

# Environmental watering supports wetlands in the Murray–Darling Basin

# Classifying aquatic ecosystems in the Murray–Darling Basin

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The Commonwealth Environmental Water Office and Murray–Darling Basin Authority have jointly developed an interim classification and typology of aquatic ecosystems across Australia's Murray–Darling Basin.

## The classification project

The project was developed using the interim Australian National Aquatic Ecosystems (ANAE) Classification Framework structure shown in Figure 1. The ANAE classification framework establishes a nationally agreed, consistent and systematic method for classifying aquatic ecosystems in the Australian landscape.

The multi-jurisdictional project integrated state-based classification work and was informed by state governments and the scientific community. Over 250 000 aquatic ecosystem features and attribute data were compiled into a single database. Features were assigned across almost 100 lacustrine, palustrine, estuarine, riverine and floodplain types based on physical and ecological attributes (see example at Figure 2).

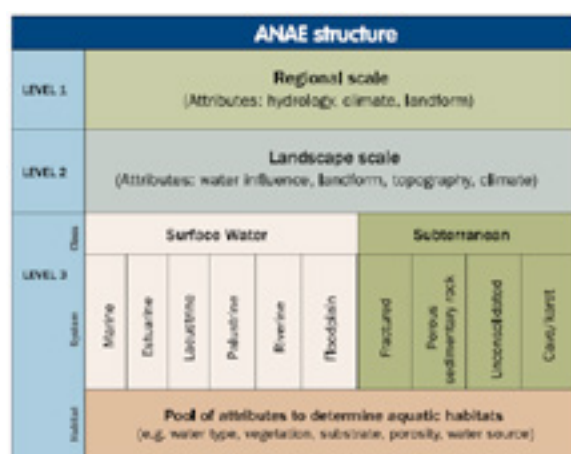


Figure 1: Structure and levels of the Interim Australian National Aquatic Ecosystems Classification Framework

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## Results

The classification project resulted in the collection and incorporation of a large range of ecosystem types into the database, including approximately:

- 8400 lacustrine (lake) features
- 37 000 palustrine (wetland) features, see Figure 3
- 157 000 riverine (stream) segments
- 33 000 floodplain units
- 37 estuarine units within the Coorong and Murray Mouth.

