

MDBA ANALYSIS OF THE IMPROVED FLOW MANAGEMENT WORKS AT THE MURRUMBIDGEE RIVERS – YANCO CREEK OFFTAKE PROPOSAL BUSINESS CASE

PROPONENT: NSW

The MDBA's advice covers the following criteria in the Basin Officials Committee agreed *Phase 2 Assessment Guidelines for Supply and Constraint Measure Business Cases* (the Guidelines reference shown in brackets):

- Eligibility (3.1)
- Ecological values of the site (4.2)
- Ecological objectives and targets (4.3)
- Anticipated ecological outcomes (4.4)
- Hydrology of the area and environmental water requirements (4.5)
- Operating regime (4.6)
- Assessment of risks and impacts of the operation of the measure (4.7)
- Complementary actions and interdependencies (4.9)
- Project governance and project management arrangements - legal and regulatory requirements (4.11.2)

Business case assessments by the Department of Agriculture and Water Resources will include advice from the MDBA on the technical feasibility and fitness for purpose of proposals as per section 4.8 of the Guidelines.

Key points/summary

- The proponent has indicated that the final set of operating rules will determine how well various adverse impacts are mitigated, and resolution of these rules is a significant piece of work that is yet to be done. This constitutes the most significant risk to the project. The residual risk may be higher than indicated in the business case as the NSW government will have to balance differing views on an appropriate operating regime.
- The Yanco modernisation project results in less return flows to the river and greater diversions. This will need to be reflected in the modelling environment so the environment is compensated for any increase in diversions. Reflecting the change in return flows may represent a non-mandated change to the benchmark model, currently under discussion.
- The business case may overestimate the potential ecological benefits of the proposal for a number of reasons as described in Section 4.1 of this advice. Without a refined operating regime the ecological benefits/adverse effects cannot be confirmed and unless it can be demonstrated that the hydrological regime of Yanco Creek is not diminished relative to the benchmark, environmental outcomes for Yanco Creek floodplain should be explicitly scored using the established framework.

- Given that monitoring and evaluation are integral to the successful implementation of the proposed measure, there should be a clear indication that funding is available and an identification of how this will be funded.
- Yanco Creek has significant environmental values, including populations of EPBC listed Murray cod and Trout cod remaining in areas of permanent flow. There is a risk that the changed operating regime (with overall lower flows) will result in adverse environmental outcomes. It is not yet clear that these risks have been comprehensively assessed or how they will be managed. The proponent is requested to provide a written assurance from DPI Fisheries that they have assessed the risks and that the potential negative effects on fish populations of the proposal are considered acceptable.
- There is a moderate residual risk that construction of a new regulator will impact on small bodied fish movement and there is an opportunity to improve fishway designs to accommodate all fish sizes which has not been explored. It is recommended that further consideration is given to the design of appropriate fishways with the designs undergoing an external review.
- The business case presents analysis of achievement of surface flow indicators (SFIs) under benchmark conditions and with the inclusion of the proposal. The discrepancy between the benchmark SFI success in Table 8 and MDBA's analysis indicates that the benchmark model has been modified. Any changes need to be appropriately justified and the updated modelling provided to the MDBA in sufficient time to allow its validation and approval by the BOC before subsequent use to assess the notified package of measures.

1. Eligibility (3.1)

The proposal meets the requirements under the Guidelines for further assessment and consideration in the SDL adjustment mechanism.

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; and
- have no detrimental impacts on reliability of supply of water to holders of water access rights that are not offset or negated.

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

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

The MDBA confirms that 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)

The description of the site's ecological values in the business case is generally consistent with the assessment criteria in the Guidelines.

A detailed description of the ecological/environmental values and features of both the Mid-Murrumbidgee Wetlands and the Yanco Creek system is provided.

3. Ecological objectives and targets (4.3)

Ecological objectives and targets are generally consistent with the assessment criteria, including provision of quantitative (flow) targets.

The business case has reproduced the ecological objectives and targets from the MDBA's assessment of environmental water requirements for the Mid-Murrumbidgee River Wetlands.

There are minor issues with SFI information that is incomplete (only the high uncertainty frequency is provided however the SFI also includes a low uncertainty frequency) or incorrect (frequency of 63,250 ML/d SFI should be 11 per cent not 12 per cent as stated in the business case).

