



Australian Government



MDBA technical report for Department of Agriculture and Water Resources

Modernising Supply Systems for Effluent Creeks-
Murrumbidgee River

Engineering Assessment of SDL Adjustment
Business Case submitted by NSW



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Executive Summary

NSW has submitted a Business Case for the SDL adjustment project: *Modernising Supply Systems for Effluent Creeks – Murrumbidgee River*.

The MDBA notes that NSW has three projects that will interact in this area. The other two projects are:

- Yanco Creek Offtake
- Murrumbidgee CARMS

Presenting three projects separately means there are uncertainties the proposed operations of the three are consistent and that the proposed benefits of one project will not be constrained by a requirement of another project.

This project seeks to modernise the supply system for diversions along the Yanco creek system in order to generate a water saving that can be converted into callable environmental entitlement.

- The works will contribute towards greater controls on flow management allowing closer alignment between supply and demand.
- Documenting, revising current operating rules and installing monitoring equipment to increase access to real-time data and improve the; operating system, diversion efficiency, optimisation of water use, and reduction in transmission losses.
- Improve irrigation supply by working with MIL and CICL

The operations of this project will be defined by the Murrumbidgee CARMS project and environmental projects running parallel through OEH and other stakeholders.

This project has no direct environmental objectives

Key issues

The proposed project aims to save water rather than provide an environmental outcome for the Effluent creeks.

The business case, therefore, does not attempt to create a revised environmental watering regime or outcome for the creek system, and so does not address ecosystem targets and outcomes.

The proposal aims to provide 14.4 GL of environmental water as a result of the modernisation.

Technical Feasibility and Fitness for Purpose

The component works are presented at feasibility design stage. The overall level of detail is quite low and will need to be significantly enhanced in the development of concept designs.

Water savings

There is minimal information regarding how the new works will deliver the 14.4 GL of savings, ie how this much of this is due to:

- Alternative source of water (supplying water from the Murray system);
- Reductions in transmission losses, and

- Reductions in end of system flows.

The report does not specifically address the issue that end of system flows for the Effluent creeks is an inflow to the River Murray system and thus the savings to the effluent creek end of system flows are a loss to the Murray system. This will have a third party impact on the security of supply to NSW entitlement that will need to be assessed. Logically this will be assessed as part of an integrated assessment of all of the proposed Murrumbidgee SDL projects.

Environmental flow regime

The lack of an environmental flow regime and entitlement leaves a risk that the provision of this into the future will be a cost (headworks and supply charges) to be borne by the environmental water holder.

Operating Regime

The works to be constructed does not specifically address environmental flows or an operating regime. It is not possible to determine whether the proposed works will enhance or limit future delivery of environmental flows.

An operating regime is important to 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). The operating regime needs to be developed and agreed upon by the key stakeholders and include mechanisms to understand how operations may be altered over time so that necessary allowance can be made in the engineering designs.

Concept designs will also need to take into consideration the operating regime proposed under the Yanco Business Case to ensure the designs do not transform into something that has significantly greater adverse ecological outcomes or renders aspects of the new works unnecessary or operating outside the optimal range.

Designs

No meaningful designs are presented – with a generalised indicative sketch for a class of work. As such it is not possible to assess the designs.

Risks

The project has four key risks that need to be addressed.

Environmental

The Business Case acknowledges an environmental watering regime is not part of this proposal and as such has not provided adequate information on the environmental values of the system. Although the Yanco system has been irrigated and regulated since the mid 1800's there are known environmental values within this system that should be identified, and an operating regime defined and simulated for the full range of flow scenarios, to demonstrate how these values will be maintained via the works proposed under the combined impact of this Business Case and the Yanco Business Case.

Riverine Flooding / Site inundation during Construction

Constructing works in a waterway and on the floodplain results in flooding that can pose a very significant financial risk, which there are limited mitigation options. These works are within a

highly modified creek with existing regulators, so small floods may be mitigated against, however large floods still pose a risk and should be considered.

The cost estimates in the Business Case has not made provision for the flood risk cost to be passed to the contractor, and as such it remains with the project proponent. Passing the flood risk cost to the contractor is not a reasonable approach in any case.

Given the Business Case is one of several proposed by NSW, which will be delivered over several years, it is unlikely that all structures would be impacted by floods. However, it is not possible to determine in advance which projects will be affected and to allocate appropriate budget to meet associated costs. A suggested approach is to allow a provision for costs associated with flooding across the whole program of works and to draw on this on an as needs basis during construction.

