

# Koondrook-Perricoota Forest Flood Enhancement Works

## Part C Environmental Impact Assessment







## 7. Environmental risk analysis

### 7.1 Purpose of the environmental risk analysis

An environmental risk analysis was undertaken to identify key issues for the Environmental Assessment associated with the project. The focus on key issues in the Environmental Assessment is in line with the approval process under Part 3A of the EP&A Act and the Director-General's requirements issued by the Department of Planning on 22 May 2009 which state that:

*The Environmental Assessment (EA) must include an ERA to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of the additional key environmental impact(s) must be included in the EA.*

The environmental risk analysis process involved:

- ▶ Research, data collection and assessment; and
- ▶ Workshops with engineering and environmental teams to confirm the magnitude of potential impacts. This included an risk workshop at Barham on 9 July 2009 to:
  - Categorise risks into either 'key environmental ' risks or 'other environmental issues';
  - Determine the likelihood and consequence of risk; and
  - Identify measures to be implemented to manage risks during construction and operation.

The results of the Preliminary Environmental Assessment (DWE, 2009) and investigations prepared during development of the concept design and evaluation phase provided background information to identify key environmental issues. Review of this information ensured that the process recognised that risk assessment has been an ongoing process during development of the project and resulted in a design that incorporates a number of features to specifically avoid or otherwise mitigate environmental risks.

The results of the workshop are summarised in Section 7.3.

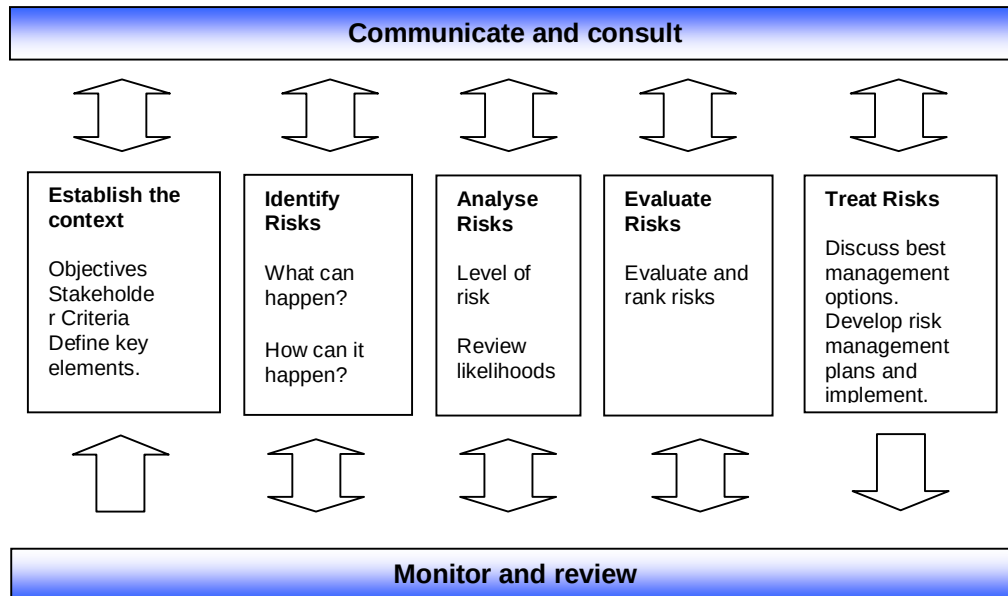
### 7.2 Method for the environmental risk analysis

The environmental risk analysis was undertaken to:

- ▶ Establish a risk framework that defined boundaries for risk likelihoods and consequences (refer to Figure 7-1 and Table 7-3);
- ▶ Identify the type of risks associated with the project;
- ▶ Analyse the identified risks;
- ▶ Evaluate the risks by ranking them according to the likelihood of the risk and its consequence;
- ▶ Outline management measures to mitigate risks to an acceptable level; and

- Determine the residual level of risk after application of management measures.

The risk management process is illustrated in Figure 7-1.



