TOWARDS A HEALTHY, WORKING MURRAY–DARLING BASIN

Basin Plan annual report 2014–15

Australian Government

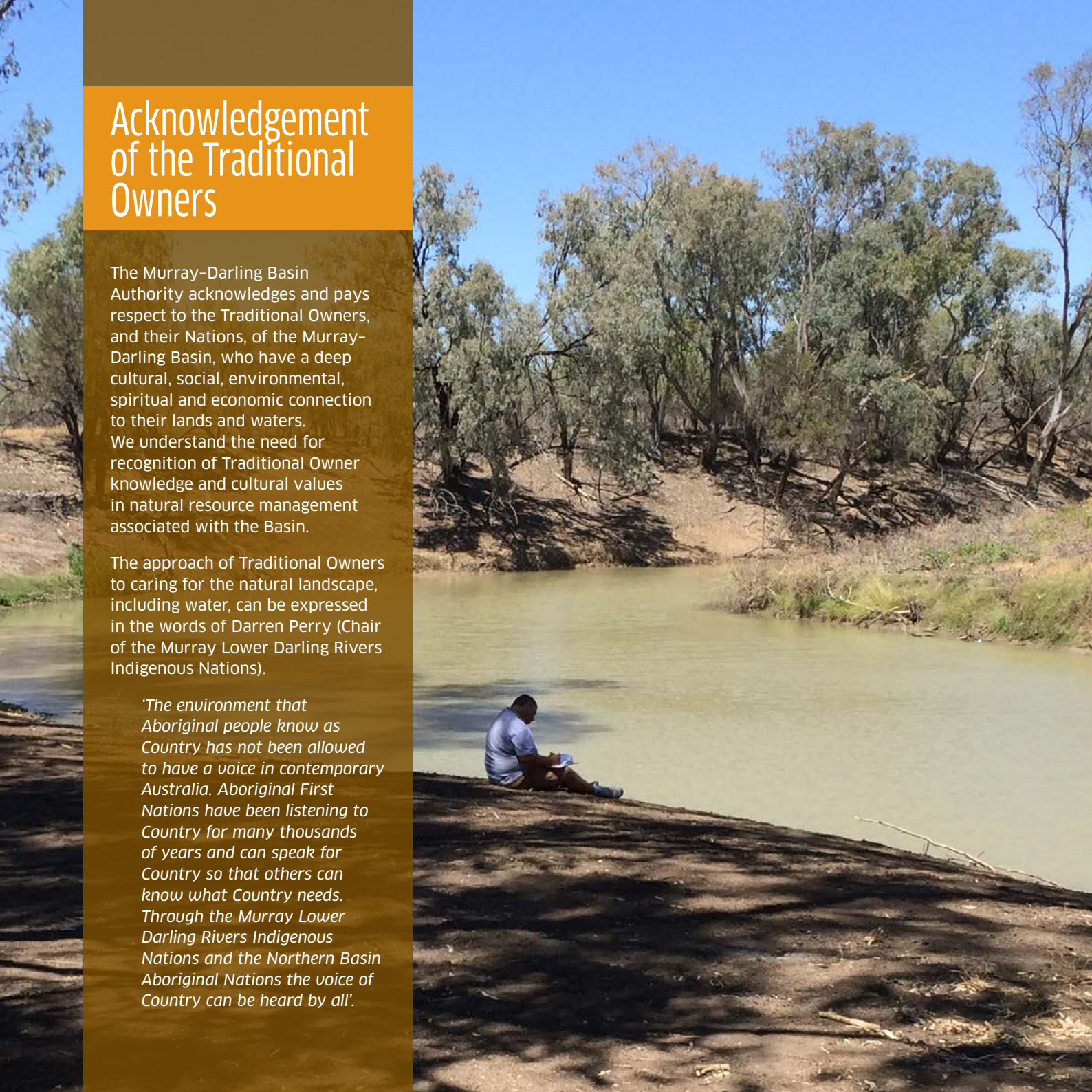
MURRAY–DARLING BASIN AUTHORITY

Acknowledgement of the Traditional Owners

The Murray–Darling Basin Authority acknowledges and pays respect to the Traditional Owners, and their Nations, of the Murray–Darling Basin, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters.
We understand the need for recognition of Traditional Owner knowledge and cultural values in natural resource management associated with the Basin.

