

Koondrook-Perricoota Forest Flood Enhancement Works

Part B Information on the project





5. Strategic context and need

This chapter describes the strategic context and need for the project. It outlines the overall Living Murray Initiative and the relationship between the Koondrook-Perricoota Forest and the Icon sites identified under this program. It details the need for the project in the context of the site itself, as well as The Living Murray Initiative.

5.1 Overview

The Gunbower-Koondrook-Perricoota Forest is one of the six Icon Sites identified under the Living Murray Initiative, established by the Murray-Darling Basin Ministerial Council (MDBMC) in response to concerns about the environmental and economic health of the Murray River system. NOW and Forests NSW have developed the project to deliver against The Living Murray Initiative objectives and achieve the interim ecological objectives for the Koondrook-Perricoota Forest in NSW.

The following sections provide an overview of The Living Murray initiative. It details the need for the project as a mechanism to ameliorate the impacts of changes to flooding regimes on the Koondrook – Perricoota Forest. It also details the need for the project as a component of The Living Murray Initiative and the relevance of the project to the other five Icon sites. In doing so, this section outlines how the project responds to concerns regarding the environmental and economic health of the Murray River system.

5.2 Context of The Living Murray Initiative

5.2.1 The Living Murray Initiative

The Living Murray Initiative is a partnership of the Australian, NSW, Victorian, South Australian and ACT governments. The Living Murray Initiative was established in 2002 by the MDBMC in response to concerns about the environmental and economic health of the Murray River system. There are a number of key agencies involved in the delivery of The Living Murray and in NSW these include:

- NOW: the delivery agency for the Living Murray EWMP. Along with having responsibility for the delivery of the EWMP Initiative, it is NOW's role to ensure that the water used by the works is consistent with NSW legislation and policy; and
- Forests NSW: a government trading enterprise of the Department of Industry and Investment. Forests NSW are the land manager of the Forest. Their role is to ensure that all aspects of the project are consistent with the principles of ecologically sustainable forest management.

A large number of structures have been implemented over an extended period of time to regulate flows in the River Murray, including four storages, 14 weirs and five barrages. While this improved the reliability of water supply and provided a range of social and economic benefits, it significantly reduced the proportion of flows that reach the mouth of the river and floods have reduced in frequency, magnitude and duration.



Changes to the flow regime, mainly due to a century of river regulation, exacerbated by the recent prolonged drought, and has significantly reduced the ecological health and productivity of the Forest. This is primarily due to a reduction in the frequency and magnitude of flooding, such that the flooding regime is inadequate to support flood dependent vegetation communities (DWE, 2009). There have been substantial changes to the ecology of the Murray River system, water quality has deteriorated, some wetlands have either dried up or been permanently inundated and native fish have declined in range and number. Some vegetation communities, such as River Red Gums, are stressed through unnatural and extended dry periods, or permanent inundation, and some areas of floodplain have become badly affected by salt (MDBC, 2008).

Icon sites

The Living Murray's First Step focuses on recovering 500 GL of water for the Murray River and using this to improve six Icon Sites which have been selected for their high ecological value. The Icon Sites are shown in Figure 5-1 and include:

- ▶ Lower Lakes, Coorong and Murray mouth;
- ▶ Chowilla Floodplain, Lindsay-Wallpolla Islands;
- ▶ Hattah Lakes;
- ▶ Gunbower-Koondrook-Perricoota Forests;
- ▶ Barmah-Millewa Forest; and
- ▶ Murray River channel.

As well as their significant ecological value, the Icon sites were chosen for their cultural significance to indigenous people and the broader community. They are important breeding sites for waterbirds and provide habitat for native fish, birds and plants. The Koondrook-Perricoota Forest is also part of the Central Murray State Forest which is listed as an internationally significant wetland under the Ramsar convention (MDBC, 2008).

Under The Living Murray initiative, improvement in the health of the Icon sites is to be achieved by recovering water for use at the sites and by investing in works to allow managed watering and other environmental outcomes such as improved fish passage. The target date for recovery of up to 500 GL (long term cap equivalent) of water is 2009 and the Audit of the Living Murray Implementation 2008-09 indicates that it is likely to be achieved by June 2010 (MBDA, 2009). Works undertaken as part of the First Step are planned to be completed by 2011 (MDBC, 2008).

As outlined in Section 1.1, the EWMP is the program being implemented to improve the health of the River Murray system by making the best use of water for the environment. The program funds infrastructure to deliver and manage water at the Icon sites to achieve The Living Murray First Step environmental objectives. This infrastructure includes regulating structures, water delivery channels and fishways and focuses on achieving environmental outcomes at the six The Living Murray icon sites (www.mdba.gov.au). The project is being funded from the EWMP.

