NSW GOVERNMENT
Office of Environment & Heritage

Environmental water use in New South Wales

Annual Report 2011–12

Front cover: Fledged bronze (glossy) ibis in the Gingham Watercourse Wetlands, May 2012. Photo: Daryl Albertson, OEH

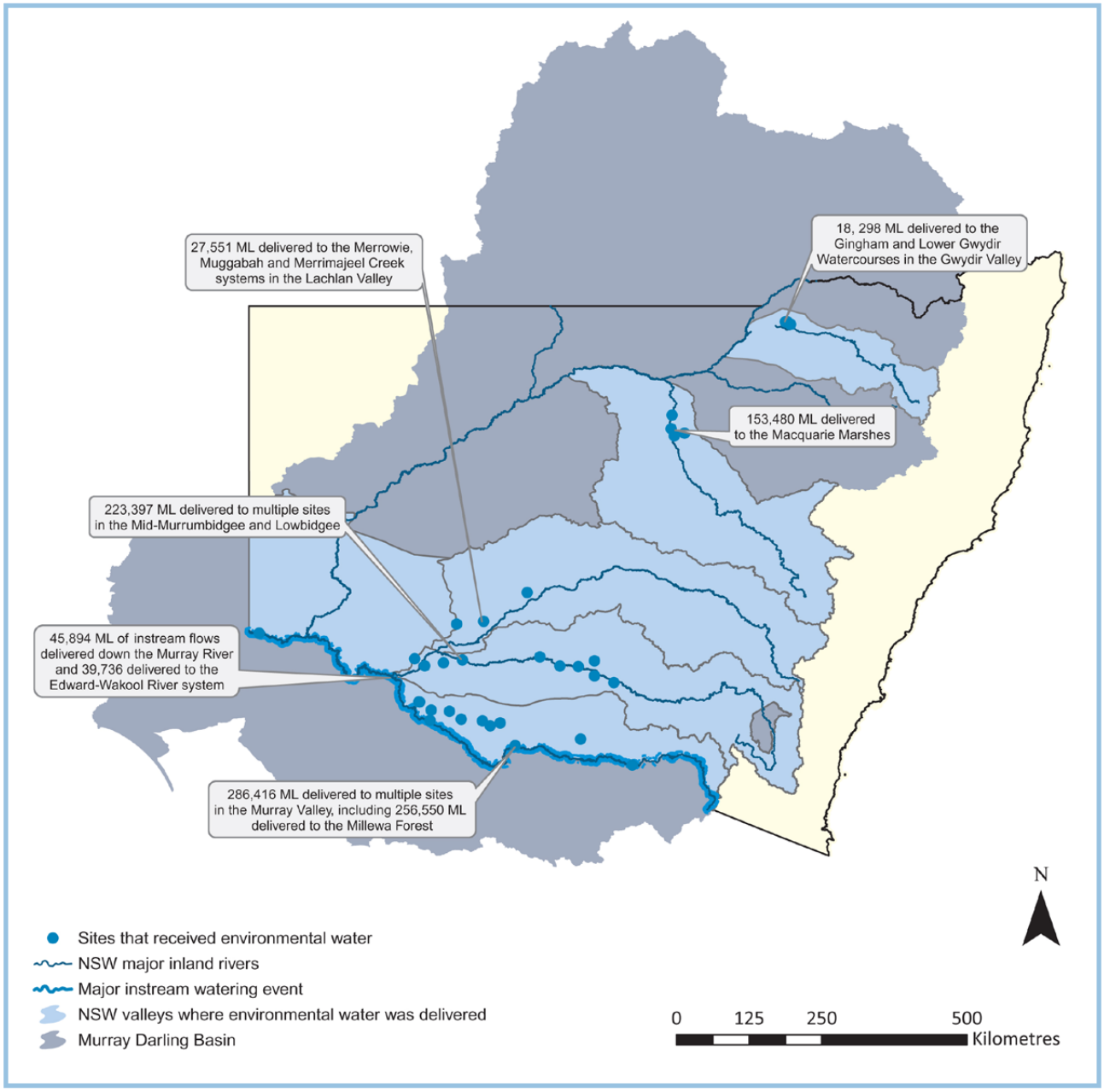
Published by:
Office of Environment and Heritage
59 Goulburn Street, Sydney NSW 2000
PO Box A290, Sydney South NSW 1232
Phone: (02) 9995 5000 (switchboard)
Phone: 131 555 (environment information and publications requests)
Phone: 1300 361 967 (national parks, climate change and energy efficiency information, and publications requests)
Fax: (02) 9995 5999
TTY users: phone 133 677, then ask for 131 555
Speak and listen users: phone 1300 555 727, then ask for 131 555
Email: **info@environment.nsw.gov.au**
Website: **www.environment.nsw.gov.au**

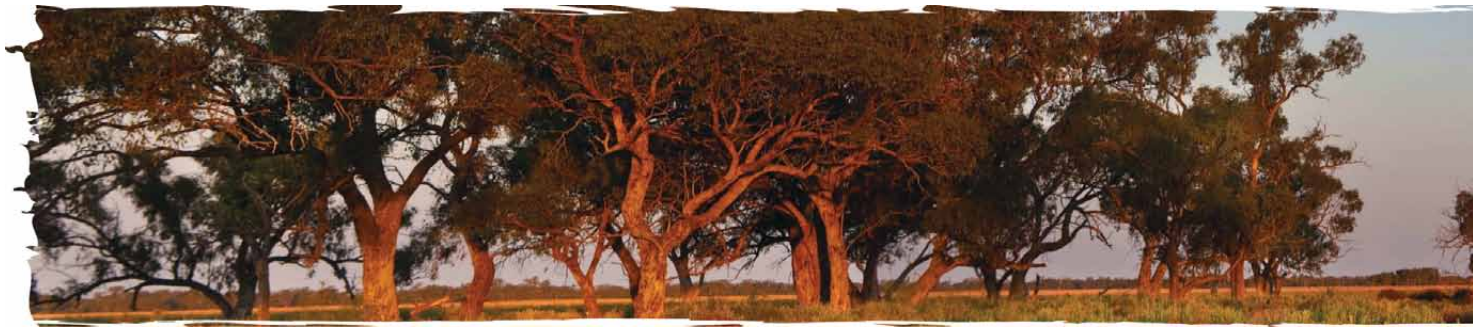
Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or **info@environment.nsw.gov.au**
See also **www.environment.nsw.gov.au**

ISSN 1838-6423
OEH 2012/0943
January 2013
Printed on environmentally sustainable paper

Contents

NSW environmental watering event sites 2011–12





Grove of black box at Macquarie Marshes Nature Reserve. Photo: Neal Foster

Foreword

With several significant rain and flooding events, and above average rainfall of over 680 millimetres, 2011–12 marked the second consecutive year of warm, wet weather in NSW. NSW environmental water managers carried out strategic water deliveries to consolidate the benefits of the last two years of wet conditions and secure the recovery of the state's most important water-dependent habitats. Natural flooding and environmental water releases boosted breeding opportunities for waterbirds and frogs, with waterbird numbers reaching levels not observed since 1984.

Environmental water management is critical for maintaining refuge habitats for threatened fauna and core wetland condition during periods of drought. It increases the health of rivers which underpin healthy communities and farms, and a healthy natural environment. NSW has many remarkable water-dependent ecosystems, such as wetlands, which provide recreational and spiritual values for the local community, contain habitat for native plants and animals, and support commercial activities such as agriculture, forestry, fisheries and tourism.

This report demonstrates that, as the state's environmental water manager, the Office of Environment and Heritage (OEH) has delivered some great outcomes for NSW. These have been achieved with landholders, local advisory groups, catchment management authorities, the Commonwealth Environmental Water Office and NSW agencies such as the NSW Office of Water, StateWater and NSW Fisheries. Our strong partnerships ensure that our investment in environmental water returns the best possible outcomes for the state's rivers, wetlands and creek systems and the local communities they support.

During 2011–12, OEH delivered over 936,000 ML of environmental water to support the health of NSW rivers and other ecosystems. In April and May 2012, OEH collaborated with the Australian Government to deliver 85,339 ML of Commonwealth environmental water to the Murray and Edward-Wakool river systems. This water increased oxygen levels and improved conditions for many native fish and other aquatic fauna. Other key highlights included the first successful major colonial waterbird breeding event in Gwydir Wetlands since 1999. In the Murrumbidgee region, environmental water was delivered to the privately owned Paika Lake which supported over 20,000 waterbirds from 35 different species, including three threatened species.

The NSW Government is committed to sustainable water management and will continue to invest in efficient water delivery and management infrastructure to support regional communities and the environment.

Sally Barnes
Chief Executive
Office of Environment and Heritage

Using environmental water to build resilient ecosystems

The Office of Environment and Heritage (OEH) plans for and makes environmental water decisions for a number of geographical regions and time scales. At the broadest level, OEH undertakes watering strategies in response to current climatic conditions while also recognising multi-year or decade-long cycles of alternating drought and flood.

The term 'available water' refers to the water accrued in a given season under the rules of a water sharing plan or an environmental water licence.

Resilience describes an ecosystem's capacity to absorb disturbance and retain its basic function and structure. Recognising that rivers, wetlands and floodplains experience extremes of wet and dry, OEH manages water during wet periods to build resilience in ecosystems and their dependent plant communities and animal populations.

Water-dependent plants and animals are adapted to wet and dry periods within certain boundaries or thresholds. Managing water to build resilience strives to prevent those thresholds being crossed and avoid risking irreversible change.

An ecosystem's capacity to endure extreme changes can be recognised by several indicators, for example:

- healthy multi-aged populations of fish and waterbirds
- adequate soil moisture storage
- recruitment of young plants
- a soil seed store and root systems that represent the plants above the ground.

In some ecosystems, the impacts of invasive species, acid sulphate soils and poor water quality will need to be managed. When resilience is low, there may be symptoms such as the local extinction of a rare species, breeding failure or rapid decline in animal populations, the death of long-lived perennial vegetation, the invasion of weeds and pests, and a breakdown of physical environmental quality.

When making environmental water management decisions, OEH considers many factors, such as the condition of plant, animal and river channel health; available water; antecedent conditions and seasonal outlook. OEH also manages its water during wetter years to minimise the potential impacts of both past and future drier years. For example, a particular ecosystem may gain greater advantage if available water is carried over to be used at a future date. Conversely, when there is limited water, it may be directed to a high priority ecosystem such as a refuge site or breeding area for a threatened species at the expense of lower priority sites.

Taking account of the above factors, OEH manages water to:

- build resilience in ecosystems
- avoid ecosystems being irreversibly changed
- ensure that the boundaries or thresholds that water-dependent plants and animals are adapted to during both wet and dry periods are not crossed.

The environmental outcomes described in this report are based on the monitoring activities of OEH and its partners, including the Commonwealth Environmental Water Office, NSW agencies, community members, universities and research organisations, and catchment management authorities. Monitoring activities include on-ground monitoring and satellite image monitoring of:

- water inundation extent and duration
- vegetation community extent and condition
- selected fauna responses including the responses of waterbird rookeries, fish and frogs.

OEH will continue monitoring environmental watering outcomes to build better knowledge of the linkages between single event outcomes, annual water management decisions, and the long-term objective of restoring and maintaining the health and resilience of the inland water-dependent assets of NSW.

This property on Willandra Creek in the Lachlan Valley has a resilient ecological community which is demonstrated by the various ages of its healthy black box trees, aquatic vegetation and stands of reeds. Photo: Paul Packard, OEH

Water for the environment

As the leading manager of environmental water in NSW, OEH works collaboratively with partner agencies and the community to deliver water to protect and improve the environmental values of rivers and wetlands. At the same time, OEH recognises the economic value of floodplain agriculture and works with its partners to minimise the adverse impacts of environmental water delivery on land access and agricultural activities.

