MDBA Analysis:
Computer Aided River Management system for the Murrumbidgee River Business Case (CARM)
Proponent: NSW

The Murray-Darling Basin Authority's (MDBA) advice addresses criteria from the Basin Officials Committee agreed *Phase 2 Assessment Guidelines for Supply and Constraint Measure Proposals.* The Guideline section reference is shown in brackets.

Key issues/summary

- This measure is a rule change, rather than a works-based, proposal that creates an entitlement from anticipated water savings, and is a decision support tool for ongoing river operations.
- The outcomes of the proposal will depend on the combined modelling of all Murrumbidgee proposals (CARM, Effluent Creeks, Murrumbidgee-Murray-River National Parks and Yanco Creek) with subsequent integrated modelling of measures across the southern Basin.
- CARM (and Effluent Creeks) have the potential to create general security entitlements. Given their interdependency, it is preferable to complete the assessment in two stages:
    1. Assess CARM and Effluent Creeks against the benchmark to evaluate the size of general security entitlements available. Modelling should specify requirements for the Murray to address any third party impacts as an inter-valley transfer account.
    2. Add the Murrumbidgee -Murray-River National Parks and Yanco Creek proposals as a package to assess additional cumulative benefits and risks from their inclusion, including any unresolved downstream impacts.
- This approach may underestimate Murrumbidgee -Murray-River National Parks and Yanco Creek proposals as they are assessed individually, but ensures that interdependencies are factored in to the overall assessment.
- Modelling by the MDBA of the interlinked Murrumbidgee proposals (this proposal, Yanco Creek Offtake and CARM) as an integrated package indicated that the CARM project led to significant negative environmental impacts for the mid and lower-Bidgee. Current collaboration between NSW and the MDBA on Murrumbidgee benchmark model issues may resolve any negative impacts. This needs to be demonstrated by the proponent.
- Unless the negative environmental outcomes can be addressed, the potential exists for no additional adjustment from the three measures or even a reduction in the SDL adjustment associated with the overall package of measures.
- The anticipated ecological benefits are described generically and qualitatively. As for other rule-change proposals, a quantitative description could easily be provided (including changes to SFI frequency, limits of change, maximum dry spell).

- Monitoring and evaluation (ME) is integral to the proposal's successful implementation, and to inform the 2024 reconciliation, but there is no clear indication that ME funding is available.
- MDBA considers the risk assessment to have underestimated reduced operating losses, impacting downstream flow reliability and existing environmental/ecological river services.
- The proposal potentially impacts the Water Sharing Plan (WSP) for the Murrumbidgee Regulated River Water Source 2016. There is concern this proposal substitutes held environmental water for planned environmental water (PEW), resulting in a net reduction of the protection of PEW (contrary to s10.28 BP). The MDBA is undertaking consideration of NSW advice on concerns relating to a potential for the net reduction in the protection of planned environmental water.
- The MDBA considers that the use of environmental equivalence scoring framework to verify equivalent ecological outcomes from PEW is not appropriate.

1. Eligibility (3.1)

1.1. Supply measure requirements (3.1.1)

The proposal would meet the definition of a supply measure under the Basin Plan (cl.7.03 and cl.7.15) to:

- operate to increase the quantity of water available to be taken in a set of surface water SDL resource units compared with the quantity available under the benchmark conditions of development
- achieve equivalent environmental outcomes with a lower volume of held environmental water than would otherwise be required
- have no detrimental impacts on reliability of supply of water to holders of water access rights that are not offset or negated

Note that a final determination will require MDBA modelling, and that effects on reliability are determined by the proponent.

1.2. Measures not included in the benchmark conditions of development (3.1.2)

The measure was not in the benchmark conditions of development (cl.7.02 of the Basin Plan).

2. Ecological values of the site (4.2)

A relatively limited description of ecological values for the three key environmental assets in the Murrumbidgee system affected by the proposal has been undertaken. As this is a rule change rather than a works proposal, this level of detail is considered adequate. The important values of the sites are considered well known and have been extensively described in readily available documents (eg assessment of environmental water requirements for the proposed Basin Plan, various Biosis reports prepared to support Nimmie-Caira business case).