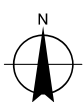


Legend

- Rivers of the Murray-Darling System
- 1, Barmah-Millewa Forest
 - 2, Gunbower-Koondrook-Perricoota Forest
 - 3, Hattah Lakes
 - 4, Chowilla Floodplain & Lindsay-Wallpolla Islands
 - 5, Lower Lakes, Coorong & Murray River Mouth
 - 6, Murray River Channel

0 25 50 100
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



CLIENTS | PEOPLE | PERFORMANCE

NSW Office of Water
Koondrook-Perricoota Flood
Enhancement Works EA

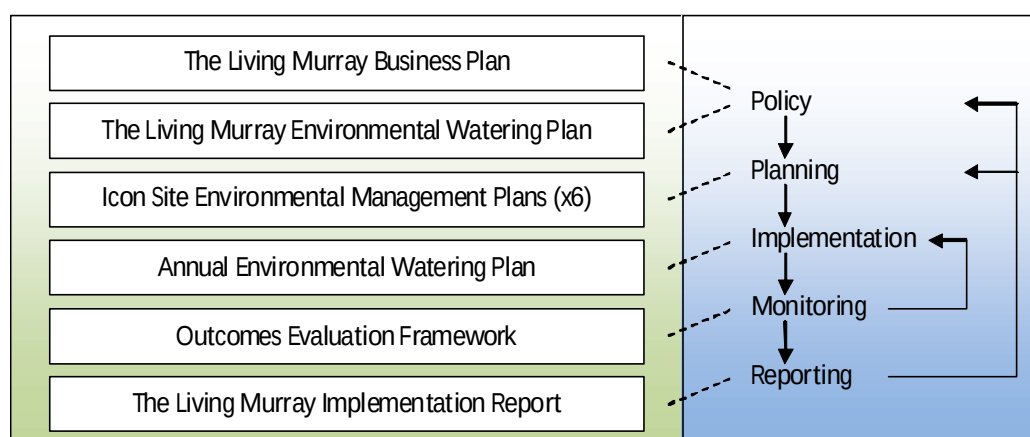
Job Number 21-18573
Revision B
Date 10 DEC 2009

Figure 5.1 - Location of the Icon sites

Environmental Watering Planning Framework

Environmental watering, planning and implementation for The Living Murray Initiative aims to maximise the environmental outcomes from the available environmental water, focusing on the Icon Sites but adopting a 'one river' approach (MDBA 2009).

The environmental watering policy (including the Business Plan and Environmental Watering Plan) is overseen and approved by the MDBMC. Environmental water planning, implementation and monitoring are overseen by the Murray-Darling Basin Authority (MDBA) and the Environmental Watering Group, which includes representatives from relevant State Governments and the Commonwealth Government. Watering activities are undertaken within a planning framework and adaptive management process as outlined in Figure 5-2.



Source: MDBA, 2009

Figure 5-2 The Living Murray planning framework and management linkages

The following sections outline the key functions of the various stages of the processes referred to in Figure 5-2.

The Living Murray Business Plan and Environmental Watering Plan

The Living Murray Business Plan and overarching Environmental Watering Plan set the policy context for the Living Murray Initiative. Amongst other things, the documents set out how environmental watering decisions are made, how water use is accounted, and how the outcomes are to be reported. As the initiative is moving from a phase of water recovery and small scale watering activities, into a longer term program of large scale watering activities, both of these documents are being reviewed (MDBA 2009).

Icon Site Environmental Management Plans

Environmental management plans (EMPs) and interim blueprints have been prepared for each Icon Site. The Icon Site EMPs have been developed to identify the water needs for each site and provide a framework for the delivery and management of environmental flows. The EMPs also identify management objectives and targets, water delivery options and the specific watering regimes required at each site (DWE 2008).

The EMPs set out responsibilities, environmental objectives and targets, activities to be undertaken to achieve those objectives, consultation arrangements, complementary actions, and the monitoring framework for each site (MDBC, 2006).

The Gunbower-Koondrook-Perricoota Icon Site EMP (MDBC, 2006) was developed in consultation with the MDBC's Environmental Watering Group to ensure a consistent approach to planning and management across the Icon sites and throughout the Basin. Since the plan was prepared in 2006, there has been substantial progress on the development of the proposed environmental works and measures, including the Koondrook – Perricoota Flood Enhancement Project, which would be the major mechanism to achieve the environmental objectives at this site.

