir Storage Gauge	Good	Moderate	Moderate	Moderate	Very Good	Moderate	
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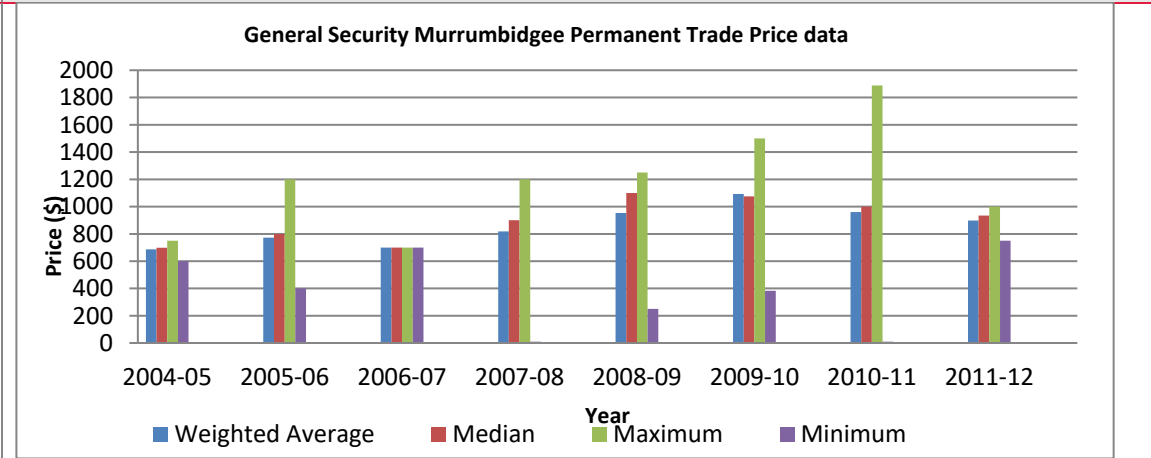
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		<p>Hardwick, L., Chessman B., Westhorpe D., Mitrovic S. (2012). Assessing translucent environmental water release in the Murrumbidgee River below Burrinjuck Dam 1999–2002. Report 1 – Background. Regulated and unregulated rivers of the Murrumbidgee water source and the effect of translucent releases – an Integrated Monitoring of Environmental Flows background report. Published: Sydney, March 2012</p> <p>McGeoch, S & Muschal M 2009, Appendix 8 – Murrumbidgee in Evaluation of water quality data and historical trends in New South Wales, NSW Office of Water, Sydney.</p> <p>NSW Office of Environment and Heritage (2011) Environmental water use in New South Wales, Annual Report 2010–11</p>	
Change in economic benefits derived from water extraction and use	<p>Maximise early season general security allocations</p> <p>Provide for commercial consumptive use</p>	<p>ABARES (2015) identifies there are many factors that impact on economic performance of the irrigation industry and few of these are affected by the Plan. Both ABARES (2015) and Aither (2017) identify that water trading has enabled irrigators and other water users to adapt to varying water availability, particularly during the Millennium drought. However, these are Murray–Darling Basin–wide conclusions.</p> <p><i>Modelled change in regional gross margin resulting from the Plan</i></p> <p>The gross margin represents the difference between revenue and the cost of goods sold. Cost of goods sold includes variable and fixed costs directly linked to the sale (including the cost of getting the produce to the point of sale). It does not include indirect fixed costs like office expenses, rent and administrative costs.</p> <p>The impact of the Plan on regional irrigated agriculture was assessed by analysing modelled changes in the regional gross margin. This provides an indication of regional gross margin with and without the Plan assuming all other variables remain constant.</p> <p>This modelling was conducted by the NSW Department of Primary Industries' using their Catchment Economic Impact Model (CEIM). The CEIM uses a combination of hydrology simulation and linear programming. Simulated hydrology data from 1906 to 2010 was obtained from the Integrated Water Quantity and Quality Model. The linear programming model optimises the land use subject to given physical constraints such as land, water, capacity of farm storage and labour.</p>	Moderate

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>For this evaluation, two scenarios were used to model changes in the regional gross margin:</p> <ul style="list-style-type: none"> a 'base case' used the rules before the Plan to estimate water diversions and regional gross margin a 'Plan scenario' using the Plan rules to estimate water diversions and regional gross margin. <p>In the scenarios, the level of irrigation development and on-farm management are assumed to remain the same in order to estimate the impact of the Plan rules.</p> <p>The annual average total regional gross margin in the base case is estimated to be approximately \$414 million. In the Plan scenario it is estimated to be slightly less at just under \$413 million. This is within the standard error range for the modelling tool.</p> <p>In years with the lowest water diversions (i.e. the driest years), the base case estimated the average annual regional gross margin to be \$353.4 million. This reduced to \$348.7 million with the Plan scenario. In years with the highest water diversions (i.e. the wettest years), average annual regional gross margins were estimated to be approximately \$426.8 million for both the base case and the Plan scenario.</p> <p>The modelling suggests that the introduction of the Plan resulted in a small decrease on the regional gross margins as a result of a decrease in availability of water for irrigation, however this percentage is within the model's standard error range and would be considered a negligible change. It also indicates that the economic impacts of the Plan are greater in years of low water availability.</p> <p><i>Change in unit price of water transferred</i></p> <p>The Plan made it possible for water access licence holders to trade their water independent of their land. The ability to buy and sell water independent of land has given farmers more flexibility to manage risks associated with changing conditions. Trading of water on this scale is new to NSW, and an assessment of the change in unit price of water transfers provides an indication as to whether the market has adjusted to this new system of trading. The price is set by the market, and it would be expected that the price would fluctuate depending on key influencers over the period such as limited water availability due to the drought. Fluctuating water prices responding to these changes maximises the economic gains from water trading.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information																																				
		<p>In the figures below, the change in price per megalitre of water transfer has been assessed based on the price of water traded in the Murrumbidgee water source.</p> <p>The weighted average price of general security licence trades peaked in the period from 2006–2007 to 2008–2009 during the extended drought period, with the highest weighted average price recorded in 2008–2009 at \$380 per ML. The maximum recorded price for the entire period was during 2007–2008 at \$1,150 per ML.</p> <p>The weighted average price of high security licence trades also peaked from 2006–2007 to 2008–2009 with the highest weighted average price recorded in 2008–2009 at \$379 per ML. The maximum recorded price for the entire period was during 2007–2008 at \$440 per ML.</p> <p><i>Price data for the assignment of allocation of general security licences in the Murrumbidgee</i></p> <div> <table border="1"> <caption>Murrumbidgee General Security Temporary Trade Price data</caption> <thead> <tr> <th>Year</th> <th>Weighted Average (\$/ML)</th> <th>Median (\$/ML)</th> <th>Maximum (\$/ML)</th> </tr> </thead> <tbody> <tr> <td>2004-05</td> <td>~100</td> <td>~100</td> <td>~150</td> </tr> <tr> <td>2005-06</td> <td>~50</td> <td>~50</td> <td>~100</td> </tr> <tr> <td>2006-07</td> <td>~250</td> <td>~250</td> <td>~550</td> </tr> <tr> <td>2007-08</td> <td>~300</td> <td>~300</td> <td>~1150</td> </tr> <tr> <td>2008-09</td> <td>~380</td> <td>~380</td> <td>~400</td> </tr> <tr> <td>2009-10</td> <td>~100</td> <td>~100</td> <td>~150</td> </tr> <tr> <td>2010-11</td> <td>~50</td> <td>~50</td> <td>~200</td> </tr> <tr> <td>2011-12</td> <td>~20</td> <td>~20</td> <td>~50</td> </tr> </tbody> </table> </div> <p><i>Price data for the assignment of allocation of high security licences in the Murrumbidgee</i></p>	Year	Weighted Average (\$/ML)	Median (\$/ML)	Maximum (\$/ML)	2004-05	~100	~100	~150	2005-06	~50	~50	~100	2006-07	~250	~250	~550	2007-08	~300	~300	~1150	2008-09	~380	~380	~400	2009-10	~100	~100	~150	2010-11	~50	~50	~200	2011-12	~20	~20	~50	
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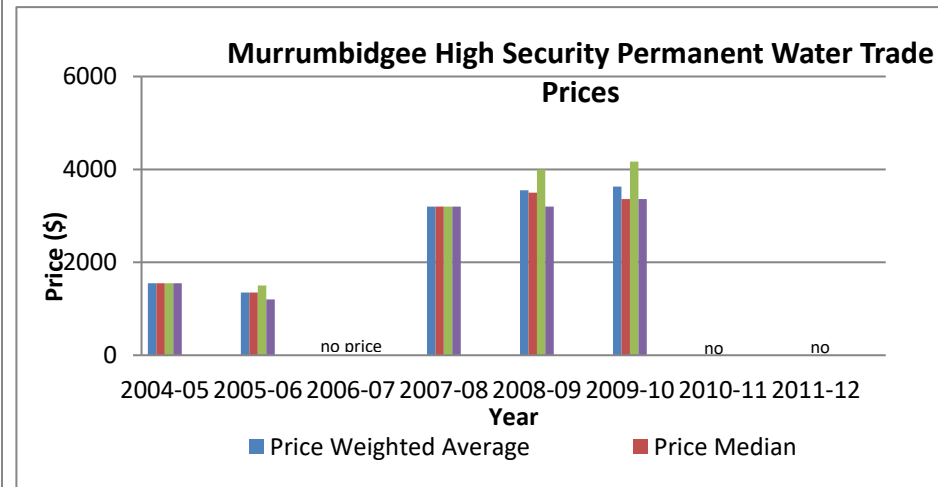
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Source: DPI Office of Water 2012