OEH is responsible for ensuring that NSW environmental water is managed in accordance with relevant statutory plans and environmental water management plans, including water sharing plans established under the *Water Management Act 2000*.

This annual report provides an overview of environmental watering actions undertaken by OEH and their ecological outcomes in NSW during 2011–12. The water reported on in this document includes water:

- held under licences (adaptive environmental water)
- held in prescribed allocations under water sharing plans
- provided by the Commonwealth Environmental Water Office
- provided through programs such as The Living Murray.

It does not include planned environmental water which is managed by the NSW Office of Water and is released in accordance with rules in the water sharing plans. These plans, developed for rivers and groundwater systems across the state, allocate a share of water to the environment and to users for various purposes, including town water supply, irrigation, industry, and native title rights.

In addition to planned environmental water use outlined in this report, there are regulated coastal water sharing plans that set aside environmental water in the form of environmental contingency allowance. The largest of these provides for 20,000 megalitres (ML) per year in the Hunter Regulated River Water Sharing Plan. OEH is currently establishing an arrangement to manage this water with the Hunter-Central Rivers Catchment Management Authority.

Environmental water managed by OEH

Adaptive environmental water is committed from a water access licence for a specified environmental purpose, supported by a water use plan. OEH water licences have been purchased from willing sellers or have been created by recovering water savings from infrastructure projects.

Adaptive environmental water licensees receive allocations on the same terms as other licensees in the same category: for example, if a general security licence is purchased and committed as adaptive environmental water, the same allocations as any other general security licence for the same water source apply.

Non-statutory environmental watering plans that inform OEH environmental water management include annual watering plans and adaptive environmental management plans. These plans help define the requirements of water-dependent assets and prioritise the use of environmental water within an area.

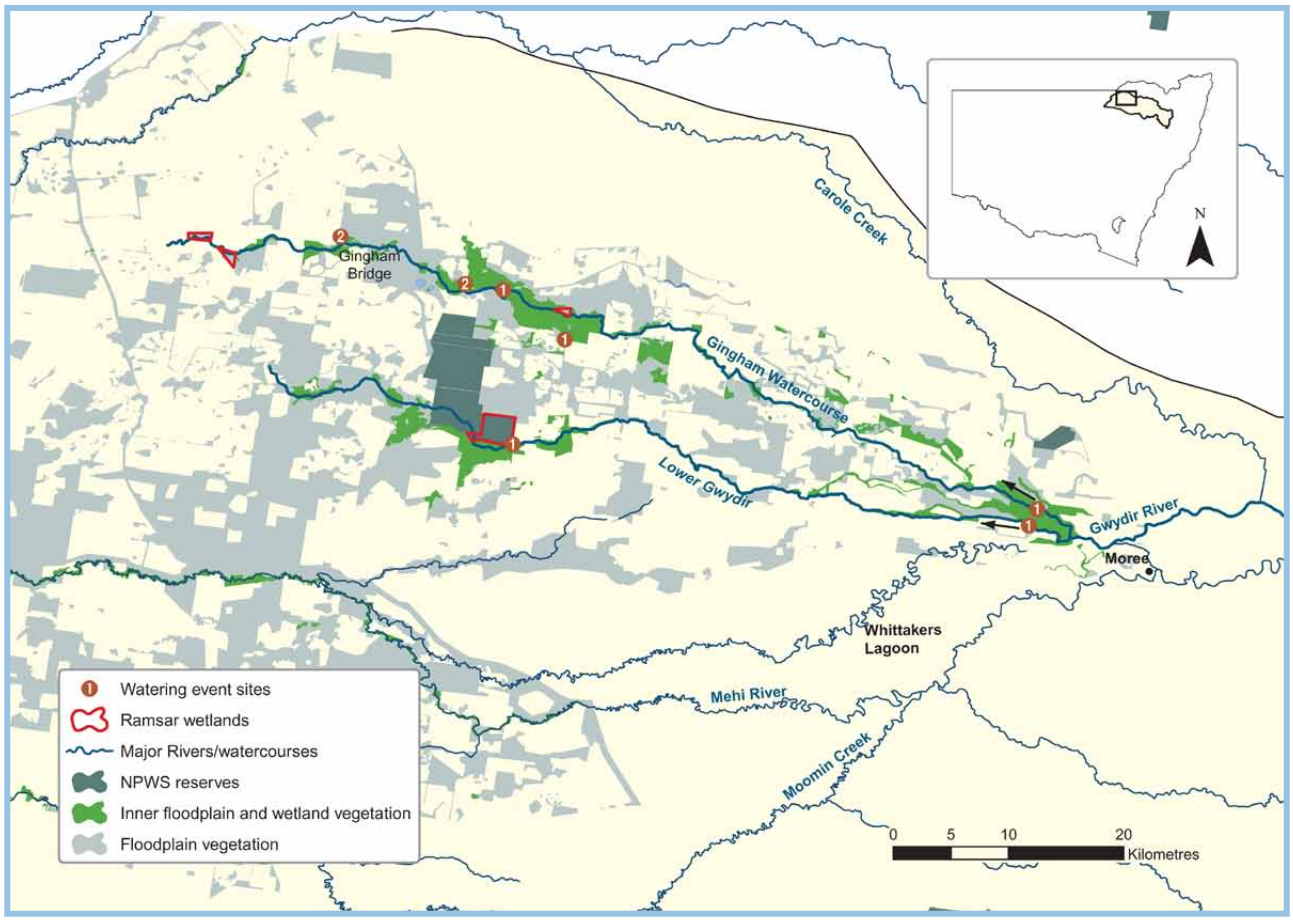
Environmental Water Advisory Groups (EWAGs) play an important role in advising OEH on how to best manage environmental water. EWAGs provide a valley-specific forum for drawing on local expert knowledge and experience. Local landholder, irrigator, environmental and indigenous community interests are represented on each of the EWAGs, which have been established in the Gwydir, Lachlan, Macquarie, Murrumbidgee and Murray/Lower Darling valleys and are chaired by the respective catchment management authority.

Environmental water being released into Cockran Creek in Murray Valley, 2011. Photo: Sascha Healy, OEH

Valley report: Gwydir

Gwydir catchment covers 26,596 square kilometres, with the source of the main Gwydir River headwaters arising in the eastern New England tablelands. As the river flows west onto the plains, it divides into many major and minor rivers and creeks. These support a mosaic of wetland types ranging from semi-permanent marshes and waterholes which receive more frequent inundation to floodplain woodlands which are only inundated during large floods.

Gwydir Valley environmental watering event sites 2011–12



Downstream of Copeton Dam, the aquatic ecosystem of Gwydir River is part of the Darling River endangered ecological community listed in the *Fisheries Management Act 2004*. This area contains several threatened native fish species including silver perch, olive perchlet, purple-spotted gudgeon and the Murray–Darling population of eel-tailed catfish.

The Gingham and Lower Gwydir watercourses and the Mehi and Mallowa systems support river red gum woodlands and coolibah woodlands as well as extensive areas of wetland vegetation such as river cooba, lignum reeds, sedges and water couch. These vegetation communities provide remnant breeding habitat for waterbirds which nest in colonies such as egrets, herons, cormorants, spoonbills, ibis and darters, as well as other waterbirds such as ducks, swans, grebes, coots and swamphens.

The Lower Gwydir watercourse contains the state's largest stand of marsh club-rush sedgeland, listed as a critically endangered ecological community in the *Threatened Species Conservation Act 1995*. It also contains common reeds and open water lagoons that provide feeding habitat for waterbirds, especially ibis and egrets. All these areas are home to species listed in international agreements, including the great egret, cattle egret and glossy ibis. Gwydir Wetlands also support a rare species of freshwater snail, discovered in the wetlands in 2010.

Gwydir Wetlands. Photo: Josh Smith, OEH

Parts of the wetlands on the Gingham and Lower Gwydir watercourses are listed under the Convention on Wetlands of International Importance (the Ramsar Convention). The listing covers parts of three private properties – 'Windella', 'Crinolyn' and 'Goddard's Lease' – and a fourth property, 'Old Dromana' which forms part of the Gwydir Wetlands State Conservation Area.

The Gamilaroi people are the traditional owners of Gwydir Wetlands, with over 160 cultural heritage sites recorded including burial sites, scarred trees and stone artefacts. Since the late 1830s, Gwydir Wetlands have supported cattle and sheep grazing. Dryland cropping of the heavy clay plains began from the 1950s onward and the development of irrigated cropping, particularly cotton, has dominated land use since the 1970s.

Regulation of Gwydir River and associated water extraction since the 1970s, along with land management activities and channel modifications, have contributed to a dramatic decline in the area and health of wetland vegetation and the diversity and numbers of native waterbirds and fish species. Weirs and other barriers restrict flow regimes, critical processes such as fish spawning, and the movement of fish and other aquatic species.

Catchment condition in 2011–12

Gwydir Wetlands began 2011–12 in a well-watered state, owing to extended inundation from natural and planned environmental water received during 2010–2011. At 1 July 2011, the environmental water accounts held in Copeton Dam were allocated 60% entitlement in the NSW general security accounts and 110% entitlement of environmental water allocation (environmental contingency allowance [ECA] account).

At the end of June 2012, the rivers and wetlands in the Gwydir catchment were well watered and mostly in good to very good condition. Substantial spring and summer rainfall starting in late October 2011 and continuing until February 2012 resulted in three separate natural floods. Heavy rainfall resulted in wide-scale natural floods across the lower floodplain which inundated agricultural lands and Gwydir Wetlands. Inflows filled Copeton Dam to 98% of capacity in February 2012, a marked improvement when compared to the 6% capacity held in July 2010. Entitlements to general security licence holders were increased to 150% and the ECA account was increased to 200% (maximum levels).

Watering aims

Environmental water deliveries to Gwydir Valley during 2011–12 aimed to continue building resilience across Gwydir Wetlands. It was planned to maintain at least six months of continuous wetland inundation where possible. Watering also aimed to support the successful completion of large-scale colonial waterbird breeding if required.

Water delivery

Water delivered in Gwydir Valley during the 2011–12 environmental watering year

Location	Start date	Finish date	ML of water delivered			
			NSW	CEW[1]	EWA[2]	Total
Gwydir Wetlands (1)*	8 Oct 2011 25 Nov 2011	21 Oct 2011 28 Nov 2011	592 –	1,206 –	– 1,500	1,798 1,500
Gingham watercourse Wetlands (2)*	10 Mar 2012	3 May 2012	–	–	15,000	15,000
Total			**592**	**1,206**	**16,500**	**18,298**

* The numbers in brackets relate to sites marked on the map.

1 CEW = Commonwealth environmental water

2 EWA = Environmental water allocation (or environmental contingency allowance) accrued under the Water Sharing Plan for the Gwydir Regulated River Water Source 2002

Three environmental water releases flowed into the Gwydir Wetlands during 2011–2012. The first release delivered 1798 ML, shared equally between the Gingham and Lower Gwydir systems. This event finished early (21 October 2011) after rainfall led to natural flows in these systems, and was resumed in a second release of 1500 ML in late November. The third release of 15,000 ML to the Gingham watercourse supplemented natural flows to support the successful completion of colonial waterbird breeding.

Ecological outcomes

The year 2011–12 was excellent for waterbirds in the Gwydir Wetlands, which supported at least 45 species of waterbird with 31 species breeding. The nationally endangered Australian painted snipe was observed, as were several species listed under the *Threatened Species Conservation Act 1995* such as magpie geese, freckled ducks and brolgas. A breeding pair of black-necked storks, also a threatened species, was observed in the Gwydir Wetlands for the second year in a row, and successfully fledged two young.