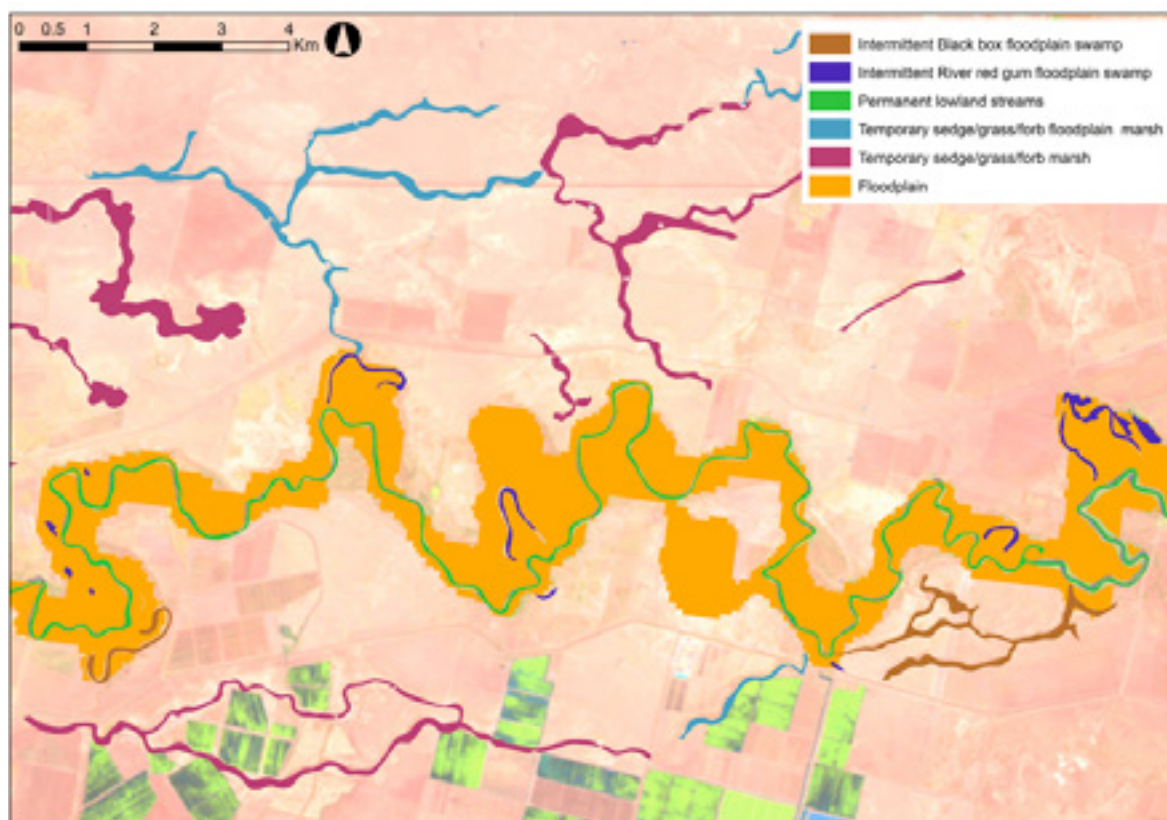


Figure 2: The Murray–Darling Basin classification across Mid-Murrumbidgee Floodplain highlights a variety of permanent, intermittent and temporary ecosystem features (© Copyright, Commonwealth Environmental Water Office)



Examples of lacustrine (Paika Lake); palustrine (Macquarie Marshes); riverine (Severn River); and estuarine (Coorong and Murray Mouth) systems (© Copyright, Australian Department of the Environment)