Ecological objectives and targets for the Yanco Creek system were taken from Alluvium's Environmental Flows Study (2013).

4. Anticipated ecological outcomes (4.4)

4.1 Anticipated ecological benefits (4.4.1)

While the business case does not explicitly describe anticipated ecological outcomes, the description of environmental objectives for each of the flow targets provides a reasonable picture of anticipated benefits generally consistent with assessment criteria. The business case indicates that the Yanco Creek did not inundate naturally until flows exceeded 40,000 ML/d in the Murrumbidgee system, and that additional control could improve opportunities to align flood flows across the southern connected basin to increase the chance that higher flows into South Australia can be achieved.

As discussed further below, the proposed operating regime is considered a draft, still to be refined and agreed. Without a refined operating regime the ecological benefits of the proposal cannot be confirmed.

Whilst the potential for ecological benefits from the proposal are acknowledged, the business case is likely to overestimate the potential benefits of the proposal for a number of reasons:

- the operation of the Yanco regulator allows for increased inundation of the mid Murrumbidgee Floodplain for a given flow event, however, this occurs at the expense of inundation in the Yanco Creek system. This trade-off of environmental outcomes will need to be explicitly scored and will affect the net benefit of the proposal (see below potential adverse ecological impacts);
- the proposal can only influence the inundation of mid Murrumbidgee wetlands downstream of the regulator. Basin Plan SFIs in the remainder of the reach upstream to Burrinjuck Dam

must still be achieved (i.e. the adjusted flow threshold will only apply to the portion of the reach downstream of Yanco weir). Analysis presented in the proposal shows slightly diminished outcomes for the upstream reach (unadjusted flow rate SFIs decrease slightly, 177 to 175 events). Further, whilst analysis shows that the achievement of the adjusted SFI flow rate increases with the proposal, no information is provided regarding the achievement of this flow rate under benchmark conditions so that the marginal benefit of the proposal can be assessed;

- commentary regarding the ability to scale back SFI delivery to within the target range for SFIs that are “over-achieved” is misleading. The limits of change prevent the frequency of an SFI being reduced by more than 10 per cent of the benchmark result, irrespective of whether the frequency exceeds the target range; and
- the business case shows reductions in Darlot end of system flows. Until further modelling of the package of Murrumbidgee supply measures is completed it is unclear what the scale of impacts will be on environmental outcomes downstream in the Murray system or on consumptive users’ reliability that would need to be mitigated.

The justifications provided in the business case for ecological objective trade-offs may not be entirely appropriate and have not undergone an external review by an independent expert. For example, as discussed below there could be an opportunity to improve fishway designs to accommodate all fish sizes. Unless it can be demonstrated that the hydrological regime of Yanco Creek is not diminished relative to the benchmark, environmental outcomes for Yanco Creek floodplain should be explicitly scored using the established framework.

The Experienced River Operators Workshop, held in 2012, identified that this project (subject to further investigation) may assist to achieve high flow targets in the lower Murray. See Sections 5.3.1 and 8.6 of the following report: <http://www.mdba.gov.au/publications/mdba-reports/summary-analysis-undertaken-support-experienced-river-operators-workshop>. This is very briefly referred to in the business case. Further exploration of the benefits would require more detailed modelling of the Murrumbidgee and Murray systems, based on proposed operating rules.

The proposal provides operators with full control of water diverted to Yanco Creek via improvements to the existing weir and constructing an additional weir. This may lead to a significantly lower volume of water entering Yanco Creek which undermines current ecological and environmental outcomes, noting that the determination of equivalent environmental outcomes and accounting for trade-offs will be undertaken through the SDL adjustment assessment framework.

4.2 Potential adverse ecological impacts (4.4.2)

As for ecological benefits, without a refined operating regime potential adverse ecological impacts cannot be confirmed.

The business case notes a number of potential adverse ecological impacts, including:

- reduced hydrodynamic diversity (water ponding);
- overwatering of a threatened ecological community from the weir pool raising on the Murrumbidgee;

- blockage of fish passage (especially small-bodied species) from Yanco Creek to the Murrumbidgee River; and
- no further facilitation of the movement of small-bodied fish through the structures on the Murrumbidgee.