Cultural Heritage

The proposed works are to be constructed within and adjacent of the creek channels. While most of the major construction will be on disturbed land some of the works will be on undisturbed land and have a high risk of disturbing cultural heritage.

Despite all of the best intention and planning the potential for cultural items to be exposed during construction remains. This could result in the need to cease work and potentially demobilise the site while investigations are undertaken and appropriate steps taken to address the issue.

The Business Case has made no allowance for costs incurred due to approval delays. This would appear to be a significant oversight.

Third Party

NSW identifies that further refinement of stakeholder engagement is necessary as the project advances. Given the project is at feasibility stage the level of stakeholder engagement at this stage is adequate.

The Business Case does not detail how any adverse impacts will be addressed. In the Living Murray Projects there was no appetite for compulsory acquisition of land or easements. If the same approach applies to this project then this represents a critical risk to the project that has not been adequately considered to date.

The MDBA is of the view that the quantification of, and process to address, third party impacts represents a critical element of the concept designs.

Failure to address the third party impacts may result in the works being constructed and unable to deliver the project objectives.

Introduction

This report has been prepared for the Department of Agriculture and Water Resources by the MDBA as part of the review of the Business Cases for projects submitted under the Sustainable Diversion Limit Adjustment process.

The report provides the Department of Agriculture and Water Resources with an overview of the Business Cases that have been prepared by the NSW Department of Primary Industries. The main body of the report sets out issues that are common across multiple projects. Additional information specific to each of the Business Cases are provided at the end of the report.

Due Diligence Review Approach

In conducting this due diligence assessment the MDBA has drawn on long experience in managing and delivering major engineering works associated with the River Murray System. In the last decade the MDBA has been responsible for the delivery of the Living Murray (TLM) Environmental Works and Measures Program (EWMP).

The EWMP is a \$338 million program that delivered major works to facilitate the provision of environmental water to floodplains and wetlands. The scale of the works varies from major works to small scale strategic infrastructure.

The works proposed in this Business Case is of a scale consistent with the works delivered under the EWMP. Assessment of designs, costs and risks have been made by comparing projects and individual project components to similar works constructed under EWMP.

Summary of Key Issues

This Business Case has been assessed against a series of engineering / technical criteria as set out in the *Phase 2 Assessment Guidelines for Supply and Constraint Measure Business Cases*. These are:

Section 4.8 - Technical Feasibility and Fitness for Purpose

- the proposal is able to deliver effectively on its stated outcomes and proposed technology will perform as intended; and
- the project delivery and operation is secure over the long term from a construction and maintenance perspective.

Section 4.10.1 Costs, Benefits and Funding Arrangements

- rationale and justification is provided for the estimate of the total cost of the project design, construction and commissioning;
- the level of contingency appears consistent with the level of risk identified;
- the benefits are appropriately described (quantitatively or qualitatively); and
- Ongoing operation and maintenance costs are realistic.

Section 4.11.4 Risk Assessment of Project Implementation

- all significant project development and delivery risks and impacts have been identified, adequately described and analysed and robust treatments and mitigations proposed;
- the risk management strategy complies with the AS/NZS ISO 31000:2009 Risk management—Principles and Guidelines; and
- all other risks are negligible or adequately mitigated.

Scope of assessment for technical feasibility and cost

The Business Case has been assessed to determine whether or not:

- The proposal is able to deliver effectively on its stated outcomes and proposed technology will perform as intended; and
- The project delivery and operation is secure over the long term from a construction and maintenance perspective.

The approach adopted for the assessment focusses on assessing the adequacy of the engineering design and includes the following elements and concepts:

- Review of engineering processes applied to design (e.g. extent and form of hydraulic/hydrologic functional requirements, application of defensive design principles for water control structures)
- Source and quality of base data and associated assumptions
- Consideration of constructability issues and temporary works requirements
- Peer review processes used to develop designs

This assessment does not extend to an assessment of the security of ongoing operation and maintenance funding or appropriateness of asset ownership arrangements.

Section 4.10.1 Costs, Benefits and Funding Arrangements

Each Business Case is assessed to determine whether or not:

- Rationale and justification is provided for the estimate of the total cost of the project design, construction and commissioning;
- The level of contingency appears consistent with the level of risk identified;
- The benefits are appropriately described (quantitatively or qualitatively); and
- Ongoing operation and maintenance costs are realistic.