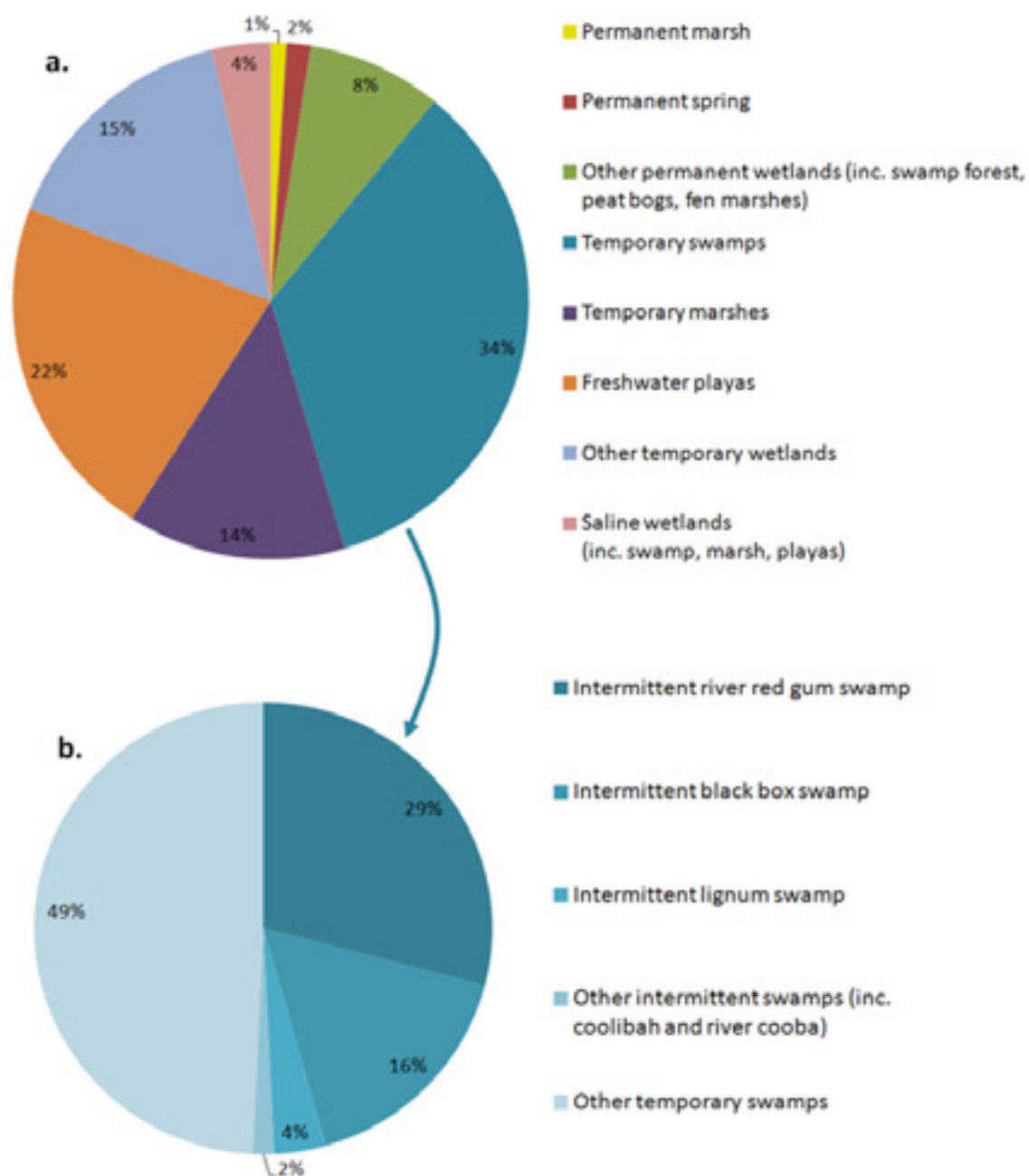


Figure 3: a) Breakdown of palustrine features and b) Further breakdown of the 'temporary swamps' subset of palustrine features (© Copyright, Commonwealth Environmental Water Office)



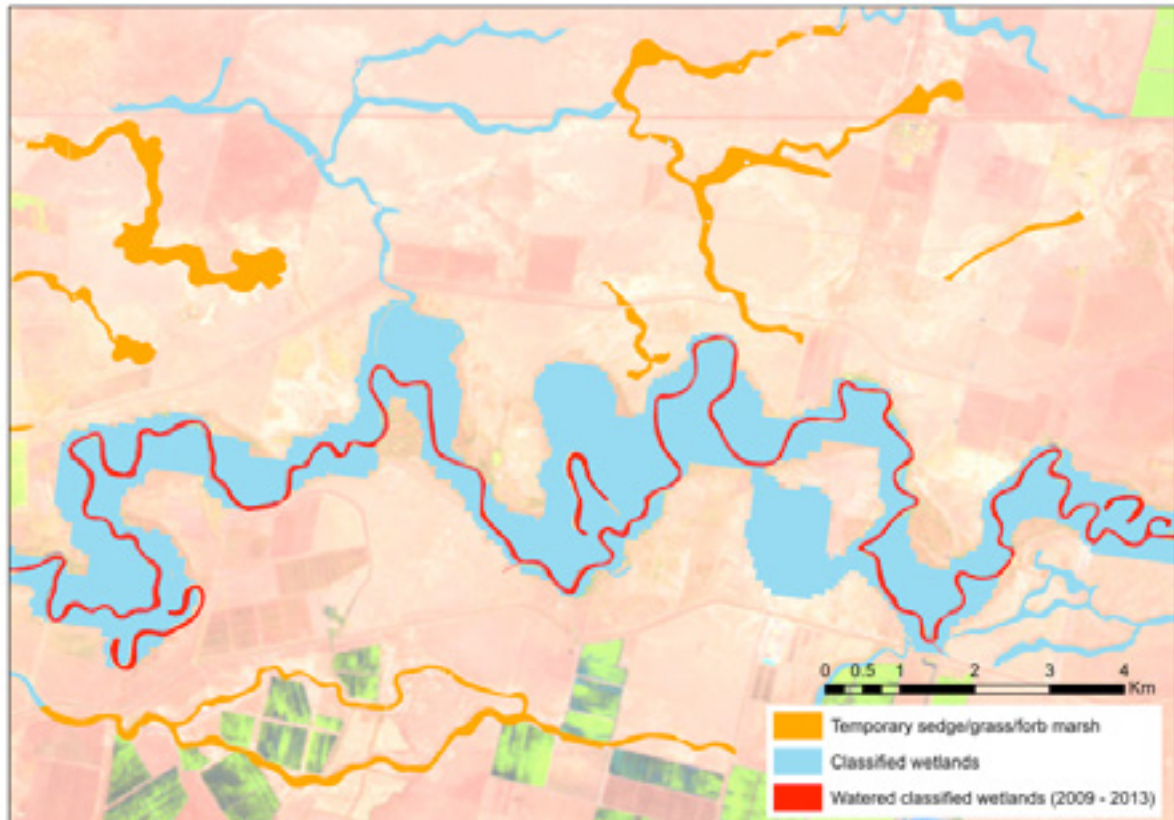
## Applying the classification to environmental water management