OEH uses water level gauges, fixed cameras and regular ground surveys to monitor water levels and breeding success. Shown above is one of the rookeries of the Upper Gingham Wetlands, April 2012. Photo: Paul Bayne

Natural floods initiated two separate colonial nesting efforts. Herons, egrets and ibis commenced breeding in late December 2011–early January 2012. Unfortunately, a major flood in early February 2012 drowned many juvenile straw-necked ibis in low-lying nests. At least 3600 juveniles did survive the flood by rafting on the top of lignum bushes in the upper Gingham colony, and were observed foraging in the surrounding floodplain during ground surveys in March 2012.

The second breeding event commenced after the February flooding had subsided. Environmental flows delivered into the Gingham colony from 10 March to 3 May 2012 supported the successful completion of the first major colonial waterbird breeding event seen in Gwydir Wetlands since 1999. The March 2012 surveys indicated that the straw-necked ibis colony in the upper Gingham wetlands successfully bred with over 80% of chicks from 2680 nests being fledged. The river cooba woodland surrounding this colony also supported 1060 nests of glossy ibis and smaller numbers of intermediate egrets, white ibis, royal spoonbill, night herons and little pied cormorants.

In the lower Gingham wetlands, larger but mostly inaccessible rookery sites were monitored using ground counts and counts of high resolution images. More than 16,000 egrets and 35,000 ibis nesting were counted as well as smaller numbers of other species such as magpie geese and ducks.

Eight species of frogs were recorded at sites in the Lower Gwydir and Gingham wetlands by Charles Sturt University researchers in October 2011. There was evidence of large-scale breeding by common frog species such as the barking marsh frog.

OEH conducted surveys that indicated positive wetland vegetation responses throughout Gwydir Wetlands, including an increase in the area of endangered marsh club-rush sedgeland in the Lower Gwydir watercourse. Water couch and spike rush displayed an increase in height and vigour at core wetland sites. Environmental flows that reconnected sites in the Gingham watercourse produced spike rush wetlands in good condition for a second year. These sites were previously dominated by chenopod shrubs such as black rolypoly and soft rolypoly in 2008, as the result of the drought.

Wetland sites that had received adequate depth and duration of flood waters also showed a decrease in cover of the invasive exotic weed, lippia, which cannot tolerate water depths of more than 20 cm for prolonged periods. This change was recorded in water couch and spike rush grasslands as well as coolibah woodlands which displayed an increase in amphibious wetland plant species. However, lippia was still present on sites that received only short periods of flooding.

Water plans

The following plans determine or help determine how environmental water is allocated and managed in the Gwydir Valley:

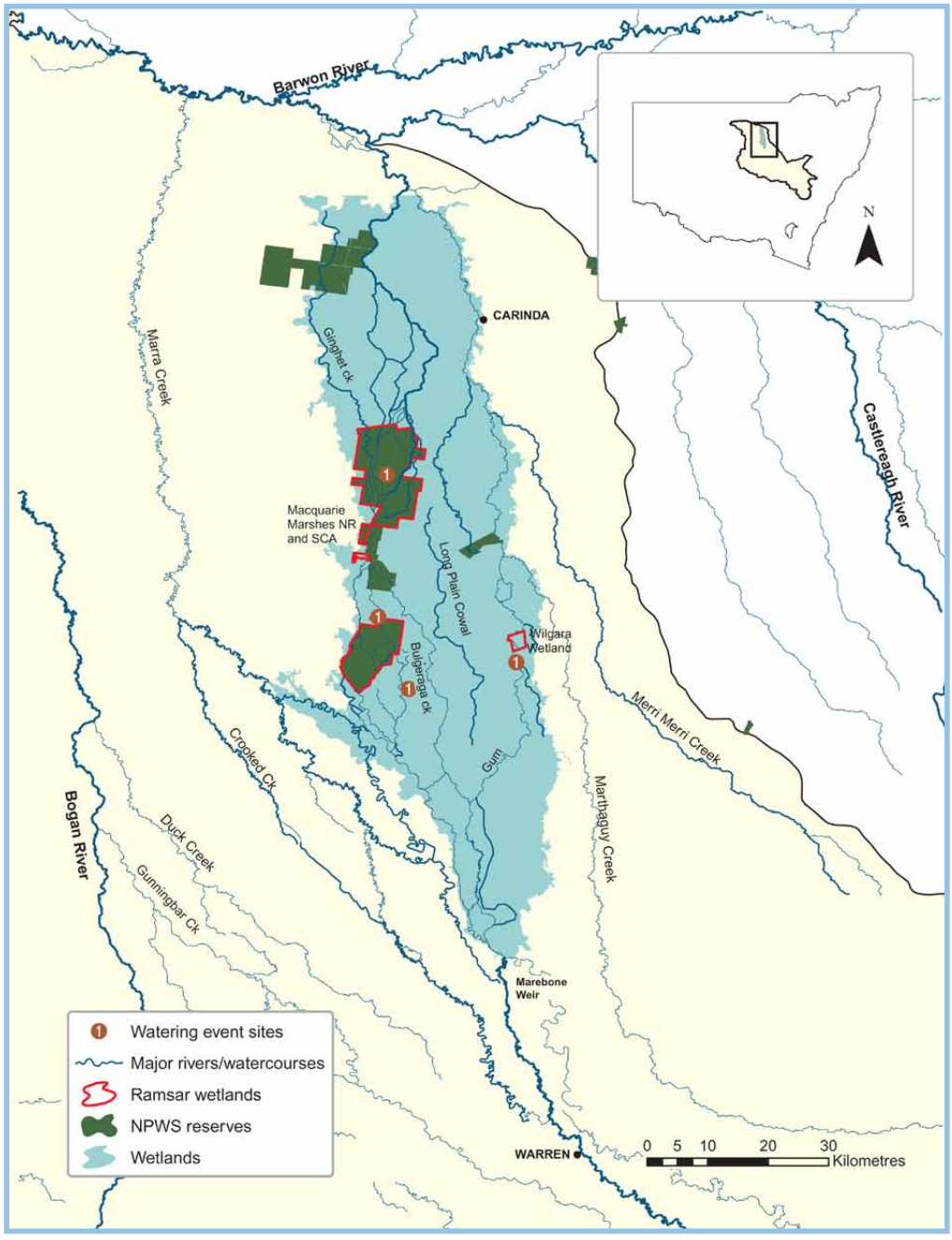
- Water Sharing Plan for the Gwydir Regulated River Water Source 2002
- RiverBank Water Use Plan for the Gwydir Water Management Area
- Environmental Watering Plan for the Gwydir Valley 2011–12
- Gwydir Wetlands Adaptive Environmental Management Plan.

Salmon striped frog, Gwydir Wetlands. Photo: Skye Wassens

Valley report: Macquarie

Spanning 75,000 square kilometres, Macquarie River flows north-west from the Great Dividing Range through the towns of Bathurst, Wellington and Dubbo, into streams around Narromine and Warren and ultimately to Barwon River. Flow in the river system is regulated by two major rural supply dams: Windamere Dam upstream of Mudgee on Cudgegong River and Burrendong Dam on Macquarie River upstream of Wellington. North of Warren, the Macquarie River channel breaks down into a braided system of channels and floodplain depressions which form Macquarie Marshes.

Macquarie Valley environmental watering event sites 2011–12



The northern area of Macquarie Marshes includes the northern section of Macquarie Marshes Nature Reserve and private lands along Bora Channel, Ginghet Creek and the lower Macquarie River. It contains extensive tracts of common reed and river red gum woodland, and open water areas like Loudens and Sinclairs lagoons which are fringed by black box and coolabah woodlands.

The southern area includes the southern section of Macquarie Marshes Nature Reserve and private lands, and significant parts of Monkeygar Wetlands, Mole Marsh, Monkey Swamp, Buckiinguy Swamp and the Marebone area. It contains the same communities as those found in the northern marshes as well as additional large water couch meadows and mixed marsh communities. Several wetlands in the south have changed significantly, with erosion and scouring disconnecting some floodplain wetland systems from the main channels. Wetland vegetation in systems previously characterised by extensive common reedbeds and open water lagoons has been lost.

In the east, the marshes include Long Plain Cowal, Dusty Swamp, Marthaguy Creek and the Gum Cowal–Terrigal Creek systems. This area is characterised by open riparian lagoons, and river red gum and river cooba woodlands on riparian floodplain areas. Large areas of Myall woodlands occur on the upper floodplains, along with black box and coolabah woodlands.

All three areas of the marshes sustain important habitat for waterbird breeding, especially for species that nest in colonies. Such species include four species of egrets, herons, cormorants, spoonbills, ibis and darters. The marshes also host a range of breeding waterbirds including terns, ducks, swans, grebes, bitterns and stilts, and provide a refuge in summer for various migratory wader species including godwits, sandpipers and Latham's snipe.

The marshes provide habitat for various bird species listed as endangered or vulnerable in the *Threatened Species Conservation Act 1995* (TSC Act) including the brolga, magpie goose, Australian painted snipe, Australasian bittern and blue-billed duck. Two local endangered ecological communities are also listed in the TSC Act: the coolibah–black box woodland and the Myall woodlands, along with numerous mammals, amphibians and plants. Two endangered fish species – the Murray cod (listed under Commonwealth legislation) and the silver perch (listed under NSW legislation) – are found in the marshes.

Macquarie Marshes Nature Reserve and parts of the privately-owned properties 'Wilgara' and 'The Mole' are listed under the Ramsar Convention. These areas are particularly important as they have supported some of the largest waterbird breeding events in written Australian history, and provide essential breeding and feeding habitat for hundreds of species of animals and plants.

Intermediate egret on the lagoon near Mole Marsh, Southern Macquarie Marshes. Photo: Tim Hosking, OEH

More than 500 cultural heritage sites are recorded in Macquarie Marshes, which lies within the traditional country of the Wailwan people. The sites include carved trees, ceremonial and burial sites, oven mounds, scar trees and stone artefacts.

Agricultural use of the Macquarie Marshes began in the early to mid-1800s with the establishment of large pastoral leases primarily for grazing. Large-scale irrigation in areas mostly upstream of the marshes began in the 1970s, following construction of Burrendong Dam in 1967. The regulation of flows through the construction of dams and weirs has altered the water regime of the marshes.

Catchment condition in 2011–12

Available water determinations in 2011–12 commenced at 32% in July and increased gradually over the course of the year until heavy rainfall in March 2012 filled Burrendong Dam to 130% of capacity, resulting in full allocations to high security and general security water accounts. The Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003 was recommenced in spring 2011, due to improved climatic conditions.

Macquarie Marshes are the primary focus for environmental water holdings in the valley. The condition of the vegetation of Macquarie Marshes has declined over decades with significant areas of wetland vegetation reported to be in poor condition in 2008, and large areas of water-dependent vegetation being replaced by terrestrial species during the drought in the first decade of this century.

The drought-breaking floods of 2010–11 and use of environmental water coupled with relatively wet conditions in 2011–12 have helped the marshes recover. Recovery will continue if sufficient water is available to ensure protracted drying can be avoided and the water needs of dependent vegetation and fauna can be met.

Watering aims

The primary objective for the marshes was to support the ecological functions and processes necessary to sustain the diversity and extent of water-dependent ecological communities. The 2011–12 watering strategy aimed to continuously inundate these communities for more than four months, to achieve the best possible ecological response in degraded areas and to support fish and waterbird breeding and fish dispersal. A key objective was to inundate up to 50,000 hectares of semi-permanent wetland vegetation, including river red gum woodlands and common reed and water couch areas.