The Icon Site EMP is being reviewed and updated to include further details on the environmental works program. A focus of the review would be the development of operating plans for the project, including an adaptive management and monitoring framework (MDBA 2009).

Annual Environmental Watering Plan

An Annual Environmental Watering Plan is prepared at the beginning of each 'water' year (July to June, aligning with the seasons and water allocation policy in the River Murray system). The plan is prepared in May/June for the forthcoming year as outlined in Figure 5-3. It sets the environmental watering priorities under The Living Murray for the next 12 month period by:

- Considering current and likely water availability for the forthcoming year;
- Considering the need and priority of watering activities at the Icon Sites; and
- Establishing a decision making framework for watering actions for the forthcoming year, based on water availability and environmental conditions at the Icon sites (MDBA 2009).

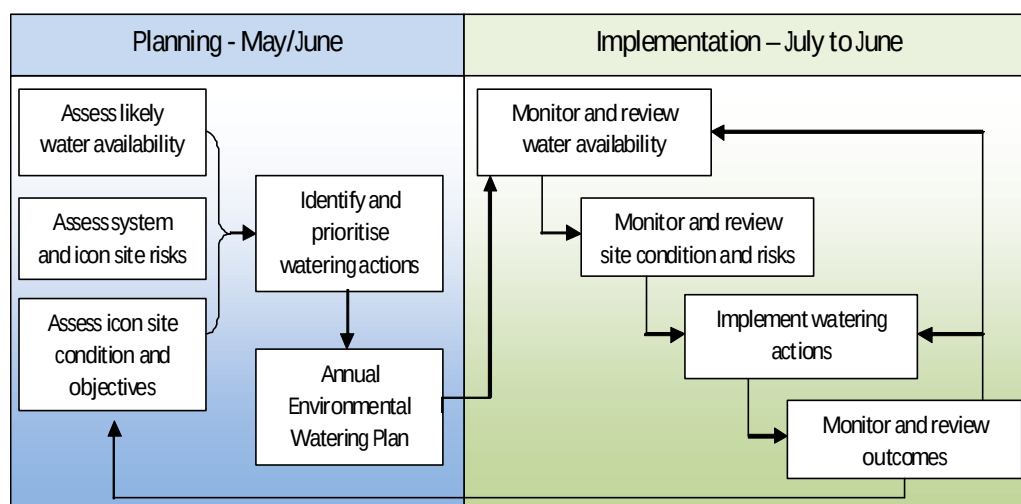


Figure 5-3 The Living Murray environmental water planning and implementation



The Annual Environmental Water Plan is built up from inputs from the Icon Site managers. The need for and priority of watering activities considers the condition of the sites, recent watering history, ecological outcomes to be targeted in that year, and other conditions, particularly related to environmental and third-party risks (MDBA 2009).

The relative priority of the proposed watering activities across the Icon Sites is then compared and a hierarchy of watering actions is developed aligning with water availability thresholds and other implementation criteria. A decision making structure is established so that rapid decisions can be made during the water year as it unfolds and water becomes available (MDBA 2009).

As the Annual Environmental Watering Plan is adaptive in response to water availability and other environmental conditions, implementation of the associated watering activities is also adaptive. To date, The Living Murray Initiative has implemented relatively small watering activities, however, once the water recovery program is complete and the proposed environmental works are constructed, much larger scale watering would be possible and adaptive management would become increasingly important.

Outcomes Evaluation Framework

The Outcomes Evaluation Framework is the framework for monitoring and evaluating the outcomes of environmental watering and the achievement of the Icon Site objectives under The Living Murray Initiative. The current framework was finalised in 2007. This led to the development of condition monitoring plans for the Icon Sites (which feed into the annual Icon Site Condition reports) and investment in many intervention monitoring projects that have improved the general understanding of ecosystem processes and the specific outcomes of watering actions (MDBA 2009).

As the project is nearing construction, and there is now a good understanding of the associated risks and adaptive management requirements, it was recently agreed that the Outcomes Evaluation Framework would be reviewed. The framework allows for adaptive management of large scale environmental watering activities, and monitoring and response to any identified risks. An updated framework would drive the development of detailed monitoring plans for the project (MDBA 2009).