The classification of the ecosystem features will help to inform the implementation of the Murray–Darling Basin Plan; prioritisation of environmental watering; monitoring, evaluation and reporting activities; and adaptive management. By way of example, the classification identifies wetland types, which can be contribute to adaptive management. GIS analysis at Figure 4 shows the wetlands that have and have not received environmental water in the Mid-Murrumbidgee Floodplain (2009–2013). This type of analysis can inform future planning and delivery of environmental water.

Importantly, the classification is one of many pieces of information available to support decisions on these matters, along with operational feasibility and other considerations.

More information on the Murray–Darling Basin Aquatic Ecosystem Classification project can be found here: [www.environment.gov.au/water/cewo/publications/interim-classification-aquatic-ecosystems-mdb](http://www.environment.gov.au/water/cewo/publications/interim-classification-aquatic-ecosystems-mdb). Further details of the Interim ANAE Classification Framework can be found here: [www.environment.gov.au/resource/aquatic-ecosystems-toolkit-module-2-interim-australian-national-aquatic-ecosystem-anae](http://www.environment.gov.au/resource/aquatic-ecosystems-toolkit-module-2-interim-australian-national-aquatic-ecosystem-anae).

Questions on the classification project can be directed to Alana Wilkes ([alana.wilkes@environment.gov.au](mailto:alana.wilkes@environment.gov.au)) or Rebecca White ([rebecca.white@mdba.gov.au](mailto:rebecca.white@mdba.gov.au)).



*Figure 4: Wetlands that have and have not received environmental water in the Mid-Murrumbidgee Floodplain (2009–2013)* (© Copyright, Commonwealth Environmental Water Office).

# SMART targets guide environmental watering of the Murray–Darling Basin

Alex Meehan and Simon Godschalx, Murray–Darling Basin Authority

The Murray–Darling Basin Authority (MDBA) has identified the improvement in ecological condition it expects to see with the benefit of additional environmental water and coordinated planning for its use.



*Egrets at the Gwydir wetlands in New South Wales* (© Copyright, William Johnson)

The expected improvement is contained in the first Basin-wide environmental watering strategy. The strategy helps environmental water holders, Basin state governments and waterway managers to plan and manage environmental water at a Basin scale over the long term.

The MDBA's best assessment of how river flows and connectivity, native vegetation, waterbirds and native fish are expected to respond to environmental water over the next decade is one of the most important features of the strategy.

These environmental outcomes have been quantified so that they are Specific, Measurable, Achievable, Realistic and Time-bound (SMART). SMART environmental outcomes are an important step in improving environmental water management because they describe the future state of the Basin in a way that facilitates adaptive management and makes it easier to evaluate and report on the effectiveness of environmental watering.

With 2750 gigalitres of water being recovered to improve the health of the Basin, one of the biggest challenges for the MDBA was to understand how much improvement would be realistic over the next 10 years. To answer that question for waterbirds, the MDBA commissioned the Centre for Ecosystem Science (CES) to forecast how waterbirds may respond.