The approach adopted for the assessment will focus on assessing the adequacy of the cost estimate and includes the following elements and concepts:

- Development of indicative cost ranges for typical infrastructure by size/capacity (e.g. regulators, bridges, culverts, levees). Data sources to include estimates and actual cost data from recent construction activity within the MDBA and associated agency programs
- Development of generic cost estimate line items for typical projects
- Development of typical project on-cost rates
- Consideration of construction scheduling

This assessment does not extend to a review of project scope to ensure optimisation of cost-effective environmental outcomes.

Section 4.11.4 Risk Assessment of Project Implementation

The Business Case should be assessed to determine whether or not:

- all significant project development and delivery risks and impacts have been identified, adequately described and analysed and robust treatments and mitigations proposed;

- the risk management strategy complies with the AS/NZS ISO 31000:2009 Risk management—Principles and Guidelines; and
- all other risks are negligible or adequately mitigated.

The approach adopted for the assessment is to

- Prepare a generic risk register (Appendix A) for environmental watering projects. This has been used as a basis to assess the comprehensiveness of risks identified in Business Cases and by extension contingency provisions based on past experience.
- Review of the risk costs presented in the Business Cases
- Identify any major risks that are not costed appropriately.

Business Case Review

The NSW Department of Primary Industries Water has prepared the *Modernising Supply Systems for Effluent Creeks - Murrumbidgee River Business Case* for consideration under the SDL Adjustment process. This Business Case has been developed and prepared by WaterNSW in consultation with the DPI Water. NSW has since confirmed that the Office of Environment and Heritage and DPI Fisheries has been engaged during the business case development and as the project progresses will involve the MDBA and the Commonwealth Department of the Environment. WaterNSW is the authority responsible for the existing assets that are proposed to be modified.

The MDBA notes that NSW has three projects that will interact in this area. The other two projects are:

- Yanco Creek Offtake
- Murrumbidgee CARM

Presenting the three projects separately, and not incorporating environmental projects, means that it is not possible to be sure the proposed operations of the three are consistent and that the proposed benefits of one project will not be constrained by a requirement of another project.

As a stand-alone business case, with no direct environmental objectives, it is unclear how this Business Case directly contributes to environmental outcomes.

This project seeks to modernise the supply system for diversions along the Yanco creek system in order to generate a water saving that can be converted into callable environmental entitlement.

- The works will contribute towards greater controls on flow management allowing closer alignment between supply and demand, which may reduce the artificial high flows for irrigation supply along these creeks.
- Documenting, revising current operating rules and installing monitoring equipment to increase access to real-time data and improve the; operating system, diversion efficiency, optimisation of water use, and reduction in transmission losses.
- Improve irrigation supply by working with MIL and CICL to provide alternative (shorter travel time) sources of supply.

The proposed package of works and operational measures will promote greater efficiency in the operation of the creek system for delivering water for consumptive use.

Technical Feasibility and Fitness for Purpose

The Business Case presents works with a level of detail that is quite limited. The investigations, designs, and costings are consistent with a feasibility level of project development rather than a concept design. As such the technical feasibility and fit for purpose cannot be realistically assessed. This is due to;

- The limited level of design detail - the application of defensive design principles cannot be assessed.
- Conflicting information on the type and number of structures, their associated cost and how they fit in the scheme – makes it difficult to understand the spatial scale

- The limited level of hydrological and ecological information and consideration of these in the designs – makes it difficult to understand the temporal scale and if future environmental watering and fish passage opportunities are limited.

Given the limited level of project development the Authority is of the view that the project should go through a further two stages of project review to enable adequate assessments:

1. Concept design. The key aspects of this include;
 - a. Development and documentation of an operating regime incorporating the Yanco Business Case structures, including the environmental flow requirements for the system,
 - b. Simulation of the agreed operating regime for a full range of hydrological conditions (multiple years) using current levels of diversion to define the water resource outcomes and the environmental outcomes;
 - c. Detailed assessment of third party impacts both within the effluent creeks system and on the River Murray system.
 - d. Full survey and geotechnical investigations for each site where works are proposed
 - e. Development of concept designs for each structure, including the fishway; and
 - f. Preliminary assessment for cultural heritage and vegetation approvals
2. Detailed design – refinement of structure components to be ready for construction and completion of all planning and statutory approval processes.

The advantage of the two stages is that it manages the risk by fully defining the requirement of the scheme before proceeding to detailed design.

Noting the above the Authority makes the following comments.

Hydrology

The hydrology of the system has not been adequately detailed. This includes natural and current hydrological regimes and their comparison under the Basin Plan under various watering scenarios.

