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Charles Sturt University

Long Term Intervention Monitoring Project Murrumbidgee System
Selected Area Project Progress Report 12
Report period: 1 April 2017 – 30 June 2017

Piggery Lake, Lower Murrumbidgee, January 2017

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Ecological responses to Commonwealth environmental water in the Murrumbidgee system as of 30 June 2017

This quarterly report outlines the watering activities undertaken and preliminary outcomes identified during monitoring of ecosystem responses to the use of Commonwealth environmental water in the Murrumbidgee Catchment undertaken as part of the Murrumbidgee Long Term Intervention Monitoring (LTIM) Project between 1st April and 30th June 2017. Monitoring includes assessment of ecological outcomes in the Murrumbidgee River and connected wetlands through the mid-Murrumbidgee and Lowbidgee floodplain wetlands as outlined in the Murrumbidgee Monitoring and Evaluation Plan. As most monitoring activities were completed by 1 April 2017 this report presents a summary of key ecological outcomes of watering actions undertaken for the entire 2016-17 water year. More information on ecological outcomes from environmental watering actions undertaken in the Murrumbidgee can be found in the annual evaluation report which will be available to the public later in the year, for more information go to http://www.environment.gov.au/water/cewo/catchment/murrumbidgee/monitoring

Highlights for 2016- 2017

2016-17 was a wet year, with widespread natural flooding occurring throughout the Murray-Darling Basin. In the Murrumbidgee widespread rain and associated high river flows during September-November 2016 inundated all LTIM monitoring sites in the mid-Murrumbidgee, Nimmie-Caira and Redbank zones. The delivery of Commonwealth environmental water was paused at this time, recommencing in November and December 2016 after flood waters had receded. A key focus of Commonwealth environmental watering actions monitored under the LTIM program were to maintain water levels in wetlands with active waterbird colonies to support successful breeding, fledging and recruitment of waterbird species. Multiple waterbird breeding events were supported by Commonwealth environmental watering through the Lowbidgee floodplain. While in the Murrumbidgee River Commonwealth environmental flows were delivered to the Balranald reach (downstream of Maude Weir) to mitigate hypoxic blackwater conditions that developed as a result of overbank flows returning to the river.

Routine wetland monitoring activities targeting water quality, microinvertebrates, fish, turtles, frogs and tadpoles, and waterbirds were completed at the 12 Murrumbidgee LTIM wetland sites (refer Appendix 1 and 2) on four occasions September 2016, November 2016, January 2017 and March 2017. Additional funding was made available to monitor key waterbird colonies in the Nimmie-Caria and Redbank zones where waterbirds began breeding in response to natural flooding and were later supported by the delivery of environmental water. Category 1 monitoring of major ibis colonies commenced in November 2016 and was completed in mid-March 2017. Additional complementary monitoring of other active waterbird colonies in the Murrumbidgee Selected Area was done by NSW OEH and CEWO staff from October 2016-May 2017.

Monitoring of water quality, stream metabolism, primary productivity, microinvertebrates and larval fish occurred in the mid-reaches of the Murrumbidgee River between Narrandera and Carrathool between October 2016 and January 2017, with loggers measuring dissolved oxygen levels in the river deployed until the end of April 2017.

Waterbird diversity

Waterbird surveys were carried out on four occasions between September 2016 and March 2017. Overall a high (>35 species) diversity of waterbird species were recorded across the mid-Murrumbidgee, Nimmie-Caira and Redbank zones in 2016-17 compared to the two previous water years. Preliminary analysis of the 2016-17 data indicates that 53 wetland-dependent species (at least 35 breeding) were recorded in 2016-17 in the Murrumbidgee Selected Area. Total species diversity peaked during the January and March surveys across all three wetland zones. This included large numbers of dabbling ducks (e.g. Grey Teal (*Anas gracilis*) and Pink-eared Duck (*Malacorhynchus membranaceus*)) which dominated waterbird communities in the Mid-Murrumbidgee zone. Large waders and fish-eating waterbirds comprised the majority of waterbirds observed in the Nimmie-Caria and Redbank zones. There was a notable increase in the number of large waders observed in the Nimmie-Caria zone (largest in the September and November quarterly wetland surveys) compared to the previous two water years, as a result of large-scale ibis colonies establishing in this zone from October-December 2016. During the NSW OEH and CEWO waterbird breeding surveys (see below) two pairs of Pied Heron (*Egretta picata*) (Plate 1) were also observed with juveniles nesting at Steam Engine Swamp, in North Redbank. This species is typically only observed outside northern Australia during major floods. Commonwealth environmental water delivered to Kieeta Lake, in the Nimmie-Caira in March 2017 to support a large pelican colony (see below) also flooded neighbouring

habitat at Kia Lake providing feeding habitat for migratory shorebirds (listed under international migratory bird agreements JAMBA, CAMBA and ROKAMBA).