Price data for assignment of shares of high security licences in the Murrumbidgee



Source: DPI Office of Water 2012

Performance indicator	Related Plan objectives	Results	Strength of information																
		<p>In 2006 and 2010, the NSW Irrigators' Survey provided information on attitudes to trade in assignment of shares for the Murrumbidgee water source. Respondents noted that permanent trading was both good and bad for the area. The survey results show that the number of respondents reporting it was good for the area dropped from around 28 to 15%.</p> <p><i>Movement to higher value crops</i></p> <p>When water prices increase, it would be expected that water would move to higher value crops in line with the market. The gross margin data from 2012 as well as crop area and water delivery volumes from Murrumbidgee Irrigation Area have been used as evidence.</p> <p>The crops that yield the greatest gross margin per megalitre are orchards, vines, cotton along with winter and summer oil seeds (see table below). Those that yield the lowest gross margins per megalitre are rice, winter cereal, pasture and fodder, and Lucerne.</p> <p><i>Crop gross margins per megalitre of water used in 2012</i></p> <table border="1"> <thead> <tr> <th>Crop</th> <th>Gross margin (\$)/megalitre</th> </tr> </thead> <tbody> <tr> <td>Vines</td> <td>\$1,345</td> </tr> <tr> <td>Vegetables</td> <td>\$856</td> </tr> <tr> <td>Cotton</td> <td>\$642</td> </tr> <tr> <td>Orchard</td> <td>\$354</td> </tr> <tr> <td>Summer oil seeds</td> <td>\$235</td> </tr> <tr> <td>Winter oil seeds</td> <td>\$223</td> </tr> <tr> <td>Summer Cereal</td> <td>\$199</td> </tr> </tbody> </table>	Crop	Gross margin (\$)/megalitre	Vines	\$1,345	Vegetables	\$856	Cotton	\$642	Orchard	\$354	Summer oil seeds	\$235	Winter oil seeds	\$223	Summer Cereal	\$199	
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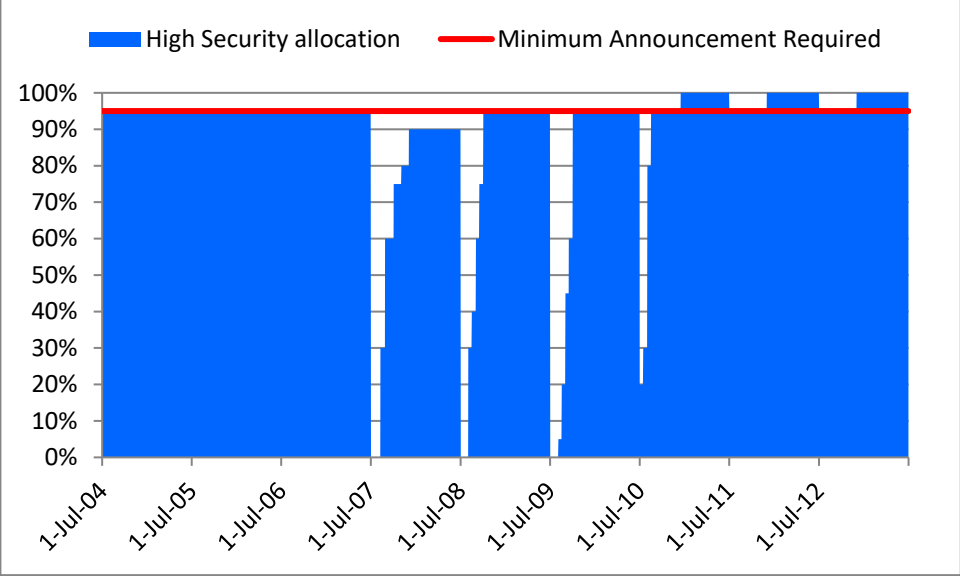
Performance indicator	Related Plan objectives	Results							Strength of information																																																
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		Winter Cereal	\$123																																																						
		Pasture and Fodder	\$114																																																						
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		While the area used to grow high value crops has been stable, with a slight increase over the evaluation period, the proportion of total water deliveries used by these crops has fluctuated considerably. In 2007–08 nearly 60% of total water delivery was used by these crops while in 2010–11 only 17% was used by these crops.																																																							
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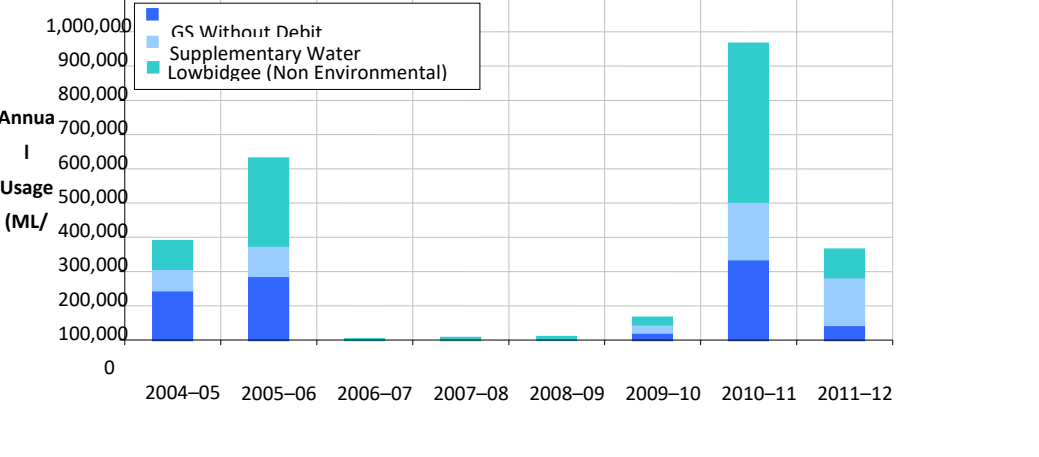
Performance indicator	Related Plan objectives	Results						Strength of information	
		Crop	Area (ha) over different water years						
			2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
		Vegetables	3,339	3,862	2,421	1,422	2,453	3,031	3,322
		Other	504	756	1,127	1,518	1,176	1,475	4,945
		Rice*	7,536	27,437	2,343	76	2,779	7,622	25,767
		Summer cereals	5,103	4,997	1,987	495	833	1,603	2,928
		Summer oilseeds	1,132	2,426	355	32	455	950	1,472
		Summer pasture	5,035	5,458	3,348	1,143	2,000	2,862	2,098
		Winter cereals	56,736	48,506	52,606	18,139	16,794	24,569	39,750
		Winter oilseeds	8,529	8,417	5,927	3,846	3,700	3,567	4,288
		Winter pasture	9,644	10,321	6,197	3,145	2,478	3,403	5,947
		Total	97,558	112,180	76,311	29,816	32,668	49,082	90,517
		<i>Source: Murrumbidgee Irrigation Ltd 2005 to 2012</i>							
		<i>Water use on lower value crops in Murrumbidgee Irrigation Area</i>							