3. Ecological objectives and targets (4.3)

Ecological objectives and targets are not specified in the proposal. Instead, it is suggested that specific flow indicators (SFIs) from Basin Plan modelling be used to measure the project's efficacy. Given the

SFIs were developed to support ecological objectives and targets specified by the MDBA, there is an implicit and reasonable assumption in the proposal that those objectives and targets remain valid.

The business case highlights that this is one of three related initiatives being progressed for the Murrumbidgee River system (along with Yanco Creek Offtake and Modernising the Yanco supply systems). Given the anticipated high level of interaction between these measures, NSW is working with the MDBA to complete the integrated modelling of all measures in the Murrumbidgee River. This modelling is critical to assist with understanding of this proposal's interaction with other measures in the Murrumbidgee River and the resulting cumulative benefits and risks. Informed by the outcomes of the integrated modelling, the proponent could more clearly articulate the dependencies and interactions between measures.

4. Anticipated ecological outcomes (4.4)

4.1. Anticipated ecological benefits (4.4.1)

The anticipated ecological benefits are described very generically and only qualitatively, i.e. conceptual expected benefits from reconnecting the river to the floodplain for a range of biota and ecological processes/functions.

To be consistent with the level of information provided to support business cases for other rule change proposals, the proponent should provide an assessment of anticipated ecological benefits in terms of changes to SFI frequency (including with reference to relevant limits of change), other limits of change (e.g. no reduction in baseflow and fresh outcomes) and maximum dry spell.

Key documents cited in the business case including the NOW 2014 baseline modelling report 'Murrumbidgee Efficiency Project' are yet to be finalised and made available. This report should accompany integrated Murrumbidgee hydrologic modelling so that MDBA can ascertain whether the modelling method and assumptions are appropriate. Currently NSW is working to resolve these issues.

There is some concern that modelling only takes account of a subset of the changes being implemented (see business case page 26). Some commentary should be provided with the updated modelling about the significance of this in determining the size of the proposed general security entitlement. In addition, the proponent is asked to explain how they will resolve the multiple general security licence estimates (ranging from 42 to 105 GL) resulting from the different timings used to match reliability.

There appears to be a high risk of benefits being overestimated requiring a reconciliation adjustment amount in 2024. For example, the business case assumes that at least 80% of tributary inflows will be utilised on the rising limb which for some inflows is an increase in utilisation of almost 200% compared to the current situation (business case page 28). This concern is compounded by:

- the need to assess operational efficiency benefits over the long-term to determine the size of equivalent water savings licences. Related to this, the actual reduction in operator risk provision cannot be determined until CARM has operated for several seasons (as stated in the business case);
- uncertainty whether river operators will operate the river consistent with CARM and therefore operational surplus savings not being realised (the business case identifies a medium residual risk rating that CARM doesn't deliver modelled operational assumptions by 2019 and a high residual

risk of CARM system design failure in terms of demonstrable improved river environmental management outcomes);

- uncertainty regarding the impact of proposed changes to the Benchmark model (which will be subject to approval by MDBA, TWG, SDLAAC and BOC and will need to be appropriately justified) on the marginal benefits of this proposal.

It is noted that remaining Murrumbidgee entitlement holders bear the risk if the size of the proposed entitlements is greater than the benefits and hence the proponent has acknowledged the need for conservative modelling. Preliminary modelling appears to have adopted a relatively conservative assessment of the potential benefits of CARM in reducing operational surplus (e.g. reduction in operator risk provision for Yanco Creek system from 25% to 20%) however this will need further assessment once the integrated modelling is completed.

The business case states that Water NSW is in the process of implementing an evaluation framework to guide the assessment of CARM implementation. Given that monitoring and evaluation is integral to the successful implementation of the proposed measure and for informing the 2024 reconciliation, there should be a clear indication that funding is available and identification of how this will be funded.

4.2. Potential adverse ecological impacts (4.4.2)

Modelling by the MDBA of the interlinked Murrumbidgee proposals (this proposal, Yanco Creek Offtake and CARM) as an integrated package indicated that the CARM project led to significant negative environmental impacts for the mid and lower-Bidgee. Any negative environmental outcomes will need to be addressed, using outcomes from the revised Murrumbidgee model.