Plate 1 Pied herons, Two Bridges Swamp December 2016 (Credit D. Paris)

Waterbird breeding

Many waterbird species can only breed when very specific water conditions occur, in particular many colonial nesting species require stable water levels to be maintained under their nests and will abandon their eggs and chicks if water levels fall too quickly. While the establishment of colonies occurred naturally following natural inundation of the floodplain due to widespread rain and associated dam releases, environmental water was critical in maintaining suitable conditions that supported successful rearing and fledging of chicks.

In 2016-17 multiple Commonwealth environmental watering actions were undertaken in the Nimmie-Caria and Redbank zones (Yanga National Park and North Redbank), including actions to support Ibis colonies at Eulimbah Swamp and Telephone Creek (Nimmie-Caria), to support breeding Australian pelicans at Kieeta Lake in the Nimmie-Caria zone, and to support Ibis breeding at the Tori Lignum Swamp in North Redbank. A further 24 heron, cormorant and egret colonies were active across the Murrumbidgee Selected Area in the 2016-17 surveys. These sites were assessed where access allowed at monthly intervals by

NSW OEH and CEWO staff. The four largest egret and heron colonies were at Steam Engine (North Redbank), Two Bridges, Tarwillie (South Redbank, Yanga National Park) and Nap Nap swamp (Nimmie-Caira) which were completed by March.

Eulimbah Swamp waterbirds

Eulimbah swamp originally filled with natural flows as a result of high river levels which allowed for water to flow through the Nimmie-Caria. Ibis established nests and produced eggs during this first unmanaged water flow, however, a rapid drop of water levels occurred due to breaches in the main levee bank resulting in the abandonment of nests and significant mortality of chicks in late November 2016. Urgent earthworks were carried out to repair the levee and Commonwealth environmental water was delivered in December 2016. While these flows could not be delivered in time to prevent the initial abandonment, they were delivered in time to allow for a second breeding attempt. Following Commonwealth environmental watering, the success rate between surveys 2 (2/12/2016) and 3 (18/12/16) was much higher. Further environmental water was delivered in early February to sustain nesting of Royal Spoonbills (*Platalea regia*). OEH and CEWO staff completed a survey of Eulimbah Swamp in early March 2017 and detected small numbers of active Royal Spoonbill and Australian White Ibis (*Threskiornis moluccus*) nests with advanced young (flappers and flyers).

Tori Swamp breeding

Commonwealth Environmental water was also used to support a new ibis colony at Tori Lignum Swamp in the North Redbank system, which established in early December 2016. Flows were delivered to this site via the North Redbank channel and then a private lateral channel. This site is traditionally used as a short-term storage before draining in to Tori Lake, an irrigation storage for cotton growing (Plate 2). Management of water levels in Tori Swamp, by preventing draining of the wetland, were vital for providing breeding and feeding habitat for colonial waterbirds this season. Due to challenges in delivering environmental water to this site, the water levels were low and with little flow movement throughout the breeding period, anaerobic (low dissolved oxygen) conditions that favour naturally occurring outbreaks of avian botulism may have been exacerbated. During the final surveys in March around 1,750 juvenile straw-necked ibis, 150 juvenile royal spoonbill, 230 juvenile white ibis, and 75 juvenile glossy ibis were counted in the colony (Plate 3). The majority of juveniles were flyers, only 5% of straw-necked ibis juveniles and 10% of royal spoonbill juveniles were flappers (i.e. could not fly). At the time of the early March surveys

many juveniles were still being fed by adults but around one third of juveniles were starting to forage in shallow parts of the colony and around the perimeter of the colony. There were a moderate number of dead juvenile straw-necked ibis on clumps in the colony and dissolved oxygen readings were low but no recently deceased waterfowl were observed.