**Figure 7-1 Risk workshop management and consultation process (source: Broadleaf, 2007)**

The first step involved identification of the consequence levels should a particular risk result in a negative impact and these are summarised in Table 7-1.

**Table 7-1 Risk consequence levels**

| Consequence level | Definition                                                                                                                                                  |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High              | Would result in a major adverse impact that would be long term and/ or irreversible. It may result in prosecution under relevant environmental legislation. |
| Medium            | Would result in medium term adverse impacts. Would result in a fine or equivalent under relevant environmental legislation.                                 |
| Low               | Would result in short term, reversible impacts.                                                                                                             |

The second step involved defining the risk rating categories. This considered the frequency of activities that may cause the impact and the likelihood (probability) of the impact occurring during that activity. The level of likelihood that a risk would occur is summarised in Table 7-2.



**Table 7-2 Level of likelihood**

| Likelihood level | Definition                                                                                                                |
|------------------|---------------------------------------------------------------------------------------------------------------------------|
| High             | The event is <b>almost certain to occur</b> in the course of normal or abnormal construction and operating circumstances. |
| Medium           | The event is <b>likely to occur</b> in the course of normal operations.                                                   |
| Low              | The event <b>could occur</b> in the course of normal or abnormal operating circumstances                                  |

The risk rating categories that were adopted for this project are outlined in Table 7-3.

**Table 7-3 Risk rating categories**

| Risk category | General description                                                                                                                                                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High          | Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts associated with the risk.                 |
| Medium        | Potential impacts can be mitigated through the application of relatively standard environmental management measures.                                                  |
| Low           | Potential impacts either require no specific management measures or can be directly managed through design measures, general mitigation measures and safety controls. |

The risk rating category of each potential impact was then determined by combining the likelihood with the consequence of the risk according to the matrix shown in Table 7-4

**Table 7-4 Risk rating matrix**

|             |            | Likelihood |            |          |
|-------------|------------|------------|------------|----------|
|             |            | 1 (Low)    | 2 (Medium) | 3 (High) |
| Consequence | 1 (Low)    | 2          | 3          | 4        |
|             | 2 (Medium) | 3          | 4          | 5        |
|             | 3 (High)   | 4          | 5          | 6        |

As indicated in Table 7-4, risk rating scores ranged between one and six. Scores between one and three were considered to be those that have a low likelihood of occurring with low consequences. A score of four indicated a medium level of likelihood and consequence. A score of five or six represents risks that have a high likelihood of occurring with high consequences.



Risks were initially allocated assuming that no management measures were in place. The risk rating was then revised to take into account the effectiveness of mitigation measures that would be implemented and this provided a residual risk rating.

### **7.3 Results of the environmental risk analysis**

The environmental risk analysis was undertaken based on the project as it is described in Section 6.2 to acknowledge that it has evolved to incorporate a range of features to specifically reduce the environmental risk profile, including but not limited to:

- ▶ Where possible, the location of infrastructure has been selected to minimise environmental impacts, particularly through positioning a substantial component of the downstream levee on the alignment of an existing levee;
- ▶ Designing structures to enable natural flows to be emulated where practicable;
- ▶ Having the flexibility to operate over a range of inflow conditions and deliver a range of different flood events according to the ecological objective. This flexibility also allows the project to be operated to reduce exposure to scenarios that have an elevated risk of leading to adverse environmental impacts, such as blackwater events;
- ▶ Including an internal floodway and return channel to ensure a significant proportion of water diverted into the Forest during large events is returned directly to the Murray River from the flood pool. This minimises water losses;
- ▶ Providing erosion protection measures such as rock armouring and grout mats around structures such as regulators;
- ▶ Designing structures such that the resultant flow velocities are reduced to minimise environmental impacts;
- ▶ Incorporating fish passage through the inlet regulator and designing one of the downstream regulators to enable it to be retrofitted with a fishway in the future if required; and
- ▶ Ensuring that the regulators have sufficient capacity to enable passage of an event equivalent to the 1956 flood, which is the largest flood on record, with minimum interference. This minimises the impact of the infrastructure on the function of the floodplain during large natural flood events.