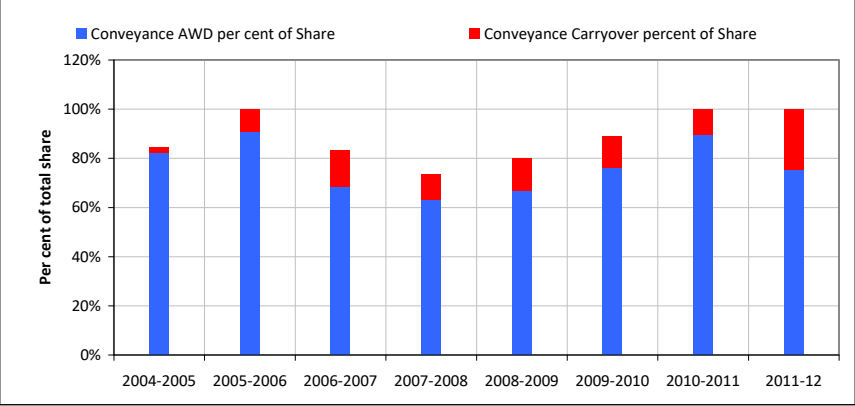
Performance indicator	Related Plan objectives	Results						Strength of information	
		Crop	Volume delivered (ML) over different water years						
			2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
		Vegetables	22,736	27,588	15,577	9,191	13,108	16,519	14,717
		Rice*	101,494	355,254	41,296	1,006	34,450	103,208	253,699
		Winter cereals	190,497	117,116	124,906	32,418	30,130	41,054	56,866
		Other crops	137,979	160,837	61,401	24,346	35,880	47,263	68,084
		Total	452,706	660,795	243,180	66,961	113,568	208,044	393,366
		Percentage of total delivery	75%	80%	59%	32%	41%	56%	80%
		<p><i>Source: Murrumbidgee Irrigation Ltd 2005 to 2012</i></p> <p><i>Use of water licence as loan security</i></p> <p>The implementation of water sharing plans enabled water access licence holder to use their water title as a loan security. In the NSW Irrigators' Surveys for 2006 and 2010, a question was asked about "Do you have a loan in which your water title has been used as security?" In 2006, 34% of respondents within the Murrumbidgee catchment reported that they have used their water title as loan security. This increased to almost 37% in 2010 and returned to 29% in 2013.</p>							

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>This indicates that landholders are gaining benefits for utilising the flexibility offered by having a water title separate to the land title to manage their financial circumstances.</p> <p>References:</p> <p>ABARES (2015), Ashton, D & Oliver, M 2015, <i>Irrigated agriculture in the Murray–Darling Basin: an economic survey of irrigators, 2012–13 to 2014–15</i>, ABARES research report 15.13, Canberra, December.</p> <p>Aither (2017) <i>Water markets in New South Wales: market outcomes, trends and drivers</i>, Report prepared for NSW Department of Primary Industries, Water</p> <p>NSW Department of Trade and Investment, Regional Infrastructure and Services (2015) <i>Monitoring economic and social changes in NSW water sharing plan areas Irrigators’ Surveys 2009/2010 and 2013 – A state wide comparison</i></p> <p>NSW Department of Primary Industries, Office of Water (2011), <i>Monitoring economic and social changes in NSW water sharing plan areas: A comparison of irrigators’ survey 2006 and 2010 – covering plans commenced in 2004</i></p> <p>NSW Department of Primary Industries – Water (2017d), <i>NSW Water Register</i>, http://www.water.nsw.gov.au/water-licensing/registers</p>	
<p><i>Additional PI identified</i></p> <p>Extent to which water requirements for high security licences have been met</p>	<p>Provide for commercial consumptive use</p>	<p>The Plan (clause 38) states that water supply will be maintained for high security licences up to 0.95 ML per unit share (95% of water requirements) through a repeat of the worst period of low inflows into this water source.</p> <p>The requirement to provide 95% allocation at the start of the water year for high security licences was not met at all times of the evaluation period. In 2007–08 allocations remained below the 95% level throughout the entire water year, while in other drought years, allocations did not achieve the 95% level until later in the season. However, Plan rules require that this target should be met for all periods where inflows to the system are greater than the previous worst period of low inflows, and the drought at this time established new low inflow records. As a result, the Plan requirements were met, even though allocations were less than the 95% allocation target.</p>	<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information																														
		<p><i>Available water determinations for regulated river high security licences in the Murrumbidgee</i></p>  <table border="1"> <caption>Estimated data from the bar chart</caption> <thead> <tr> <th>Date</th> <th>High Security allocation (%)</th> <th>Minimum Announcement Required (%)</th> </tr> </thead> <tbody> <tr> <td>1-Jul-04</td> <td>100</td> <td>95</td> </tr> <tr> <td>1-Jul-05</td> <td>100</td> <td>95</td> </tr> <tr> <td>1-Jul-06</td> <td>100</td> <td>95</td> </tr> <tr> <td>1-Jul-07</td> <td>100</td> <td>95</td> </tr> <tr> <td>1-Jul-08</td> <td>60</td> <td>95</td> </tr> <tr> <td>1-Jul-09</td> <td>90</td> <td>95</td> </tr> <tr> <td>1-Jul-10</td> <td>45</td> <td>95</td> </tr> <tr> <td>1-Jul-11</td> <td>100</td> <td>95</td> </tr> <tr> <td>1-Jul-12</td> <td>100</td> <td>95</td> </tr> </tbody> </table> <p>During the period of severely reduced allocations for high security, the former Office of Water released a monthly “Critical Water Planning Communiqué”. As part of this process, high security licence holders with immediate water needs, such as intensive livestock, forestry industry, abattoirs, wine processing, and non–deciduous tree crops, were given the opportunity to apply for “Survival Water” on a case by case basis.</p> <p>References:</p> <p>NSW Department of Primary Industries 2012, Farm Budgets and Costs</p> <p>NSW Department of Primary Industries 2012 – Catchment Economic Impact Model</p>	Date	High Security allocation (%)	Minimum Announcement Required (%)	1-Jul-04	100	95	1-Jul-05	100	95	1-Jul-06	100	95	1-Jul-07	100	95	1-Jul-08	60	95	1-Jul-09	90	95	1-Jul-10	45	95	1-Jul-11	100	95	1-Jul-12	100	95	
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Performance indicator	Related Plan objectives	Results	Strength of information
<p><i>Additional PI identified</i></p> <p>Extent to which water provided for high security, general security and supplementary licences in that order of priority</p>	<p>Provide for commercial consumptive use</p>	<p>The Plan (clauses 38–41) allows for maximum water to be provided for high security, general security and supplementary licences once water has been allowed for environmental water, BLR, local water utility, and domestic and stock. These are to be provided in the following order of priority: high security, general security and then supplementary licences.</p> <p>Water is provided through the available water determination (AWD) process, which has been implemented and adjusted during the evaluation period. As a result, this process is now clear and relatively straight forward. The process has an emphasis is on risk avoidance (with the use of the ‘worst drought on record’ assumption), and a clear set of priorities about allocations. Water is often reserved for essential requirements in the current and future seasons, which is required to ensure the requirements of the Plan in relation to higher levels of priority are satisfied.</p> <p>Under normal conditions the assessment of AWDs is carried out at monthly intervals until both high and general security licences have received their full entitlement. During the extended drought, this assessment was also carried out although the emphasis was on securing supply to higher priority users. During this period, water was only provided to high security users based on an assessment of need to keep livestock and permanent plantings such as orchards and vineyards alive. Information on how the calculations were being undertaken and the likelihood for improvement was regularly provided from the former Office of Water to water users through Critical Water Planning Communiqués. This process ensured transparency in the decision making process surrounding water availability.</p> <p>When a supplementary event occurred, the water was made available and extracted (see graph below). There were no supplementary events from 2006–2007 to 2008–2009 during the extended drought.</p> <p><i>Total extraction during supplementary events in the Murrumbidgee</i></p>	<p>Moderate</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		 <p><i>Source: NSW Office of Water 2012</i></p> <p><i>Note: Total volume of water extracted includes water taken by General Security licence holders during supplementary events during low allocation periods under the “without debit” clause (39(6)) and Lowbidgee diversions (not including licensed environmental water). Until the 2012 Plan amendments, Lowbidgee diversions occurred during supplementary event announcements. Currently, Lowbidgee diversions are made under supplementary water (Lowbidgee) access licences.]</i></p>	
<p><i>Additional PI identified</i> Provide sufficient water for irrigation corporation conveyance licences to allow</p>	<p>Provide for commercial consumptive use</p>	<p>Conveyance licences are established in irrigation corporation schemes to account for water lost in the transfer of water within the scheme. The rules (Clauses 40 and 412) relate the volumes available for conveyance with the volumes of water made available to licence categories within the scheme. This relationship ensures that when an allocation is made to high security, sufficient conveyance water is made available to allow delivery of this entitlement, with further conveyance water allocated as general security allocations are declared. The graph below shows the allocation made to conveyance licences during the evaluation period.</p> <p><i>Available water determinations for conveyance licences in the Murrumbidgee</i></p>	<p>Good</p>