The Living Murray Implementation Report

Progress on implementation of the Living Murray Initiative and compliance with the Murray-Darling Basin Cap are independently audited on an annual basis. This auditing is undertaken in accordance with the Intergovernmental Agreement on Addressing Water Over-allocation and Achieving Environmental Objectives in the Murray-Darling Basin that was signed on 25 June 2004 by Ministers of the Murray- Darling Basin Ministerial Council from NSW, Victoria, South Australia, the ACT, and the Australian Government. Clause 78 of this agreement requires that:

The following would be subject to annual external auditing to the satisfaction of the MDB Ministerial Council:

- *Financial records of expenditure accredited against funding commitments under the Intergovernmental Agreement;*
- *Financial records of any temporary or permanent trade of recovered water;*
- *Registries of recovered water;*



- ▶ *The environmental management of recovered water; and*
- ▶ *Management of the impacts on the Long Term Diversion Cap which result from the recovery and delivery of water under the Intergovernmental Agreement.*

The outcome of the audit is recorded in The Living Murray Implementation Report.

5.3 Relationship between this project and the other Icon Sites

EMPs and interim blueprints have been prepared for each of the six Icon sites to identify the water needs for each site and provide a framework for the delivery and management of environmental flows. The EMPs also identify management objectives and targets, water delivery options, and the specific watering regimes required to achieve the objectives under The Living Murray for each site.

This planning process involved identification, evaluation and development of works and measures to meet the varying ecological needs and the unique characteristics of each site. As such, the works and measures vary between the sites in their type, location and scale due to their differing objectives. Some examples of structural works include removal of redundant regulators, installation of new regulators to manage flows, pumping water to stressed areas and the installation of fishways. Other strategies include re-snagging works, weed management and de-silting works (DEW, 2008).

The interim blueprints assessed management options and the rationale for selection of the proposed works to achieve the environmental objectives at each of the Icon Sites. This process identified that the project is the preferred mechanism to achieve the environmental objectives for the NSW component of the Gunbower-Koondrook-Perricoota Icon Site.

Examples of structural works that have been or are proposed to be implemented at the other Icon sites are summarised in Table 5-1. No works have been undertaken within the Gunbower-Perricoota-Koondrook Icon Site under The Living Murray Initiative. While the strategies implemented at each Icon site would be specifically developed to achieve the objectives for that site, they would also be implemented within the overall framework of The Living Murray. The relationship between the planning and implementation of events within and across the Icon sites is discussed in Section 5.2 and reflects that works at individual sites contribute towards a broader strategy that responds to concerns about the environmental and economic health of the Murray River system.

Table 5-1 Examples of structural works at other Icon sites

Icon site	Overarching management objective	Example of structural works
Barmah – Millewa	For the Barmah-Millewa Icon Site, the interim ecological objective is to enhance forest, fish and wildlife values, ensuring: ▶ successful breeding of thousands of colonial waterbirds in at least three years in ten; and ▶ healthy vegetation in at least 55% of	Planned works ▶ Construction of regulators to control unseasonable flooding of wetlands. ▶ Construction of Gulf Creek Fishway ▶ Construction of new regulators to deliver water to the eastern Millewa Forest.



Icon site	Overarching management objective	Example of structural works
	the area of the forest (including virtually all of the Giant Rush, Moira Grass, River Red Gum forest, and some River Red Gum woodland) (MDBC 2003).	
Hattah Lakes	The management objectives for the Hattah Lakes are to: - Restore healthy examples of all original wetland and floodplain communities; - Restore the aquatic vegetation zone in and around at least 50% of the lakes to increase fish and bird breeding and survival; - Increase the successful breeding events of colonial waterbirds to at least 2 years in 10 (spoonbills, bitterns, egrets and night herons); and - Increase the population size and breeding events of Murray Hardyhead, Australian Smelt, gudgeons and other wetland fish	Works undertaken According to The Living Murray environmental works and measures website (November, 2009) the only works that have been undertaken to date on Hattah Lakes include the watering of severely stressed watercourses and wetlands.
Chowilla Floodplain and Lindsay-Wallapolla Islands	The key objectives are to maintain high biodiversity values of the Chowilla floodplain: - Current area of River Red Gum maintained, and - At least 20% of the original area of Black Box vegetation maintained.	Works undertaken - Purchase of four mobile pump sets and associated equipment to enable pumping of water into high value wetlands and vegetation communities (2005/06); - Construction of a trial groundwater extraction bore and associated infrastructure on the Bookpurnong floodplain to test techniques for use at Chowilla and other floodplains (2005/06); and - Construction of regulators at Lake Wallawalla, Horseshoe Lagoon and Webster's Lagoon (2006/07); Planned works - Repair and replacement of existing regulators; and - Construction of regulators to enhance floodplain and wetland flooding at Lindsay, Mulcra and Wallpolla Islands.
Lower Lakes, Coorong, and	The overall objective for the Lower Lakes, Coorong and Murray Mouth Icon Site is to	Works undertaken