As discussed in Section 6.4, the project would be operated in accordance with an Operating Plan. One of the key functions of this plan is to provide a framework to enable operation to occur in accordance with the principles of adaptive management so that lessons from one event are applied to subsequent events. As events would be planned well in advance based on a range of factors, there are significant opportunities to minimise risks associated with individual events. This would include watering during cooler months (winter and early spring) being favoured over summer watering. As discussed in Section 10.2.4, there is a greater risk of blackwater events during flood events over summer as water temperatures are higher. Watering during cooler months would reduce the risk of these events occurring. Depending on the water requirements at the site, water made available during summer may be rejected in favour of autumn watering. Section 6.4 outlines the watering and management principles that would be implemented to maximise benefits and minimise risks.



The risk analysis was undertaken by members of the environmental assessment study team, as well as representatives from agency stakeholders that form part of the project team and have been intimately involved in preparation of background investigations during the evaluation and development of the project. The agency stakeholders include organisations such as MDBC, NOW, State Water and Forests NSW that have extensive experience in operation of the Murray River, construction and operation of water management infrastructure, and ecological issues associated with the Koondrook-Perricoota Forest.

### **7.3.1 Identification of key issues for the Environmental Assessment**

A summary of results from the environmental risk analysis are presented in Table 7-5. Risks have been identified as either construction or operation risks and separated into 'key' risks to the project and 'other' environmental risks.

The key potential impacts were identified based on the:

- ▶ Characteristics and sensitivity of the receiving environment;
- ▶ Potential impacts likely to occur, including their duration, intensity and degree to which they can be mitigated; and
- ▶ Level of uncertainty of the anticipated residual impacts.

The key issues are those that are considered to have medium or high adverse environmental impacts, if not effectively mitigated, during either the construction or operational phases. They include issues that require detailed investigation to ensure a high degree of certainty that potential risks can be effectively managed. Key issues are assessed in Chapters 8 - 13.

Other environmental risks are those that are considered to have low risks associated with adverse impacts and these are assessed in Chapter 14.



**Table 7-5 Summary of results of the environmental risk analysis**

| Aspects                         | Summary of potential adverse impacts                                                                                                                                 | Construction impact | Operation impact | Overall likelihood | Overall consequence | Risk rating | Proposed mitigation                                                                                                                                                                       | Residual risk rating |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------|--------------------|---------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>Key risks to the project</b> |                                                                                                                                                                      |                     |                  |                    |                     |             |                                                                                                                                                                                           |                      |
| Water quality                   | Blackwater event leads to fish kills in the Forest or downstream waterways                                                                                           |                     | ✓                | Medium             | High                | High        | Able to be mitigated by targeting watering events to cooler months, and discharging blackwater to the Murray River where it would be diluted. Mitigation measures detailed in Section 10. | Medium               |
| Hydrology                       | The project would result in significant adverse impacts on the hydrology of the Murray River, the Forest, or Barbers Creek, leading to impacts on adjacent land use. |                     | ✓                | Low                | High                | Medium      | Project to be operated in accordance with adaptive management principles to minimise adverse hydrological effects. Mitigation measures detailed in Section 9.                             | Medium               |
| Terrestrial ecology             | Removal of areas of Inland Grey Box Woodland (an endangered ecological community) that would not benefit from an enhanced flood regime                               | ✓                   | ✓                | High               | High                | High        | Impacts on this community offset by the offset strategy. Mitigation measures detailed in Section 8.7.                                                                                     | Low                  |
|                                 | Significant adverse impacts on threatened species, populations or endangered ecological communities                                                                  | ✓                   |                  | Low                | High                | Medium      | Extent of clearing minimised by mitigation measures detailed in Section 8.7.                                                                                                              | Low                  |