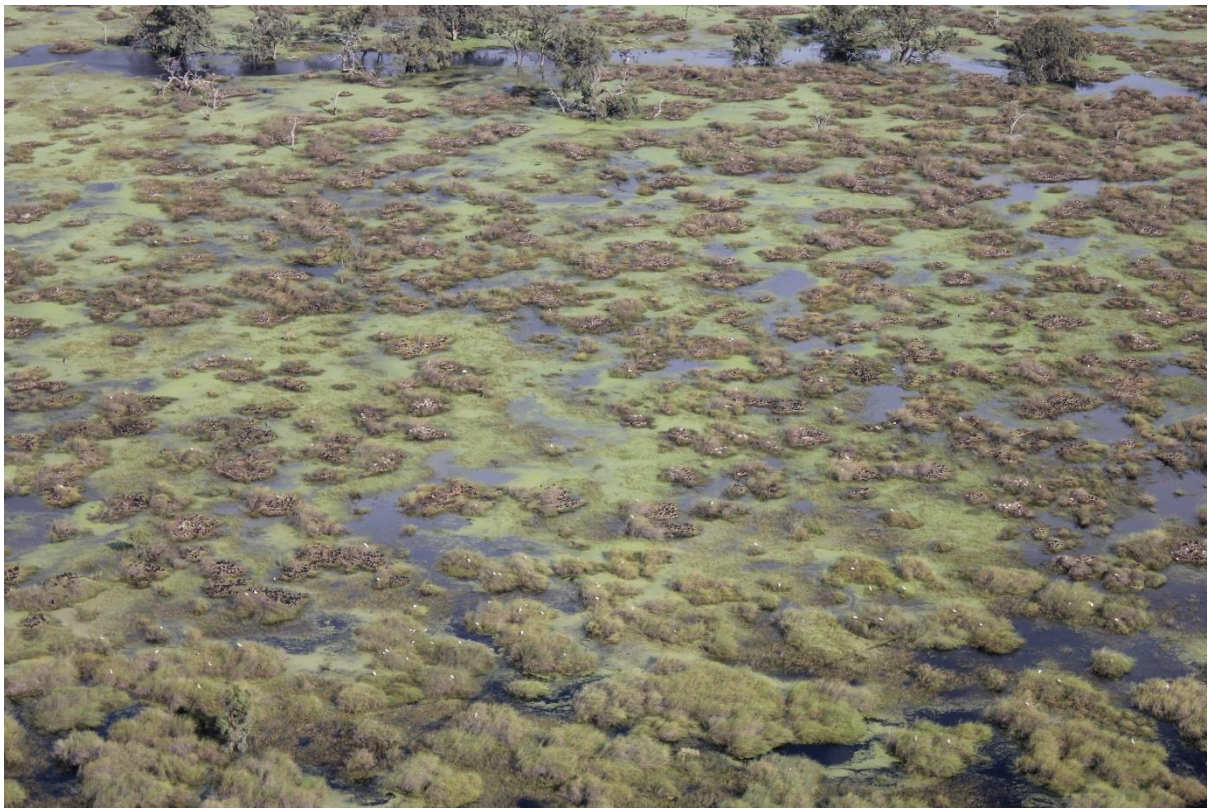

Plate 2 Straw-necked ibis, Australian white ibis, glossy ibis and royal spoonbill nests at Tori Lignum Swamp. (Photo A. Borrell, NSW NPWS).

Pelican Breeding at Is-y-Coed

A pelican breeding colony established over January 2017 at Kieeta Lake, in the Nimmie-Caira. Commonwealth environmental water was delivered to this site in February 2017 to prevent wetland drying and to ensure that water levels remained high to enable chicks to grow to fledging stage. The outcomes of this watering action were monitored by NSW OEH and CEWO staff. The watering action supported an estimated 5,000-6,000 pelican nests with most containing eggs in the February survey and juveniles were observed during the May survey (Plate 3). On the neighbouring flooded area, either side of the levee bank where the pelicans were nesting, large numbers of non-colonial waterbird species, including the NSW listed blue-billed duck or resident shorebirds were recorded feeding in the area.