Icon site	Overarching management objective	Example of structural works
Murray Mouth	have a healthier Lower Lakes and Coorong estuarine environment. This objective contains three sub-objectives: ▶ An open Murray Mouth; ▶ More frequent estuarine fish spawning and recruitment; and ▶ Enhanced migratory wader bird habitat in the Lower Lakes and Coorong	▶ Completion of works enabling the remote operation of 24 barrage gates to provide greater flexibility in the delivery of water and the provision of fish passage between the Lower Lakes and the Coorong estuary (2005/06); and ▶ Completion of a trial rock-ramp and vertical slot Fishway at the Tauwichee Barrage and a vertical slot Fishway at Goolwa Barrage (2005/06). Planned works Construction of fishways and remotely operated barrage gates.
Murray River channel	The main objectives for the River Murray Channel Icon Site are: ▶ Increase the frequency of higher flows in Spring, that are ecologically significant; ▶ Overcome barriers to migration of native fish species between the sea and Hume Dam, and ▶ Maintain current levels of channel stability.	Works undertaken ▶ Construction of a new Fishway at Lock 10, Wentworth; ▶ Construction of a new Fishway at Lock 9, Kulnine; ▶ Construction of a new Fishway at Locks 8 and 7 (Wangumma and Lake Victoria); and ▶ Construction of the Packer's Crossing regulator on the Great Darling Anabranch to allow delivery of environmental flows through the Anabranch to the River Murray. Planned works ▶ Construction of regulators to enhance flooding and drying of wetlands, anabranches and floodplains adjoining the river. ▶ Purchase of easements between Hume Dam to Yarrawonga Weir to pass environmental flows downstream; and Construction of fishways at Locks 1, 2, 3, 4, 5, 6 and 11



5.4 Need for the project in the context of The Living Murray Initiative

The following section details the need for the project by outlining the:

- ▶ Ecological, social, cultural and economic values of the Forest;
- ▶ The current condition of the Forest with reference to the interim objectives of the First Step of The Living Murray; and
- ▶ Changes to the flood regime.

It also details how the project has been developed to be the primary mechanism to achieve the interim objectives for the Forest.

5.4.1 Values associated with the Koondrook–Perricoota Forest

As indicated in Section 5.2, the combined Gunbower–Koondrook–Perricoota Forests form one of six Icon Sites established under The Living Murray. The Koondrook–Perricoota Forests are State Forests which are managed by Forests NSW in accordance with the Riverina Ecologically Sustainable Forest Management Plan (Forests NSW 2008) and *Forestry Act 1916*.

Management recognises and responds to the values attributed to the forest which are associated with its importance as a resource supplying River Red Gum timber, as well as significant conservation, cultural, heritage, tourism and recreation values.

The following sections summarise the various values of the Forest described in the Icon Site EMP (MDBC, 2008).

Ecological values

The Koondrook–Perricoota Forest is part of the NSW Central Murray State Forests which are listed as internationally important wetlands under the Ramsar convention. It provides habitat for at a number of globally threatened fauna species listed by the World Conservation Union (IUCN 2000). A number of these species are also protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Fisheries Management Act 1994* and the *Threatened Species Conservation Act 1995* (MDBC, 2006).

A further 40-50 fauna species are of conservation significance at national and state levels, or are listed in migratory bird agreements between Australia and Japan (JAMBA) and China (CAMBA). The forests also contain the nationally threatened plant species Swamp Wallaby Grass (*Amphibromus fluitans*).

River Red Gum (*Eucalyptus camaldulensis*) is the predominant overstorey species, which occupies over 80% of the state forest estate. It usually forms a pure stand and only occurs with other eucalypt species on less frequently flooded sites. Tree height and diameter are related to moisture availability, with better quality forests occurring on frequently flooded areas or on sites with shallow water tables (MDBA, 2006).

Black Box (*E. largiflorens*) occurs on areas prone to floods of lower frequency and duration. Other overstorey species, such as Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*) and White Cypress (*Callitris glaucophylla*), occur higher on the floodplain on lighter textured soils and sandhills (MDBA, 2006).

Further information on the ecological value of the Forest is provided in Section 8.