NSW state clearly they;

- Will not change the broader use of the system,
- Will not re-introduce the natural hydrological regime, and
- Will reduce end of system flows.

Given the system has been highly regulated since the 1800's and the ecosystem will have evolved to the new hydrological regime not changing the broader use or re-introducing the natural regime is a reasonable approach. However, consideration should be made to introduce a new hydrological regime to accommodate the existing environmental values.

Without a clear understanding of the spatial and temporal hydrological changes in the system or how the Yanco and CARMS Business case interacts with this project, it is difficult to assess how the proposed structures and the extent of its operations will benefit or be detrimental on environmental values.

The Authority would expect the combined changes of the Yanco project and this Effluent creek project could significantly alter the hydrology of this system, in particular removing high flows that have historically entered the effluents under a high flow on the Murrumbidgee.

For modelling purposes NSW has used a 'lumped weir' approach to estimate the impact of individual weirs located close together – basically the combined change in capacity and regulation has been modelled as if it were a single weir. The use of a lumped weir approach is reasonable for feasibility but may over-estimate the water supply benefits. The spatial differences in demand and re-regulating capacity may reduce the effectiveness of the actual works compared to the model output. This needs to be refined in the concept design with the hydrologic model set to accurately reflect each asset, its current and proposed capacity and operating rules, as well as an accurate representation of demands – both spatially and temporally. This level of detail will be essential for the implementation of the system in CARMS and thus does not represent an onerous level of model complexity.

End of system flows

Reduction of end of system flows (Darlot Weir) is an important target for this project to achieve its water saving. However, it is not adequately detailed how this reduction will affect the hydrology in the Murray system.

The outflows of the Yanco creek system (Billabong creek at Darlot) form an inflow to the River Murray system. As such a reduction of flows at Darlot will have an impact on reliability of supply for NSW River Murray entitlement holders. This point is not well made in the Business Case and the Authority is of the view that the third party impact on NSW Murray entitlements must be assessed.

The hydrological modelling integration and feedback between the River Murray model and the overall changes to the Murrumbidgee system has not been assessed but will need to be as part of concept design.

Given the inter-related nature of the Murrumbidgee SDL projects this should logically be assessed as part of an integrated assessment of all of the proposed Murrumbidgee SDL projects.

Ecological impacts

It is unclear if any ecological demands of the Yanco Creek system have been included in the updated hydrological model.

Without the analysis this remains an unknown, with the risk that the significant capital investment will miss an opportunity to maximise the environmental and water supply benefits for the system.

The Business Case does state ecological values will be impacted.

The ecological impacts are a side-affect to reaching the project target of reducing 'transmission losses', which will be converted into callable environmental water for this system or other sites. The ecological values that will be affected are;

- Reduction of bank vegetation. This is to enable the project to meet its water savings target. The reduction of water surface area in channel will reduce evaporation rates and discourage vegetation growth along the creek, and
- Reduction of 'spillage' into floodrunners and billabongs.

The ecological impacts implies any natural flow variation within channel is not considered and a major reduction of floodplain inundation, wetland and anabranch watering may be limited by the works in the future.

The Authority is of the view that the project should define the environmental values of the system and the associated water demands of these values (eg Wangenella Swamp) and include these in the hydrological analysis of the system and the proposed operational changes. This will determine whether the timing of environmental demands and irrigation demands are such that both can be met from the upgraded system, if the proposed works are designed to provide the capacity and flexibility that the combined supply option will require.

Hydraulics

A hydraulic model, that covers the full scope of the proposed works, has not been developed.

At this stage of the project the Authority is of the view that the hydrological model is the priority, taking into account the environmental demands and modelling at a scale that includes each water regulation asset.

The hydraulic model can feed into the hydrological model for specific aspects of the system so they can be adequately parameterised within the hydrological model.

For the type of works proposed the Authority would expect the development of localised hydraulic models to allow specific hydraulic design aspects of each structure to be defined in detailed design.

The placement of the vertical slot fishway is a key consideration in the design of the proposed structures. Computational fluid dynamics (CFD) modelling or physical hydraulic modelling will be crucial for determining the optimal position for the fishway entrance.

Given the critical role of hydraulic models to the optimisation of the proposed structures the MDBA is of the view that they should also be subject to independent expert review.

