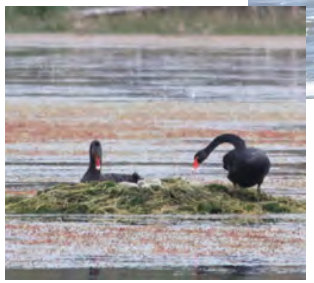

South Australia's River Murray Environmental Watering Program

2009—2010

Government of South Australia

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Egret, Lake Woolpolool

Summary

During the 2009-10 water year, Government agencies, community organisations and landholders worked together to support the River and its floodplain during the extended drought by facilitating the delivery of water to the environment. For much of the floodplain it was well over a decade without inundation. The dry conditions caused widespread problems such as salinisation, exposure of acid-sulfate soils, the potential loss of water-dependent seed and egg banks, and the decline in health or death of long-lived vegetation such as River Red Gums and Black Box.

Efforts to preserve species and habitat through environmental watering are being rewarded.

Environmental water plays a vital role in supporting the future health of South Australia's River Murray floodplains and wetlands, allowing recolonisation and reestablishment of species and ecosystem function as conditions improve.

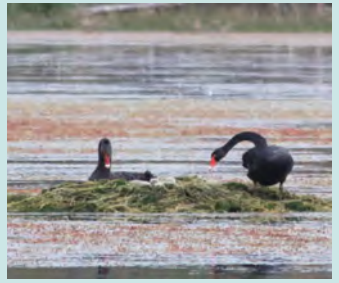
Thirty five wetland sites along the River Murray in South Australia (SA) received 534 900 million litres or megalitres (ML) of environmental water during the 2009-10 water year. Over 90% of this water was allocated to Lakes Alexandrina and Albert, with the remaining delivered to 33 wetlands located along the length of the River. The main purpose of providing environmental water to these priority sites was to restore and protect key refuge sites for plants and animals during the ongoing drought. This report presents a summary of the wetlands watered and the ecological benefits of environmental watering.

Environmental water was sought by SA from a variety of sources: The Living Murray initiative (TLM—52 835 ML), Commonwealth Environmental Water Holder (CEWH—28 923 ML) and donations from non-government organisations (NGOs—47 ML). Further environmental water was allocated through the SA Environmental Water Reserves (248 000 ML), increases in state water allocations (26 000 ML), inflows from the Darling River (170 000 ML), the SA River Murray Drought Water Allocation Decision Framework (9 000 ML) and Environmental Land Management Allocations (ELMA—95 ML).

The allocation, delivery and management of environmental watering were overseen by the River Murray Environmental Water Management team in the Department of Water, Land and Biodiversity Conservation (DWLBC, now the Department for Water). The delivery of water and monitoring programs undertaken at the various sites occurred under the management of teams from the South Australian Murray Darling Basin Natural Resources Management Board (SA MDB NRM Board), Department for Environment and Heritage (DEH, now Department of Environment and Natural Resources - DENR), DWLBC, South Australian Research and Development Institute (SARDI) and local community groups.

Efforts to preserve species and habitat through environmental watering over the past few years are being rewarded. An improvement in condition is seeing the natural reconnection of the floodplain and wetlands to the main River channel.

The watering program will be adapted with the changing River conditions to continue to deliver water to achieve the best possible environmental outcomes for the community.



Contents

Photo Callie Nickolai

The 2009-10 Environmental Watering Program targeted restoration and protection of key refuge sites

1. Introduction

During 2009-10, the Murray-Darling Basin continued to suffer the effects of the prolonged drought. Flows into SA remained at levels which were dramatically lower than the long term average with very limited water available for the environment. To address the impacts of the low flow conditions, 35 River Murray sites in South Australia benefited from the 2009-10 environmental watering program, which targeted the restoration and protection of key refuge sites for plants and animals.

This report outlines the environmental watering program undertaken by the South Australian Government in the South Australian Murray-Darling Basin in 2009-10, including the sites and volumes of water delivered. Several priority sites are featured in greater detail as an indication of the types of wetlands and ecological benefits that have been achieved through this program.

... the drought had pushed the resilience of many systems to the limit.

Why are we watering wetlands?

Over recent years Australia has experienced the worst drought since records began in the 1880s. The River Murray system continued to experience dry conditions during 2009-10 resulting in ongoing below-average levels of inflow and water allocation, and subsequent dramatic impacts on the health of the River system with stands of dying River Red Gums and loss of other vegetation an all too common sight. While wetlands can benefit from drying out for short periods of time and have ways of coping with limited water, the drought had pushed the resilience of many systems to the limit.

To ease the stress caused by extended low River flows during the drought, a selection of wetlands along the River Murray received environmental water. Environmental water is used specifically to maintain the health of river, wetland and estuarine ecosystems. By watering, drought refuges are created for plant and animal communities including a number of threatened species. When flows in the River Murray increase and floods return, those ecosystems that have received water are more likely to respond.

Environmental water prioritisation was based on the following principles:

- Sustain small, critical refuge areas for native plants and animals
- Maintain critical connectivity between sites
- Protect previous investments in environmental watering.

The following criteria were also applied to identify priority sites:

- Criticality (consequence of not acting)
- Environmental benefit (objectives for watering each site)
- Opportunity (capacity to take advantage of other events).

Photo Callie Nickolai

Nesting black swans with cygnets

Some improvements in inflows during 2009-10 enabled an increase in allocations of environmental water for use at priority sites, but the focus remained on the prevention of irreversible environmental damage and provision of refuges to prevent critical loss of threatened species.

The delivery of environmental water to Lakes Alexandrina and Albert to ensure the prevention of large scale acidification was a priority for SA in the use of environmental water.

Monitoring confirmed the importance of repeated watering during extended low flow periods.

Environmental watering in 2009-10

Each wetland watered in 2009-10 was monitored before and after the watering took place. Fish, birds, frogs, vegetation, groundwater and surface water were measured. Numerous species listed under State and Commonwealth legislation as rare, threatened, vulnerable and endangered have benefited from the environmental watering at priority sites.

Environmental water allocations were more than 15 times greater in 2009-10 than in the previous year, which represents an increase of approximately half a million megalitres (500 812 ML). The increase in environmental water availability was due to improving conditions in the Murray-Darling Basin.

A similar number of sites were watered — 35 in 2009-10 compared to 47 in 2008 -09. Of the total volume allocated, 91% (or 486 300ML) went to two key sites – Lakes Alexandrina and Albert. The remaining 9% was delivered to 33 sites located between the border and Murray Mouth. Of these, 15 had received environmental water allocations in the previous year.