Cultural / social values

The Forest has a high level of cultural heritage value related to the extensive use by the Indigenous people of the area and the central role the river and forests played in the economic development of the early non-Indigenous settlements. Large numbers of Indigenous sites occur in the area, including scarred trees from which canoes or shields were cut, sacred or significant sites, middens, ovens and burial sites. A few relics of early non-Indigenous settlement are scattered through the Forests and include remains of irrigation schemes, barges and early timber operations (MDBC, 2006).

The Forests attract a particularly high level of recreational use, including four-wheel driving, motorcycling, horse riding, picnicking, camping, swimming, boating, skiing and fishing. A large number of simple, widely dispersed recreation facilities have been developed in the forests, primarily in riverside locations. The scenic values of the Forests are considered to be very high and are an important aspect of the overall recreational values (MDBC, 2006).

Further information on the cultural and heritage value of the Forest is provided in Section 12.

Economic values

The economic value of the Forest is primarily derived from a range of commercial activities permitted under the *Forestry Act 1916*. This includes harvesting River Red Gum timber which has long been valued for a range of products from heavy construction to furniture, and from landscape timbers to firewood and charcoal. This timber is harvested from across the forests on a perpetual and sustainable basis in accordance with the Riverina Ecologically Sustainable Forest Management Plan (MDBC, 2006).

Domestic firewood collection by residents of the surrounding towns and villages is a social and economic use of the Forests that is undertaken in accordance with permits issued by Forests NSW.

Grazing is permitted in the Forest in accordance with the Riverina Grazing Strategy (SFNSW, 2000) and conditions of permits issued by Forests NSW. Purposeful management of grazing in River Red Gum forests may achieve positive environmental effects by using tactical grazing systems to favour native understorey species, reducing fine fuel loads to reduce wildfire hazard, and bringing about beneficial changes in ground cover species composition.

Apiary is an important forest-based activity as River Red Gums are considered to be fairly reliable for the production of heavy blossom, which often produces high flows of nectar and large quantities of pollen. Permits for apiary are issued by Forests NSW.

5.4.2 Current condition of the Koondrook-Perricoota Forest

Modification of the natural flood cycle and drought has resulted in significant adverse impacts on the ecological health of the Koondrook – Perricoota Forest. There is evidence of tree mortality across large areas of the forest and this includes large dominant trees, as well as areas of dense regrowth. Only isolated areas are reported to be in a relatively healthy condition.

A survey conducted across the Icon Sites in 2006 indicated that there had been decline in River Red Gum health since the previous survey in 2005. Results from the 2006 forest health survey indicated that of the River Red Gums:

- ▶ 19% were healthy;
- ▶ 59% were unhealthy; and
- ▶ 22% were severely stressed/dead (DWE, 2009).

The areas in the poorest condition were primarily in the Koondrook Forest at higher elevations and at the downstream margins of the forest (DWE, 2009). The photographs in Figure 5-4 and Figure 5-5 were taken in October 2009 and are indicative of the poor condition of River Red Gum communities and large number of dead or dying trees in sections of the Forest.



Figure 5-4 Photograph of River Red Gums adjacent to Barbers Creek



Figure 5-5 Photograph of River Red Gums along the downstream levee alignment

The Black Box and Grey Box stands were generally much healthier than River Red Gum stands. Overall, the majority of the River Red Gum sites (81%) have an unhealthy or average health status. Signs of severe stress have been evident in a large proportion of River Red Gums for several years, including dead and dying limbs, loss of leaf cover, and epicormic growth (DWE, 2009).

The last substantial flood event in the Forest occurred in 1993 and no floodwaters have been received since the condition assessments were undertaken. Recent observations of the forest canopy reveal some leaf growth following small rain events, but overall condition is poor, and is continuing to decline (DWE, 2009).

The Living Murray Icon Site Condition Report (MDBC 2008) outlines changes in condition of Icon Sites since the First Step Decision. The report is based upon available monitoring and investigations and observations at the six Icon Sites. Table 5-2 summarises the condition of the Gunbower-Koondrook-Perricoota Forest Icon Site compared to the interim objectives set by the MDBMC (MDBC, 2008).



Table 5-2 Koondrook-Perricoota Forest condition compared to the interim objectives for the overall Gunbower-Koondrook-Perricoota Icon site

Objective	Result
30% of River Red Gum forest in healthy condition 80% of permanent and semipermanent wetlands in healthy condition	In the Koondrook-Perricoota Forest, signs of severe stress have been evident in a large proportion of River Red Gums for several years, including dead and dying limbs, loss of leaf cover, and epicormic growth. The areas in the poorest condition are primarily in the Koondrook Forest at higher elevations – along the high riverbank, and at the margins of the forest.
Successful breeding of thousands of colonial waterbirds in at least three years out of ten	No waterbirds were recorded in summer 2008, as all wetland sites were dry across the Icon Site. The annual aerial waterbird survey, undertaken in November 2007, found that most shallow floodplain wetland habitat in the Gunbower-Koondrook-Perricoota Forest system was dry and few waterbirds were present.
Healthy populations of resident native fish in wetlands	Wetlands in the Koondrook-Perricoota Forest were dry.