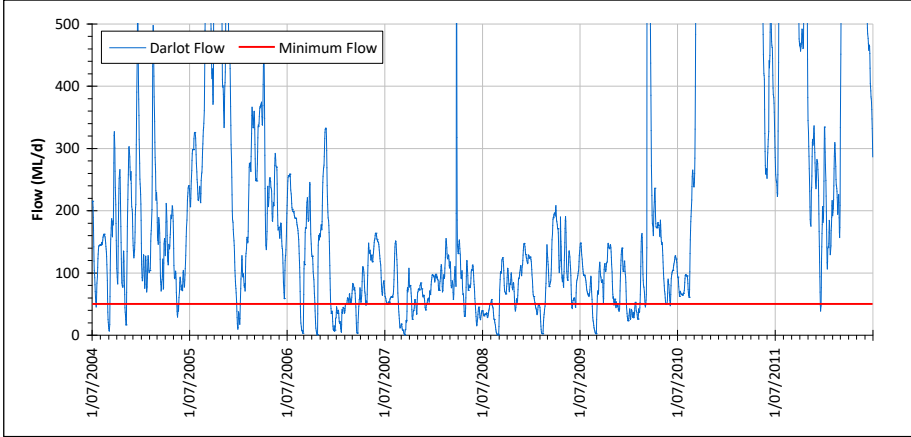
Performance indicator	Related Plan objectives	Results	Strength of information
delivery of water allocations		 <p>The rules within the Plan which allocate water for conveyance licences provide sufficient water to ensure delivery of allocated high and general security water</p>	
<p><i>Additional PI identified</i></p> <p>Increase water supply to general security licences in dry years</p>	Provide for commercial consumptive use	<p>The lower level of priority granted to general security licences under the NSW Water Management Act, 2000 (the Act) means that they are the most heavily impacted licence category when storage levels are low. As the Act and the Plan defines the rules around this level of priority, the options for increasing water supply to general security licences in dry years is limited, as any water stored in Burrinjuck and Blowering Dams will already be allocated to higher priority licence categories. However, the Plan (clause 39(6)) allows for General Security licences to access supplementary water events without debit to their accounts during low allocation periods. This means that if a supplementary event occurs, general security licence holders may access water even if they have no water in their accounts. Significant volumes of water were accessed by general security licences under these circumstances. However, during the extreme drought period (2006 – 2009), the lack of supplementary events limited the ability of this clause to increase water supply to general security.</p>	Good
<p><i>Additional PI identified</i></p>	Provide for commercial consumptive use	<p>The Plan (clause 51) specifies that access to water should be limited to supplementary water access licences when general security water allocations in the Murray are low and those in this</p>	Good

Performance indicator	Related Plan objectives	Results	Strength of information
Increase water supply security to general security licences in the Murray in dry years		<p>water source are high. For this limit to supplementary licences to come into effect, both of the following criteria must be satisfied:</p> <p>Allocation in the Murray, combined with carryover, resulting in an average of 0.6 ML/share account water for general security licence holders in the Murray</p> <p>Allocation in the Murrumbidgee of less than 0.7 ML/share for general security licences</p> <p>While there were periods where each of the above criteria were satisfied, there were no periods when both criteria were satisfied together. Consequently, there are no occasions when the plan was able to increase water supply security to the Murray.</p>	
<p><i>Additional PI identified</i></p> <p>Maximise early season general security allocations</p>	<p>Provide for commercial consumptive use</p> <p>Maximise early season general security allocations</p>	<p>The Plan (clauses 38–41) specifies that AWDs should be revised on a monthly basis throughout the year. AWDs are the mechanism by which water is added into a water account, and are also used by water users to inform their annual cropping decisions.</p> <p>In dry years AWDs tend to start low and increase over time as more inflows occur. The number of announcements within a given year demonstrates the responsiveness to changes in water availability. There tend to be more frequent announcements in years with smaller inflow events.</p> <p>Limited water availability at the start of the water year in 2007–08 to 2010–11 resulted in initial AWD announcements at least a few months into the year (see Figure 35). Following this initial allocation, there was a high level of responsiveness as announcements occurred as soon as water became available. The announcements were made most months and based on events, except when allocations were suspended in 2006.</p> <p>In addition to water made available via the AWD process, the Plan (clause 48) also allows general security water users to control the volume of remaining account water they can carry over from one year to the next. This Plan rule has the effect of reducing the allocation level, however this is offset by the account water remaining in licence holders accounts.</p> <p>When the Plan was suspended in 2006, water credited in accounts, or held in accounts for carryover purposes was suspended and used for essential supplies, effectively reducing the allocation level which had previously been announced.. Although this water was recredited to accounts as conditions improved, it had a significant impact on general security water users. Feedback received during stakeholder interviews identified the need for certainty around water</p>	Good

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>allocations, particularly once they had been announced. This is due to the large upfront costs involved in cropping and the lead times required as decisions about areas of planting are made on the basis of the announced allocations that are known in the spring and autumn:</p> <p>“When there was a reduction in allocation in 2006 there was a hell of a blue. We would much rather them be conservative than reducing the allocation.” (Murrumbidgee irrigator 2012, pers. comm., 3 October)</p> <p>“The problem happened in 2006 – in dealing with the drought. In late October there were new minimum inflows that hadn’t been dealt with before. In the first week in November the allocation was reduced from 20% to 13%. We need to create a works approval for a new agreement with State Water, and more explicitly define resource assessment. We set up a much better communication line with State Water. It was a matter of bedding down a process to cope with a previously unknown experience.” (Office of Water 2012, pers. comm., 3 October)</p> <p>This experience highlights the importance of providing certainty to licence holders when setting early season allocations.</p>	
<p><i>Additional PI identified</i></p> <p>Increase the ability for licence holders to trade licence entitlements and allocations</p>	<p>Provide for commercial consumptive use</p>	<p>The Plan (clauses 52 to 58) provides for trading of water allocations and entitlements within the water source and between this source and the Murray subject to various rules. These rules aimed to streamline and support water trading, so it is anticipated that trade would have increased since the start of the Plan.</p> <p>The main dealings conducted in the Murrumbidgee Regulated River include:</p> <p>trade of water allocation assignments (‘temporary trade’) and/or assignments of shares (‘permanent trade’)</p> <p>trade within the Murrumbidgee Regulated River and/or with outside water sources (e.g. inter–valley trade)</p> <p>trade across different licence categories.</p> <p>There is a trend towards increased trade in water allocation across the evaluation period. High levels of trade during the drier years from 2007–08 to 2009–10 reflects demands for water within a period of limited water availability. Particularly towards the end of the drought, some</p>	<p>Good</p>