Using a combination of survey data, ecological modelling and expert opinion, the CES calculated that by the year 2024:

- waterbird abundance could increase by 20–25 per cent
- nest and broods for waterbirds could increase by 30–40 per cent
- species richness would most likely be steady.

As part of this analysis, the CES helped to identify the most important wetlands in the Basin that must be maintained in a state of good health to achieve these targets. These wetlands will be the focus of a new waterbird monitoring program.

The hallmark of a good monitoring program is one where the information generated can be used to evaluate how effective a policy or intervention has been. To that end, the MDBA has designed its ecosystem monitoring program to evaluate the effect of environmental water on improving rivers flow and connectivity, vegetation extent and condition, waterbirds and native fish.

To track the condition of waterbirds, the MDBA will invest in a major project over the next four years to undertake new and augmented aerial surveillance of the most important wetlands across the Basin for waterbirds along with the remaining Ramsar sites in the Basin. This will support the Australian Government in reporting on its international treaty obligations.

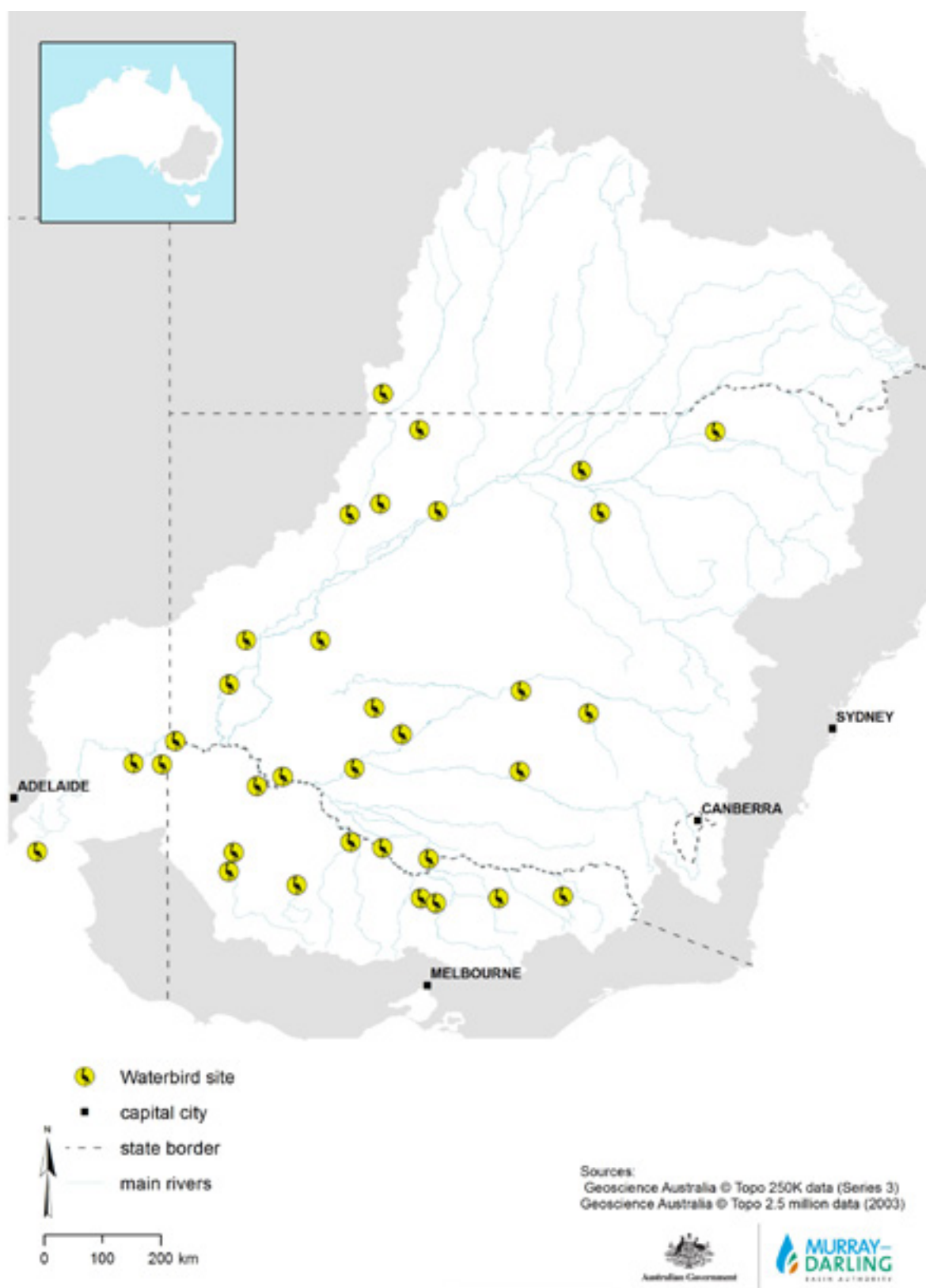
The survey will measure waterbird abundance, breeding abundance and species richness every year and will be supplemented by complementary asset scale monitoring and evaluations. Information collected will enable the MDBA to evaluate whether the environmental outcomes have been achieved, and how the condition of the Basin has changed because of environmental watering. The MDBA plans to make the data available online to interested stakeholders.