The approach of Traditional Owners to caring for the natural landscape, including water, can be expressed in the words of Darren Perry (Chair of the Murray Lower Darling Rivers Indigenous Nations).

> *'The environment that Aboriginal people know as Country has not been allowed to have a voice in contemporary Australia. Aboriginal First Nations have been listening to Country for many thousands of years and can speak for Country so that others can know what Country needs. Through the Murray Lower Darling Rivers Indigenous Nations and the Northern Basin Aboriginal Nations the voice of Country can be heard by all'.*



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About this report

This is the second stand-alone report on how the Basin Plan and associated reforms are tracking against social, economic and environmental outcomes. It provides an update on progress made during 2014–15 towards achieving the sustainable and equitable use of the Murray–Darling Basin's scarce water resources.

The Murray–Darling Basin is a complex, diverse and dynamic system. Its characteristics are constantly changing in response to the influences of people, the climate and the way water is used – for production, communities and the environment.

The aim of the Basin Plan is to ensure that water is shared between all users, including the environment, in a sustainable way. It does this by managing the Basin as one system. This will enable the river systems to continue to support communities and industries in the long term as they adapt to changes, including a changing climate.

In 2014–15, the Murray–Darling Basin Authority (MDBA) continued working with Basin governments and communities. This included reviewing the Plan's settings for sustainable diversion limits, and exploring ways to deliver environmental water more effectively and efficiently by easing constraints. The Plan is designed to adapt the way the Basin's water resources are managed based on what is learnt.

This year more water was recovered to improve the Basin environment, bringing the total to 71% of the water recovery target (up from 69% in 2013–14). As part of the water recovery program, the Australian Government invested a further $550 million in water-efficient infrastructure.

The first ever Basin-wide environmental watering strategy was released, setting measurable outcomes for improvement. Governments worked together to deliver over 2,000 GL to meet Basin-wide annual watering priorities. Early results show that environmental watering benefited native fish, native vegetation, waterbirds and river flows.

The Basin Plan is a long-term reform. It is being rolled out over many years to give communities time to adapt. Even so, some communities are more vulnerable than others and face particular challenges. Many are feeling the stress of economic, climatic and policy changes that have occurred over recent decades.

The MDBA has been gathering information and identifying long-term social, economic and environmental trends and changes happening in communities and industries. The next step will be to identify causes of long-term trends and changes and isolate those which are likely to have been influenced by the Basin Plan. This work will contribute to a much more detailed evaluation of the Plan.

> This report uses three themes to track progress: productive and resilient industries and confident communities; healthy and resilient rivers, wetlands and floodplains; and working together.
>
> This report draws from information provided by Basin state governments, the Commonwealth Environmental Water Office, the Department of Agriculture and Water Resources, the MDBA and other Australian Government agencies.

THE 2014–15 YEAR IN REVIEW

Reports from the Basin governments for 2014–15 show that they are working together in consultation with Basin communities to progressively implement different elements of the Basin Plan.

Productive and resilient industries and confident communities

(page 7)

SOCIAL AND ECONOMIC EVALUATION

- The MDBA continued to collect information to assess how communities are adjusting to change and the impact of the Basin Plan

WATER TRADE

- New water trade rules took effect, improving opportunities for water users to manage risks

RECOVERING WATER FOR THE ENVIRONMENT

- As at 30 June 2015, 1,951 GL (71%) of the water recovery target of 2,750 GL has been recovered, up from 69% last year
- The Australian Government invested a further $550 million on water-efficient infrastructure on farms, and water delivery systems
- The Australian Government introduced legislation (which took effect in October 2015) to cap surface water purchases in the Basin at 1,500 GL

Healthy and resilient rivers, wetlands and floodplains

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PLANNING AT A BASIN-WIDE SCALE