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>irrigators were trading their allocated water to others to increase cash flow, while others traded in allocation to keep permanent plantings alive.</p> <p>More allocated water was traded out of the Plan area than into the Murrumbidgee in nearly all years of the evaluation period. This resulted in a net flow of allocated water out of the Murrumbidgee during the term of the Plan. The high number of trades of water allocations out of the Murrumbidgee Regulated River from 2007–2008 to 2009–2010 was due to the late announcement of AWDs. This late announcement meant that early season crops were not planted, and when allocations were made, it was too late to plant these crops, resulting in licence holders having an excess of allocated water. Due to the differences in levels of reliability between NSW systems and interstate, water made available in NSW appears to have been attractive to interstate irrigators. Higher volumes in 2010–11 and 2011–12 reflected greater volumes of account water available for trade due to higher AWDs.</p> <p>Most permanent trade, particularly in general security licences increased over the evaluation period. It is considered that these rules are effectively working both during wet and dry periods.</p> <p>Only a small number of permanent inter valley trades have been made during the term of the Plan. These have all involved transfers out of the Murrumbidgee to either Victoria or South Australia.</p> <p>Transfers from one category to another are also allowed by clause 55 of the Plan. Under 55(3) and 55(4), conversions are allowed between general security and high security licences. A conversion factor was established on 20 July 2006 so that 1 share of general security would receive 0.55 shares of high security. In 2007–08 and 2008–09, approximately 140,000ML of general security entitlement was converted from general security to high security categories (see Figure 39). No transfers were made from high security to general security. The volume of conversions, and the lack of interest in conversions in the opposite direction, suggests that the conversion factor may have been set too low.</p> <p>In July 2008 the decision to allow conversions was reversed. The Australian Competition and Consumer Commission later released a report (ACCC, 2009) raising concerns that the conversion of licence categories may have third party impacts. In total, 29 licences were converted, with 141,503 shares of general security converted to 77,827 shares of high security.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information												
		<p>The Plan also allows for conversion of irrigation district conveyance licences to general security licences. A conversion factor for this transfer was never established, so no conversions ever took place. As a result of the potential for third party impacts discussed above, it appears unlikely that these conversions will be allowed.</p> <p>While trade is occurring, a number of rules have been identified by stakeholders and DPIE staff during consultation as being barriers to trade.</p> <table border="1"> <thead> <tr> <th>Plan rules</th> <th>Original purpose</th> <th>Reason it has been identified as a barrier</th> </tr> </thead> <tbody> <tr> <td>Deadlines for trades for high security and general security within a water year</td> <td>To restrict unused water being traded, ensuring a higher starting allocation in the following year.</td> <td>Did not achieve original purpose—licence holders could change behaviour to trade earlier. Consequently it has become an additional and unnecessary consideration</td> </tr> <tr> <td>5 km buffer rule for restrictions of trade of supplementary water across licences</td> <td>Limit growth in use triggered by movement of account allocations down the river system chasing access to announced events</td> <td>Extra management introduced in other systems (expression of interest in access and event management taking this into account) means that the original purpose can be achieved by other means</td> </tr> <tr> <td>Conversion of access licence categories</td> <td>Enable movement of entitlement between licence categories</td> <td>No conversion factors established/ability to trade suspended</td> </tr> </tbody> </table>	Plan rules	Original purpose	Reason it has been identified as a barrier	Deadlines for trades for high security and general security within a water year	To restrict unused water being traded, ensuring a higher starting allocation in the following year.	Did not achieve original purpose—licence holders could change behaviour to trade earlier. Consequently it has become an additional and unnecessary consideration	5 km buffer rule for restrictions of trade of supplementary water across licences	Limit growth in use triggered by movement of account allocations down the river system chasing access to announced events	Extra management introduced in other systems (expression of interest in access and event management taking this into account) means that the original purpose can be achieved by other means	Conversion of access licence categories	Enable movement of entitlement between licence categories	No conversion factors established/ability to trade suspended	
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Conversion of access licence categories	Enable movement of entitlement between licence categories	No conversion factors established/ability to trade suspended													
Extent to which basic landholder rights	Protect basic landholder rights, as specified in the Act,	Water for BLR (domestic and stock purposes) is a very small proportion of total water extraction in the Murrumbidgee. It is estimated to be 4,560 ML per year however as no licences													

Performance indicator	Related Plan objectives	Results	Strength of information
<p>requirements have been met</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced domestic and stock access requirements have been met</p>	<p>including native title rights</p>	<p>are required for extraction of water for BLR, it is difficult to assess accurately. This requirement was only partially met during the drought when the Plan was suspended.</p> <p>The Plan also requires a flow of 50 ML per day in Billabong Creek at Darlot, which is listed under system operation rules in the Plan but is understood to maintain flow for BLR (as well as licensed requirements) on this regulated tributary stream. However, this is not specified in any documentation. While there were extended periods of non-compliance with the flow target when the Plan was suspended, outside of this period the target was largely met.</p> <p><i>Comparison of flow in Billabong Creek at Darlot with 50 ML per day target from 2004–05 to 2011–12 (Darlot gauge site 410134)</i></p> 	
<p>Extent to which local water utility requirements have been met.</p>	<p>Protect town water supply</p>	<p>The Act (Section 58) requires that water for local water utilities, major utilities, and domestic and stock access licences is prioritised above all other classes of licence. The Plan supports these priority requirements and has rules that require that the system is managed so that full supply of town water supply can be maintained through a repeat of the worst drought on record. Volumes of water are set aside in the water allocation process to ensure this.</p> <p>13 water access licences were held by local utilities supplying domestic and business water to towns such as Gundagai, Cootamundra, Temora, Junee, Coolamon and Wagga Wagga in the east. In the central and western areas important regional centres such as Narrandera, Leeton,</p>	

Performance indicator	Related Plan objectives	Results						Strength of information
		<p>Griffith, Coleambally, Darlington Point and Hay also accessed water. High security (town water supply) access licences also supported the large areas controlled by Murrumbidgee and Coleambally Irrigation. While total water for these populations is often a combination of ground and surface water, the Murrumbidgee River plays an important role.</p> <p>When the Plan was suspended, full supply of entitlement to town water was not provided. For part of this time, the system was managed to ensure that enough water was available for “critical human needs”, but this volume was substantially less than the full entitlement available to towns under normal conditions. The definition of critical human needs is not defined in the Act or the Plan.</p>						
		Local Water Utility access licences			High security licence (Town water supply)			
		Water year	Water made Available (ML)	AWD allocations	Water usage (ML)	Water made Available (ML)	AWD allocations	Water usage (ML)
		2004/2005	23,586	100%	11,497	19,769	100%	19,769
		2005/2006	23,586	100%	13,128	19,769	100%	19,699
		2006/2008	23,586	100%	16,615	19,769	100%	19,769
		2007/2008	22,407	95%	14,241	18,781	95%	18,781
		2008/2009	22,407	95%	14,241	18,781	95%	18,781
		2009/2010	22,407	95%	12,714	18,781	95%	18,781

Performance indicator	Related Plan objectives	Results							Strength of information
		2010/2011	23,587	100%	8,006	19,769	100%	19,769	
		2011/2012	23,586	100%	7,637	19,769	100%	19,769	
		2012/2013	23,816	100%	10,331	19,769	100%	19,769	
		2013/2014	23,816	100%	10,473	19,769	100%	19,769	
		<p>As the drought was worse than the worst on record, the Plan (clause 37(6)) requires an adjustment of the volumes of water set aside to ensure the ongoing security of supply to towns. Due to the potential impact on other licence categories, this has not been undertaken. It is recommended that DPIE consider the knowledge gained from the extended drought, including management of the system in line with “critical water needs” and the Plan rules associated with setting aside volumes of water to protect supply to towns.</p>							
<p>Extent to which native title rights requirements have been met.</p> <p><i>Additional PI component identified:</i></p> <p>Extent to which licenced water has been made available and used for Aboriginal purposes</p>	<p>Protect identified indigenous and traditional uses of water</p>	<p>At the commencement of the Plan, there were and still are no extractions in this water source for native title rights under the Commonwealth’s Native Title Act 1993. During the evaluation period, there have been no applications for native title rights, so this requirement has not come into effect.</p> <p>A CSIRO study into Indigenous water use in the Murray–Darling Basin (Jackson et al. 2010) identified that little is known about the pattern of Indigenous water use within the area.</p> <p>To increase understanding of Aboriginal cultural water use in NSW, the former Office of Water undertook a range of consultation activities from 2011 to 2012 as part of the National Water Commission ‘Aboriginal Community Engagement and Consultation in Water Sharing Planning in NSW’ project. The Office of Water Aboriginal Water Initiative was established in June 2012 to continue this work which will assist water sharing planning and evaluation in the future.</p> <p>As detailed information about identified Indigenous uses of water in the Murrumbidgee water source is not available, this evaluation has used common types identified by the Murray–Darling Basin Indigenous water use study: customary access and native title use, commercial needs and critical human needs (Jackson et al. 2010).</p>							