Why do we re-water the same sites?

A lot has been learnt from the extensive monitoring undertaken since the environmental watering programs started in SA with the River Red Gum Rescue program in 2005. Monitoring has confirmed the importance of repeated watering of sites during these extended low flow periods to consolidate and improve on the benefits achieved through previous watering events.

It is only through repeat watering of key sites that the health of long-lived vegetation and ongoing survival of animals that depend on these systems can be assured.

Photo Ed Wilby

Delivery of water to Lakes Albert and Alexandrina was a priority in SA

Where has the water come from?

Water for the environment has come from various sources and has been specifically allocated to the environment. Just over half of the total volume of environmental water used (53%) came from State allocations and almost one third (32%) from Darling inflows. The remaining volume was sourced through Commonwealth and inter-jurisdictional initiatives, with 10% from TLM and 5% from the CEWH (see table at start of each river section for more information).

The Living Murray (TLM)

TLM is a partnership of the Australian, New South Wales, Victorian, SA and Australian Capital Territory governments. The TLM 'first step' decision was committed to recovering 500 GL of water to achieve ecological benefits at six icon sites. Three of these sites are partially or wholly located within SA – Chowilla Floodplain and Lindsay-Wallpolla Islands; the River Murray Channel; and Lower Lakes, Coorong and Murray Mouth. Only wetlands and water bodies located within an icon site are eligible to receive TLM water.

Commonwealth Environmental Water Holder (CEWH)

The Commonwealth Government is acquiring water for the environment as part of the *Water for the Future* initiative. The CEWH was established under the *Water Act 2007* to manage these water entitlements to protect and restore environmental assets.

State allocations

Environmental water allocations within SA came from a variety of sources and are described within the SA River Murray Prescribed Water Course Water Allocation Plan 2002 and the SA River Murray Drought Water Allocation Decision Framework.

When was the water delivered?

Early announcements by the MDBA allowed spring watering of 11 sites with water from TLM. Spring is considered the optimal time to undertake environmental watering as it is the main growing and breeding season for wetland flora and fauna. Water delivery at other times is still beneficial particularly considering the stressed condition of the sites.

The outcomes of environmental watering are not always immediately evident. While changes in water levels and chemistry can be directly measured, it is often weeks or months before responses are detected through long-term monitoring programs. Ecological outcomes, particularly improvements in tree health, may not become fully apparent until at least one year after watering.

Ecological outcomes may not become fully apparent until at least one year after watering.

Photo Grant Whiteman

Black Winged Stilt

SA River Murray Environmental Watering Sites for 2009-10

Watering Sites 2009-10

Wetlands

River

2. Chowilla floodplain

On the Chowilla floodplain 26 sites have been watered in the period since 2004. Most sites have received water two or three times in that period. Follow-up environmental watering through 2009-10 played an important role in ensuring the health of key wetland areas was maintained, providing refuges for key plant and animal species.

The importance of repeat watering has been reinforced on Chowilla.

The Chowilla floodplain is the largest area of remaining riverine woodland on the lower River Murray in SA and forms part of one of six Living Murray Icon Sites. River Red Gums, Black Box woodland, River Coobas and Lignum provide habitat for birds, mammals and invertebrates. Wetlands on the floodplain are home to threatened species such as the Southern Bell Frog, Australian Shoveler, Freckled Duck, Musk Duck, Intermediate Egret and Glossy Ibis. In 2009-10, the lower Murray was still experiencing reduced river flows and less frequent inundation of the floodplain and Chowilla's wetlands were continuing to suffer and required further watering.

The importance of repeat watering has been reinforced by results of the extensive monitoring program on Chowilla. It has shown that where watering has occurred on three occasions, the number of healthy trees has remained stable, while at sites that have been watered only once or twice, the decline in tree health has continued.

Work commenced during 2010 on the construction of an environmental regulator on Chowilla Creek. This major infrastructure project is being built as part of the MDBA's Living Murray Environmental Works and Measures Program and will enable water levels in the Chowilla Creek to be raised under relatively low flow conditions, inundating floodplain that would otherwise only receive water under much higher river flows. The operation of the regulator will enable inundation across 35 to 50 percent of the floodplain including large areas that are unable to be flooded through the environmental watering program alone. The environmental watering

Photo Erin Lenon

River Red Gums respond to watering at Coppermine

program plays an important role in ensuring refuge sites are maintained which will support the wider recovery of floodplain species in the future, through natural flooding events and operation of the environmental regulator.

The environmental watering program will continue to play an important role at Chowilla in conjunction with the operation of the regulator. Together, these initiatives will ensure that the health of this iconic floodplain is maintained through the extended periods of low flows that are projected under climate change scenarios.

Of the nine wetlands watered on the Chowilla floodplain in 2009-10, Lake Limbra and Coppermine Complex are featured in further detail in this report.

Chowilla watering sites

Wetland	Total Volume (ML)	Source of Environmental Water and Volume (ML)	
		TLM	CEWH
Pilby Lagoon	215	215	
Werta Wert	711	711	
Twin Creeks	124	124	
Punkah Creek	50	50	
Lake Littra	999	999	
Monoman Island Horseshoe	152	152	
Coppermine	1 999	1 999	
Coombool Swamp	3 144		3 144
Lake Limbra	4 204		4 204

Photo Erin Lenon

Photo Mark Schultz

Photo Erin Lenon

From top: Pilby Lagoon, Lake Littra, Werta Wert

Lake Limbra

Lake Limbra is a large terminal wetland north of the Chowilla anabranch system. The last time Lake Limbra received water was in 2000 when natural flooding resulted in partial inundation of the wetland. The site is ringed by mature stands of Black Box trees. The inlet channel, Hancock Creek, is fringed by Black Box, Lignum and flood-dependent understory vegetation.

Watering overview

Volume of water used	Source of water	Start of watering	End of watering	Watering method
4 204 ML	CEWH	May 2009	June 2009	Pumped

Watering Lake Limbra in 2009-10 was the first step in the long term recovery of this site.

Black Box woodlands at this site are an important ecological asset as they include many large mature trees with well developed hollows that provide refuge, areas for breeding and crevices for birds, lizards and small mammals.

Why water Lake Limbra?

Watering Lake Limbra was necessary to attempt to slow the decline of important Black Box populations which had begun to decline since the last overbank river flows in 2000. The aims of watering were to help restore the flood-dependent nature of the understorey vegetation, and to freshen the groundwater and soil profile to further improve conditions for plants. It was also envisaged that watering would benefit the varied habitat along Hancock Creek, which provides excellent habitat for birds including waterfowl, waders and colonial nesters.