- The Basin-wide environmental watering strategy was published. It sets Basin-scale long-term measurable outcomes and provides guidance on watering strategies

ENVIRONMENTAL WATER DELIVERED TO WHOLE-OF-BASIN PRIORITIES

- Whole-of-Basin priorities received over 2,000 GL of environmental water, as water was re-used to provide multiple benefits downstream
- Monitoring showed improvements for native fish, waterbirds and native vegetation in response to environmental watering events
- New water management structures, designed to maximise the use of environmental water, were tested
- Three Aboriginal communities trialled the Aboriginal Waterways Assessment tool as a way to consistently measure and prioritise river and wetland health

Working together

(page 37)

WORKING WITH GOVERNMENTS

- Basin governments are developing projects to reduce the water recovery target while still achieving equivalent environmental outcomes
- Basin governments are developing proposals to deliver environmental water more efficiently (addressing constraints)

WORKING WITH COMMUNITIES

- Communities were involved in decisions about where and when to water, and maximising benefits for different water users
- The MDBA and states worked with landholders to better understand the effects of addressing constraints
- The Northern Basin Advisory Committee, industry groups, communities and scientists contributed to progress on the northern Basin review

2014–15 CLIMATE – PERSISTING DRY CONDITIONS

Rainfall across the Basin was lower than average, with particularly dry conditions in Victoria, compared to the previous year. Overall the drought is continuing which is reflected in storage volumes declining further, compared to 2013–14, see Figure 1.

Northern Basin

- average to below average rainfall, except in the lower Darling, where rainfall was above average
- drought conditions eased slightly in Queensland but not enough to make a significant impact for agricultural production
- rainfall very much below average in the Barwon–Culgoa area

Southern Basin

- lowest rainfall on record for Victoria
- drought conditions intensified compared to the previous year
- the 2015–16 water year may involve lower allocations