The business case highlights that flows within the Yanco Creek will be reduced as a consequence of the proposal e.g. reduced end of system flows (Table 14) and reduced Yanco Creek environmental flow performance for some parts of the flow regime (Table 15). There is a risk that lower flows will result in adverse environmental outcomes, of particular concern for the significant environmental values of Yanco Creek. It is not yet clear that these risks have been comprehensively assessed or how they will be managed. While application of scoring for the environmental equivalence test, if undertaken, can provide a level of environmental protection at the broader regional scale, the test is not designed to safeguard outcomes at the species specific level. This limitation is relevant and significant in relation to this proposal given the national conservation status of some of the fish species potentially negatively impacted. The proponent is requested to provide a written assurance from the NSW Department of Primary Industry fisheries section that risks have been assessed and potential negative effects on fish populations including EPBC listed species are considered acceptable.

The business case states that the proposal generally maintains benchmark environmental flow results throughout Yanco Creek. This assertion is not well supported by information within Table 15 which shows that bankfull flows in particular are affected by the proposed operating regime changes. Similarly for some flow components the business case assessment suggests 'negligible change' with no basis for this categorisation. Negligible change is the assessment for reach 1 however modelling results show there is a consistent reduction in frequency of fresh, bankfull and overbank events, which could be ecologically significant.

As discussed further in the assessment of risks and impacts of the operation of the measure section below, the proponent has indicated that the final set of operating rules will determine how well various adverse impacts are mitigated with resolution of these rules yet to be undertaken. As an example it is stated there is potential to address many of the concerns regarding backwater effects and the protection of flowing water habitat (crucial for native fish populations) through the operating rules. However, impacts cannot be quantified as inundation mapping, extent of weir pool raising and the operating rules have not been defined with further assessment required during the development and following confirmation of the operating rules.

The proposed operating rules for Yanco Creek (pg. 56) do not coordinate higher environmental flows down the Murrumbidgee and Yanco systems. This means that environmental flows will not occur in Yanco Creek when flows in the Murrumbidgee are between 24,000 ML/d and 45,000 ML/d - the range at which the three deliverable Mid-Murrumbidgee SFIs operate (26,850, 34,650 and 44,000 ML/d respectively). The current benefits to the water-dependent ecosystems of Yanco Creek from a system-wide response to higher flows (e.g. increased connectivity and dispersal, chemical cues as a stimulus for migration, pulses of carbon with corresponding increases in productivity) would potentially be lost as a result of this lack of coordination.

NSW is asked to consider how the uncertainty regarding the final operating rules and the consequent potential negative impacts as a result of this project could be reduced. This could include providing a

commitment to include all the recommendations from the Yanco Creek System Environmental Flows Study in the Murrumbidgee Long Term Watering Plan, and confirming that all the key NSW agencies will have to agree to the final set of operating rules (DPI Water, Water NSW, OEH, DPI Fisheries).

The provision of fish passage represents a key cost \$7.7m (about 30 per cent of the construction costs) however the proposal does not explore the opportunity to enhance fishway design to address the adverse impacts of weirs/regulators on passage of strong and healthy populations of small bodied native fish (shown in the proposal's assessment of a moderate residual risk that construction of a new regulator will impact on small bodied fish movement). It is, however, recognised that a rationale for the prioritisation of conservation significant large bodied species such as Murray cod and Trout cod has been provided.

In addition to assessments on the Murrumbidgee River, consideration of the potential for reduced environmental outcomes in the Yanco Creek system using the SDLAM framework is considered highly desirable to enable a rigorous fit-for-purpose assessment of this proposal. The proponent should provide available floodplain inundation datasets for the Yanco Creek system to allow this assessment of potential ecological outcome trade-offs. Alternatively, as discussed between the MDBA and the proponent, if the proponent's hydrological modelling can demonstrate that the proposal can maintain the same achievement of Yanco Creek System Environmental Flows Study (Alluvium, 2013) recommended flow targets as the benchmark, then this will suffice as a test of environmental equivalence. Consequently, as the proposal would then not involve a trade-off of environmental outcomes in Yanco Creek this would not require a formal assessment by the MDBA using the SDLAM framework. The Murrumbidgee model recently provided to the MDBA by NSW includes additional demand time-series to maintain benchmark environmental conditions of the creek system based on the environmental flow targets. It is yet to be tested during the interim and final package assessments that equivalent environmental outcomes are achieved.