Watering Lake Limbra in 2009-10 was the first step in the long term recovery of this site. It is anticipated that multiple watering of Lake Limbra is required to achieve the full benefits. The lake will benefit from regular inundation once the Chowilla Creek environmental regulator is operational.

Ecological outcomes

Surveys have revealed significant use of Lake Limbra by waterbirds since watering commenced. Initial sightings included hundreds of Black Swans and Australian Shelduck and notable species such as Yellow-billed Spoonbills, White-faced Heron, Straw-necked Ibis and Blacked Winged Stilts.

Twenty species of waterbird have been recorded using Lake Limbra since March 2010 and the March survey recorded the largest number of individuals (292). Several uncommon species, such as Royal Spoonbills, have been observed. Intermediate Egret (listed as rare in SA) and Caspian Tern (listed under the China Annual Migrating Birds Agreement) have also been observed.

Photo Erin Lenon

Lake Limbra

Coppermine Complex

Another watering was required to consolidate the benefits of previous watering events.

Watering overview

Volume of water used	Source of water	Start of watering	End of watering	Watering method
1 999 ML	TLM	Nov 2009	Nov 2009	Pumped

Coppermine Complex is a large floodplain complex incorporating the Coppermine Waterhole – a large temporary wetland on the Chowilla floodplain. Mature and regenerating River Red Gums fringe the wetland while the surrounding floodplain of the complex has areas of dense Lignum understorey, Black Box and Acacia woodlands, and open floodplain areas. When flooded, Coppermine supports a range of aquatic vegetation and frogs and provides refuge for a number of species of waterbirds.

Coppermine Waterhole was previously watered in February 2005, October 2006 and November/December 2008. The entire Coppermine Complex was watered once before, in 2006.

The Coppermine Waterhole is a valuable drought refuge. Once inundated, it holds water for a long time. Waterbirds in significant numbers (1 000 to 2 000 birds) have been recorded using the site at times. It provides breeding habitat for frogs, including the Southern Bell Frog. The Southern Bell Frog is a nationally listed species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Why water Coppermine Complex?

Previous environmental watering events undertaken at Coppermine Waterhole were aimed at restoring the health of Lignum and River Red Gums and providing drought refuge. The last watering event of the wetland in 2008 generated a positive response from the surrounding River Red Gums with increased canopy growth and new shoots on woody sections of the trees. It provided important refuge for 20 species of waterbird, including the SA-listed Australian Shoveler, and seven frog species. Another watering was required to consolidate the benefits of previous watering events.

Photo Erin Lenon

Coppermine Complex

The primary aims of watering the entire Coppermine Complex were to:

- maintain high value wetlands
- maintain current area of River Red Gum and at least 20% of the original area of Black Box vegetation
- provide breeding opportunities for the Southern Bell Frog, and the NSW-listed Long-thumbed Frog
- provide breeding opportunities and refuge for waterbirds including State-listed species.

Ecological outcomes

The inundation of Coppermine Complex saw large numbers of waterbirds move into the wetland: 29 species of wetland birds were recorded at the waterhole, including two species of conservation significance within SA (Freckled Duck and Musk Duck). Two species were observed to be breeding within the wetland with eight Australian Grebe nests recorded and one clutch of Grey Teal.

Frog night-call surveys recorded six species of frog.

The understorey vegetation across the Coppermine floodplain responded very strongly. Upon drying, several flood dependent species which are not commonly found in Chowilla were observed including one species which has not been recorded at surveyed locations in Chowilla since 1989 (*Cyperus difformis* or Rice Sedge).

Importantly, the vegetation responding at Coppermine was heavily dominated by native species with only a low number of exotic species recorded.

Photos Lara Suitor

Wetland birds recorded at Coppermine include the Egret (top) and Ibis (bottom).

3. From Chowilla to Lock 1

Between the Chowilla floodplain and Lock 1, 17 wetlands were watered in 2009-10. These included eight wetlands with existing flow control structures that can be connected to the River at pool level and filled via gravity. Water was also delivered via pumping to nine temporary wetlands located higher up on the floodplain.

Watering these wetlands in 2009-10 has been crucial

... supporting their important role as islands of life along a River that continued to be under enormous stress.

A number of these wetlands had previously received water through the River Red Gum Rescue project undertaken in 2005-06 to address the large-scale decline of River Red Gum populations due to lack of water. This project had significant positive outcomes including new growth on mature trees and establishment of seedlings.

Monitoring during 2009 found that the trees were under stress as there had been no flood events since the project was undertaken. Priority sites to receive water were identified based on the likely benefit to mature and sapling River Red Gums.

The diverse range of wetlands along the River play a variety of important roles during the drought, acting as refuge sites for birds, mammals, invertebrates, reptiles and fish. With the ongoing lack of flooding flows in the River, many of the wetlands were disconnected from fresh River water inflows.

Watering these wetlands in 2009-10 was part of an ongoing program and has been crucial in maintaining their health, especially through the prolonged drought, and supporting their important role as islands of life along a River that continued to be under enormous stress.

Three of the 17 sites along this stretch of the River Murray that received water in 2009-10 are featured in further detail in this report: Lake Merretti, Schillers Lagoon and Overland Corner.

Photo Grant Whiteman

Ibis at Lake Merreti

Chowilla to Lock 1 watering sites

Wetland	Total Volume (ML)	Source of Environmental Water and Volume (ML)		
		CEWH	SA River Murray Drought Water Allocation Decision Framework	SA Environmental Water Reserves 2009-10 & 2010-11
Weila	220	220		
Lake Merreti	3 397		3 397	
Lake Woolpolool	1 400		1 400	
Winding Creek	126		126	
Little Duck Lagoon	22		22	
Katarapko Creek Wetland	20	20		
Inner Mundic Floodrunner	8		8	
Mussel Lagoon Complex	1 733		1 733	
Overland Corner	497	200	297	
Beldora	186		186	
Akuna Station	80		80	
Schillers Lagoon	1 359		1 359	
Hogwash Bend	14		14	
Morgan Conservation Park - managed - unmanaged	 250 319	 319	 250 	
Wigley Reach	248	248		
Molo Flat	327	327		
Lake Bonney	26 000			26 000

Photos Grant Whiteman

Birdlife, Lake Woolpolool
From top: Red-capped Plover; Egret; Australian White Ibis

Lake Merreti

Watering overview

Volume of water used	Source of water	Start of watering	End of watering	Watering method
3 397 ML	SA River Murray Drought Water Allocation Decision Framework	Feb 2010	Jun 2010	Gravity

Lake Merreti is the largest freshwater, floodplain lake in the Riverland Ramsar site and is part of Calperum Station, managed by the Australian Landscape Trust. Originally a temporary wetland, the lake became permanently inundated in the 1950s due to river regulation, until 1994, when a wetting and drying regime was returned. In late 2006, the wetland was disconnected due to the drought to achieve evaporative water savings. Since disconnection, the wetland received water in 2008-09, and again in 2009-10.