Options assessment

A multi-criteria assessment was used to prioritise project areas for alternate water supply sources. The criteria was based on value for money, water saving, feasibility and community response. Environmental benefits were noted but were not part of the criteria to prioritise these project areas. As such it is not possible to determine if the projects, as proposed, will maximise the environmental benefits or, with minor changes, could achieve greater environmental outcomes.

Two project areas, from the five identified in Phase 1, did not pass the multi-criteria section process (areas 4 & 5). It was noted these areas had a large number of wetlands and floodrunners that could benefit from works to improve the ecological values. However, due to high transmission losses and restrictions to provide minimum passing flows during summer months these project areas didn't proceed into Phase 2. It is unclear whether these project areas would have been prioritised to progress to Phase 2 if the multi-criteria assessment included an environmental component.

Operating Regime

Overall

An operating regime is not clearly defined.

The works proposed under this business case and the Yanco Business Case relies on the CARMS project to determine the system operations of the Yanco system.

It is essential to acknowledge the potential for the operating regime to be altered over time, as this may alter the environmental benefits and costs that are proposed with the project. While the issue of altered operating regime applies to all of the SDL proposals – it is of particular concern with this proposal due to the very high interdependence of the works and the operation of water supply in the Murrumbidgee. Integration of the proposed works with the delivery of irrigation supplies and environmental flows needs to be addressed and presented as part of the concept design phase.

The MDBA would expect to see modelling that demonstrates how the works will benefit the environment under different watering scenarios and how this differs from the existing regime and how the works have been optimised to mitigate any adverse outcomes. The MDBA would also expect to see scenarios that incorporate the works proposed in the Yanco Business Case.

A key aspect of developing concept designs is to have a defined operating regime for the works and how NSW proposes to ensure that the operating regime does not transform into something that has significantly greater adverse ecological outcomes, or renders aspects of the new works unnecessary or operating outside the optimal range.

Environmental

The Business Case states: *The proposed project is not an 'environmental works and measures' initiative..... The business case, therefore, does not attempt to create a revised environmental watering regime or outcome for the creek system, and so does not address ecosystem targets and outcomes.*

Any environmental outcomes will be delivered separately through local stakeholders, including YACTAC, and the Local Land Services; however, will be subject to available funding. NSW further clarified that OEH will call upon environmental water as part of their watering plan.

Without the full and clear definition of an operating regime for the full Yanco system (including the offtake from the Murrumbidgee) it is not possible to assess whether the project is environmentally beneficial, benign or detrimental.

It is unclear whether:

- Environmental outcomes can be achieved using the current design parameters under this project, or
- CARMS will incorporate environmental flows into their system operations.

This leads to concern that;

- There could be potential conflict between irrigator demand and environmental values for future watering priorities in the system,
- The proposed structures cannot accommodate future environmental flows to achieve the optimal ecological demands of the system, and
- What charges will apply for the delivery of environmental flows through the system.

Structure type and Functionality

The designs are at feasibility level. The designs are;

- Sketches only, and
- Based on an existing structure in the system and multiplied to describe the type of structure proposed for various locations.

The business case lacks detail on specific structure locations and the construction method for these proposed structures. Although the structures appear to be conventional designs, without information on locations it is difficult to assess whether the structure type and its functionality are adequate.

There is no site specific geotechnical investigation validation to support this design, and as such this project has not applied defensive design principles. This would be a key issue to be considered in the development of concept designs and throughout the detailed design process.

There is also no detail in the business case on whether the structures have been designed in consideration of the maximum 2,500 ML/day flows identified in the Alluvium 'Environmental Flow Recommendations for Yanco Creek' report, and proposed as part of the Yanco Creek Business case.

The business case has provision of upstream fish passage and will be achieved through a vertical slot fishway at each structure. This conflicts with the advice provided by NSW that a bypass slotted fishway will be installed. Both seem to be of similar design, and can be refined during concept design.

The two types of regulators proposed are described below:

Regulators

Regulators are proposed for Wanganella town weir, Puckawidgee, and Hartwood. A standard design has been proposed for each site.

The proposed design is a three bay regulator with lay flat gates designed for a maximum flow rate for consumptive demand of 600 ML/Day. A key consideration for the next stage of design will be to optimise each structure based on site specific considerations (location, geotech, cultural heritage etc).

There is no detail how the structures will be constructed (ie within channel or a bypass channel). NSW has confirmed flow must be maintained during construction, but has not provided a method and the associated risks with each method (ie cultural heritage, foundation conditions, private landholders etc). The Authority's experience with Living Murray works is that maintaining a

bypass flow can greatly increase construction complexity, footprint and cost. This is an aspect that should be specifically considered as part of concept design.