Whistling Duck Lagoon, Wilgara Wetlands, part of the Macquarie Marshes Ramsar site. Photo: Peter Terrill, OEH

Water delivery

Water delivered in the Macquarie Valley during the 2011–12 environmental watering year

Location	Start date	Finish date	ML of water delivered			
			NSW	CEW[1]	EWA[2]	Total
Macquarie Marshes (1)*	16 Aug 2011	27 Jan 2012	25,251	40,000	88,229	153,480
Total			**25,251**	**40,000**	**88,229**	**153,480**

* The numbers in brackets relate to the sites marked on the map.

1 CEW = Commonwealth environmental water

2 EWA = Environmental water allocation accrued under the Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003

Total gauged inflows to Macquarie Marshes during 2011–12 were over 650,000 ML (measured at the Marebone gauges) with approximately three-quarters of the volume supplied from tributary flows and flood mitigation zone releases.

Most flows to the marshes between August and late January were environmental releases, with subsequent rain-fed tributary flows from December to February extending the duration of inundation. Significant rainfall in early March resulted in high tributary inflows followed by an extended period of releases from Burrendong Dam from the flood mitigation zone through to the end of the year (July 2012).

Ecological outcomes

Between September 2011 and January 2012, environmental flows and tributary inflows flooded 73% of the core wetland area of the marshes (36,700 hectares). While this inundation fell short of the targeted 50,000 hectares due to reduced daily delivery rates from November, the extended duration of inflows ensured waterbirds bred successfully.

Vegetation in the northern Macquarie Marshes area responded well, particularly in areas that were still in good or intermediate condition during the drought in 2008.

Forty per cent of all river red gum areas in the marshes were watered by the environmental flow. Subsequent releases from the flood mitigation zone resulted in inundation of all river red gum areas in the marshes for the second time since the 2010 flood. Healthy stands of river red gums maintained intermediate or good canopy condition, and some river red gum seedlings established.

Wetland understorey species replaced terrestrial flora in the river red gum forests with an increase in the number of species present. River red gum sites that received a second year of sufficient depth and duration of inundation showed a marked reduction in the invasive aquatic weed lippia, with no subsequent record of this species at most sites.

Water couch and mixed marsh spike rush wetlands showed good condition for the second year running. Wetland plant species recolonised areas that had previously been invaded by the terrestrial native shrubs black rolypoly and soft rolypoly during protracted drought conditions. In other areas of the marsh, water couch and mixed marsh spike rush sedgelands were replaced by beds of common reed, having received adequate depth and continuity of flooding for two consecutive years.

Two egret and heron colonies were established in the northern area of the marsh in 2011–12. Both colonies were relatively small, containing 1500–2500 nests each. On-ground and aerial observation of colonies confirmed nesting was successfully completed at both sites.

Ibis colonies did not establish themselves in the marshes in 2011–12 despite favourable wetland conditions. The reasons for this outcome are not known, but may be related to local factors such as food availability, condition of the nesting sites, or reeds not recovering to the required density or condition; or there may have been regional factors such as more favourable conditions at other wetland sites such as Gwydir, Narran or Lachlan.

Other significant waterbird activity in 2011–12 included sightings of the endangered Australian painted snipe at a number of locations.

Water milfoil, Macquarie Marshes. Photo: Debbie Love, OEH

Water plans

The following plans determine or help determine how environmental water is allocated and managed in the Macquarie–Cudgegong Valley:

- Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003
- RiverBank Water Use Plan for the Macquarie River
- Environmental Watering Plan for the Macquarie Valley 2011–12
- Macquarie Marshes Adaptive Environmental Management Plan.

Macquarie Valley: Pillicawarrina floodplain restoration

Three years on from its addition to the Macquarie Marshes Nature Reserve, Pillicawarrina is being turned back into a functioning floodplain ecosystem.

Pillicawarrina occupies the main floodplain connecting to the northern section of Macquarie Marshes Nature Reserve. OEH purchased 2400 hectares of the property in 2009 to restore the function of the floodplain and allow for the strategic delivery of environmental water to northern Macquarie Marshes. The water licence held by the property was also purchased.

Historically, Pillicawarrina comprised native vegetation that supported the ecological function of the floodplain, including the breeding of internationally important waterbirds such as the glossy ibis. It was later developed for floodplain cropping, including irrigated cotton production.

Various infrastructure, earthworks and clearing associated with development had, since the late 1970s, diverted flood waters away from the river and floodplain and influenced the progress of water into northern Macquarie Marshes Nature Reserve. The many kilometres of embankments and artificial channels impeded fish movement and the normal passage of flood waters across the floodplain to and from the river channels.

Rehabilitation work funded by the Rivers Environmental Restoration Program (RERP) has removed redundant levees, banks and channels to reinstate flows of water and increase fish passage across the floodplain. These works are complemented by the construction of fish friendly infrastructure in the broader marshes area, including a new fishway at Marebone Weir which enables fish communities to access an additional 214 km of water along Macquarie River and in Macquarie Marshes.

Natural flooding events in 2010, 2011 and 2012, supplemented with environmental water deliveries, have created ideal conditions which help many key wetland species flourish. Periods of prolonged inundation for three to six months during spring and summer have led to the abundant growth of many well-known wetland plant species such as river cooba, lignum and water couch. Native species now dominate sites which have been regularly inundated and have been least disturbed. Many terrestrial plant species that had established in these sites during the drought in the early part of the decade have been replaced by amphibious wetland plant species.

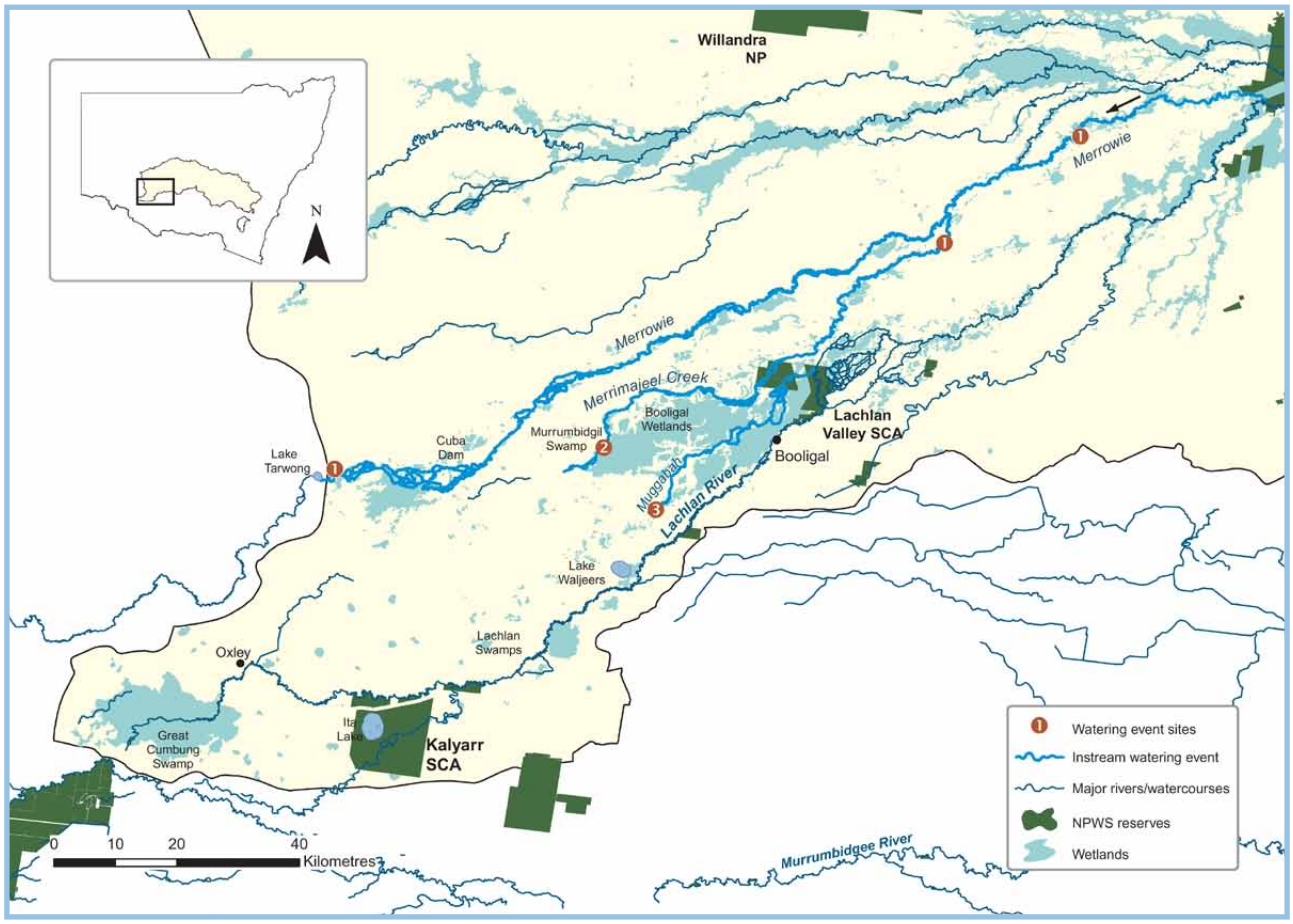
Having now increased the level of connectivity between the river channels and the surrounding floodplains, OEH will continue to manage the Pillicawarrina floodplain to promote diverse and resilient plant communities. These communities will provide improved habitat for aquatic and terrestrial fauna on the floodplain and in the adjacent northern and southern Macquarie Marshes Nature Reserves.

The Pillicawarinna floodplain has undergone a vast improvement from its former condition in 2008 (photo on the left: William Johnson) following restoration works and flooding through natural and environmental flows. Photo on the right: Robert Smith, OEH

Valley report: Lachlan

Lachlan River is one of the most variable river systems in Australia. The catchment encompasses an area of 90,649 square kilometres and three wetlands of high ecological value that are listed in the Directory of Important Wetlands in Australia: Booligal Wetlands, the Great Cumbung Swamp and Lachlan Swamp.

Lachlan Valley environmental watering event sites 2011–12



Since 2006, OEH has prioritised the delivery of environmental water to several smaller lagoons upstream in the mid-Lachlan anabranches near Condobolin, and downstream near Booligal. These lagoons are representative of hundreds of others along the river and are vital for maintaining river health. When flooded, they provide important habitats for waterbirds, fish and aquatic plants. The particular sites chosen for watering have strategic importance and are also highly valued by the community. One site supports a reintroduced population of the endangered purple-spotted gudgeon, another hosts a breeding pair of the vulnerable brolga as well as a diverse frog population and others support diverse aquatic plant communities which supply seed sources for riparian and wetland areas further downstream.

Extended periods of lower flows increase the capacity of these lagoons to recover and contribute to the broader recovery of riverine and wetland ecosystems. This approach is particularly important as Lachlan Valley has many dams, weirs and other features which have changed the hydrology and ecology of the area and decreased the inundation of wetlands and floodplains, resulting in greater fragmentation of aquatic habitats.

Environmental water slowly receding at Lake Tarwong, at the end of the Merrowie Creek channel system in the lower Lachlan Catchment. Photo: Paul Packard, OEH

In the lower Lachlan Valley, the Booligal Wetlands floodplain is made up of braided creek channels and flood runners, numerous small wetlands and swamps including Booligal, Merrimajeel, Murrumbidgil and Lower Gum swamps. Booligal Wetlands support lignum, river red gum, black box and river cooba vegetation communities, and many colonial waterbirds that breed and forage in the area including ibis species and royal spoonbill. The Australasian bittern, blue-billed duck and freckled duck, which are listed as threatened species in the *Threatened Species Conservation Act 1995* (TSC Act), breed in the area. The wetlands also provide habitat for species such as the great egret, glossy ibis and sharp-tailed sandpiper, which are listed in various international migratory bird agreements.