The lake is a significant site for waterbird breeding in the region, supporting major Ibis (White and Straw-necked Ibis) and Cormorant (Little Pied and Little Black) rookeries. It is fringed with a strip of River Red Gum forest that, while still in reasonable health, has declined significantly over the past 10 years.

The nationally vulnerable Southern Bell Frog as well as 12 State-listed species have been recorded on the lake. It has also supported 17 species of waterbird protected under International Migratory Bird Conventions.

Why water Lake Merreti?

In the past, Lake Merreti has been a significant site for waterbird breeding. Since 1994, the lake has been disconnected from the river system, leading to complete drying for extended periods of time on several occasions.

Since 2004, the water dependent, fringing vegetation (particularly Lignum), in which the birds breed, has declined substantially in area and quality. The decline in health of riparian River Red Gum forest and Black Box woodlands was also reducing the quality and range of habitats.

The 2008-09 watering was a short fill event and the wetland was only connected to the River for approximately two months, barely giving water levels time to reach pool level before beginning another drying cycle.

A water regime that involves short fill events and extended dry periods poses a significant risk to managed wetlands and therefore the repeat watering in 2009-10 was vitally important.

A water regime that involves short fill events and extended dry periods poses a significant risk to managed wetlands...

Repeat watering in 2009-10 was vitally important.

Photo Grant Whiteman

Waterbirds, Lake Merreti

Ecological outcomes

Monthly monitoring of waterbirds in Lake Merreti showed that at times more than 6 000 waterbirds from 50 species occupied the lake in 2009-10, including 11 State-listed species such as White-breasted Sea Eagle, Australasian Bittern, Freckled Duck, Blue-billed Duck, Musk Duck and Australasian Shoveler.

In 2010, the substantial expansion of Lignum patches resulted in a good rookery of several hundred breeding White and Straw-necked Ibis. At least half of the other 48 species recorded on the lake also bred there during 2010.

Photo Grant Whiteman

A five-day survey of fish in early 2010 found seven native and three introduced species in the lake, with the Australian Smelt being the most common native species. Six species of frog were also recorded calling including the Southern Bell Frog.

The health of mature River Red Gum, Black Box and River Cooba in the riparian zone of the lake has shown significant improvement, with regeneration of River Red Gums and River Cooba. Lignum patches have regenerated and expanded, as have stands of Bullrush, providing an increase in the range of fauna habitats around the lake.

Photos Grant Whiteman

Images of regeneration...
Lake Merreti

Schillers Lagoon

Impacts to the ecology of the wetland were evident... Inundation was important to freshen groundwater and prevent loss of riparian vegetation.

Watering overview

Volume of water used	Source of water	Start of watering	End of watering	Watering method
1 359 ML	SA River Murray Drought Water Allocation Decision Framework	Feb 2010	Jun 2010	Gravity

The Nigra Creek / Schillers Lagoon Complex is directly adjacent to Lock 2 and 16km north-west of the township of Waikerie. The inlet to Nigra Creek is located upstream of Lock 2. The creek flows into the Lagoon which has its outlet downstream of the Lock. As the wetland complex flows around Lock 2, it has the potential to be managed as a flow-through system. Flowing systems are uncommon in SA, particularly at low River flow conditions. Therefore, this complex has a unique hydrology within the region. A flow regulator at the junction of Nigra Creek with Schillers Lagoon allows the two water bodies to be managed separately.

In late 2006, Schillers Lagoon was disconnected from Nigra Creek and the River to achieve evaporative water savings for critical human needs during the drought. The wetland received water for approximately four months in 2009 before again being disconnected. Schillers Lagoon was still partially inundated when the 2010 watering commenced in February. This watering included a short flow-through event beginning in May 2010 for a period of 11 weeks. This was the first time a flow-through event had occurred since 2006. Nigra Creek remained connected to the River throughout as it supplies water to an irrigator's offtake.

Schillers Lagoon provides important habitat for waterbirds, including the Australasian Shoveler and Great Crested Grebe, both listed as rare in SA, and a number of migratory bird species listed under the EPBC Act 1999. The wetland also provides habitat for Regent Parrots, which are listed as 'vulnerable' both in SA and nationally. Five frog species, including the nationally vulnerable Southern Bell Frog, have been recorded at the wetland.

The Nigra Creek / Schillers Lagoon landholder group together with the Riverland West Local Action Planning Association and the SA MDB NRM Board are responsible for management and monitoring at Schillers Lagoon.

Why water Schillers Lagoon?

Prolonged drying events during the drought resulted in significant salinity impacts to the wetland, with groundwater discharge and salt scalds visible on the wetland bed. Impacts to the ecology of the wetland were evident

Photo Callie Nickolai

Schillers Lagoon

in the declining health of some fringing, long-lived vegetation and the replacement of semi-aquatic plant species with more salt tolerant species, such as Samphire, or a complete loss of vegetation in some areas of the wetland bed. Inundation was particularly important to freshen the local groundwater and prevent the loss of riparian vegetation including River Red Gums and Lignum. Loss of this long-lived vegetation would diminish habitat for waterbirds and at least two threatened species, Regent Parrot and Southern Bell Frog, which are known to use the site for breeding.

The 2009 watering... led to increased abundance and diversity of wetland fauna.

The 2009 watering generated a significant response from vegetation communities in and around Schillers Lagoon, which in turn led to increased abundance and diversity of wetland fauna. Aquatic vegetation, such as Sea Tassel, Charophyte and Red Watermilfoil, regenerated in abundance. Lignum produced extensive new growth and flowers, and many River Red Gum and River Cooba trees were observed with new growth.

Photo Kate Mason

Schillers Lagoon provided an important drought refuge for wetland fauna after the 2009 watering. Five species of frogs were heard calling, including the Southern Bell Frog. The Long Thumbed Frog was also recorded here for the first time. Two bird surveys recorded a total of 27 waterbird species with 1 257 individuals observed in the spring survey. A number of species of conservation significance were observed including Blue-Billed Duck, Australasian Shoveler, Darter, Musk Duck and Freckled Duck. Two species listed under international migratory bird agreements were recorded, Caspian Tern and the Sharp Tailed Sandpiper, as well as 12 other significant migratory species.