Consideration should be given to any adverse impacts of reducing previous operating losses which currently serve to increase reliability downstream or help to achieve better CLLMM outcomes. The business case assesses there to be low residual risk for the protection and recognition of existing environmental/ecological river services. The current and proposed controls provided in Appendix 2 do not appear to address all of the concerns above. Accordingly, based on the information presented within the business case, MDBA consider that the assessment of risk for this matter has been underestimated by the proponent. Once initial modelling is complete it will be clearer if any negative impacts occur.

5. Hydrology of the area and environmental water requirements (4.5)

5.1. Current hydrology and proposed changes to the hydrology (4.5.1)

NSW has supplied a Murrumbidgee model with this proposal. An initial modelling assessment shows that flow indicators especially mid-Bidgee are affected significantly, and fresh flow requirements at Balranald are not maintained at benchmark with subsequent impacts to the Lower Murray. MDBA continues to work with NSW to resolve these issues.

While the proposal is to create an entitlement from anticipated water savings, the entitlement must have normal general or high security characteristics for environmental water recovery to be reduced on a one-one basis. Otherwise an equivalent yield must be calculated to remove any third party impacts.

5.2. Environmental water requirements (4.5.2)

For the purposes of the business case, preliminary modelling has assumed a flat demand pattern for use of the entitlement, with the assumption that the bulk of the account will be ordered at Balranald for environmental flows in the Murray River. Subsequent integrated Murrumbidgee modelling uses water in accordance with the environmental watering strategy in the benchmark modelling, ie delivery timed to provide benefits to achievement of SFIs in the Murrumbidgee and Murray systems. These water requirements are supported by scientific evidence and are linked to the ecological values, objectives, and targets of the sites and therefore represent a more appropriate assumption for use of the entitlement than the flat demand pattern used in early modelling work.

6. Operating regime (4.6)

As CARM is a decision support tool to support river operations, there is no need to describe the operating regime. The water savings are to be converted to a general security access licence account. It is anticipated that the water will be used for environmental flow events on the River Murray. Consistent with the requirements of the pre-requisite policy measures, this water will need to be protected from extraction, re-regulation, and substitution when it reaches the River Murray.

7. Assessment of risks and impacts of the operation of the measure (4.7)

The business case indicated that adverse ecological outcomes are not expected from this measure and it is unlikely there will be a discernible change in salinity and water quality downstream. Detailed modelling and analysis is required to provide evidence of future water quality impacts downstream. The current proposal has not provided evidence relating to all significant potential adverse water quality impacts especially when there is a likelihood of increased flows downstream as result of the supply measure.

The existing Murrumbidgee Regulated River Water Sharing Plan identifies water in excess of the long-term extraction limits as planned environmental water (PEW). There is a concern that this proposal substitutes held environmental water for PEW, which could result in a net reduction in the protection of planned environmental water, and the MDBA is currently undertaking consideration of NSW advice on concerns relating to a potential for the net reduction in the protection of planned environmental water. Under s.10.28 of the Basin Plan a WRP must ensure there is no net reduction in the protection of planned environmental water compared to the protection under State water management law immediately before the commencement of the Basin Plan. This would also be inconsistent with the commitment not to substitute held environmental water for planned environmental water in the Intergovernmental Agreement.

Step 4 on page 36 of the business case involves assessing changes in SFI achievement in the Murray and Murrumbidgee and subsequently determining environmental outcome scores using the ecological elements methodology. The MDBA does not consider the environmental equivalence scoring framework an adequate test to establish equivalent ecological outcomes from planned environmental water.

The ecological elements methodology has been specifically designed as a test of environmental equivalence constrained by the requirements of Schedule 6. It cannot be used to determine whether planned environmental water volumes are maintained over the long-term and does not address in-

channel parts of the flow regime such as baseflows and freshes. It is therefore not considered adequate to assess impacts on planned environmental water. Whilst environmental outcomes scores are one measure that could be used to assess equivalent outcomes from planned environmental water, a more comprehensive assessment should be undertaken that addresses the limitations of this approach, and the proponent is asked to provide evidence that planned water substitution will not occur.

The business case proposes the creation of a general security entitlement to secure water savings in a way that does not affect irrigation users in Murrumbidgee. It is likely that reducing operational surplus only affects benchmark environmental outcomes, however would also reduce flows at the end of system, affecting all water users in the Lower Murray. Therefore determination of the size of the general security entitlement for this project should takes into account irrigation users and environmental outcomes. To address impacts to Murray downstream users, an account is proposed to be established at the end of valley (i.e. an inter-valley trade account). The size and characteristics of the account should be determined by an assessment of the volume of callable water required to counter-balance these third party impacts.