Further down the system, Lachlan Swamps encompass Lake Waljeers, Lake Bullogal, Peppermint Swamp and Ita Lake, which contain stands of black box, river cooba, river red gum, lignum and nitre goosefoot. When Lachlan Swamps are flooded, they support many waterbird colonies, including great egret colonies, and vulnerable species including the blue-billed duck, brown treecreeper, grey-crowned babbler, magpie goose and freckled duck. The swamps also contain two listed plant species, the Mossgiel daisy and Menindee nightshade.

At the end of Lachlan River, the Great Cumbung Swamp is a significant terminal NSW reed swamp which acts as a drought refuge during dry conditions and contains common reed and river red gum communities interspersed with patches of black box and lignum. The swamp and its floodplain support one of the largest continuous areas of river red gum in NSW, and the threatened Australasian bittern, blue-billed duck and freckled duck are found there. Several other waterbirds listed in international bilateral bird agreements are also found in the swamp, including the great egret, glossy ibis, common greenshank, Latham's snipe, white-bellied sea-eagle, and sharp-tailed sandpiper.

The riparian and wetland components of the Booligal Wetlands complex, the Great Cumbung Swamp and Lachlan Swamps are all listed as endangered ecological communities in the *Fisheries Management Act 2004*.

Catchment condition in 2011–12

The recommencement of the Water Sharing Plan for the Lachlan Regulated River Water Source 2003 reinstated environmental flow provisions in the Lachlan Valley for 2011–12 onwards. In July 2011, high-security licence holders commenced the watering year with full entitlements. Relatively low inflows occurred, and no general security allocations were made until March 2012, when substantial flood inflows caused Wyangala Dam to spill for the first time in over a decade. The filling of all storages resulted in general security accounts being reset to 136% of entitlement. Heavy rain fell across the catchment with associated significant, extended tributary inflows. These flows occurred in all the creeks before arrival of the main flood in the river, and most of the floodplain lakes and deflation basins were inundated or surcharged.

Wetlands of the Lachlan Valley have now experienced two or more inundation events of substantial extent and duration during the last two years, although recovery of vegetation following the drought has been variable. Most wetland vegetation communities are at different stages of recovery with vigorous regeneration occurring at many sites.

Watering aims

Below average rainfall across the catchment between July 2011 and February 2012 led to modest watering objectives for the first half of the watering year. The key watering objective was to improve and extend healthy and resilient ecosystems by increasing the duration of inundation and the connectivity of river and creek systems.

The approach taken was to undertake follow-up watering of key assets in the creeks in the lower Lachlan Valley during the cooler months to support the early stages of vegetation recovery. Water releases aimed to enhance and extend the positive outcomes of the previous year's environmental watering and support continuing improvements to the health of wetlands and waterbird breeding areas.

Water delivery

Water delivered in the Lachlan Valley during the 2011–12 environmental watering year

Location	Start date	Finish date	ML of water delivered			
			NSW	CEW[1]	EWA[2]	Total
Merrowie Creek to Lake Tarwong (1)*	1 Jul 2011	24 Oct 2011	4,242	11,568	–	15,810
Merrimajeel Creek, Murrumbidgil Swamp and Lake Merrimajeel (2)*	1 Jul 2011	13 Sep 2011	1,835	5,006	–	6,841
Muggabah Creek, part of the Booligal Wetlands (3)*	14 Aug 2011	10 Oct 2011	1,315	3,585	–	4,900
Total			**7,392**	**20,159**	**–**	**27,551**

* The numbers in the brackets relate to the sites marked on the map.

1 CEW = Commonwealth environmental water

2 EWA = Environmental water allocation accrued under the Water Sharing Plan for the Lachlan Regulated River Water Source 2003

Ecological outcomes

Flood inflows in March 2012 built on the benefits of environmental flows delivered in winter and spring 2011, extending the recovery responses of vegetation and opportunities for bird foraging and breeding.

The Merrowie Creek system, which includes Cuba Dam and Lake Tarwong, provides habitat for a range of threatened and migratory species. Environmental flows successfully inundated the length of Merrowie Creek, increasing cross-floodplain connectivity between Box Creek and its confluence with Merrimajeel Creek.

The prolonged inundation of Lake Tarwong improved vegetation condition. Lignum, an important waterbird nesting plant, displayed new growth and flowers around the shoreline and near-channel areas of Lake Tarwong, and the near-channel areas upstream and downstream of Cuba Dam.

Although river red gum seedlings that had established during environmental watering at Lake Tarwong before the March 2012 floods probably drowned, a new generation of river red gum seedlings should develop as the flood waters recede.

At Murphy's Lake, environmental flows supported the successful breeding of a pair of white-bellied sea eagles, and various cormorant species (around 120 nests) and darters, with parents and young observed flying over and foraging on the lake. Flocks of glossy ibis also returned this year to forage on the lake shores.

Environmental flows reconnected Muggabah and Merrimajeel creeks across the braided channels of the Booligal Wetland system. Aquatic vegetation responded well in Muggabah Creek with new growth of nardoo, water primrose and various rushes. Lignum also grew vigorously, particularly upstream of, and in areas closer to, the braided channels downstream of Boxyards Road.

Murrumbidgil Swamp and Lake Merrimajeel benefited from the flows delivered down Merrimajeel Creek. At Murrumbidgil Swamp, which was previously severely affected by drought, significant river red gum germination occurred around the shorelines and in the bed of the water channels as the water dried. In some areas, seedling densities ranged from 50–200 per square metre. More than 1000 pairs of cormorants and darters nested in the centre of the swamp during the inundation. Significantly, before this colonial waterbird breeding event, Murrumbidgil Swamp had not been noted as a major cormorant breeding site.

Waterbirds also flocked to Lake Merrimajeel. A resident population of more than 250 glossy ibis foraged on the shallow shoreline and lakebed during spring until the lake finally dried. Other birds observed included pelicans, magpie geese, royal spoonbills, yellow spoonbills, egrets, black-winged stilts, red-kneed dotterels, shelducks, black swans and swamp harriers.

Water plans

The following plans determine or help determine how environmental water is allocated and managed in the Lachlan Valley:

- Water Sharing Plan for the Lachlan Regulated River Water Source 2003
- RiverBank Water Use Plan for the Lachlan Water Management Area
- Environmental Watering Plan for the Lachlan Valley 2011–12
- Lachlan Environmental Water Management Plan.

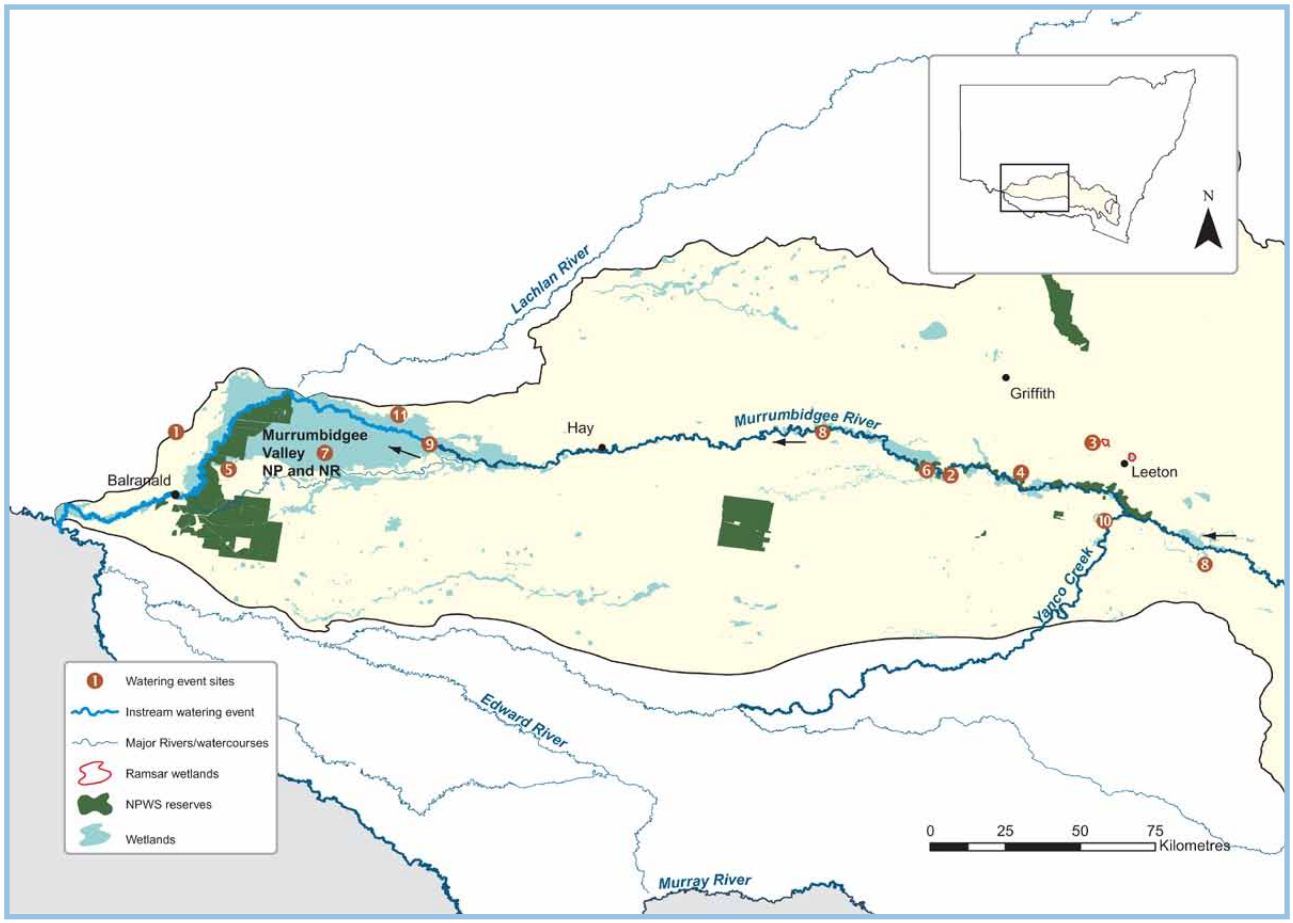
Cumbungi reeds and myriophyllum on Lake Merrimajeel after environmental water receded, December 2011. Photo: Paul Packard, OEH

Intermediate egrets forage at Lake Tarwong following delivery of environmental water, December 2011. Photo: Paul Packard, OEH

Valley report: Murrumbidgee

Murrumbidgee Valley covers 81,527 square kilometres and contains a 1690-kilometre stretch of river with associated wetlands. It also includes national parks, nature reserves and conservation areas which contain important wetlands. The valley has one of the most diverse terrains in NSW, ranging from the alpine areas of Kosciuszko National Park and the Monaro Plains through to the grazing and grain belts of the south-west slopes. The valley also includes the shrublands and grasslands of the semi-arid western Riverina and the riverine floodplains of the lower Murrumbidgee River around its confluences with the Lachlan and Murray rivers.

Murrumbidgee Valley environmental watering event sites 2011–12



For OEH's environmental water planning purposes, Murrumbidgee Valley is split into two areas for management: the mid-Murrumbidgee and the lower Murrumbidgee floodplain known as the 'Lowbidgee'.

The mid-Murrumbidgee wetlands are listed in the Directory of Important Wetlands in Australia. Dominant vegetation communities in the area include river red gum, black box, spike rush, water lilies and water ferns. The area supports five species listed in the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act): trout cod, plains wanderer, superb parrot, southern bell frog and floating swamp wallaby-grass. Several species of birds, fish, reptiles, mammals and plants found in the mid-Murrumbidgee wetlands are also listed in the *Fisheries Management Act 2004* (FM Act), Threatened Species Conservation Act 1995 (TSC Act), and various international agreements.