Rewatering Schillers Lagoon in 2010 was important to build on the success of the 2009 event. Given that the wetland had been dry for so long during the drought, increasing the duration of inundation was important to further improve groundwater conditions, and maintain the condition and habitat diversity of the wetland. Increased water availability in 2010 also meant it was possible to generate a flow event through the wetland allowing the export of salt from the wetland system. Fish passage and fish breeding events are also promoted by flow-through events.

Photo Amy Scott

Southern Bell Frog (above) and tadpole (top), benefiting from environmental water

Ecological outcomes

Surface water quality monitoring indicated that the flow-through event was very effective in lowering the salinity of Schillers Lagoon, enabling the wetland to support a broader range of wetland biota, such as tadpoles.

Groundwater monitoring showed that groundwater gradients were reversed so that they were moving away from the wetland. The hydraulic pressure generated by the presence of the surface water reduced the threat of groundwater intrusion by freshening the groundwater profile under and immediately adjacent to the wetland bed, which in turn benefits the long-lived vegetation around the wetland.

Seven species of frog were heard calling including large numbers of the Southern Bell Frog.

Bird surveys were again undertaken in 2010 with additional species recorded, bringing the total to 32 wetland bird species recorded over the two year period.

Overland Corner

Overland Corner supports populations of Southern Bell Frog and Regent Parrot

Overland Corner is a complex of temporary wetlands on the River Murray floodplain immediately below Lock 3 and 14 kilometres northwest of Barmera. When flooded, the wetland provides diverse habitat with areas of open water, shallow water, exposed wet and dry mud, fringing River Red Gums, perching trees and hollows, and both emergent and submerged vegetation.

Watering overview

Volume of water used	Source of water	Start of watering	End of watering	Watering method
497 ML	CEWH SA River Murray Drought Water Allocation Decision Framework	Mar 2010	Jun 2010	Pumped

Overland Corner supports populations of Southern Bell Frog and Regent Parrot as well as a range of other species of conservation significance including the Australasian Shoveler, Freckled Duck and the Great (Large) Egret. Plants recorded include the Dwarf Daisy, Grass Daisy and Spreading Goodenia, all rare in SA.

The Overland Corner Wetland Group, National Trust of SA, Berri Barmera Local Action Planning Committee and SA MDB NRM Board are actively involved in management and monitoring of the wetland and floodplain. The wetland is used for camping, house-boating and recreation and is an important community site.

Why water Overland Corner?

The wetland had remained dry from 2000-01 until water was first pumped into it in 2004 with follow-up watering in 2006 and 2009. The wetland was completely dry again by December 2009.

The 2009 watering had a positive response triggering extensive growth of aquatic vegetation such as Red Water Milfoil. Long-lived vegetation responded well with new growth and flowering on Lignum shrubs, and new growth and seedlings established by River Red Gums.

During the 2009 watering, breeding calls of seven frog species were heard, including the Southern Bell Frog. Bird surveys recorded 28 waterbird species using the wetland. These include a number of species of conservation significance including the Australasian

Photo Amy Scott

Overland Corner, 2009

Shoveler, Freckled Duck, Caspian Tern and Great Egret, and 13 significant migratory species. Regent Parrot was also recorded at the site.

The follow-up watering in 2010 aimed at continuing favourable conditions for wildlife and further improving groundwater quality to support long-lived vegetation. It is anticipated that regular watering will establish a freshwater lens beneath the wetland and lower adjacent groundwater salinity. The repeated watering is especially important to ensure that improvements in the health of the mature trees can continue.

Three species – the Grey Teal, Australian Shelduck and Australian Wood Duck – were recorded with young.

Ecological outcomes

The 2010 watering triggered a good frog calling and breeding response with a total of six frog species heard calling including the Southern Bell Frog. The wetland provided habitat for a number of waterbird species, and three species – the Grey Teal, Australian Shelduck and Australian Wood Duck – were recorded with young.

Photo Amy Scott

Overland Corner

Aquatic vegetation responded well with new growth and flowering on Lignum, new growth on River Red Gums, and regeneration of emergent species such as Spiny Sedge and Common Spike Rush, submerged species such as Red Water Milfoil, and the floating species Nardoo.

Before — Mar 2009

Photos Amy Scott

After—Feb 2010

4. From Lock 1 to Wellington

Large sections of the floodplain along the River between Lock 1 and Wellington have been completely altered with levee banks constructed to keep out River water, vegetation removed and the floodplain bed levelled. Only 75 wetlands now remain in this 200 kilometre stretch of River. In 2009-10, the continuing drought conditions meant ongoing low flows and very low river pool levels below Lock 1, leaving most wetlands dry. The use of environmental water to maintain some key wetland sites in this River reach became critically important.

Photo Kate Mason

Water milfoil flourishing at Paiwalla

Inundated wetlands in the area provide drought refuge to water-dependent fauna. They also help maintain the seed and egg banks for aquatic plants and animals, which then act as a source supply when conditions improve, and thereby help other wetlands to recover from the drought.

Paiwalla is one of the three sites between Lock 1 and Wellington that received environmental water in 2009-10.

Lock 1 to Wellington watering sites

Wetland	Total Volume (ML)	Source of Environmental Water and Volume (ML)			
		CEWH	Healthy Rivers Australia	SA River Murray Drought Water Allocation Decision Framework	ELMA
Paiwalla Wetland	383	241	47		95
Rocky Gully	8			8	
Noonawirra	120			120	

Paiwalla Wetland

Paiwalla is a 60 hectare wetland that was formerly developed as an irrigated dairy pasture. Wetlands Habitat Trust has undertaken substantial rehabilitation works to restore Paiwalla to natural wetland habitat for birds, fish, frogs and other native wildlife. The levee bank at Paiwalla was retained giving it the capability to hold water that is pumped to the site during times of low River flows. Paiwalla received water in March and June 2009, providing an important service to the region as drought refuge habitat.

Watering overview

Volume of water used	Source of water	Start of watering	End of watering	Watering method
383 ML	CEWH Healthy Rivers Australia Inc. ELMA	Feb 2010	Jun 2010	Pumped

Paiwalla supports highly diverse and significant wetland flora and fauna. Management of the wetland's water regime and subsequent changes in water levels has resulted in a rich assemblage of fringing plant species. This has increased the habitat and food sources available to a greater number of fauna species.