5.4.3 Changes to the flow regime

Changed flow regimes in the Murray River due to the long term effects of a century of river regulation and more recent effects of prolonged drought have significantly reduced the ecological health and productivity of the forest. This is primarily due to a reduction in the frequency, duration and magnitude of flooding, such that the current flooding regime is inadequate to support flood dependent vegetation communities (DWE 2009).

Figure 5-6 shows the average monthly flow downstream of Torrumbarry Weir, for modelled natural flows¹, actual recorded flows¹, modelled current flows¹ and predicted flows under the CSIRO Median Climate Change scenario. The figure shows the average reduction in magnitude in late winter/spring flows (DWE 2009).

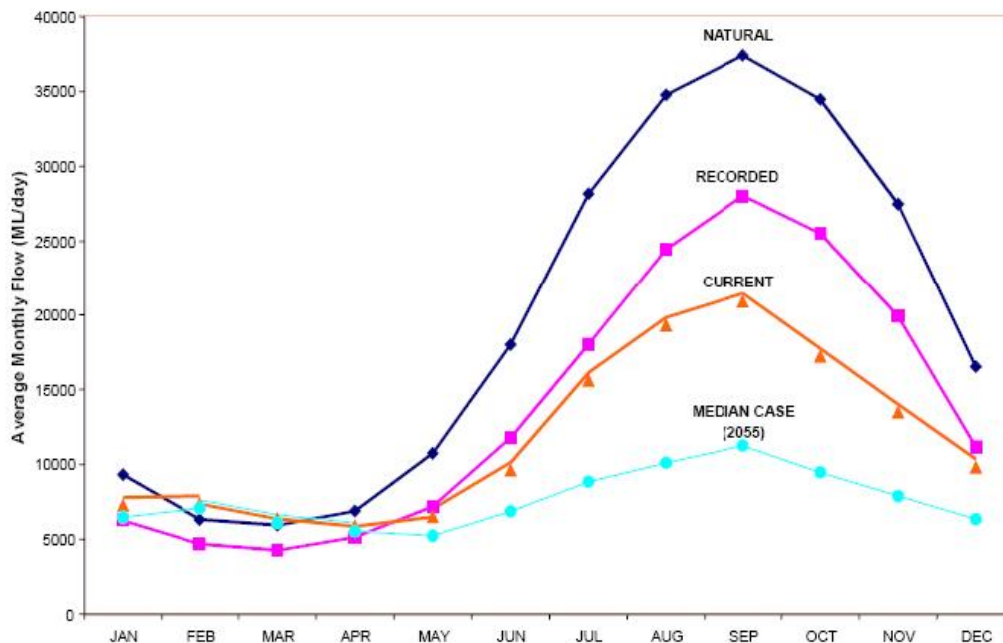
Average flows for September have dropped from approximately 37,000 ML/day to approximately 28,000 ML/day. Flows are predicted to fall to approximately 21,000 ML/day without climate change, as the impact of river regulation takes affect on the long-term average.

Average flows for September are predicted to fall to approximately 12,000 ML/day under the influence of climate change (median scenario). However the average timing (seasonality) of the peak has not changed (DWE 2009).

The frequency of effective, large scale flooding (flows >30,000 ML/day) has reduced by 61% and is predicted to occur in only 7% of years under the median climate change scenario, which represents an 87% reduction compared in the natural frequency (NOW, 2009).

^{1 1} Murray Darling Basin Committee (MDBC) MSM simulator, 119 years, 113 years, 119 years respectively.

Further details on changes to the flow regime are provided in Section 9.



Source: DWE, 2008

Figure 5-6 Average monthly river flows downstream of Torrumbarry Weir

5.4.4 Need for the project

The significance of Koondrook–Perricoota Forest is recognised in a number of forums, particularly its listing as a wetland of international importance under the Ramsar convention, and its identification as one of only six sites considered having iconic value to the River Murray. The importance of these six Icon sites is reflected in the 2003 decision to commit \$500 million to the First Step of the Living Murray to recover 500 GL of water to improve the environmental flows at these sites. The Forest is also of substantial importance to the local and regional community due to its ecological, social, cultural and economic values.