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

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

Proposed operating rules aim to meet environmental requirements for the Yanco Creek system and achieve higher inundation at main stem, however as noted the rules are at the draft stage only and require refinement.

Under current configurations, the model assumes around 10 per cent diversions to Yanco Creek when flow is less than ~30,000ML/d at D/S Yanco weir. Diversions increase slightly as flows increase, until flow reaches 56,000 ML/d where Yanco Creek reaches almost its full capacity. Historical data shows this approximation is reasonable for a low flow regime but no data is available to confirm this for a higher flow regime.

It is essential to understand the current hydrology and the changes proposed to meet ecological objectives within an irrigated system. While a Murrumbidgee model has been provided to the MDBA, assessments are yet to be completed on the volume of water used, environmental water returns, changes in flow, fitness for purpose of the model, assumptions used in the development of the model and model calibration.

The Yanco modernisation project results in less return flows to the river and greater diversions. This will need to be reflected in the modelling environment so the environment is compensated for any increase in diversions. Reflecting the change in return flows may represent a non-mandated change to the benchmark model, currently under discussion.

5.2 Environmental water requirements (4.5.2)

Information on environmental water requirements has generally been provided to an appropriate level of detail to meet Guidelines criteria.

The proposal adopts the environmental water requirements (surface flow indicators (SFIs)) developed as part of the Basin Plan for the mid Murrumbidgee River. The water requirements are supported by scientific evidence and are linked to the ecological values, objectives and targets of the sites. Limited other information on environmental water requirements is presented within the business case with the exception being information on the desired water regime for river red gum forests and black box woodlands, derived from work undertaken on the Lower Murrumbidgee floodplain. The source material has not been provided so it is difficult to assess whether these are supported by scientific evidence although the MDBA's preliminary assessment is that the water requirements specified are not inconsistent with accepted literature (e.g. Roberts and Marston 2011).

Additional information provided by the proponent states that the development of fish spawning and recruitment hydrographs can help to guide regulator operations. Further information is sought on whether NSW is committed to undertaking the development of these hydrographs, who will lead this work, when it is anticipated to be completed and how it will be used to inform the operational rules.

The business case presents analysis of achievement of SFIs under benchmark conditions and under proposal conditions. Discrepancies between the benchmark SFI success in Table 8 and the MDBA's analysis indicate that the benchmark model has been modified by NSW. Initial discussions have been held between the proponent and MDBA modellers regarding proposed changes to benchmark in the Murrumbidgee, and the SDLA Technical Working Group endorsed the changes to go to SDLAAC for approval.

Any changes need to be appropriately justified and the updated modelling provided to the MDBA in sufficient time to allow its validation and approval by the BOC before subsequent use to assess the notified package of measures.

6. Operating regime (4.6)

The current operating regime and designs are considered feasibility stage rather than concept designs (the included designs are sketches, there is no specific geotechnical investigation validation to support the design and, as such, the proposal does not presently incorporate defensive design principles for water control structures).

The key aspect of developing concept designs for this project is to have a defined operating regime for the works and to understand how NSW proposes to ensure that the operating regime does not result in adverse ecological outcomes or render aspects of the new works unnecessary or operating outside the optimal range. Understanding how best to achieve a more natural environmental outcome within the current system will determine the operating hydrological regime, which then

determines the type, location and size of structures. Once the works are at concept design cost/benefit review can be undertaken, but without refined operating rules the proposed structures cannot be justified or assessed. Preliminary concerns noted include:

- the business case recognises the importance of overbank flows along the Yanco Creek but does not clearly link this with the proposed structures or operating regime.
- there appears to be minimal reasoning to raise the Yanco Weir by 2.5m and further justification should be provided.
- the draft operating rules do not encompass all structures and omit the coordination of high flows in the Murrumbidgee River with flows in Yanco Creek.
- The lack of clear operating rules represents a key risk for the project as the scale of the negative environmental outcomes of raising the Yanco Weir by 2.5m define how this additional weir capacity is used (e.g. as a re-regulating storage for irrigation supply).

From TLM experience it is recommended the designs undergo an external review process using similar independent reviewers.