Significant waterbirds, including cryptic and migratory species (such as the nationally vulnerable Painted Snipe, the State endangered Little Bittern and the State vulnerable Lewin's Rail) rely on the sheltered waters inundating rush and reed beds for safe foraging. All but one of SA's duck species have been recorded at Paiwalla over the last few years.

The wetland is a nesting ground for the State vulnerable Broad-Shelled Tortoise, which lays its eggs during autumn in the wetland fringes. The success of these breeding events benefits from ongoing fox-baiting undertaken by the Wetland Habitats Trust.

Why re-water Paiwalla Wetland?

Extremely low water levels persisted in the River Murray below Lock 1 during 2009-10 and Paiwalla remained one of the few wetlands in the reach with the capacity to retain water. While River levels remain low, pumping water into Paiwalla is required to prevent the wetland from drying through evaporation. Rewatering Paiwalla in 2010 was important to maintain a drought refuge below Lock 1 for wetland species including native fish, waterbirds and tortoises.

Rewatering Paiwalla in 2010 was important to maintain a drought refuge below Lock 1 for native fish, waterbirds and tortoises.

Photo Kate Mason

Diverse reed and rush community fringing Paiwalla

Paiwalla was identified as a potential home for a critically endangered native fish species, the Southern Purple-spotted Gudgeon. This fish was thought to be extinct in SA until a remnant population was found in a River Murray wetland located near Paiwalla. A small number of individual fish were rescued from this wetland through work lead by Native Fish Australia (NFA) not long before the low flow conditions below Lock 1 resulted in the wetland completely drying out. A captive-breeding program was undertaken collaboratively between the NFA, Healthy Rivers Australia, DENR and the SA MDB NRM Board. Paiwalla Wetland was selected as a site for the reintroduction of captive-bred Southern Purple-spotted Gudgeon into natural habitat. For the successful establishment of a wild population, the wetland cannot be allowed to dry out.

Paiwalla Wetland now provides secure refuge habitat for the critically endangered Southern Purple-spotted Gudgeon

Ecological outcomes

Over 12 hectares of vegetated mudflats were inundated as a result of the watering. The aquatic plant, Water Milfoil, germinated and spread providing important foraging areas for herbivorous birds, such as Black Swan and ducks, and habitat for macroinvertebrates, fish and tadpoles. The diversity of fringing reed and rush species increased, providing foraging and nesting areas for waterbirds. Water levels were managed to expose extensive areas of mudflat over summer to provide habitat for migratory bird species.

Five significant migratory bird species were observed following the 2010 watering. The wetland successfully provided breeding habitat for two bird species, with multiple nestings by Musk Duck and Black Swan. The threatened species, Freckled Duck, has been seen regularly at the wetland.

Spring surveys recorded seven species of frogs calling, including the Southern Bell Frog. Large numbers of tadpoles were captured during fish surveys (450 individuals at one site alone). This included metamorphs (tadpoles in the final stages of development) from five species, clearly demonstrating that successful frog breeding had occurred in Paiwalla.

The main basin of Paiwalla continued to successfully provide habitat to native fish with surveys resulting in the capture of four species (Carp Gudgeon, Flathead Gudgeon, Dwarf Flathead Gudgeon and Bony Bream). These species were able to tolerate fluctuating water levels and water quality as a result of temporary disconnection from the River. Yabbies, freshwater shrimp, prawns and other macroinvertebrates were caught during fish surveys.

Photo Kate Mason

Flathead Gudgeon, Paiwalla Wetland

Paiwalla Wetland now provides secure refuge habitat for the critically endangered Southern Purple-spotted Gudgeon. The population of rescued and captive-bred juvenile fish were translocated in March 2010 into the smaller wetland basin at Paiwalla, which has been disconnected and filled separately from the main basin. This is part of a broader recovery program for the species. This project was supported through a water donation to fill the smaller basin from Healthy Rivers Australia.

5. Lower Lakes, Coorong, Murray Mouth

Emergency measures were required... to avert the critical loss of species.

In 2009-10, water in the Lower Lakes remained at historic low levels and the fringing wetlands were cut off from their primary source of water. The Lower Lakes were suffering and a range of emergency measures were required to mitigate significant threats from acid-sulfate soils and increasing salinity to avert the critical loss of species.

Large volumes of environmental water were delivered to Lakes Alexandrina and Albert in 2009-10, which averted acidification and hyper-salinisation that could have led to catastrophic system failure and irreversible ecological damage.

The area encompassing the Lower Lakes, Coorong and Murray Mouth is one of the six Living Murray Icon Sites. It is also designated as a Wetland of International Importance under the Ramsar Convention on Wetlands. The site covers an area of approximately 140 000 hectares, incorporates 23 different types of wetlands ranging from hyper-saline lagoon systems to permanent freshwater swamps, and includes the only estuarine area within the River Murray system. It provides habitat for over 85 species of waterbirds, including a number of nationally threatened species and migratory waders. The native fish community consists of 49 species including the Murray Hardyhead, Southern Pygmy Perch and Yarra Pygmy Perch.

Lower Lakes watering sites

Wetland	Total Volume (ML)	Source of Environmental Water and Volume (ML)			
		TLM	CEWH	Darling inflows	SA Environmental Water Reserves 2009-10 & 2010-11
Boggy Creek	9	9			
Turveys Drain	26	26			
Narrung	250	250			
Lake Albert	87 900	13 900	20 000		54 000
Lake Alexandrina	398 400	34 400		170 000	194 000

In 2008-09, water was pumped into two fringing wetlands of the Lower Lakes to prevent them from drying out and to support isolated populations of Murray Hardyhead.

The Murray Hardyhead is a small native fish that is listed as vulnerable under the Commonwealth EPBC Act 1999, endangered (Provisional) under the SA National Parks and Wildlife Act 1972 and protected under the SA Fisheries Management Act 2007.

One of the Murray Hardyhead wetlands (Boggy Creek) and Narrung Wetland are discussed in detail in this report, as well as the Lower Lakes.

Photos Adrienne Frears

Historic low water levels in the Lower Lakes... A priority for environmental watering

Narrung Wetland

Narrung Wetland is a fringing wetland of the Lower Lakes located on the north-eastern tip of the Narrung Peninsula. The wetland is made up of three lagoons that cover a total area of 33 hectares, and is very shallow and flat.