The Lowbidgee floodplain incorporates the Nimmie–Caira and Redbank floodplain systems and includes Yanga National Park. Vegetation communities found on the floodplain include river red gum, black box, common reed, cumbungi, river cooba, nitre goosefoot, cane grassland and chenopod shrublands. The area supports numerous species listed in the EPBC Act including Murray cod, Australian painted snipe, regent honeyeater, regent parrot, superb parrot, austral pipewort, chariot wheel, slender darling pea, Menindee nightshade and southern bell frog. The floodplain supports several birds, fish, reptiles, mammals and plants listed in the FM Act, TSC Act and various international agreements. Murrumbidgee River is also part of the endangered ecological community of lower Murray River, declared in the FM Act.

There are numerous cultural heritage sites in Murrumbidgee Valley due to a long and continuous Aboriginal occupation before European settlement. For instance, Tuckerbil Swamp contains an ancestral burial ground which is significant to the Wiradjuri people. Many resident indigenous families of the Narrungadera Wiradjuri community live in the Riverina region and maintain a strong connection to the land and wetlands such as Fivebough and Tuckerbil swamps, which are listed in the Ramsar Convention.

Murrumbidgee Valley contains 26 river storage or diversion structures under NSW operation, making it one of Australia's most regulated river systems. Such regulation has substantial impacts on the water regime and on the availability of water to floodplains and wetlands.

Catchment condition in 2011–12

Wet conditions throughout 2011 provided good allocations for Murrumbidgee water users in July 2011, with high security licence holders granted 95% allocation and general security users 44% of entitlement allocation. Regular rainfall continued into 2012, resulting in extended periods of tributary flows, and 100% allocations were later granted to general and high security users. The Water Sharing Plan for the Murrumbidgee Regulated River Water Source also recommenced.

The wet conditions culminated in a major flood along Murrumbidgee River during March–April 2012.

River red gums receive environmental water at Sunshower Lagoon. Photo: James Maguire, OEH

Overall, the wetlands of Murrumbidgee River floodplain have been fairly resilient and are in a much better condition than during the drought. Large scale environmental flows combined with successive floods have improved red gum, black box and lignum health significantly. However, thousands of dead trees remain, highlighting the severity of the drought.

Watering aims

The high availability of environmental water and natural flows enabled several key objectives in 2011–12 to improve and maintain the diversity of wetland types in Murrumbidgee Valley to be achieved.

Throughout the year, water releases aimed to:

- provide sufficient inundation to maximise aquatic plant recovery
- provide native fish habitat and potential spawning cues
- dilute low dissolved oxygen in floodplain waters
- create habitat for threatened species, improve vegetation health and prevent further decline in stressed vegetation communities.

Water delivery

Water delivered in the Murrumbidgee Valley during the 2011–12 environmental watering year

Location	Start date	Finish date	ML of water delivered			
			NSW	CEW[1]	EWA[2]	Total
Paika Lake/Cherax Swamp (1)*	1 Jul 2011	16 Jan 2012	–	–	15,315	15,315
Tombullen Swamp (2)*	4 Oct 2011	12 Oct 2011	–	–	200	200
Tuckerbil Swamp (3)*	15 Nov 2011	4 Dec 2011	–	–	368	368
Gooragool Lagoon (4)*	24 Nov 2011	23 Dec 2011	–	–	2,242	2,242
Lower North Redbank (5)*	25 Nov 2011	14 Feb 2012	–	22,485	2,359	24,844
Murrumbidgee River wetland reconnection (6)*	17 Nov 2011	28 Nov 2011	–	–	11,243	11,243
Eulimbah Swamp and Telephone Bank rookery maintenance flow in the Nimmie Caira wetlands system (7)*	17 Nov 2011 18 Jan 2012	21 Nov 2011 20 Feb 2012	– 6,670	– –	2,029 –	2,029 6,670
Murrumbidgee/mid-Murrumbidgee River wetlands (8)*	1 Dec 2011	16 Dec 2011	–	–	98,175	98,175
Lower Murrumbidgee River, instream habitat maintenance (9)*	11 Feb 2012	29 Feb 2012	–	33,749	–	33,749
Molley's Lagoon (10)*	22 Feb 2012	27 Feb 2012	–	–	72	72
Lower Murrumbidgee blackwater dilution (11)*	15 May 2012	21 May 2012	1,745	26,745	–	28,490
Total			**8,415**	**82,979**	**132,003**	**223,397**

* The numbers in brackets relate to the sites marked on the map.

1 CEW = Commonwealth environmental water

2 EWA = Environmental water allocation accrued under the Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003

Environmental flows to Paika Lake attracted over 20,000 waterbirds, including hundreds of pelicans. Photo: James Maguire, OEH

An environmental release in December 2011 took advantage of rainfall in the tributaries below the dams and much greater rainfall and inflow above the dams to supplement natural flows. This release replicated approximately 35% of the flow which would have passed down the system without river regulation. The flow delivered in-stream benefits along the Murrumbidgee River, and reconnected dozens of wetlands such as Berry Jerry, Sunshower and Yarradda lagoons.

Ecological outcomes

Environmental watering in 2011–12 supported a significant increase in aquatic vegetation. This helped to maintain key habitat through summer, which encouraged a high diversity and abundance of waterbirds.

In the Lowbidgee, Paika Lake became prime foraging habitat. Surrounding river red gums were inundated, and black box trees in nearby Cherax Swamp thrived and provided feeding habitat for thousands of waterbirds. Surveys estimated that well over 20,000 waterbirds from 35 different species gathered at the lake, including three threatened species – the blue billed duck, freckled duck, and Australian painted snipe. Pelicans, coots, egrets, ibis and grebes were also spotted in their hundreds with successful breeding observed for darters, swans, ducks and native hens. The water delivery path from North Redbank Channel to Paika Lake also benefited a significant area of river red gum forest and several kilometres of creek running through the property, 'Narwie'.

Also on the Lowbidgee floodplain, an estimated 7000 hectares of river red gum forest, and swamps and lagoons in the North Redbank system, were inundated for three months. Wetlands responded well with abundant and diverse aquatic plant growth. Thousands of waterbirds were observed feeding throughout the flooded river red gum forest and swamps. Targeted environmental flows were delivered to support two small ibis rookeries at Telephone Bank Swamp and Eulimbah Swamp in the Nimmie–Caira Wetlands. The rookery at Telephone Bank contained approximately 1500 glossy ibis, which is a considerable gathering for this internationally significant waterbird.

A total of 36 waterbird species were recorded at McKennas Lagoon in the mid-Murrumbidgee wetlands including glossy ibis, great egrets and white-bellied sea eagles listed in international agreements. Australasian grebes, great cormorants, little pied cormorants and darters were also breeding in this area, and there was limited colonial waterbird breeding on Gooragool and Yarrada lagoons.

Several turtle species including long necked turtles, and Murray River turtle hatchlings and adults, were observed in the mid-Murrumbidgee Wetlands. Photo: James Maguire, OEH

There has been a marked increase in the abundance of frog species in the mid-Murrumbidgee wetlands and on Paika Lake. Signs of breeding activity were observed for the barking marsh frog, spotted marsh frog and Peron's tree frog following environmental water releases in the area.

Native fish utilised environmental flows to recolonise wetlands. Six native species were recorded in several mid-Murrumbidgee wetlands as well as freshwater shrimp and yabbies. Juvenile golden perch, carp gudgeon, Australian smelt, unspecked hardyheads, Murray–Darling rainbow fish and bony bream were observed at several sites, indicating successful recruitment of these native species. Long-necked turtles and Murray River turtle hatchlings were also observed in wetlands in the mid-Murrumbidgee wetlands, including Yarrada and Molleys lagoons.

During March–May 2012 the mid-Murrumbidgee and Lowbidgee floodplains were inundated by natural flooding to the largest extent witnessed since 1974. Accumulated organic materials on the floodplains, principally leaf litter which decayed under the flood waters, resulted in standing and slow moving water that was rich in dissolved organic carbon (blackwater).

As floods receded, the blackwater flowed back into the river system, lowering the levels of dissolved oxygen to a level dangerous for fish survival. Very low dissolved oxygen levels were recorded in the lower sections of Murrumbidgee River during May 2012, and several landholders reported small scale fish deaths.

Once flooding had receded to a level where no further connection with the floodplain could occur, managed flows were introduced into the river system to dilute the blackwater as it continued to drain back into the river. The clean water flows allowed dissolved oxygen to return to a level which was safe for native fish.

Environmental water releases totalling 28,490 ML of Commonwealth and NSW environmental water maintained a steady base flow of 6200–6500 ML a day in the river channel, measured downstream of Maude Weir. This watering was complemented downstream by additional releases of Commonwealth environmental water into the mid-Murray River.

Water plans

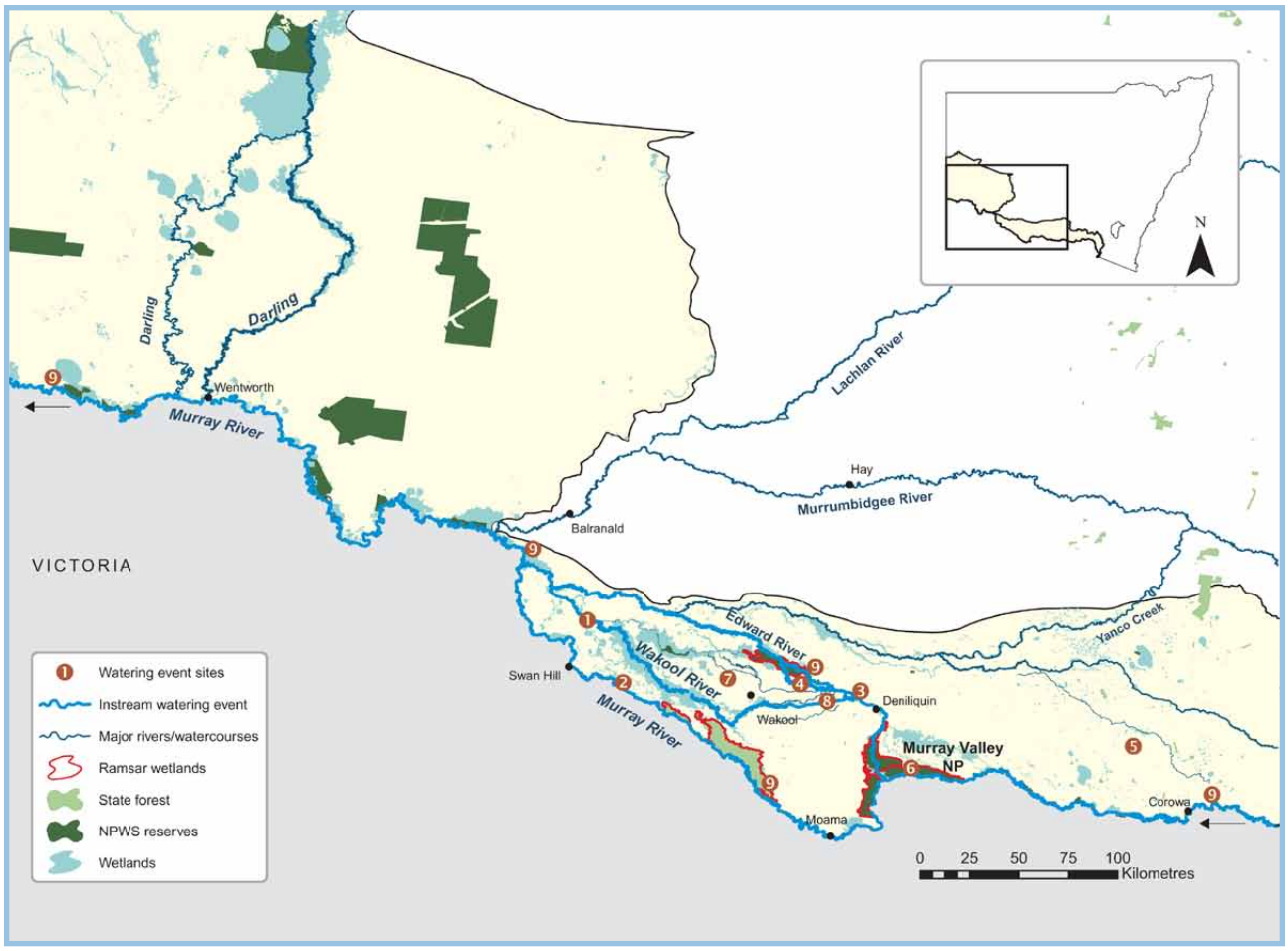
The following plans determine or help determine how environmental water is allocated and managed in the Murrumbidgee Valley:

- Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003
- RiverBank Water Use Plan for the Murrumbidgee Water Management Area
- Environmental Watering Plan for the Murrumbidgee Valley 2011–12.