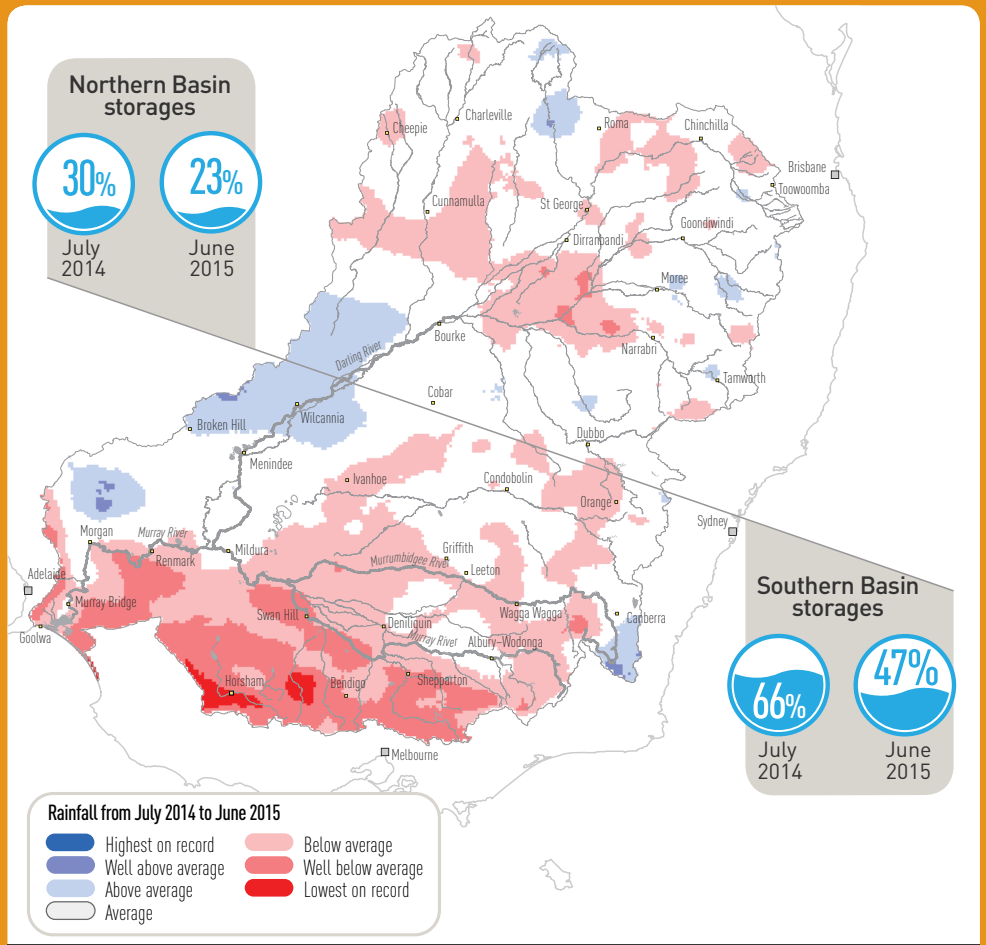


Figure 1: Murray–Darling Basin rainfall and storage (storage figures do not include water in private storages)

Water diversions across the Basin

Surface water

Watercourse diversions in the Basin dropped to a low of around 4,000 GL at the height of the millennium drought in 2009. They have gradually recovered to a recent peak of around 11,000 GL by June 2013, and dropped to around 7,400 GL in the 2014–15 water year, see Figure 2.

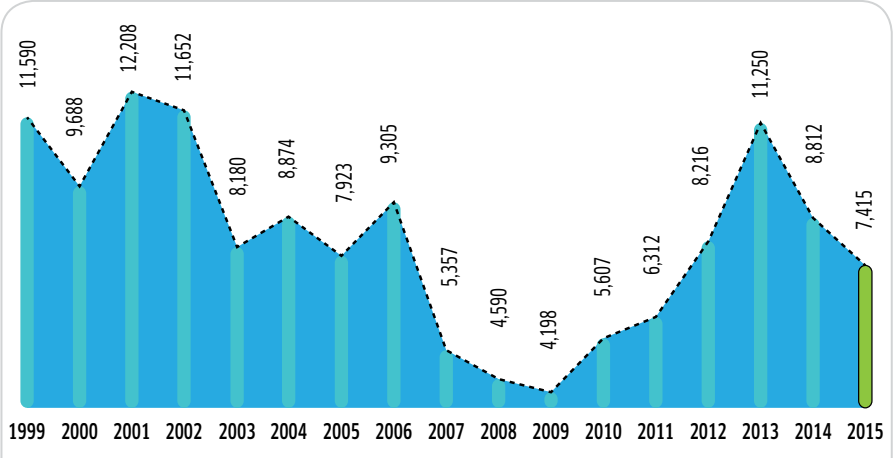


Figure 2: Surface water diversions (consumptive) in the Murray–Darling Basin (surface water figures do not include interceptions ie activities which intercept surface water before it flows into rivers, aquifers and dams)

Groundwater

Groundwater use reached a peak in 2007–08 at around 1,800 GL. This was during the drought and when use of surface water was declining. Groundwater use in the Basin was lowest in 2011 at around 700 GL. Since then use has gradually increased to around 1,500 GL in June 2015, as the northern Basin has become drier, see Figure 3.

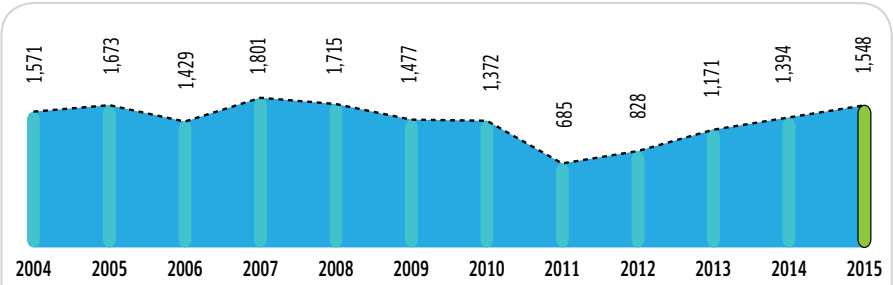


Figure 3: Groundwater diversions (consumptive) in the Murray–Darling Basin (2004 was the first year that it was possible to accurately report on volumes)

Note: Figures are based on information provided by the Basin states through reporting on compliance with the Cap on surface water diversions and the Basin Plan.