Watering overview				
Volume of water used	Source of water	Start of watering	End of watering	Watering method
250 ML	TLM	Oct 2009	Dec 2009	Pumped

The main lagoon is connected to Lake Alexandrina by a long, man-made channel and separated from Lake Albert by a causeway. Narrung Wetland has a temporary water regime and connects to Lake Alexandrina when water levels in the lake are above approximately 0.7m AHD. Prior to the drought, this generally meant that the wetland filled during spring when lake levels were highest and remained inundated until January. The wetland had previously received water from Lake Alexandrina in late 2006, under higher lake levels. Since then, it had been only infrequently inundated for short periods of one to two weeks as a result of local rainfall.

When inundated, Narrung Wetland supports extensive areas of submerged aquatic vegetation and the State rare Spiny Lignum is found growing on the edge of the wetland. The wetland provides habitat to waterbirds, and 12 migratory bird species listed under the EPBC Act have been recorded at the site.

An ongoing monitoring program at Narrung Wetland is undertaken by the SA MDB NRM Board and the Narrung Wetland Group, and includes surface water, groundwater and photopoint monitoring.

Why water Narrung Wetland?

From 2007 to 2010, Narrung Wetland has been disconnected from both Lakes Alexandrina and Albert due to low water levels and during this period has only partly filled for a few weeks at a time following rainfall. These short periods of inundation pose a risk to the seed and egg bank of the wetland by triggering 'false starts'.

Plant seeds and aquatic invertebrate eggs are stimulated to germinate following rainfall but, because the water dries up within a couple of weeks, have insufficient time to complete their reproductive cycle and replenish the seed/egg bank. Watering was aimed at providing a longer period of inundation, allowing aquatic flora and fauna to complete their lifecycle and prevent the depletion of the propagule bank, particularly for Ruppia species.

An assessment of submergent plant seed banks at several fringing Lower Lakes wetlands by the Raukkun Natural Resources Management Team found that Narrung had the largest and most diverse seed bank. With the improvement of

Photos John Kruger

Birdlilfe at Narrung: Sharp Tailed Sandpipers (top); Black Swans (bottom)

lake levels, Narrung Wetland provides a diverse seed source for aquatic species to recolonise other parts of the Lower Lakes system. These species provide important food sources for waterbirds, fish and macroinvertebrates.

The watering event at Narrung Wetland helped prevent the critical loss of key aquatic species such as birds, frogs, invertebrates and vegetation in the Lower Lakes by creating a drought refuge that provided habitat and food resources. The watering improved the general habitat condition of the wetland and supported fringing vegetation under threat of being smothered by drifts of sediment from the dry wetland bed.

... environmental watering inundated the wetland long enough for plants and invertebrates to successfully reproduce and replenish the propagule bank.

Ecological outcomes

A dense cover of aquatic vegetation was established in the Narrung Wetland following the provision of environmental water. By January, almost the entire main lagoon was covered by submerged aquatic vegetation. The majority of the vegetative cover was due to one species of Charophyte. However, at least seven other aquatic plant species were detected, including two species of Ruppia.

Aquatic invertebrates flourished following the watering of Narrung including at least four species of zooplankton, Dipteran larvae and pupae and ostracods.

Research revealed that the seed banks of Ruppia species and the propagule banks of Chara and two species of ostracod were higher immediately after the period of watering compared with immediately before the period of watering. This indicates that the environmental watering inundated the wetland long enough for plants and invertebrates to successfully reproduce and replenish the propagule bank.

Fringing vegetation, such as Salt Club Rush, Common Reed and Samphire, also benefited from the watering event. A considerable number of different waterbird species, including piscivores or fish eaters, grazers and waders, used the wetland when filled. Six migratory species listed under the EPBC Act were recorded using Narrung Wetland. One survey alone detected 379 birds from nine species. These numbers have not been recorded at Narrung since October 2006, just prior to the wetland becoming disconnected from Lake Alexandrina.

Photo Adrienne Frears

Narrung Wetland

Boggy Creek

Boggy Creek is a freshwater creek system located at the eastern end of Hindmarsh Island near the mouth of the River Murray in Lake Alexandrina. It is part of the Hindmarsh Island wetlands system, which is made up of a complex network of interconnecting wetlands, creeks and channels.

Watering overview

Volume of water used	Source of water	Start of watering	End of watering	Watering method
9 ML	TLM	Dec 2009	Jun 2010	Pumped

Boggy Creek is a permanent wetland that receives water naturally when water levels in Lake Alexandrina are over approximately 0.3mAHD. From 2007, lake levels were below this critical level, isolating Boggy Creek from its water source.

Why water Boggy Creek?

In 2008, a threatened fish condition monitoring program located a population of more than 500 adult Murray Hardyhead in Boggy Creek. The population was stranded as a result of drought conditions, with receding water levels concentrating the fish in a small section of the creek. By early 2009, the site was in danger of completely drying out. As part of the government's Drought Action Plan, approximately 200 Murray Hardyhead were removed to be maintained in captivity before the site dried completely in February 2009.

Boggy Creek was one of only a few remaining freshwater channel systems in the Lower Lakes

Environmental water was successfully secured for Boggy Creek in 2009. This allowed approximately half of the fish to be released back into Boggy Creek in April 2010.

Boggy Creek was one of only a few remaining freshwater channel systems in the Lower Lakes and is one of only four remaining sites that currently host Murray Hardyhead in the Lower Lakes.

It was critical that Boggy Creek receive environmental water in 2009-10 to prevent the site from drying out and to maintain water levels within tolerance thresholds for Murray Hardyhead.

Photos Adrienne Frears

Rewatering Boggy Creek

Ecological outcomes

Weekly monitoring within Boggy Creek has found that water quality parameters have largely stayed within the range for Murray Hardyhead. Frequent monitoring allowed pumping to be undertaken to address any problems with water quality and maintain adequate water levels at all times. Photopoint monitoring showed the expansion of fringing reed beds into the water, providing ideal fish habitat.

Results signal the success of watering intervention

A fish survey in November 2009 successfully captured Murray Hardyhead in relatively low numbers. Most of the fish were young-of-year. The survey was repeated in March 2010 and higher numbers of Murray Hardyhead were captured, all of which were adults. These results confirm that a successful recruitment event by Murray Hardyhead occurred in the 2009-10 breeding season.

Photo John Kruger

Nationally threatened Murray Hardyhead

All Murray Hardyhead captured in the March 2010 survey were in very healthy condition, suggesting that the watering of Boggy Creek triggered a food-web response that provided food resources for the fish, particularly zooplankton.

These results signal the success of watering intervention, which prevented the habitat from drying and maintained water of suitable quality to allow breeding by this nationally threatened fish.

Lakes Alexandrina and Albert

The Lower Lakes were identified as SA's highest priority for environmental water in 2009-10.