Plate 3 Recently fledged Pelicans (light grey feathers on heads) with parents at the Kieeta Lake Pelican colony, 1st May 2017 (Credit: C. Amos)

Frogs and tadpoles

While the primary targets of Commonwealth environmental watering actions were waterbird breeding, all had expected secondary benefits for frogs, turtles, wetland vegetation and fish. Overall, 2016-17 was a very good year for frogs and tadpoles with six frog species recorded. Key highlights include the continuing presence of southern bell frogs at Yarradda Lagoon (Plate 4) in the mid-Murrumbidgee which has been actively been managed with Commonwealth and NSW environmental water since 2014 and has shown steady increases in the diversity (number of different species present) and abundance of frogs and tadpoles. Environmental watering of wetlands through the Nimmie-Caria zone between 2014 and 2017 have also contributed to overall increases in the number of southern bell frogs. In 2016-17 particularly high numbers of southern bell frogs were recorded at Nap Nap Swamp (100-200 individuals) which received Commonwealth environmental watering in both 2015-16 and 2016-17. Southern bell frogs also benefited from Commonwealth environmental watering at the main waterbird breeding sites Telephone Creek and Eulimbah Swamp.

Plate 4 Threatened Southern bell frog *(Litoria raniformis)* observed at Yarradda Lagoon in March 2017

Turtles

Like frogs, turtles benefited from natural inundation and Commonwealth environmental watering actions that targeted waterbirds which helped maintain suitable habitat through summer. Juvenile and adult turtles found at nine of the 12 LTIM monitoring sites. Eastern long-necked turtles *(Chelodina longicollis)* (Plate 5) were found in all sites, except for Avalon Swamp (dam), Eulimbah Swamp and Piggery Lake. Broad-shelled turtles *(Chelodina expansa)* were detected at four of the sites: Yarradda Lagoon, Waugorah Lagoon, Sunshower Lagoon and Telephone Creek. Macquarie River turtles *(Emydura macquarii)*

were the least commonly detected species, occurring at only two of the sites Yarradda Lagoon and Two Bridges Swamp. Hatchling Macquarie River turtles were also recorded at Two Bridges Swamp (Plate 3). Yarradda Lagoon has received Commonwealth environmental water over multiple years with the objective of supporting turtles and other aquatic vertebrates and now supports all three turtle species, including juveniles.

Plate 5 hatchling long-necked turtle captured in the fyke nets set at Mercedes Swamp, January 2017.

Managing dissolved oxygen in the river

A natural high flow event in the Murrumbidgee Catchment began during June 2016, with river discharge at Balranald remaining above 7,000 ML/day until mid-October. River height then peaked at 31,583ML/day on 11 November 2016, falling to 6,000 ML/day by the end of December 2016. Overbank flows in the lower Murrumbidgee River commence at approximately 9,000-10,000 ML/day. Subsequent floodplain inundation between September and December 2016 flushed large amounts of carbon and nutrients, from inundated areas that had been dry since 2012, into the Murrumbidgee River. In response to these additional carbon inputs, dissolved oxygen concentrations began falling at Redbank Weir on or around 15 September and fell below 2 mg/L by 18 October 2016. Other river sites in the Murrumbidgee also recorded low dissolved oxygen concentrations, with spot measurements <3mg/L as far upstream as Carrathool. Sites closer to Darlington Point recorded values of 3.9 and 4 mg/L. Values were within the normal range in the Narrandera

reach. It does not appear that persistent hypoxia (i.e. <2mg/L) occurred above the gauge at Maude, however values less than 4mg/L persisted for the period 7 October to 7 November 2016 at Maude.

Approximately 370,839 megalitres, made up of 150,978 ML Commonwealth environmental water, 134,861 ML NSW environmental water and 85,000 ML the Living Murray (TLM) water was delivered to the lower Murrumbidgee River between 29 October 2016 and 5 January 2017. These flows aimed to dilute the returning floodwater after the peak of the flood had passed, providing oxygenated refugia for fish that were able to migrate upstream and to bring forward the recovery of oxygenated water in the affected reach. Dissolved oxygen concentrations recovered rapidly during the recession, reaching a concentration of 4 mg/L at Balranald by 4 December 2016 and 6 mg/L by early January 2017.

Preliminary observations indicate that the watering action were successful in preventing fish mortality. No major adverse effects of hypoxia black water on native fish were recorded in the Carrathool reach and there is still a varied size structure in the Murray cod population. Although not monitored under this program, no fish kills were reported to NSW DPI fisheries downstream of Carrathool.