The proposal to install new weirs rather than retrofit old structures appears sound given uncertainties surrounding the structural integrity of the existing structures. The business case does not detail the existing weir or regulator structures or how the new structures will alter the current flow capacity or how the operation of the new structures may alter the current weir pool height or length of slack water.

Regulators for weir pool re-regulation

Six new weir pool regulation structures and fishways are proposed; Four locations on Colombo Creek (Cocketgegong Weir, Chesney Weir, Coonong Weir, Eight-Mile (ski-club) Weir), and two locations on Yanco Creek (unspecified).

The prioritisation of the new and upgraded structures on the Colombo and Yanco Ck is unclear. At this level of project development clear justification for the number, final location and design flow capacity of these structures would be expected.

The proposal to install new weirs downstream of existing structures rather than retrofit the old structures appears sensible, given the uncertainties regarding the structural integrity of the existing weirs and blocking banks.

These structures are sheet pile structures with regulating gates capable of passing 500 ML/Day. They will be located downstream of existing weir structures and will be raised 150mm above the existing weirs. The existing weirs will remain insitu and will either be stripped or crest height reduced by 0.2m. It is unknown if the existing structures will pose a fish passage restriction and this should be a key consideration when developing concept designs.

Blocking banks

It is unclear if there are new blocking banks proposed under this proposal. It seems, from a sketch, there are existing blocking banks located in channel to divert water down other creek channels, which will regulate flows via regulator structures. There is no information of the blocking banks structural integrity, their locations, or whether there has been consideration to modify the blocking banks to accommodate the proposed weir pool height of 150mm.

There is also no mention of modifying the blocking banks to enable environmental flows, or whether this is a possibility.

Alternate Supply Options

Alternative supplies are proposed to improve the efficiency of water delivery. The success of proposed alternate supply options relies on the establishment of inter-valley transfer agreements from Murrumbidgee to Murray valleys.

Of particular concern is the risk identified in the Risk Register *“the retention of major flows within the creek system for environmental flows could reduce the volume of water savings - making the project unviable”*. This appears at odds if the hydrology of the system is to remain unchanged.

The capacity of the alternate supply systems has not been addressed in detail. Spare capacity must be available in these systems at critical times to deliver environmental water. The risk of

decreased capacity in these supply systems in the future does not appear to have been addressed.

The transfer of customers to alternate irrigation supplies may result in losses being transferred to these systems. It is not clear if this has been accounted for in the calculation of water savings.

The implementation of operational rules underpins the success of the alternate supply options and the ability to carry out inter-valley transfers. As such, these are a key risk to the success of the project and the achievement of the projected water savings and should be addressed as a priority.

Natural Flood Flows

The impact on natural flooding is likely to be a critical consideration for sizing of regulators. Concept designs should specifically review the impact of the works on flood flows and what impact any increase in afflux will have on third parties.

Fish Passage

Any new structure in a waterway must include fish passage. This is a NSW statutory requirement and this proposal adheres to this requirement.

A fishway design is not yet defined and NSW indicate further analysis will be carried out to incorporate the current best practice and latest design features into any new fish passage. To date the business case indicates a vertical slot fishway is preferred, due to the isolated locations on the Colombo Creek and Yanco Creek. NSW has since considered the by-pass slotted vertical fishway, which is very similar in design and NSW claim it can be incorporated structurally with a sheet pile weir. This needs to be resolved and defined as part of concept design.

Concept design should specifically review the overall fish passage requirements in the system/reach to ensure the designs are appropriate for;

- the expected or targeted fish species,
- what fish size is acceptable/exclude etc.
- range of flows fish passage is expected to operate for,
- how often fish passage is required,
- the maintenance requirement of the proposed fish passage solution, and
- designs must also incorporate safe downstream fish passage when considering appropriate gate design and plunge pools.

The concept design will also need to assess how the existing structures, located 150m upstream from the new re-regulating structures, will not impede on fish passage. When the upstream weirs are decommissioned velocity through these structures would need to be limited to a level that permits fish passage for the same range of fish that the fishway is designed for.

Constructability

The proposed works appear within the scale and complexity of works that have been constructed under the Living Murray program. The design appears feasible. However there is limited detail on the final location of structures or geotechnical investigation to underpin the proposed design.