The Lower Lakes (Alexandrina and Albert), Coorong and Murray Mouth collectively are considered a site of State, national and international significance. The Lower Lakes are isolated from the Murray Mouth and Coorong by a system of barrages that prevent saline water from entering the Lakes. Fresh water flows into Lake Alexandrina from the River Murray. Lake Alexandrina is the primary source of water for Lake Albert, which is a terminal lake. Lakes Alexandrina and Albert are surrounded by important and diverse fringing wetlands.

Watering overview

	Volume of water used	Source of water	Start of watering	End of watering	Watering method
Lake Alexandrina	398.4 GL	SA Environmental Reserve Darling Inflows TLM	Dec 2009	Jun 2010	Gravity
Lake Albert	87.9 GL	SA Environmental Reserve CEWH	Dec 2009	Jun 2010	Pumping

Historically, with adequate flow conditions, the Lower Lakes are operated within a narrow band of 0.6m – 0.85m AHD to maintain adequate water levels for water supply systems and prevent the intrusion of highly saline groundwater.

Lakes Alexandrina and Albert are ecologically important. They are part of:

- an internationally listed Ramsar wetland
- the Murray-Darling Basin's only estuary
- the Lower Lakes, Coorong and Murray Mouth Icon Site through The Living Murray program.

The Lower Lakes also:

- support numerous global, national and state-listed threatened species
- provide major waterbird habitat, supporting significant proportions of Australia's waterbirds and international migratory species
- provide the only access to the Murray-Darling Basin for fish species that use both fresh and marine habitats.

During 2009-10, the EPA, SA MDB NRM Board and DEH monitored water

Photo Karl Hillyard

Lake Alexandrina

quality in the Lower Lakes with funding support from the MDBA to identify any environmental impacts associated with the declining water levels and exposure of acid-sulfate soils.

The Lower Lakes were identified as SA's highest priority for environmental water in 2009-10.

Environmental water was critical to avoid catastrophic damage to the Lakes

Why water the Lower Lakes?

Due to the drought and substantially reduced River flows since 2006, water levels below Lock 1 (including the Lower Lakes) were significantly reduced. The levels in the Lakes fell below sea level (0m AHD), causing disconnection of the Lakes from the fringing lake wetlands and a loss of habitat for aquatic animals. Large areas of sulfidic lakebed had been exposed and acidified. With the site being under significant stress and exposed to threats due to decreased water levels, delivery of environmental water was crucial.

Freshwater flows were also needed for Lakes Alexandrina and Albert to maintain salinity levels within the range for native aquatic plants and animals. It was important to stop the decline in condition and restore habitat for key species such as small-bodied native fish, *Ruppia* and wading birds.

The provision of environmental water was critical to ensure that, even if record low inflows continued throughout 2010, water levels would not fall below trigger levels and expose greater areas of high risk acid-sulfate soils that would cause catastrophic damage to the Lakes.

Watering outcomes

Fortnightly water quality sampling demonstrated that the delivery of water to the Lakes, combined with other initiatives (such as limestone dosing) had been successful in achieving this aim. Results in June 2010 showed that pH levels were relatively stable and within ANZECC guideline levels at all sites in the main water bodies of Lake Alexandrina and Lake Albert.

While the effect of delivering extra water could be directly measured for water levels, pH and salinity, the ecological benefits are not as easy to demonstrate in the short term. However, preventing a drop in water levels was also a means of preventing further decline in habitat and species, thereby assisting the recovery of the Lakes system once River conditions improved.

Photo Karl Hillyard

Dunns Lagoon, Lake Alexandrina

Surveys of aquatic and littoral vegetation were undertaken in the Lower Lakes and fringing wetlands in autumn and spring. The drying of wetlands resulted in the loss of submerged species and colonisation by terrestrial species, particularly exotic agricultural weeds. However, the ability of dry sites to recover was shown by the re-establishment of a diverse community of aquatic plants in areas of the Goolwa channel that became inundated by the establishment of the Clayton regulator.

Fish sampling in the Lower Lakes took place in November 2009 and March 2010 with a particular focus on three threatened fish species (Murray Hardyhead, Yarra Pygmy Perch and Southern Pygmy Perch). Overall, 18 native fish species were recorded indicating the Lakes still supported native fish populations, although there was a shift from populations dominated by obligate freshwater fishes to one dominated by common freshwater, estuarine and alien species.

Results indicate that Murray Hardyhead and Southern Pygmy Perch continued to survive at a small number of sites, with some recruitment by Murray Hardyhead. No Yarra Pygmy Perch were captured. This species has not been recorded since February 2008 and is thought to be extinct in the Basin.

A captive maintenance and breeding program by DENR continues to support the Yarra Pygmy Perch (and other threatened fish species) until improved conditions allow for reintroduction to the Lower Lakes.

Photo Karl Hillyard

Eastern Banjo Frog, Lower Lakes

6. Conclusion

The benefits of the ongoing program of environmental watering along the River Murray in SA are significant. As the environment along the River continued to suffer from the prolonged period of low flows, the importance of the watering program in maintaining refuges for plants and animals increased.

On the Chowilla Floodplain and in wetlands and waterbodies down to Lock 1, environmental watering supported the survival and regeneration of pockets of River Red Gums, Black Box and Lignum. These long-lived plants provide vital habitat for many fauna species and take decades to replace once lost. Two threatened species in particular are known to benefit from the protection of this habitat through watering, the Regent Parrot and the Southern Bell Frog.

An improvement in conditions is seeing the natural reconnection of the floodplain and wetlands to the main River

Below Lock 1 and around Lakes Alexandrina and Albert, environmental water has been delivered to a handful of water bodies in a reach that became otherwise devoid of inundated wetlands as the drought continued. These sites have provided critical drought refuges for aquatic plants and animals as well as maintaining a seedbank for recolonisation as conditions improve. Importantly, the environmental watering program has helped to prevent the loss of two threatened fish species from the area, the Southern Purple-spotted Gudgeon and the Murray Hardyhead.

Lakes Alexandrina and Albert received over 486 000 megalitres of environmental water. This water prevented a further drop in lake water levels, helping to avert wide-scale and catastrophic impacts such as salinisation and exposure of acid-sulfate soils.

Delivery of water to priority sites and monitoring of outcomes was made possible by work undertaken by government agencies, community organisations and landholders. The efforts to preserve species and habitat through environmental watering over the past few years are being rewarded. An improvement in conditions is seeing the natural reconnection of the floodplain and wetlands to the main River channel. The watering program will be adapted with the changing River conditions to continue to deliver water to achieve the best possible environmental outcomes for the community.