Appendix 1

Summary of monitoring activities undertaken between April and June 2017 as part of the Monitoring and evaluating ecological responses to Commonwealth environmental water use in the Murrumbidgee River Valley

Zone	Site name	Status as of March 2017	Water Quality	Microinvertebrates Chlorophyll A	Carbon Nutrients	Ecosystem metabolism	Larval fish	Riverine fish	Tadpoles, fish and turtles	Frogs	Waterbirds	Vegetation
mid-Murrumbidgee	Gooragool	½ full	✓	✓	✓				✓	✓	✓	✓
	Mckennas	¼ full	✓	✓	✓				✓	✓	✓	✓
	Sunshower	¼ full	✓	✓	✓				✓	✓	✓	✓
	Yarradda	½ full	✓	✓	✓				✓	✓	✓	✓
South Redbank	Mercedes	¼ full	✓	✓	✓				✓	✓	✓	✓
	Two Bridges	½ full	✓	✓	✓				✓	✓	✓	✓
	Piggery Lake	¼ full	✓	✓	✓				✓	✓	✓	✓
	Waugorah Lagoon	Channel only	✓	✓	✓				✓	✓	✓	✓
Nimmie-Caira	Nap Nap	½ full	✓	✓	✓				✓	✓	✓	✓
	Avalon	Dam-only	✓	✓	✓				✓	✓	✓	✓
	Telephone	Channel only	✓	✓	✓				✓	✓	✓	✓
	Eulimbah	¼ full	✓	✓	✓				✓	✓	✓	✓
River sites	McKennas (Carrathool zone)		Complete 31 March 2017			Apr 17	Complete 31 December 2016	Completed April 2017				
	Bringagee (Carrathool zone)											
	Yarradda (Carrathool zone)											
	Narrandera (Narrandera zone)					Apr 17						
	Euroley (Narrandera zone)											
	Dairy (Narrandera zone)											

Appendix 2

About the Murrumbidgee Long-Term Intervention Monitoring Project (LTIM Project)

The Long Term Intervention Monitoring (LTIM) Project for the Murrumbidgee River system is funded by the Commonwealth Environmental Water Holder ($3.7M 2014-2019) and is being delivered as a collaborative partnership led by Charles Sturt University (Institute for Land, Water and Society) with NSW Department of Primary Industries (Fisheries), University of NSW, NSW Office of Environment and Heritage, and Riverina Local Land Services.

The Murrumbidgee LTIM Project is designed to provide a robust framework to evaluate the ecological outcomes of Commonwealth environmental water within wetland and river systems downstream of Narrandera, NSW. Monitoring activities target multiple taxonomic groups and ecological processes with a focus on indicators of high ecological and community significance, such as large bodied native fish, waterbirds, and endangered species.

Monitoring activities within wetlands are focused on the responses of fish, frogs, tadpoles, turtles, microcrustacea (a component of the zooplankton), waterbirds, vegetation, along with the changes in water quality, carbon and nutrients associated with black water and algal bloom risks, and hydrology measured before, during and after environmental watering. The riverine component includes intensive monitoring of native fish breeding and fish community responses to environmental watering actions, along with microcrustacea, stream metabolism (stream productivity) and water quality associated with black water and algal bloom risks, and hydrology.

The Murrumbidgee LTIM Project is being undertaken across three key ecological regions within the Murrumbidgee, the mid and lower Murrumbidgee River channel and adjacent mid-Murrumbidgee wetlands between Narrandera and Hay, and the Lowbidgee floodplain downstream of Maude, that is further divided into separate monitoring "zones" representing areas with common ecological and hydrological attributes.

The framework includes 12 fixed monitoring sites across three key wetland types, oxbow lagoons of the Mid-Murrumbidgee, lignum-black box wetlands through the

Nimmie-Caira system and river red Gum-spike rush wetlands through the Redbank systems and six fixed sites across the mid and lower the Murrumbidgee River channel (Figure 1 and 2). Copies of the Murrumbidgee Monitoring and Evaluation plan are available at:
http://www.environment.gov.au/system/files/resources/bc51ee00-ac5f-4e65-910d38f23416823e/files/murrumbidgee-me-plan.pdf