8. Complementary actions and interdependencies (4.9)

In addition to this project, there are three other supply measures proposed in Murrumbidgee including: modernisation of effluent creek systems; Yanco regulator; and Nimmie-Caira infrastructure modifications. Given the CARM project proposes to reduce operational surplus leading to reduced flow along the river, water savings from the other measures will interact with each other. As a result of reduced flow at Balranald, implementing the CARM also affects Murray downstream users including the environment.

Given the interactions with the other Murrumbidgee projects, water savings and the size of entitlement depend on the order of project inclusion in the modelling framework, especially for the projects creating a new entitlement.

9. Project governance and project management arrangements (4.11)

9.1. Legal and regulatory requirements (4.11.2)

The proposal potentially has impacts for the Water Sharing Plan (WSP) for the Murrumbidgee Regulated River Water Source 2016, which is a transitional water resource plan (WRP). Similar issues would also arise for a WRP for the Murrumbidgee area put forward for accreditation under the Basin Plan.

The business case has identified that, under this proposal:

- modelling indicates that control of up to 200 GL/year of operational surplus can be achieved
- part of this surplus can be used to create an SDL adjustment (an initial general security licence at Balranald of between 42 GL and 105 GL)
- a new entitlement will subsequently be established that can be called upon to enhance environmental outcomes. It is anticipated that the account created for environmental purposes would be in the form of a Murrumbidgee general security account, that will be incremented with Murrumbidgee Available Water Determinations, and will have all the same use, carryover, account limit and trade attributes of other Murrumbidgee general security licences.

- a rules-based account would be established to ensure that Murray water users' reliability of supply is not diminished. This account could act similarly to the existing Inter-Valley Trade account used to manage the trade of water between the Murrumbidgee Valley and the wider Murray system.
- the accounts created will be established through issue of appropriate shares of entitlement in the regulated Murrumbidgee Valley, and through amendment of the WSP for the Murrumbidgee Regulated River Water Source.

The 2003 version of the WSP Murrumbidgee Regulated River was in place immediately before the commencement of the Basin Plan, so the 'no net reduction in the protection of PEW' test is applied against this plan. Section 14(1) of the WSP for the Murrumbidgee Regulated River Water Source 2003 states:

(1) This Plan establishes the following planned environmental water rules:

a) water volume in excess of the long-term average annual extraction limits in clauses 32 and 32A of this Plan may not be taken from this water source and used for any purpose, and

b) access to water is to be managed as specified in clauses 34 and 34A of this Plan to ensure water volume in excess of the long-term extraction limit is not being taken.

Based on modelled diversions it is estimated that this WSP will:

a) after its 5th year, limit Murrumbidgee extractions to around 1,890,000 ML/year, on average over the long term, and

b) limit Lowbidgee extractions to around 296,000 ML/ year, on average over the long term.

By doing this, the Plan will ensure that approximately 50% of the long-term average annual flow in this water source (estimated to be 4,360,000 ML/year) will be preserved and contribute to the maintenance of basic ecosystem health.

Unless the proponent can provide evidence that transmission losses and operational surplus are not captured by the definition of PEW as water in excess of the long-term extraction limits set out in section 14(1), the proposed approach of issuing a general security entitlement to the CEWH is problematic. This is because s10.28 requires that a water resource plan ensures no net reduction in the protection of PEW from the protection provided for under State water management law immediately before the commencement of the Basin Plan. Issuing a held water entitlement would appear to reduce the long-term average volume of PEW. In this regard, the proponent should consider the methods for assessing the effect of changes in the use of PEW for example, use of the flow stress ranking method from the Sustainable Rivers Audit 2. There is merit in applying such a method (or something similar) now as it is possible this type of assessment will be triggered if NSW submit an updated Murrumbidgee WRP for accreditation which requires a demonstration that there is no net reduction in the protection of PEW compared to the protection provided under State water management law immediately before the commencement of the Basin Plan. Consideration should also be given to the effect on the long-term average volume of PEW under the Plan.

An alternative approach could be to maintain water savings as PEW rather than issue them as a held entitlement. If this approach was adopted, careful consideration would still be required to ensure the new arrangements for PEW would meet the requirements of s.10.28.