| Aspects                    | Summary of potential adverse impacts                                                                                    | Construction impact | Operation impact | Overall likelihood | Overall consequence | Risk rating | Proposed mitigation                                                                                                                                                        | Residual risk rating |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------|------------------|--------------------|---------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Aquatic ecology            | The project creates barriers to fish passage                                                                            |                     | ✓                | Medium             | Medium              | Medium      | Structures designed to enable fish passage. Barbers Creek regulator able to be retrofitted with a fishway if required. Mitigation measures detailed in Section 8.7.        | Low                  |
| Groundwater                | Transfer of solutes and highly saline soils as a result of Acid Sulfate Soils or Potentially Acid Sulfate Soil run-off. | ✓                   | ✓                | Medium             | Medium              | Medium      | Groundwater to be monitored during watering events and the results used to adaptively manage subsequent events.                                                            | Low                  |
| Spoil and waste management | Inappropriate disposal of spoil may impact on the environment.                                                          | ✓                   |                  | High               | Low                 | Medium      | Spoil to be reused on the project where feasible. Residual spoil to be placed such that environmental impacts are minimised. Mitigation measures detailed in Section 13.2. | Low                  |
|                            | Vegetation would be removed to enable construction to occur and would need to be disposed of                            | ✓                   | ✓                | High               | Low                 | Medium      | Where practicable, timber would be recovered and sold commercially to make best use of this construction by-product. Mitigation measures detailed in Section 13.2.         | Low                  |
| Aboriginal heritage        | Construction would have negative impacts on known or unknown items of Aboriginal heritage importance.                   | ✓                   |                  | Low                | High                | High        | Earthworks to be monitored during construction. Infrastructure sited to avoid potential impacts where possible. Mitigation measures detailed in Section 12.4.              | Medium               |
| Soil                       | Significant adverse impacts due to erosion in the vicinity of the structures and                                        | ✓                   | ✓                | Low                | High                | Medium      | Installation of measures to limit the potential for significant erosion to occur. Mitigation measures detailed in Section                                                  | Medium               |



| Aspects                                | Summary of potential adverse impacts                                                                               | Construction impact | Operation impact | Overall likelihood | Overall consequence | Risk rating | Proposed mitigation                                                                                                                                    | Residual risk rating |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------|------------------|--------------------|---------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                                        | downstream areas due to the project                                                                                |                     |                  |                    |                     |             | 11.3.                                                                                                                                                  |                      |
| <b>Other risks to the project</b>      |                                                                                                                    |                     |                  |                    |                     |             |                                                                                                                                                        |                      |
| Social impacts                         | Access to the Forest would be reduced such that there are significant social impacts                               | ✓                   | ✓                | Low                | Medium              | Low         | Local community to be advised of the timing and duration of impacts associated with the project.                                                       | Low                  |
| Construction noise                     | Construction noise would significantly affect amenity of the nearest sensitive receivers                           | ✓                   |                  | Low                | Low                 | Low         | Local community to be advised of the timing and duration of impacts associated with the project. Mitigation measures detailed in Section 14.3.4.       | Low                  |
| Construction traffic                   | Construction would increase traffic that would substantially affect the capacity of local and regional roads.      | ✓                   |                  | Low                | Medium              | Low         | The majority of vehicle movements would occur outside existing peak periods. Mitigation measures detailed in Section 14.2                              | Low                  |
| Non-Aboriginal heritage                | Construction would have negative impacts on known or unknown items of Aboriginal heritage importance.              | ✓                   |                  | Low                | Medium              | Low         | Where possible, construction would avoid impacts on known items of non-indigenous heritage significance. Mitigation measures detailed in Section 14.6. | Low                  |
| Landscape character and visual amenity | That all design components would not compliment the surrounding landscape character and the area's visual amenity. | ✓                   | ✓                | Medium             | Low                 | Low         | Natural regeneration would partially screen infrastructure.                                                                                            | Low                  |
| Air quality                            | Excavation and construction activities generate dust that significantly impacts the nearest sensitive receivers.   | ✓                   |                  | Low                | Low                 | Low         | Disturbed areas are maintained in a moist condition to minimise dust. Mitigation measures detailed in Section 14.5.                                    | Low                  |