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## **EXECUTIVE SUMMARY**

This report documents the ecological responses to Commonwealth environmental watering of the Lower Murrumbidgee River and floodplain during 2011-2012. The Lower Murrumbidgee was targeted for Commonwealth environmental water due to the three key areas of ecological significance in this region: the Murrumbidgee River channel, Lower Murrumbidgee floodplain (Lowbidgee, extending from west of Hay downstream to Balranald) and the wetlands between Balranald and the junction of the Murray River. Parts of these areas are of national and international significance and have been listed under international conventions. The lower Murrumbidgee River supports significant biota including; large areas of river red gum (*Eucalyptus camaldulensis*) forest and woodland, black box (*Eucalyptus largiflorens*) woodland, lignum (*Muehlenbeckia florulenta*) as well as habitats for migratory birds, colonial bird breeding, southern bell frog (*Litoria raniformis*) and fishing bats (*Myotis macropus*). The region has been observed to support up to 650,000 waterbirds during times of major flooding.

In the lower Murrumbidgee River channel and Lowbidgee wetlands, three environmental watering events were undertaken in 2011-12:

- From November 2011 to February 2012 an initial filling of the North Redbank wetlands in the Lowbidgee to support wetland habitat and water dependent species. This used 20,200 ML of environmental water, including 17,800 ML of Commonwealth and 2,400 ML of NSW environmental water.
- During February a controlled release of some of the water from the lower North Redbank wetlands through an escape into the Murrumbidgee River channel during which time:
  - 4,700 ML of Commonwealth environmental water was provided into the top of the North Redbank Wetlands so water levels in the wetlands were maintained and;
  - 33,700 ML of Commonwealth environmental water was provided in the Murrumbidgee River channel to dilute the carbon rich water from the North Redbank Wetland escape (Baupie Escape) and to promote spawning opportunities for small bodied fish.

- Environmental watering was suspended from the end of February until mid May 2012, due to a large natural flood event. Environmental water was then delivered in the lower Murrumbidgee River after the peak of the flood had passed to improve water quality and therefore fish habitat. A total of 28,500 ML of environmental water was delivered (26,700 ML of Commonwealth environmental water with the remainder contributed by NSW).

The Commonwealth Environmental Water Office contracted the University of New South Wales, via a consortium managed by the Murray Darling Freshwater Research Centre, to monitor the ecological and hydrological responses to their environmental watering actions and the large natural flood pulse in the Lower Murrumbidgee River and wetlands between February and June 2012. This report describes the project, activities undertaken, methodologies, results as well as an analysis and evaluation of the monitoring data outputs.

The overall goals of the Commonwealth Environmental Water Office funded study were to:

- measure the outcomes of Commonwealth environmental water use
- contribute to the improvement of flow management in the North Redbank Wetlands and Lower Murrumbidgee River, by understanding the benefits and risks of inundating wetlands and then returning water to the main channel via the Baupie Escape.

The project aimed to evaluate the results of delivering flows at different times of year and adjusting the operation of water-return regulators (escapes). We evaluated this aim on our first sampling trip in February 2012. The management (via environmental water deliveries) of a large natural flood event from March became the focus of our monitoring on subsequent trips in March and May. Outcomes from the project will provide information to guide future water deliveries and maintain data continuity across years. Prior to the delivery of the environmental water, the Commonwealth Environmental Water Office identified two risk factors: carp movement and recruitment and low dissolved oxygen levels. This project aims to understand the scale and impact of these risks and therefore enable the Commonwealth Environmental Water Office to adaptively manage the watering into the future.

The specific aims of the project were to identify:

- What were the ecological (fish, frogs, turtles and microcrustaceans) and hydrological (water quality) conditions at the Baupie escape, in the main channel and in associated wetlands before water was released back into the river from the North Redbank Wetlands;
- What were the ecological (fish, frogs, turtles and microcrustaceans) and hydrological (water quality) conditions at the Baupie escape and in the main channel after water was released back into the river from the North Redbank Wetlands;
- How have fish communities, microcrustaceans and water quality in the main channel of the Lower Murrumbidgee River responded to the timing of this environmental flow event and the subsequent natural flood event; and

- Given the current ecological and hydrological condition of off-channel wetlands, is the Baupie escape regulator the most useful route for returning water back to the river in future; and,
- Has the environmental flow event or subsequent natural flood stimulated fish recruitment responses, as identified through analysis of fish otoliths (bones that can be used to age fish)?

During the period of managed environmental watering actions, twenty sites were sampled in wetlands, escapes and along the main channel of the Lower Murrumbidgee River, some before and after environmental flows. A summary of the key ecosystem responses to the Commonwealth environmental water actions were as follows:

- Inundation of the Lowbidgee wetlands increased the productivity and biodiversity of fish and microcrustaceans in the lower Murrumbidgee floodplain-river system.
- The wetlands supported higher densities and biodiversity of microcrustaceans suitable for successful fish recruitment.
- The wetlands supported higher biodiversity of native fish communities as well as tadpoles and turtles.
- The higher productivity and diversity in wetlands was underpinned by the higher stores of carbon and nutrients within the sediments that is released into the water when flooded.
- The release of water through Baupie escape provided hydrological (increased temperature, electrical conductivity, total suspended solids, and a decreased dissolved oxygen concentration) and some ecological connectivity between the wetlands and the river.
- The ecological connectivity may be enhanced by modification of the Baupie escape regulatory structure.
- The subsequent natural flood event created significant ecological connectivity between the wetlands and the river for microcrustaceans, carbon and nutrients.
- During the natural flood event and associated environmental watering, water quality, particularly dissolved oxygen, did not deteriorate in the Murrumbidgee River.
- Recruitment was detected in three species of native fish (bony bream, carp-gudgeon and golden perch) in response to the Commonwealth environmental water actions and natural flooding, as well as in common carp and *Gambusia*.