Performance indicator	Related Plan objectives	Results	Strength of information																				
		<p>The primary way that the Plan protects Indigenous water use is through specific access licences. The Act (Section 61) provides for the granting of specific purpose access licences, which the Water Management (General) Regulation 2004 (section 19f) states includes for Aboriginal cultural purposes.</p> <p>Within the Plan (clause 30), these licences are specified as high security (Aboriginal cultural) access licences with a maximum total entitlement of 2,150 ML per year for this category of licence. The Plan (section 59, clause 9) states that the conditions for this licence subcategory “allow the taking of water by Aboriginal persons or communities for personal, domestic and communal purposes including the purposes of drinking, food preparation, washing, manufacturing traditional artefacts, watering domestic gardens, cultural teaching, hunting, fishing, and gathering, and for recreational, cultural and ceremonial purposes”. As with other high security licences, the licence has an annual fee separate to the use fee. In line with its definition, this licence cannot be used for other purposes including trade for other uses or used for financial gain (e.g. to grow crops).</p> <p>There is one high security licence (Aboriginal cultural) in the Murrumbidgee issued in 2009. This was initially assigned 500 ML and was then increased to 2,150 ML in 2011–12, which is the full entitlement for this category. During the evaluation period, the full entitlement for this licence was not met during the drought when the Plan was suspended.</p>																					
		<p>Aboriginal Cultural access licences within the Murrumbidgee Regulated River Water Source</p>																					
		<table border="1"> <thead> <tr> <th>Water year</th> <th>Total share component</th> <th>AWD allocations</th> <th>Water made Available (ML)</th> <th>Water usage (ML)</th> </tr> </thead> <tbody> <tr> <td>2008/2009</td> <td>500</td> <td>95%</td> <td>–</td> <td>301</td> </tr> <tr> <td>2009/2010</td> <td>500</td> <td>95%</td> <td>475</td> <td>470</td> </tr> <tr> <td>2010/2011</td> <td>500</td> <td>100%</td> <td>500</td> <td>450</td> </tr> </tbody> </table>	Water year	Total share component	AWD allocations	Water made Available (ML)	Water usage (ML)	2008/2009	500	95%	–	301	2009/2010	500	95%	475	470	2010/2011	500	100%	500	450	
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Performance indicator	Related Plan objectives	Results					Strength of information															
		2011/2012	2,150	100%	108	364																
		2012/2013	2,150	100%	2,150	506																
		2013/2014	2,150	100%	2,150	1,093																
		<p>The Plan does not provide specific licences for Aboriginal commercial purposes. However, Aboriginal individuals and groups have the ability to access water for commercial purposes through the Plan's water trading mechanisms. There is limited information available about what licences are held by Aboriginal individuals and groups, and how these are used. Therefore, this has not been assessed in this report.</p> <p>There are no Plan rules relating to other traditional uses of water, so this has not been evaluated in this report.</p> <p>In addition to the high security (Aboriginal cultural) access licence, the Nari Nari also access water under four other licences in accordance with the Plan. Water management is a key management tool on their properties, and watering from the Murrumbidgee River has allowed for significant re-growth in the wetland area adjacent to the river (Jackson et al. 2010).</p> <p><i>Water access licences held by the Nari Nari Tribal Council</i></p>																				
		<table border="1"> <thead> <tr> <th>Licence/approval</th> <th>Category</th> <th>Share component (ML)</th> </tr> </thead> <tbody> <tr> <td>40AL402433</td> <td>Domestic and Stock</td> <td>58</td> </tr> <tr> <td>40AL403234</td> <td>Regulated River (High Security)</td> <td>3</td> </tr> <tr> <td>40AL403235</td> <td>Regulated River (General Security)</td> <td>1944</td> </tr> <tr> <td>40AL403236</td> <td>Domestic and Stock</td> <td>171</td> </tr> </tbody> </table>					Licence/approval	Category	Share component (ML)	40AL402433	Domestic and Stock	58	40AL403234	Regulated River (High Security)	3	40AL403235	Regulated River (General Security)	1944	40AL403236	Domestic and Stock	171	
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Performance indicator	Related Plan objectives	Results			Strength of information
		40AL40323	Regulated River (High Security) (Aboriginal Cultural)	500	
<p><i>Source: DPI Office of Water 2012</i></p> <p>Any use of the Aboriginal cultural licence goes through the Murrumbidgee Traditional Custodians Advisory Group, which is an advisory group made up of Aboriginal people from across the Murrumbidgee catchment. This group is supported the Murrumbidgee Catchment Management Authority (CMA).</p> <p>There is no clear evidence available about whether the use of the water has been effective. However, the consultative process required for using the water and the use of the combined water access licences by NNTC for areas including the IPA indicate that it is being used for cultural benefit.</p> <p>Due to the ongoing fees involved in the high security (Aboriginal cultural) access licence, the CMA became the caretaker holders of the licence and pay the annual fee which is approximately \$4 per ML. During interviews for this evaluation with the CMA, some concerns were raised about the licence requirements. This included the requirement for a usage fee when environmental water does not have an associated fee, and the inability to use the licence for economic benefit:</p> <p>“Can’t trade, licence fees, very difficult...” (CMA, pers. comm., 4 October 2012)</p> <p>“In general terms, flexibility would be good...We have sorted through all the administrative issues...there is an opportunity to do something more” (CMA, pers. comm., 4 October 2012)</p> <p>The evaluation identified that it is considered that the costs involved in accessing the water can be prohibitive to its use. This includes the infrastructure, pumping and fuel costs, and annual fees.</p> <p>References:</p> <p>Jackson, S, Moggridge, B & Robinson, CJ 2010, Effects of changes in water availability on Indigenous people of the Murray–Darling Basin: A scoping study – Report to the Murray Darling Basin Authority, Commonwealth Scientific and Industrial Research Organisation, LOC.</p>					

Performance indicator	Related Plan objectives	Results	Strength of information
Extent of recognition of spiritual, social and customary values of water to Aboriginal people	Protect identified indigenous and traditional uses of water	<p>The Plan (Schedule 2) identified that there are billabongs and wetlands that have particular cultural importance, however there were no specific sites identified at the start of the Plan. Since then, a number of sites have been recognised as having Indigenous significance:</p> <p>Toogimbie Indigenous Protected Area – declared in March 2004 and part of Australia’s National Reserve System, which is set up to protect unique landscapes, flora and fauna in Australia (DEWR 2007)</p> <p>Wiradjuri Reserve – listed in July 2012 as a culturally significant site for “corroborees, scar tree, tribal wars, 1988 Reconciliation gathering area, Cultural crossing area” on the Office’s Cultural Assets register.</p> <p>The Office of Water undertook a project from 2011 to 2012 to build understanding about the values of water in the Murrumbidgee Valley to Aboriginal people. The project was funded by the National Water Commission, as part of ‘Aboriginal Community Engagement and Consultation in Water Sharing Planning in NSW’. It focussed on engaging Aboriginal people in water planning through a series of workshops focused on inland NSW including the Murrumbidgee catchment area. This led to the production of a series of reports, a fact sheet and the ‘Our Water Our Country’ information manual (DPI Office of Water 2012).</p> <p>The project also involved identifying base data and ongoing information requirements to report against relevant cultural PIs in the water sharing plans. A database was established to record key information about performance measurement, as well as cultural water asset information. While sites such as Wiradjuri Reserve are included in this database, information about the regime of water necessary for its use and consideration as part of the Plan rules is still to be collected.</p> <p>“Additional work still needs to occur to identify areas of water–dependent cultural value, and the monitoring of the flow and water requirements for specific sites must progress” (Office of Water, pers. comm., October 2012)</p> <p>In June 2012, the Office of Water established the Aboriginal Water Initiative to improve Aboriginal involvement and representation in water planning and management within NSW. This initiative unique within Australia and was funded for four years to June 2016.</p>	