Valley report: Murray and Lower Darling

Murray River is an extensive system that travels across NSW, Victoria and South Australia. The river stretches over 1800 kilometres across NSW and makes up part of the border between NSW and Victoria. The NSW portion includes the large Edward–Wakool anabranch system with its intricate network of floodplain waterways. It also includes a floodplain area of 14,490 square kilometres which contains a mosaic of wetland types ranging from ephemeral wetlands and creeks to permanently wet lagoons and rivers.

Murray and Lower Darling valleys environmental watering event sites 2011–12



The freshwater habitats in the Murray and Lower Darling valleys are hydrologically and ecologically complex. They include floodplain wetlands, ephemeral lakes and waterways, and instream habitats. Several sites on the river are recognised internationally under the Ramsar Convention such as the NSW Millewa Forest (36,000 hectares) which forms part of the Murray Valley National Park and State Conservation Area.

The Millewa Forest and the ephemeral Darling Anabranch and associated lakes are identified in A Directory of Important Wetlands in Australia. Although the larger wetland complexes are in NSW reserves, many others on the NSW River Murray floodplain are located on private property.

The NSW Millewa Forest makes up over half of the Barmah-Millewa icon site under the Living Murray Program, which extends across the border of NSW and Victoria. This icon site is the largest river red gum forest in the world and also contains river cooba, black box, lignum, common reed, Moira grass, spike rush and giant rush communities.

Koondrook–Perricoota Forest, the eastern section of Chowilla floodplain in NSW, and the River Murray Channel are also icon sites under The Living Murray program. Watering of the icon sites is coordinated by the Murray–Darling Basin Authority in conjunction with state and Australian governments.

The Murray and Lower Darling valleys contain areas that are recognised as important habitat for threatened and vulnerable fauna listed in the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*. Parts of Millewa Forest provide habitat for the southern pygmy perch as well as breeding habitat for the superb parrot and colonial nesting birds and migratory bird species. Several of these species are listed in international agreements.

Several sites in the Mid Murray and Lower Murray Darling rivers support the southern bell frog and may provide breeding habitat for the regent parrot. The Mid Murray River also contains sites that provide habitat for the bush stone-curlew and brolga. Many other fish, birds, mammals, reptiles and plants occurring in these habitats are listed in the *Fisheries Management Act 2004* and *Threatened Species Conservation Act 1995*, and various international agreements.

Reed beds flourish in the internationally significant North Millewa Forest. Photo: Rick Webster, OEH

In the Murray Valley and surrounding areas, more than 968 cultural heritage sites have been recorded. Most of these are in Millewa Forest (Cummergunja people), Werai Forest (Deniliquin people) and the eastern portion of Koondrook Forest (Cummergunja and Moama people). Cultural heritage sites include scar trees, burial sites, shell middens and oven mounds.

Many human activities have had an impact on the ecological values of the Murray region including river regulation, livestock grazing, fishing, water diversions and timber harvesting. River regulation and water extraction have reduced small and medium flood events and the extent and condition of floodplain wetlands.

Catchment condition in 2011–12

The 2011–2012 water year in the Murray and Lower Darling valleys continued the wet conditions of the previous year, exceeding the 10-year average and long-term average for inflows, particularly from late February 2012. The ongoing good rainfall resulted in the recommencement of the Murray and Lower Darling water sharing plan, following several years of drought suspension and 100% of entitlements being granted to water licence holders in November 2011.

Many wetlands were inundated during 2010–2012 during high system flows, localised rainfall and environmental allocations, resulting in an overall improvement in vegetation communities. In the Lower Murray-Darling catchment, foliage cover and understorey and associated wetland plant species have been more abundant. Such abundance has also been observed on the mid-Murray River, particularly on sites in OEH's Private Property Wetlands Project and individual private wetland sites including Brechin, Tueloga and Comersdale. Many sites remain wet from prolonged inundation and will be allowed to dry out during 2012–2013 to allow floodplain vegetation species to complete their lifecycles.

Watering aims

Plentiful environmental water in the NSW Murray and Lower Darling valleys enabled several key objectives in 2011–12 to be considered with an overarching aim to improve or maintain the condition and diversity of wetland types.

In 2011–2012, water was delivered to targeted areas to benefit wetland ecosystems; to provide feeding and breeding habitat for aquatic fauna such as waterbirds, fish and frogs; and to prevent further decline in the health of several river red gum and river cooba communities.

Other watering objectives included promoting native fish breeding and dispersal; providing opportunities for aquatic plant communities to germinate, regenerate and set seed; and mitigating flows of water with low levels of dissolved oxygen coming from other catchments into Murray River.

OEH worked with the landholder to deliver environmental water to Brechin Wetland during October–November 2011. Photo: Emma Wilson, OEH

Water delivery

Water delivered in the Murray and Lower Darling valleys during the 2011–12 environmental watering year

Location	Start date	Finish date	ML of water delivered				
			NSW[1]	CEW[2]	EWA[3]	TLM[4]	Total
Comersdale Wetland (1)*	3 Sep 2011	10 Sep 2011	60	–	–	–	60
Tueloga Wetland (1)*	18 Sep 2011 5 Mar 2012	1 Nov 2011 9 Mar 2012	20 10	– –	– –	– –	20 10
Brechin Wetland (2)*	16 Oct 2011	8 Nov 2011	55	–	–	–	55
MIL private property wetlands (3)*	1 Oct 2011	16 May 2012	1,452	–	–	–	1,452
Elimdale Wetland (4)*	30 Oct 2011 6 Dec 2011	12 Nov 2011 22 Dec 2011	117 100	– –	– –	– –	117 100
Colligen Creek (Wakool–Yallakool Fish Flow Project) (4)*	18 Nov 2011 7 Feb 2012	7 Dec 2011 6 Mar 2012	1,717 6,881	5,500 7,500	– –	– –	7,217 14,381
Rilverside Wetland (5)*	25 Nov 2011	20 Dec 2011	227	–	–	–	227
Barmah–Millewa Forest (6)*	12 Sep 2011	7 Feb 2012	15,000	–	141,550	100,000	256,550
Jimaringle and Cockran creeks (7)*	2 Mar 2012	13 Apr 2012	3,227	3,000	–	–	6,227
Edward–Wakool River System – blackwater dilution (8)*	13 Apr 2012	14 May 2012	291	39,445	–	–	39,736
Murray River – blackwater dilution (9)*	16 Apr 2012	17 May 2012	–	45,894	–	–	45,894
Total			**29,157**	**101,339**	**141,550**	**100,000**	**372,046**

* The numbers in the brackets relate to the sites marked on the map.

1 The total amount shown for NSW adaptive environmental water in the above table does not include an amount of 590 ML that was delivered in 2010–11, but was amended after the close of trade for that year (July 2011).

2 CEW = Commonwealth environmental water

3 EWA = Environmental water allocation accrued under the Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers Water Sources 2003

4 TLM = Water sourced from The Living Murray coordinated by the Murray–Darling Basin Authority. The Barmah-Millewa Forest event delivered a combination of TLM, NSW EWA and AEW allocations (100,000 ML, 141,550 ML and 15,000 ML respectively) in conjunction with an equivalent contribution by the Victorian Environmental Water Holder.

Ecological outcomes

Environmental watering in the Murray and Lower Darling valleys in 2011–12 built on the ecological outcomes achieved from water delivered previously to several key sites, including Barmah-Millewa Forest and Jimaringle and Cockran creeks. OEH staff also collaborated with Murray Irrigation Limited (MIL) landholders to deliver environmental water to privately owned wetlands and achieved positive ecological outcomes.

The fauna and flora on Murray and Lower Darling sites have benefited from environmental water and high river releases in 2011–2012. OEH staff reported an increase in foliage cover on riparian trees such as river red gums, black box and understorey lignum. Higher diversity and abundances of native wetland plants were also observed on most Murray and Lower Darling sites.

Numerous waterbirds flourished in response to environmental water in Millewa Forest. Approximately 1700 pairs of colonial species including 800 Australian white ibis and straw-necked ibis, 120 great egrets, 200 royal spoonbills, 400 cormorants and 200 Australasian darters successfully bred and fledged their young.

Most sites receiving environmental water provided ideal frog breeding and recruitment habitat, which was observed through the detection of calling males, egg masses and tadpoles/metamorphs. Surveys throughout 2011–2012 in the Murray and Lower Darling valleys recorded high abundances of frogs. Ten species were observed during 2011–12 compared with eight species during 2009–2010.

Fish monitoring in the Darling Anabranch system during 2011–2012 detected the movement and recruitment of yellowbelly throughout the system, and also recorded freshwater catfish in the lower part of the system which connects to the Murray River. OEH managed and contributed environmental flows to the Wakool–Yallakool Fish Flow Project being undertaken by the Commonwealth Environmental Water Office, NSW Department of Primary Industries and the Murray Catchment Management Authority. This project investigates fish response to flow pulses and ways of promoting native fish movement and spawning using environmental water flows.

Environmental water was also delivered to the Murray and Edward–Wakool River systems in April and May 2012. This delivery was a combined event using mostly Commonwealth and some NSW environmental water to mitigate hypoxic blackwater that was entering the system. The environmental water increased dissolved oxygen levels and sustained habitat for native fish. Monitoring during the period showed that dissolved oxygen levels rose to levels acceptable for fish survival in almost all areas.

Water plans

The following plans determine or help determine how environmental water is allocated and managed in the Murray Valley:

- Adaptive Environmental Water Use Plan for the NSW Murray and Lower Darling Water Management Areas (in preparation)
- Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers Water Sources 2003
- Environmental Watering Plan for the Murray Valley 2011–12
- The Living Murray Annual Environmental Watering Plan 2011–12.

More than 200 pairs of royal spoonbills successfully bred and fledged their young in Millewa Forest in 2011–12. Photo: Peter Terrill, OEH

Murray Valley: Teamwork helps Murray Valley creeks thrive

The Jimaringle and Cockran creeks (JCC) system is an important ecological asset that has brought together the local community and government agencies to see it thrive in response to environmental flows.

Located in the Edward–Wakool system in the Murray Valley, this 130-kilometre long ephemeral creek system travels through the properties of around 30 landholders. The impacts of extensive clearing and changed flow regimes were intensified by the low water flows that had entered the system during the previous decade.

Despite a decline in native flora and fauna, landholders and the local community recognised that the area still supported a significant and diverse ecosystem. The community, in conjunction with Murray Irrigation Limited, developed an action plan which identified that the main issues in the system, such as high salinity and sulfidic sediments, could be mitigated using environmental water.