NSW has confirmed passing flows are required to be maintained during construction but has not elaborated on the method of construction or flow requirements. The Authority's experience with Living Murray works is that maintaining a bypass flow can greatly increase construction complexity, footprint and cost. This is an aspect that should be specifically considered as part of concept design

Third Party Considerations

Construction and Operations

The project has received in-principle support from a range of stakeholders that have been engaged throughout the project development phase.

There is limited detail regarding how the changes to weir pool levels might impact on flooding of private land when environmental water is called or a natural flood is raised overbank from the new structures. The development of agreements with private landholders may be required. However, the potential for stakeholder opposition still represents a significant risk to the project and effective engagement will be crucial to the success of the proposal.

Based on experience with the Gunbower and Koondrook EWMP projects, both of which required negotiation with private landholders and interactions with water supply for irrigation, the MDBA's observation is the work involved in resolving such agreements is often extensive, time consuming and underestimated early in the project.

Water supply

NSW confirm that the rules-based approach will be applied to protect against third party impacts regarding additional inflows into the Yanco system from the Murray via MIL. To ensure the additional water delivered via MIL (effectively an inter-valley transfer) is "repaid" to the Murray, modification to the existing Inter-Valley Trade accounting is proposed (the "rules based approach"). This does not include the use of existing rules-based environmental water to replace any reductions in water delivered to the Yanco Creek system.

NSW Murray entitlements

The outflows of the Yanco creek system (Billabong creek at Darlot) form an inflow to the River Murray system. As such a reduction of flows at Darlot will have an impact on reliability of supply for NSW River Murray entitlement holders.

Given the inter-related nature of the Murrumbidgee SDL projects this will logically be assessed as part of an integrated assessment of all of the proposed Murrumbidgee SDL projects.

Quality Assurance Method & Review

No external review appears to have been undertaken for the proposed works. This is consistent with a feasibility level of project development. It would be logical for the concept designs to be subject to independent review before proceeding to detailed design.

This project is dependent on other proposed projects. Combining the three projects would ensure they interact appropriately for constructability and operational purposes and to ensure irrigation and ecological demands are met. This should also be subject to independent review before proceeding to concept design.

Appropriate allowance should be made in project planning for both the cost and time of this review.

Ownership and O&M Arrangements

The business case indicates WaterNSW will incur ongoing costs of the ownership and operation of the new assets, which will be recovered through annual water charges. NSW has applied 1.5% of the asset value for O&M costs, which is based on an existing structure in the system - the Tarabah regulator (concrete regulator). Although the proposed regulators are sheetpile structures this costing is adequate noting these costs will be refined in concept design.

Experience with The Living Murray works indicate fishways require additional research and monitoring to ensure they are passing fish as designed. NSW has indicated PIT tag readers will be installed on each new structure but hasn't mentioned fish trapping to inject the PIT tags into fish. This should be incorporated into the O&M costs as it is an ongoing cost that is significant

The new structures will be SCADA and CARM enabled to facilitate remote operation. This will require significantly greater operating cost than the fixed crest weirs that currently exist.

Cost Considerations

Detailed Design and Approvals

The allowance for detailed design and approvals has been estimated based on a percentage of total capital cost. Costs for survey, investigation, design and modelling have been valued at 10% of the total direct cost of the project. Given the project is at feasibility stage this cost seems low.

The business case has identified the statutory approvals required and made an appropriate allowance for the necessary investigations and reports to support the approvals process, but has not made an allowance for costs incurred due to approval delays. This is a significant oversight and the MDBA would suggest, that as part of the development of concept designs, a strategy for approvals and cultural heritage management be developed and costed. This should also inform the timeframe for obtaining the relevant approvals.

In particular the project has costed environmental and cultural heritage approvals (including a 25% contingency) at \$344,000, and development of the EIS and EPBC referral at \$100,000. Experience with The Living Murray indicate approvals take longer and cost more than originally predicted in the feasibility stages. Given the uncertainty of the construction method and footprint area this cost is too low for the works proposed and should be re-assessed.

Construction

The cost estimate is high level, which is consistent with the feasibility level of project development.

The business case estimates the construction of each fishway will cost \$1m per meter lift. This may be an underestimate at some sites but across the multiple structures is adequate for feasibility level of investigation. It would be expected that this estimate be optimised for each structure based on an evaluation of flows under the proposed operating regime and should be a key consideration for the optimisation of the design head difference for concept design.

Construction Contingency

A 50% contingency has been applied to all regulating structures. This is considered an appropriate level of contingency for the current stage of project development, given the uncertainty surrounding final design, geotechnical conditions, method of construction, and final location of the regulators. It will be expected the contingency will be refined during concept and again during detailed design.