Performance indicator	Related Plan objectives	Results	Strength of information
		<p>One of the objectives for the Aboriginal Water Initiative is to ensure that measurable Aboriginal water outcomes for cultural, environmental and commercial use are achieved and reported. As part of this they are continuing to build an understanding of values through their engagement with the Aboriginal community in the Murrumbidgee, and to further develop and grow the database with this information. As the initiative commenced at the end of this evaluation period, it is too early to assess their activities.</p> <p>The Act references the “fostering” of Aboriginal people’s ‘spiritual, social, customary and economic use...’. Fostering can be defined as encouraging and promoting development of these values to Aboriginal people.</p> <p>The Office of Water Aboriginal Water Initiative was established is to ensure there is ongoing effective state-wide and regional engagement with Aboriginal communities in water sharing plans. A number of the initiative’s objectives relate to encouraging and promoting the development of these values to Aboriginal people:</p> <ul style="list-style-type: none"> • Improve engagement of regional Aboriginal communities in water management • Identify key water-related environmental, social, cultural and economic opportunities and priorities for Aboriginal communities • Achieve relevant State Plan and national partnership targets including Aboriginal employment, capacity development, and training. <p>The initiative intends to consult and support Aboriginal people within the Murrumbidgee catchment, including the Murrumbidgee Traditional Custodians Advisory Group.</p>	
<i>None identified in plan</i>	Provide for identified recreational water needs	<i>No performance indicators identified in plan</i>	
<i>Additional PI identified:</i> Change in surface water	Manage the cumulative impacts of water management	<p>Providing a limit on extractions at current levels of development ensures that further impacts on the environmental values associated with river flows are minimised. I</p> <p>The LTAAEL for the Murrumbidgee Regulated River water source is 1,925GL/year. This Plan Limit is the long-term average diversion, based on running the Plan Limit simulation model for</p>	Poor

Performance indicator	Related Plan objectives	Results	Strength of information						
extraction relative to the long term average annual extraction limit	licences and other activities on water sources and their dependent ecosystems	<p>the full period of simulation: 1st January 1890 to 30th June 2016. Note that the LTAAEL is approximately 65GL below the long-term average MDB Cap, principally due to the additional environmental water created by the 1998 environmental flow rules and their adaptation for the Plan.</p> <p>Compliance with the LTAAEL is assessed by running a model to model comparison of development conditions at the start of the Plan, compared with updated development conditions. The LTAAEL is regarded as exceeded when model to model comparison shows modelled diversions as more than 3% above the LTAAEL. (Note that this differs from the Murray-Darling Basin Cap, where a model run generates a climate-adjusted “target” limit at the end of each year and cumulative debits and credits are accrued, when actual diversions are more or less than the annually variable targets). LTAAEL compliance is therefore not assessed using actual total observed diversions in any given year.</p> <p>The LTAAEL approach requires an updating of development conditions in the model from time to time to enable the assessment of compliance to take place. While these conditions do not vary on an annual basis, the Plan implies that they will be updated, and the model run on an annual basis. According to the implementation audit reports, this annual assessment did not occur during the Plan term, because development conditions were not updated in the model on an annual basis.</p> <p>The cumulative assessment is currently being carried out in 2017 (DPI Water Modelling Unit Head <i>pers comm</i>).</p> <p>Annual diversion data is available from the NSW water register (shown in the table below). The MDBA Cap register shows the Murrumbidgee as being in cumulative credit and therefore compliance with Cap. However, as noted above, these sources cannot be used directly to assess LTAAEL compliance.</p> <table border="1"> <thead> <tr> <th>Water Year</th> <th>Diversion (GL)</th> </tr> </thead> <tbody> <tr> <td>2004–2005</td> <td>1,533</td> </tr> <tr> <td>2005–2006</td> <td>1,933</td> </tr> </tbody> </table>	Water Year	Diversion (GL)	2004–2005	1,533	2005–2006	1,933	
Water Year	Diversion (GL)								
2004–2005	1,533								
2005–2006	1,933								

Performance indicator	Related Plan objectives	Results		Strength of information
		2006–2007	921	
		2007–2008	569	
		2008–2009	569	
		2009–2010	823	
		2010–2011	1,280	
		2011–2012	1,738	
		2012–2013	2,369	
		2013–2014	1,690	
		<p>An additional long-term extraction limit (clause 32A) was created when the Lowbidgee Irrigation Area was included in the Plan area in October 2012. This allows a long-term average extraction limit of 296,000 ML for the Lowbidgee area. As a result, the Murray–Darling Basin Cap for the Plan area has been adjusted to a total of 2,221 gigalitres (GL).</p>		

Appendix 14 – Murrumbidgee regulated river internal logic diagrams

Relationship diagrams show the internal Plan logic supporting the delivery of each of the Plan's outcomes. One diagram has been created for each of the economic, social / cultural and environmental outcomes. The diagrams show linkages from the Plan vision (green box) through the broad objectives (navy boxes) to the targeted objectives (blue boxes) and the rules (grey boxes). Where gaps in the program logic have been identified, these are shown as question marks in a box of the appropriate colour. Gaps have been identified at the targeted and broad objectives levels in this evaluation.

The vision for this Plan is to provide for equitable sharing of limited water resources to sustain a healthy and productive river and the welfare and wellbeing of Murrumbidgee regional communities.

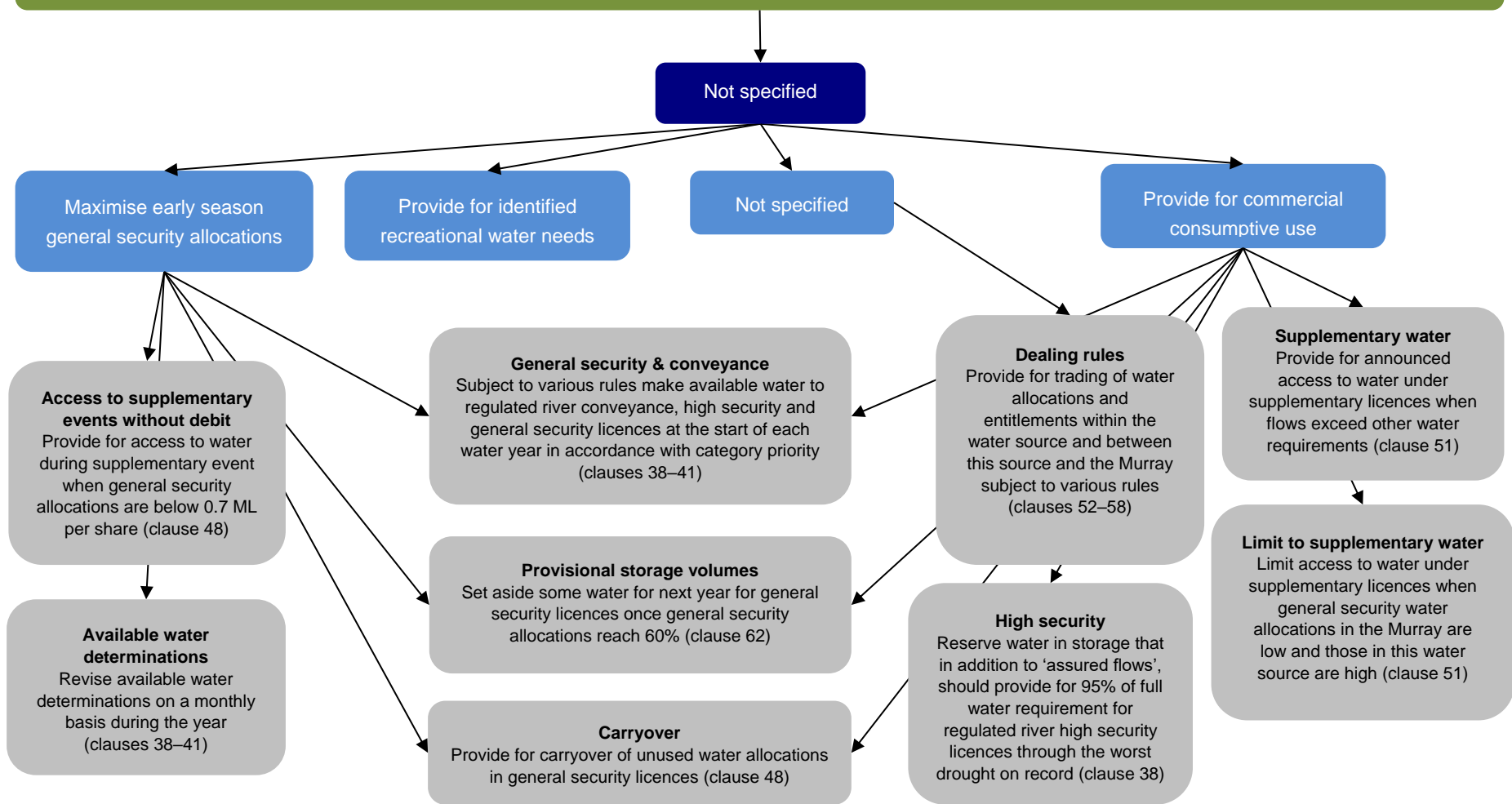


Figure 21: Economic internal logic relationship diagram

The vision for this Plan is to provide for equitable sharing of limited water resources to sustain a healthy and productive river and the welfare and wellbeing of Murrumbidgee regional communities.