Natural flooding in part of the system during 2010–11 and again in 2011–12 provided an opportunity for OEH to conduct a trial environmental watering event using water sourced from OEH and the Commonwealth Environmental Water Office.

During autumn 2011, 3557 ML of NSW and Commonwealth environmental water was delivered with a further 6220 ML delivered in autumn 2012. The most recent water delivery, in conjunction with high river flows, connected the JCC system to Niemur River. Monitoring by the Murray Catchment Management Authority (Murray CMA) and landholders reported positive results of low salinity readings, as the system had been effectively flushed by the environmental water flowing through the creek.

Emma Wilson, OEH project officer said that the JCC community support of the project has been vital to its success.

'The landholders have provided extensive local knowledge of the system and have assisted OEH and the Murray CMA with monitoring and consents to allow access to properties and delivery of environmental flows,' said Ms Wilson.

A local landholder and OEH project officer, Emma Wilson, inspect Jimaringle Creek following environmental flows. Photo: Vince Bucello

The ecological communities within the creek system have flourished in response to the return of seasonal inflows for two consecutive years. The fringing river red gums, black box and lignum have improved in condition, demonstrating fresh new growth and flowering. Wetland vegetation such as spike rush and duckweed have increased in abundance. OEH staff identified several frog species including the pobblebonk, Peron's tree frog and the wrinkled toadlet. More than 20 species of waterbirds were observed foraging in the creek system, including egrets and cormorants. The water rat, a native Australian mammal, was also found at several locations.

Landholder Dennis Gleeson, who has been one of the key drivers behind the project, has been pleased to see water in the creek again after so many years. 'The trees have come back to life and there are so many birds! The JCC community are looking forward to continuing to work with OEH to further improve the creek,' said Mr Gleeson.

OEH will continue to work closely with the local community, the Commonwealth Environmental Water Office and the Murray CMA, and may investigate options to expand the project to include Gwynnes Creek and additional sections of Cockran Creek in future water years.

NSW environmental water holdings

A total of 6822 megalitres (ML) was added to the NSW environmental water holdings in 2011–12 through the purchase and recovery of high security, general security and unregulated water, bringing the cumulative total to 358,941 ML.

Cumulative environmental water holdings recovered to 30 June 2012 (ML)

	NSW environmental water holdings				The Living Murray	Total
Valley	HS[1]	GS[2]	SA[3]	UR[4]	LTCE[5]	
Gwydir	–	17,092	441	0	–	**17,533**
Macquarie	–	48,419	1,452	2,980	–	**52,851**
Lachlan	1,000	24,569	–	184	–	**25,753**
Murrumbidgee	–	27,676	5,679	7,962	–	**39,517**
NSW southern Murray–Darling Basin[6]	–	–	–	–	221,487	**221,487**
Subtotal	**1,000**	**117,756**	**7,572**	**11,126**	**221,487**	
Total						**358,941**

Note: This table is an operational record, so some minor adjustments may need to be incorporated when the data is verified by audit.

'Water holdings' are environmental water entitlements. Each entitlement has a share of total water access for a particular category. The different categories reflect the long-term average reliability of water allocation which will vary with seasonal dam storage and inflows.

1 HS = High security: shares are likely to receive close to 100% of their allocation in most years

2 GS = General security: allocation varies depending on inflows and storage levels

3 SA = Supplementary access: subject to event-based announcements

4 UR = Unregulated entitlement: available water is not regulated by a major storage. For many valleys, water sharing plans for unregulated water sources have not yet been completed and licences are administered under the *Water Act 1912*

5 LTCE = Long-term cap equivalent: a unit of measure for entitlement purchased under The Living Murray which approximates long-term water availability and includes all entitlement categories (HS, GS, SA, Conveyance). A breakdown of water purchase and recovery measures is available at www.mdba.gov.au/programs/tlm under 'Further information'

6 Includes water recovered from the Murray, Murrumbidgee and Lower Darling valleys for the benefit of the Murray River (The Living Murray).

A royal spoonbill forages in the Upper Gingham Wetlands, May 2012. Photo: Daryl Albertson, OEH

Partners

The management and delivery of environmental water by OEH relies on the cooperation of a number of NSW agencies, the Australian Government and other partners. OEH would like to acknowledge the contribution of the following partners.

The **Commonwealth Environmental Water Office** (CEWO) supports the Commonwealth Environmental Water Holder to manage environmental water holdings that have been purchased by the Australian Government through the water market or acquired through investment in water savings infrastructure. Commonwealth environmental water is contributed to NSW events undertaken by OEH and its partners. The NSW and Australian governments work cooperatively to ensure the best environmental outcomes in managing environmental water.

The **Department of Sustainability, Environment, Water, Population and Communities** leads implementation of national water reforms and administers the Australian Government's Water for the Future–Water Smart Australia Program.

The **NSW Department of Trade and Investment, Regional Infrastructure and Services** (formerly Industry & Investment NSW) remediates weirs, levees, banks and other water infrastructure. It provides special technical and policy advice to water recovery and environmental water use projects and plans, particularly those dealing with on-farm water use efficiency, floodplain forests, and fisheries and wetland management.

The **NSW Office of Water** is responsible for implementing the *Water Act 1912* and *Water Management Act 2000*, determines water availability, manages flow events in unregulated and regulated rivers, monitors water use, and implements and monitors the outcomes of rules-based planned environmental water under water sharing plans. The NSW Office of Water is an agency within the Department of Trade and Investment, Regional Infrastructure and Services.

NSW Fisheries provides specialist technical and policy advice on fisheries management in water recovery and environmental water use projects and plans, and is an agency within the Department of Trade and Investment, Regional Infrastructure and Services.

State Water manages river operations and water delivery in regulated river systems across NSW under licence to the NSW Government.

Other partners with significant roles in environmental water management in NSW include:

- private landholders, many of whom provide access to their properties, advice and on-ground support to OEH during watering events
- the 13 catchment management authorities who work with regional communities to respond to key natural resource management issues facing their catchments and who have a role in environmental water advisory groups in NSW
- environmental water advisory groups who provide expert knowledge, including local knowledge and experience, when advising OEH on managing environmental water
- the Murray–Darling Basin Authority, which is the Australian Government agency responsible for managing the water resources within the basin, including preparing a Basin Plan and coordinating the management of water recovered for The Living Murray icon sites
- the Natural Resources Commission of NSW which provides independent advice to NSW Government agencies on managing the state's natural resources, including progress towards meeting the statewide natural resource targets
- Murray Irrigation Limited, one of the largest irrigation companies in southern NSW – its infrastructure assists with delivering environmental water to projects within the mid-reach of the Murray Valley
- universities who support OEH in monitoring and research assistance – Charles Sturt University, University of New England, University of New South Wales and the University of Technology, Sydney.

The Macquarie-Cudgegong Environmental Flows Reference Group visit Macquarie Marshes, 2011. Photo: Tim Hosking, OEH

Water recovery programs

Water recovery programs in NSW improve environmental outcomes for rivers and wetlands while supporting regional, social and economic objectives. These programs operate through investment in efficient water delivery and management infrastructure and the purchase of water access licences from willing sellers.

Current programs

The **Environmental Works and Measures Feasibility Program** is a $10-million Australian Government-funded partnership with the states. It will investigate the feasibility of environmental works and measures that can:

- reduce the size of the sustainable diversion limit required under the Murray-Darling Basin Plan
- achieve improved environmental outcomes from environmental watering.

OEH is leading two projects under the program in NSW – the Upper Murrumbidgee Environmental Flow Enhancement Project and the Southern Macquarie Marshes Environmental Flow Enhancement Project. Progress on both these projects will be reported on in 2013.

Pipeline NSW is a $7 million program being implemented by the NSW Office of Water to improve the efficiency of delivering water for rural stock and domestic use by replacing open channels and dams with piped systems, tanks and troughs. Pipeline NSW is jointly funded with $3.5 million each from OEH's RiverBank Program and the Australian Government's Water for the Future–Water Smart Australia Program. At 30 June 2012, the program is on track to achieve water savings from reduced system and operational losses in three project areas.

Although three years of flooding have caused delays, this program is nearly completed. The final survey, design and plans have been completed for projects in the Lower Barwon and Lower Lachlan regions, and preliminary works are being carried out. The Lower Gwydir project has again experienced delays, due to flooding throughout the summer of 2012.

Straw necked ibis nests in Gwydir Wetlands. Photo: Josh Smith, OEH

Completed programs

NSW RiverBank commenced in 2005–06 and was the first program in Australia dedicated to the purchase of water entitlements for the environment. The purchase of water entitlements from willing sellers was completed in June 2012. The $105 million program, funded by the NSW Environmental Trust, purchased 94,166 ML of water entitlement by 30 June 2012.

The OEH Environmental Water Business Plan allows for the periodic trading of water allocations in the accounts of OEH water access licences to provide revenue to meet the statutory charges associated with holding and using the licences. In 2011–12, OEH traded 25,200 ML of water in 12 separate trades across the Gwydir, Macquarie, Lachlan and Murrumbidgee valleys. Increased levels of temporary trading are likely to occur in future years to optimise management of the portfolio of water products that OEH has acquired.

This gauging station in Narran Lake Nature Reserve records rainfall, water quality and air and water temperature and was funded through the Rivers Environmental Restoration Program. Photo: Peter Terrill, OEH

The **Hawkesbury–Nepean River Recovery Program** was a $77.4-million program funded by the Australian Government's Water for the Future fund. The program aimed to improve river health below the system's major water supply dams, by increasing the amount of water retained in the river for the environment, and by reducing nutrient inputs and loads.

A Hawkesbury–Nepean Water Licence Purchase Project was delivered under this program by OEH and is now complete. OEH purchased 3658 ML of unregulated river access licence shares from willing sellers across the Hawkesbury-Nepean catchment for $4 million. The purchased entitlement will be reserved as environmental water and will contribute to a healthier river.

Water for Rivers was established by the NSW, Victorian and Australian governments in 2003 to recover 282,000 ML of water in NSW and Victoria by 2012 for the Snowy and Murray rivers. Water savings are being achieved through investment in more efficient water infrastructure, innovation and technology and the purchase of water access licences. As at 30 June 2012, the program is on track to deliver its target savings.

The Living Murray was established by the Murray–Darling Basin Ministerial Council, in partnership with the Australian, NSW, Victorian, South Australian and Australian Capital Territory governments. The program has recovered almost 500 GL of water to improve the environmental health of six 'icon' sites along the Murray River. The NSW Government contributed $115 million to this program, along with investments from its partners. Over 221 GL was recovered within NSW for The Living Murray, more than 45% of the total water recovered under the program. A structural works program is being undertaken to facilitate the efficient delivery of environmental water recovered under The Living Murray.

The **Rivers Environmental Restoration Program** (RERP) was completed in June 2011. The $181-million program aimed to arrest the decline of some of the most important and threatened wetland habitats in NSW through water recovery and effective management of environmental water. RERP recovered 33,905 ML of water entitlement (in addition to the 92,366 ML recovered by NSW RiverBank at that time) through the purchase of water licences and water savings from infrastructure projects. Investment under RERP programs improved the science of wetland management, improved the delivery of environmental water through infrastructure projects, purchased wetland national park additions and created local community partnerships. The RERP Final Report is available at **www.environment.nsw.gov.au/environmentalwater/rerp.htm**.

The **NSW Wetland Recovery Program** was completed in June 2010, having recovered 9383 ML of environmental water. This $26.8 million program was jointly funded by the NSW and Australian governments. The program invested in wetland research, management tools, wetland management plans, grazing projects, weed control and infrastructure projects to recover water and improve environmental water flow in the Gwydir Wetlands and Macquarie Marshes. For information on the achievements of the program, visit **www.wetlandrecovery.nsw.gov.au**.

www.environment.nsw.gov.au/environmentalwater