The operating regime also needs to be developed with agreement from key stakeholders, and include mechanisms to understand how it may be altered over time so that necessary allowance can be made in engineering designs. A consultative stakeholder process led by NSW is proposed in the business case to consider stakeholders' multiple objectives, trade-offs, compromises (where applicable) and operational flexibility. The MDBA is nominated as the party responsible for final decision making in relation to operational arrangements (see section 5.7). The MDBA River Operations team is supportive of this approach, however, it remains unclear how this is to be managed to ensure the MDBA retains this decision-making responsibility.

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

The business case acknowledges that the operating regime should mitigate major environmental, cultural, structural, and socio-economic risks.

The proponent has indicated that the final set of operating rules will determine how well various adverse impacts are mitigated and resolving operational rules for structures/works on the Murrumbidgee River and Yanco Creek is identified as one of the largest residual risks associated with the project. Resolution of these rules is a significant piece of work that is yet to be done. The residual risk may be higher than indicated in the business case as the NSW government will have to balance the differing views on an appropriate operating regime.

The development of concept designs will be dependent on a solid understanding and simulation of the proposed operating regime. This will inform the scale of third party impacts and adverse ecological impacts, as well as define the key hydraulic aspects of the design (e.g. differential head for the fishways). Resolving the head difference and hydraulic conditions that the fishways will need to operate under represents a critical aspect of this project. Once the preferred option for the overall scheme to take to concept design is agreed upon, the resolution of these issues will become a key task.

Factors such as timing of ponding at the weirs, backwater effects on flora and fauna, impacts on fish movement (particularly small bodied fish), vegetation ecological requirements, and hydrology changes, inundation of private property, and cost effectiveness and flexibility of operating the structures cannot be assessed until operating rules and concept designs are refined.

In addition Page 7 (Section 2.2) of the business case states:

“The new regulator is designed to target the supply of environmental flows of up to 45,000 ML/d for the Mid Murrumbidgee Floodplain Wetlands– the basis for this target flow rate is described later in Section 2.5.1. The proposed works include:

- *A regulator on Yanco Creek that can manage flows of up to 45,000ML/d in the river.”*

The flows currently under consideration in the Murrumbidgee constraints concept proposal are less than this. The highest flow scenario, including a buffer, will provide only 38,800 ML/day at Narrandera. It is therefore unclear why the regulator needs to be so large.

If the proponent reduced the size of the regulator to accommodate the lower flows it would reduce the required height of the weir, reducing costs and the area flooded by the weir pool. It may even mean that a completely new Murrumbidgee Weir at Yanco Creek was no longer needed.

The business case described threats from an increased backwatering effect that may create localised salinity impacts as low risk and provided mitigation measures. If the risks from the supply measures associated with other water quality degradation types outlined in Chapter 9 of the Basin Plan are not significant then a statement to that effect should be made and supported.

The business case notes that monitoring data is required to plan weir pool raising and lowering regimes, to manage risks and to refine ecological objectives. Given that monitoring and evaluation are integral to the successful implementation of the proposed measure, there should be a clear indication that funding is available and identification of how this will be funded.

8. Complementary actions and interdependencies (4.9)

The business case articulates the potential interactions with other supply measures being progressed for the Murrumbidgee River system, namely Modernising Supply Systems for Effluent Creeks – Murrumbidgee River, and Computer Aided River Management. However, it is not clear from the business case whether this project would achieve stated environmental outcomes without the other projects proceeding.

A key risk is that the constraints management project in the Murrumbidgee is not implemented. This is not considered in this business case and it is recommended it be added. If the constraints project does not proceed then the environmental benefits of the Yanco Creek regulator are likely to be negligible for the following reasons:

- There is no guarantee that increased flows from the Yanco regulator would be deliverable as increased flows would cause flooding of private land.
- The rationale behind the new higher weir on the Murrumbidgee is to send up to 2,500 ML/day down the Yanco Creek with only moderate flows in the Murrumbidgee. A flow of

2,500 ML/day in Yanco Creek would also flood private land and without permission to do so (through the constraints project) it will not be able to be used for that purpose.

9. Project governance and project management arrangements (4.11)

9.1 Legal and regulatory requirements (4.11.2)

The proposal does not appear to impact any transitional or interim plans. However, if any actions in the project result in an amendment to a transitional or interim water resource plan we would expect that the Basin State would seek accreditation of any such amendment in the normal way.