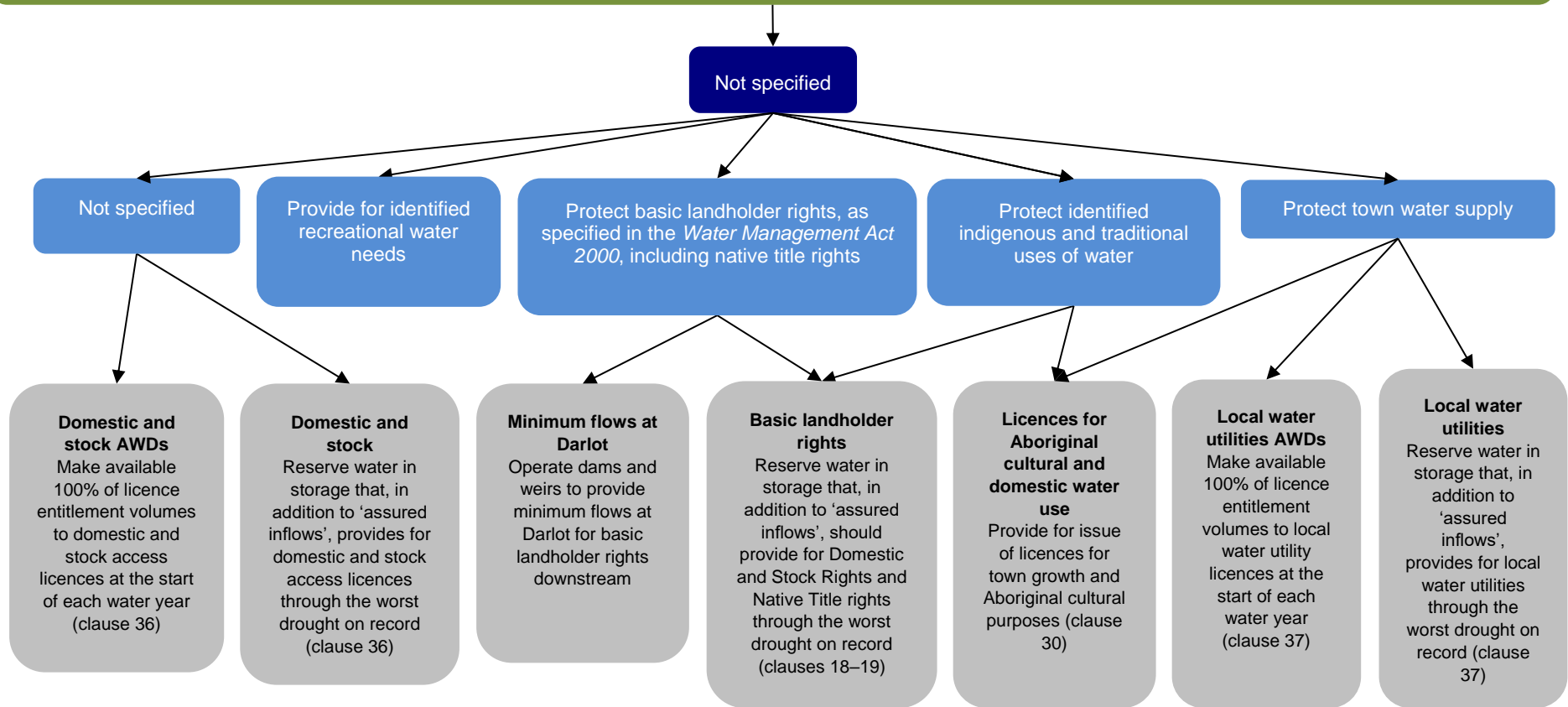


Figure 22: Social / Cultural internal logic relationship diagram

The vision for this Plan is to provide for equitable sharing of limited water resources to sustain a healthy and productive river and the welfare and wellbeing of Murrumbidgee regional communities.

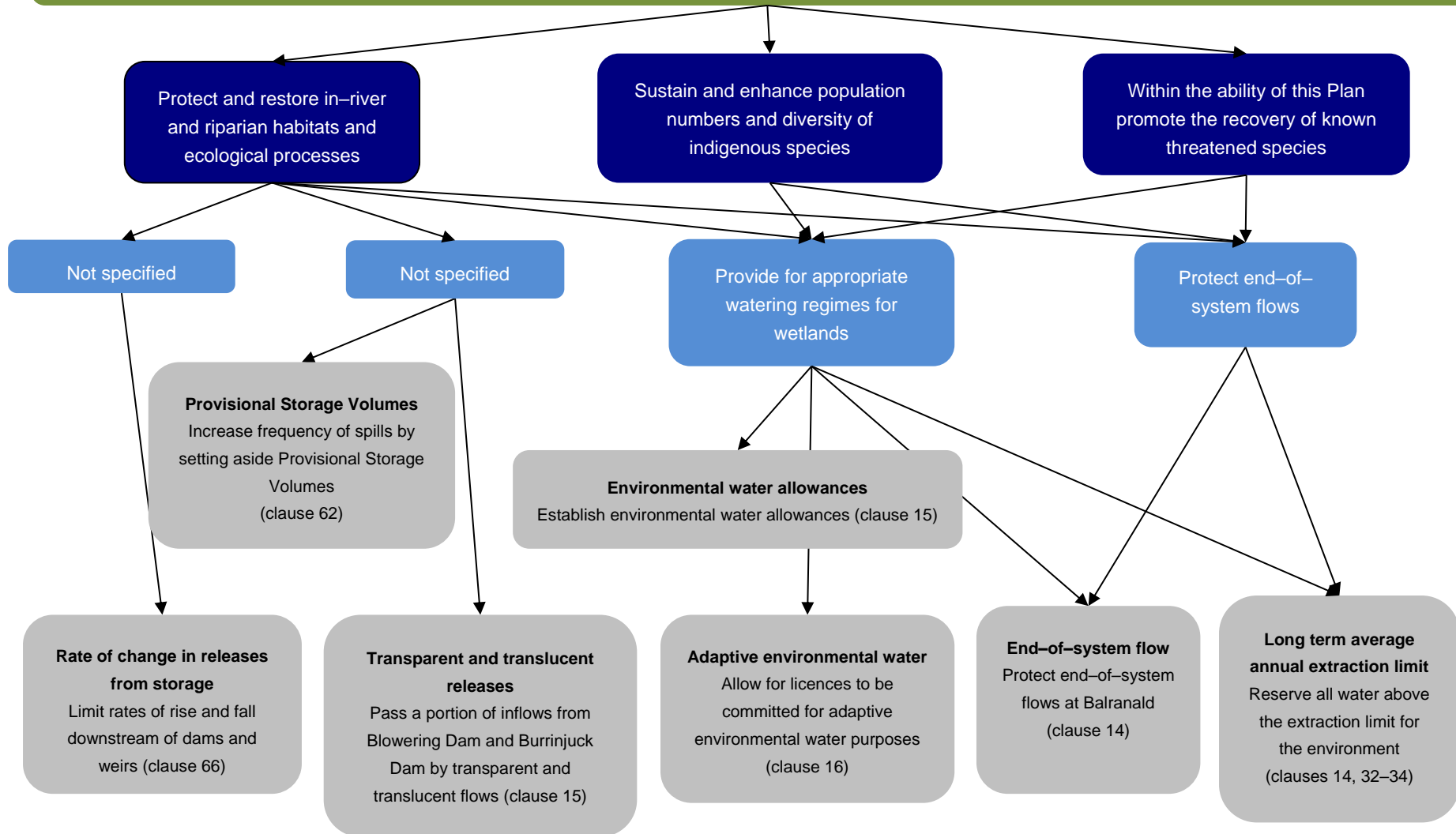


Figure 23: Environmental internal logic relationship diagram