A contingency has not been applied to the fishways as they assumed \$1m/metre is meant to cover this. Given the fish way design is not yet determined a level of contingency reflecting this level of uncertainty should be applied. The 50% applied to the weirs / regulators would appear equally appropriate for fishways of an unknown type.

Project Management

Costs for project management is valued at 20% of capital works (total cost of the regulators and fishways). This is considered a reasonable approach.

Risk Assessment of Project Implementation

A risk assessment and proposed mitigation strategies are included in the Business Case. The risk assessment is very high level - consistent with a project in the feasibility stage.

A more robust risk assessment should be undertaken as part of concept design once further information (e.g. geotechnical investigations, preliminary cultural heritage field surveys) has been undertaken.

As set out in the Risk Report (Appendix A) the majority of the risks that a project will be exposed to can be contained and managed within the project.

The MDBA has identified five key financial risks that need to be further considered for this project.

Environmental

The Business Case does not consider the ecological demands in the system.

The Living Murray projects built structures to achieve environmental outcomes. This meant focusing on hydrological and ecological requirement, choosing an appropriate operating regime to match the natural conditions, within the current system, as closely as possible and designing the structures to enable the operating regime.

To reduce the risk of inadvertently delivering adverse ecological outcomes, or rendering aspects of the new works unnecessary or operating outside the optimal range the MDBA is of the view that an operating regime(s), to meet environmental demands as well as consumptive demands, is essential.

Flooding

No allowance is made in the Business Case for flood risk.

Flood risk was underestimated in the early stages of The Living Murray and was not costed appropriately and was considered the greatest financial risk to the projects, with very little mitigation options available.

During the EWMP program the definition of a flood, when a flood delay would occur, and associated costs payable was altered in the construction contracts to reflect the learnings from flooding in early projects which incurred major costs.

The key learnings from EWMP that are relevant to the SDL Business Cases are:

- it is not financially realistic to pass the risk of flooding to the contractor;
- there is a practical limit to the amount of flood mitigation that can be achieved by use of temporary works, beyond this level it is cheaper to accept the cost of demobilising / remobilising site;
- projects need to plan the timing of the works to minimise the flood risk (this is something that should be addressed in the detailed design / approvals phase of the projects);
- sufficient funds need to be allocated to cover the risk that a flood(s) will require a work site to be demobilised and remobilised at a later date. This incurs large costs to both the construction team and for the project management team.

Cultural Heritage

No allowance has been made in the Business Case for delays during construction.

Funding for cultural heritage was underestimated in the early stages of The Living Murray and was not costed appropriately.

Despite the best intention and planning the potential for cultural items to be exposed during construction remains. This could result in the need to cease work and potentially demobilise the site while investigations are undertaken and appropriate steps taken to address the issue.

The overall magnitude of the proposed allowance is a matter of judgement and risk appetite. If significant cultural heritage is found in places that were not identified in the CHMP process, as occurred in the EWMP Koondrook project, the costs can be vary significantly and the allowances will not be adequate.

Third Party

No consideration has been made in the Business Case on whether land acquisition or easements may be required. This could be a high risk of community backlash.

In the Living Murray Projects hydrological models were based on 20m² which was not accurate enough to highlight potential areas of private land inundation. There was no appetite for compulsory acquisition of land or easements. The risk is the delayed use of the works to its full design capacity and can be costly. If the same approach applies to this project then this represents a critical risk to the project that has not been adequately considered to date.

The MDBA is of the view that the quantification of, and process to address, third party impacts represents a critical element of the concept designs. Failure to address the third party impacts may result in the works being constructed and unable to deliver the proposed benefits.

Third party impacts should be addressed, either specifically or referring to a report that covers multiple projects. This includes the outflows at Darlot and IVT accounting.

Redundancy of works

No consideration has been made on how the works proposed will function with other projects in the same system.

The Living Murray projects focused on landscape scale works to mitigate against structures that could potentially become redundant from larger scale works in the future. Working on a landscape scale is beneficial to understand the overall hydrological and ecological requirements of the system. This helps to determine the structure types, sizes and fish passage requirements, which may indirectly reduce the number of structures required in the system.

The MDBA is of the view that NSW integrate this proposal with the two other related SDL proposals on the Murrumbidgee and the local environmental projects (eg Wangenella Swamp) running in parallel. Until this integration and associated Quality Assurance is complete it won't be clear whether these works will function for system wide ecological and operational benefits.