2014–15 figures are yet to be confirmed with Basin states.

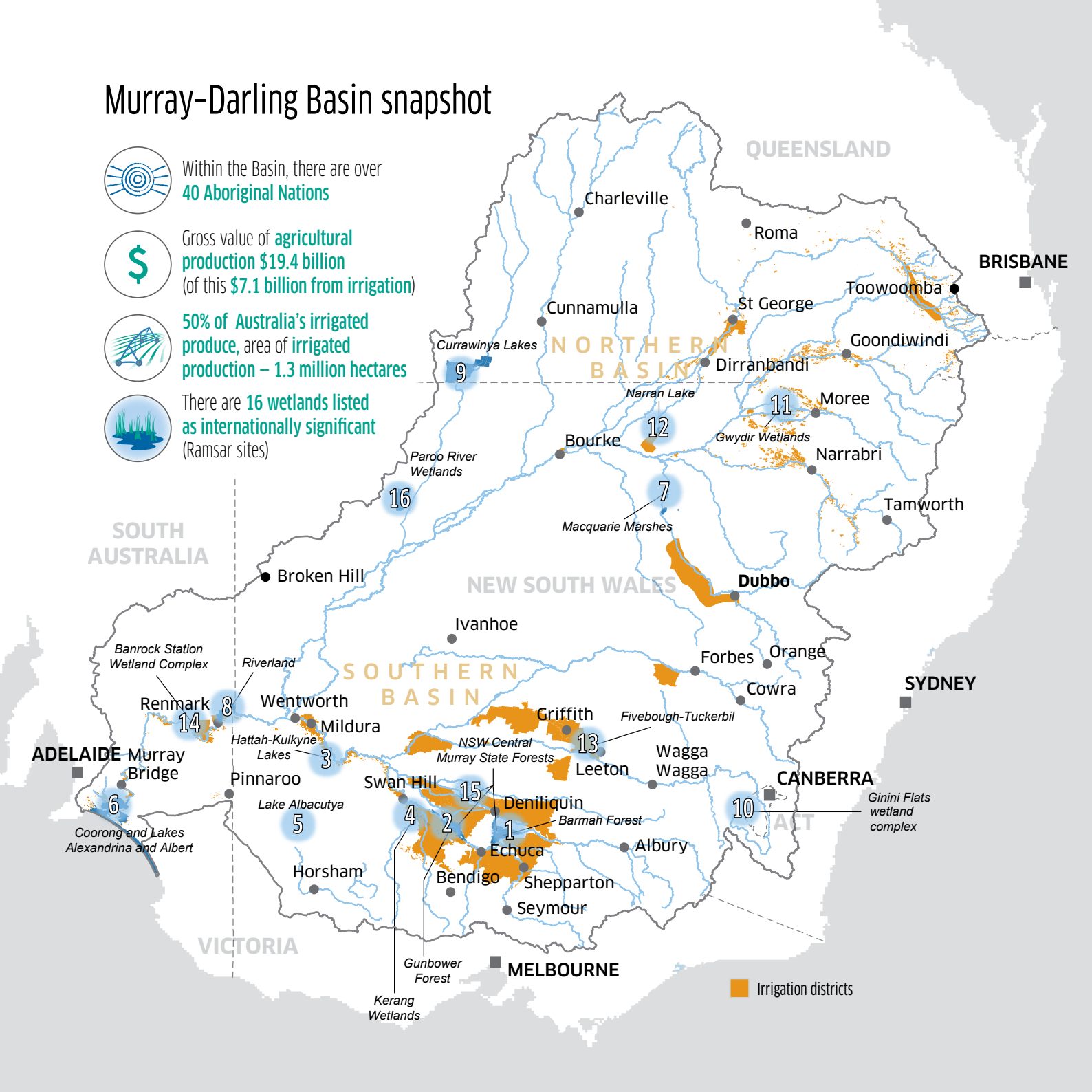
Murray–Darling Basin snapshot

Within the Basin, there are over **40 Aboriginal Nations**

Gross value of **agricultural production $19.4 billion** (of this **$7.1 billion from irrigation**)

50% of Australia's irrigated produce, area of **irrigated production – 1.3 million hectares**

There are **16 wetlands listed as internationally significant** (Ramsar sites)



Productive and resilient industries and confident communities

The Basin Plan is aiming to:

- improve long-term water security
- improve water trade
- keep water fit for industrial and community uses
- provide greater certainty for all water users
- provide time to transition.