For further information, see the following references:

Murray–Darling Basin Authority 2014. Basin-wide environmental watering strategy. Murray–Darling Basin Authority for and on behalf of the Commonwealth of Australia. 89pp.  
[www.mdba.gov.au/what-we-do/environmental-water/basin-watering-strategy](http://www.mdba.gov.au/what-we-do/environmental-water/basin-watering-strategy)

Bino G, R.T. Kingsford, K. Brandis, and J. Porter 2014. Setting waterbird objectives and priorities for the Basin-wide environmental watering strategy. Centre for Ecosystem Science, University of New South Wales. Report to the Murray–Darling Basin Authority. 152pp.

Murray–Darling Basin Authority 2014. Murray–Darling Basin water reforms: Framework for evaluating progress. Murray–Darling Basin Authority for and on behalf of the Commonwealth of Australia. 29pp.  
[www.mdba.gov.au/what-we-do/mon-eval-reporting/bp-evaluation-framework](http://www.mdba.gov.au/what-we-do/mon-eval-reporting/bp-evaluation-framework)



*Significant sites for waterbirds in the Murray–Darling Basin* (© Copyright, Murray–Darling Basin Authority)



# Follow that sound — it's the southern bell frog!

New South Wales Office of Environment and Heritage

## Environmental flows have triggered the return of an endangered amphibian to the Lower Lachlan River in south-west New South Wales.

The southern bell frog (*Litoria raniformis*) had not been seen or heard in the Lachlan catchment for more than 30 years until major floods in 2012 led to the recording of an individual in Lake Bullogal. The lake had been dry for more than 20 years and it is thought the frogs survived unnoticed in nearby farm dams and billabongs.

In an effort to consolidate the positive effects of the 2012 floods, an environmental flow of 90 000 megalitres was released into the Lower Lachlan River over the winter of 2013. As a result of this flow, the frogs were heard calling soon after from a billabong at 'The Ville', a property 5 kilometres from Corrong, on the Lower Lachlan River. While not seen, researchers were able to record the distinctive call, confirming that the frog had returned. The remarkable response has reinforced the position that careful and well-planned use of environmental water can assist the recovery of this endangered amphibian.

The New South Wales Office of Environment and Heritage (OEH), which manages these environmental flows, has funded researchers from Charles Sturt University to undertake surveys to establish the responses of frogs to the flows. Further monitoring and event-based surveys are also planned. OEH staff are also on the lookout for southern bell frogs in other areas of the catchment using audio recording equipment to capture their calls.

It is hoped that further environmental flows may encourage existing populations to recover and repopulate the catchment. The Lachlan community continues to play an important role in the recovery of the southern bell frog. Landholders are in an ideal position to provide valuable intelligence on the presence of the southern bell frog on their properties, and OEH staff are keen to hear from anyone who thinks they may have southern bell frogs on their land.