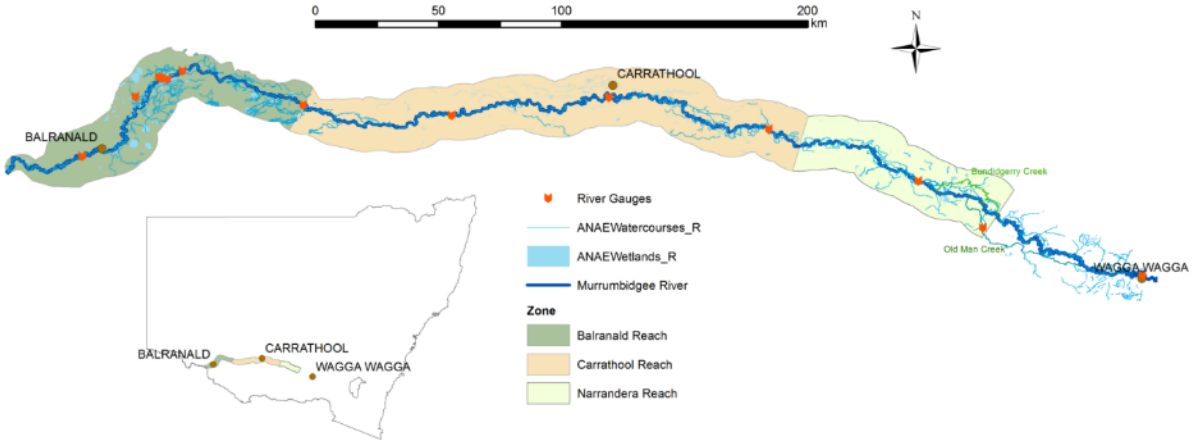

Figure 1 Distribution of riverine zones in the Murrumbidgee Selected Area.

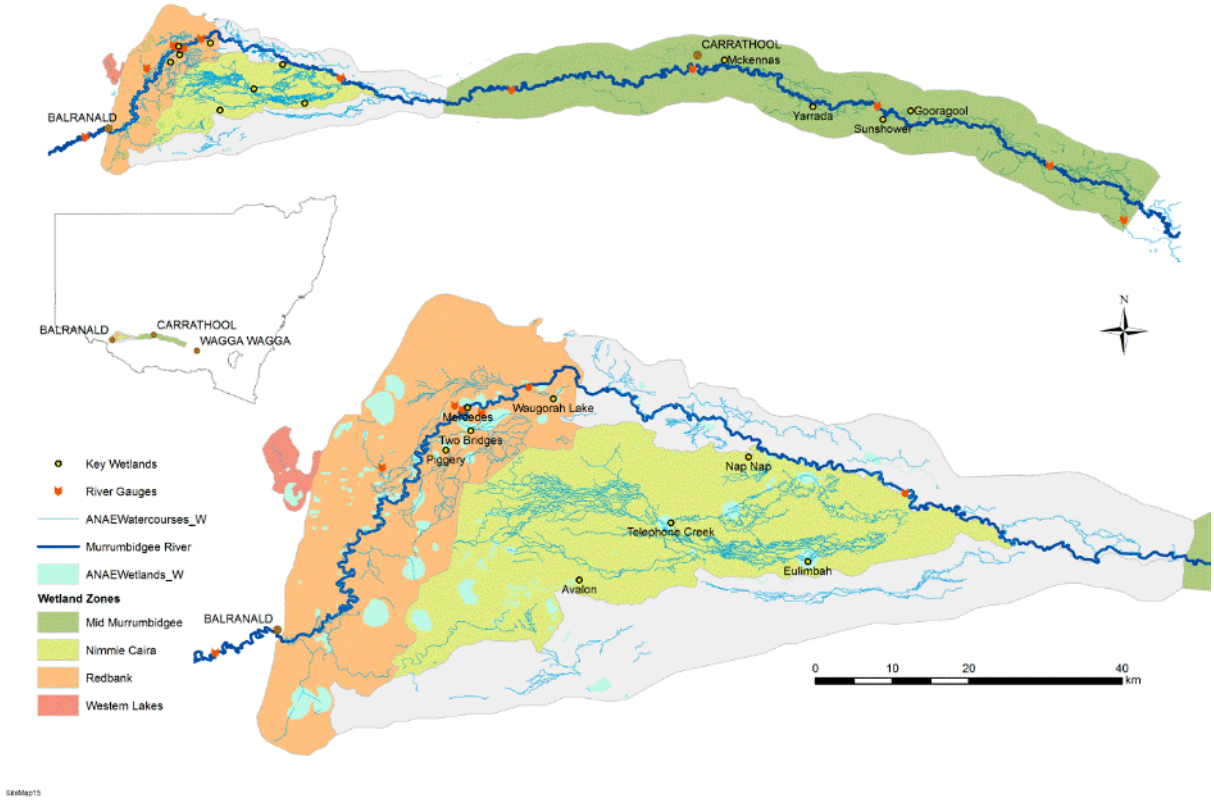

Figure 2 Distribution of wetland zones in the Murrumbidgee Selected Area and locations of key wetlands.