As discussed in Section 5.4.2, the Koondrook–Perricoota Forest is in a state of decline and evidence of the ecological stress has been particularly evident in River Red Gum communities. Monitoring undertaken by the MDBC between 2005 and 2008 indicates that the health of the forest has measurably declined over this relatively short period of time.

Changes to the flood regime due to the long term effects of river regulation as well as the recent effects of drought have been identified as the main factor contributing to the decline in the ecological health of the Forest. This is recognised in the Icon Site EMP (2006) which identifies inappropriate water management (quantity, frequency, season and duration) as a threat to achieving the interim objectives for the Forest. As detailed in the Icon Site EMP (2006), changes to the natural flow regimes of the River Murray associated with river regulation have changed vegetation distribution and health, and reduced the abundance and diversity of waterbirds, native fish and many other fauna species. The banks of the Koondrook-Perricoota Forest are



relatively high and flows greater than about 18,000 ML/day downstream of Torrumbarry Weir are required to enable water to naturally enter the Forest. The Koondrook-Perricoota Forest has been substantially affected by river regulation as the frequency and duration of flows greater than about 18,000 ML/day downstream of Torrumbarry Weir have reduced significantly. As a result, the extent, duration and frequency of floods entering the Forest have decreased and the ecosystem is displaying signs of severe stress.

The project is needed at a regional level because unless action is taken to restore extensive flooding to the forest, the ecological condition of the NSW component of the Gunbower-Koondrook-Perricoota Forest would continue to decline. Although low to medium floods would still occur in the absence of the project, these would be unlikely to provide the frequency, volume or duration of flows to meet the water requirements of significant areas of the forest. Maintaining the ecological health of the forest is essential for retaining the cultural, social and economic values for which Gunbower-Koondrook-Perricoota Forest is recognised (DWE, 2009).

The project has been designed to specifically address the requirements of the interim objectives set by the MDBMC as part of First Step for the Living Murray. The overarching objective for the Gunbower-Koondrook-Perricoota Icon Site is to "Maintain and restore a mosaic of healthy floodplain communities." The interim ecological objectives are:

- ▶ 30% of River Red Gum forest in healthy condition;
- ▶ 80% of permanent and semi-permanent wetlands in healthy condition;
- ▶ Successful breeding of thousands of colonial waterbirds in at least three years out of ten; and
- ▶ Healthy populations of resident native fish in wetlands.

The project is considered to be the most effective mechanism to achieve these objectives as it would have the flexibility to operate over a wide range of flows to enhance the natural flow regime. The desired inundation durations for vegetation communities that would be achieved by the project are summarised in Table 6-8. It would be capable of managing a large flood event that would inundate approximately 52% of the forest every three or four years to meet the interim objective of 30% of River Red Gum forest in healthy condition. These large flood events would be managed to be of sufficient duration to support colonial waterbird and fish breeding events. The project would also be able to convey small flood events on a more frequent basis to assist maintain wetlands in a healthy condition. It would deliver water in a manner that would support recruitment and long term survival of wetland dependent flora and fauna across the Icon site and provide habitat for species that use the site as a refuge.

The project has been designed specifically to enable flexible operation to respond to the following conditions and issues:

- ▶ Changes in water availability that may enable the watering activity to be extended to achieve additional or different environmental outcomes (e.g. a watering event initiated to provide a vegetation response may be extended to support colonial nesting waterbird breeding);
- ▶ Monitoring of environmental outcomes (e.g. if a fish spawning event is observed, the event may be extended to allow this to be completed);



- ▶ Monitoring of environmental risks (e.g. blue-green algae or blackwater); and
- ▶ Monitoring of impacts on third-parties (e.g. impacts on downstream landholders or other communities) (MDBA 2009).

The project would be operated to target specific environmental outcomes and different events would target different outcomes. For example, short duration events would target maintenance of vegetation, while longer duration events would enable successful bird breeding. To achieve long term objectives, planning for future watering events would give careful consideration to the environmental response to previous events.

The project is therefore needed because:

- ▶ The Forest is significant at a local, regional, national and international level;
- ▶ The Forest is displaying evidence of ecological stress and change to the flood regime has been identified as the main contributing factor to this ecological stress; and
- ▶ It would enable a more natural flood regime to be implemented by diverting water from the Murray River into the Forest. This is required to meet the interim ecological objectives established for the Gunbower Koondrook-Perricoota Forest under The Living Murray.