For more information about NSW Office of Environment and Heritage environmental watering please visit: [www.environment.nsw.gov.au/environmentalwater](http://www.environment.nsw.gov.au/environmentalwater).



*Early results of environmental watering in the Lachlan catchment of New South Wales show encouraging signs for the recovery of the southern bell frog (Litoria raniformis)*

(© Copyright, New South Wales Office of Environment and Heritage)

# Mallee Wetlands: A rehabilitation program in the making

Commonwealth Environmental Water Holder, Victorian Environmental Water Holder and the Mallee Catchment Management Authority

## An environmental watering program aims to support the rehabilitation of floodplain wetlands along the River Murray.

The watering program, being organised by the Mallee Catchment Management Authority (CMA) in partnership with the Commonwealth Environmental Water Holder and the Victorian Environmental Water Holder (VEWH), will complement other natural resource management activities within the Mallee region in Victoria. The expected outcomes of the program include:

- improved condition and maintenance of native floodplain and wetland vegetation
- improved diversity and condition of frog and waterbird populations through maintenance of suitable aquatic habitat
- managed transport and export of salt from the River Murray system to the Southern Ocean.

The watering program aims to support the long term recovery of the endangered Murray hardyhead (*Craterocephalus fluviatilis*), a unique freshwater fish that flourishes in moderately saline waters.

An environmental watering program has been undertaken at two wetlands in the Mallee region, Cardross Lakes and Lake Koorlong, for over ten years to maintain stable Murray hardyhead populations. The long-term aim of the rehabilitation program for the floodplain wetlands, which are ecologically important as they contain remnants of the River Murray floodplain natural character and attributes, is to provide appropriate habitat to support translocated

populations of Murray hardyhead. Translocation has started at Brickworks Billabong, in an attempt to establish self-sustaining populations and build further resilience of this species in the region.

The success of the translocation of Murray hardyhead into new wetland sites hinges on adaptive management to maintain suitable habitat conditions and on providing either the necessary dilution flows or reducing rates of discharge from wetlands to maintain river salinities below target thresholds. Preliminary monitoring suggests that Brickworks Billabong is suitable for Murray hardyhead, and that Psyche Lagoon may provide a suitable translocation site within 12–18 months. In addition to water quality monitoring at the Murray hardyhead sites and downstream in the River Murray, preliminary fish monitoring indicates that Murray hardyhead continue to survive in Lake Koorlong, with annual recruitment occurring.

Photopoint locations have been established to show riparian response before and after watering. At the end of the 2013–14 water year, many sites had only just finished receiving environmental water, and as such, it is too early to see a definitive response in vegetation condition. However, observations have indicated high visitation by waterbirds including ducks, pelicans and cormorants, which have been sighted at Brickworks Billabong, Woorlong Wetland, Karadoc Swamp and Bullock Swamp following inundation.



*Psyche Lagoon, Victoria, prior to (above) and during (below) environmental watering. Psyche Lagoon is a possible site for the translocation of Murray hardyhead (*Craterocephalus fluviatilis*)* (© Copyright, Mallee Catchment Management Authority)

The environmental watering program is managed by the Mallee CMA in line with the VEWL Seasonal watering Plan 2014–15. Up to 27 000 megalitres of Commonwealth environmental water has been made available to support the watering program at these wetlands over a three-year period (out to 2015–16), which will be delivered in conjunction with water made available by the VEWL.

If you would like to know more about environmental watering in the Victorian Mallee region, please contact the Mallee CMA on 03 5051 4377 or visit [www.malleecma.vic.gov.au](http://www.malleecma.vic.gov.au).



# Black Box floodplains bouncing back in New South Wales

New South Wales Office of Environment and Heritage

Black Box floodplains are bouncing back to health thanks to environmental watering at Bottle Bend Reserve near Mildura.



*Black swans (Cygnus atratus) at Bottle Bend Reserve near Mildura in New South Wales* (© Copyright, Sashca Healy)

The NSW Office of Environment and Heritage (OEH) has overseen two watering events targeting a 423 hectare area within the 1700 hectare reserve.

In 2012–13, 1650 megalitres of environmental water was delivered to the site followed by a further 2000 megalitres in 2013–14. The flows were timed to provide the black box (*Eucalyptus largiflorens*) with water during periods of most active growth and to minimise disruption to reserve visitors. The site became the largest area of black box dominated floodplain to be targeted by environmental water in NSW.

For almost two decades prior to environmental watering, the floodplain had not received any natural flooding. As a result, the ecosystem was showing signs of severe stress.

Despite this extended dry spell, the vegetation response to successive years of watering has been positive. Black box have set seed and seedlings have grown. Wetland plants including nardoo (*Marsilea angustifolia*), water ribbon (*Cynogeton procerum*) and spike rush (*Eleocharis spp.*) have responded well to the watering which has provided an opportunity for plants to recruit and reset the seed bank.



Environmental flows have improved the condition of scar trees in the reserve and benefited native ground-layer species, many of which are thought to be traditional food and medicine plants. Environmental water has attracted numerous birds including hundreds of ducks, black swans (*Cygnus atratus*), spoonbills, herons and egrets along with confirmed sightings of the threatened hooded robin (*Melanodryas cucullata*).

Monitoring has shown the presence of at least five species of frogs as well as numerous aquatic insects including *Cladocerans*, *Daphnids* and shield shrimp (*Lepidurus apus*). The OEH has incorporated soil moisture mapping into its monitoring program. This will provide water managers with more detail on the effects of environmental watering on the soil profile and vegetation root zones.

As well as plant and animals responses, the watering event at Bottle Bend Reserve has provided an opportunity for members of the Barkindji Maraura Elders Environment Team (BMEET) to assist OEH with ecological monitoring and conduct cultural heritage surveys on the reserve.

BMEET participants accompanied OEH staff as they revisited a number of known heritage sites documented more than 20 years ago. Several additional significant features including canoe trees, burial sites and fireplaces were identified.

Environmental and cultural outcomes continue to be a priority for the OEH. Working closely with the land manager, in this case Crown Lands, OEH hopes to continue providing similar opportunities within the community over the coming years.

For more information about NSW Office of Environment and Heritage environmental watering please visit:  
[www.environment.nsw.gov.au/  
environmentalwater](http://www.environment.nsw.gov.au/environmentalwater).

# Research to support environmental watering: a collaborative approach in the Murray–Darling Basin

The Murray–Darling Freshwater Research Centre

The Murray–Darling Basin Environmental Water Knowledge and Research Project (MDB EWKR) will support the evolving needs of environmental water managers in the Murray–Darling Basin.

The knowledge generated by this \$10 million project will support the environmental and adaptive management objectives of the Basin Plan. The project commenced in 2014 with a scoping and planning phase to engage water managers and researchers in an analysis of environmental water knowledge and research needs. This phase will identify research priorities and establish a work plan for five years of investigations.

Phase two of the project will be on-ground investigations conducted by a range of collaborating teams, commencing mid-2015. Through a range of partnerships between government agencies and research institutions, this research will generate new knowledge about the complex response of aquatic ecosystems to changes in flows across a range of spatial and temporal scales in the Basin. Phase 2 research seeks to:

- improve identification, assessment and understanding of the links between ecological responses to watering regimes (e.g. natural and/or managed events) and incremental changes in ecological condition
- investigate medium- and long-term changes in ecological condition, including the effects of threats (hydrological, aquatic and terrestrial) which may reduce or prevent the ecological improvement expected.

The research outcomes are expected to make a significant contribution to the ability to assess and understand incremental changes in ecological condition in the medium- to long-term, within the context of multiple management interventions, stressors and pressures

The Murray–Darling Basin Environmental Water Knowledge and Research Project is supported through funding from the Australian Government and co-ordinated by the Murray–Darling Freshwater Research Centre (MDFRC). For updates and information about MDB EWKR, visit the dedicated section on the MDFRC website at [www.mdfrc.org.au/projects/ewkr](http://www.mdfrc.org.au/projects/ewkr).