Snapshot for 2014–15

- the MDBA continued to gather information to evaluate what is driving social and economic change in communities, before determining the effects of the Basin Plan
- some communities have been experiencing adversity and are more susceptible to change, including water reform. The MDBA is focusing on these regions and industries, particularly where there has also been significant water recovery
- at 30 June 2015, 1,951 GL (71%) of the water recovery target of 2,750 GL had been recovered, up from 69% last year
- the Australian Government invested $550 million on infrastructure improvements in 2014–15. Just over $60 million was spent on purchasing water
- the total investment in infrastructure and efficiency measures since 2007–08 is more than $3 billion, benefiting more than 10,000 individual irrigators. The total investment in water purchased is $2.3 billion.

Citrus farmer near Bourke, New South Wales (photo by Irene Dowdy)

Evaluating social and economic outcomes

As the Basin Plan is implemented, the MDBA is monitoring and evaluating the social and economic outcomes of putting water use on a sustainable footing for Basin communities, industries and the environment.

Many communities have undergone big changes over the past decades due to economic, climatic and policy changes. Some communities that have been going through adversity for some time are more susceptible to change, including water reform. Some of these communities have had significant water recovery to date (relative to the total water availability in their local area). During the development of the Basin Plan some of these were identified as potentially more vulnerable to negative effects of water recovery. These areas include Dirranbandi, Warren, Collarenebri, Deniliquin–Wakool, Berri–Barmera–Loxton–Waikerie and Kerang–Cohuna. The MDBA is doing more research in these areas to separate out the effects of the Basin Plan, leading into a more detailed five-year evaluation of the Basin Plan.

Since 2013–14 the MDBA has been looking in detail at areas and industries that are most likely to be affected by the Basin Plan water reforms. In 2014-15 this work included interviewing community members to help interpret the information collected. People spoke to the MDBA about their experiences of adapting to the water reforms in constantly-changing social and economic circumstances. This information is helping to build a complete picture of the changes in Basin communities and what is causing those changes.

The next steps in 2016 and 2017 will be to analyse the information and separate out the effects of the Basin water reforms from other sources of change in communities. This includes working out how the water recovery approach (including the method and timing of recovery) intersects with other social and economic conditions to affect community wellbeing in different communities.

Community wellbeing is influenced by economic activity, community condition, the natural environment and the links between them (University of Canberra regional wellbeing survey).

The MDBA is using many sources of information to identify the contributors to community wellbeing and the ways they are changing. This includes information on irrigated agriculture production, water use, patterns of water trading, measures of productivity, new developments and investment, changes in the population, age profiles and migration into or out of rural communities, employment, and estimates of social and economic conditions. In 2015–16, the MDBA will expand this work to explore specific indicators for wellbeing among Aboriginal people.

The Basin Plan is being implemented over many years to give communities time to adapt. The full effects will take years to emerge. The MDBA's social and economic monitoring and evaluation is structured over a similar time frame:

2013–14 identify suitable indicators and sources of information

2014–15 gather information and identify long-term trends and changes in communities and industries

2015–16 identify causes of long-term trends and changes in communities and industries, and determine which are likely to have been caused by the Basin Plan

June 2017 identify changes caused by the Basin Plan for the five-year evaluation of the Plan

Beyond 2017 continue to monitor and evaluate changes in communities and industries to inform governments, for implementation and future reviews of the Basin Plan.

Regional wellbeing survey

The University of Canberra's regional wellbeing survey measured community wellbeing in 2013 and 2014. Just over 12,000 people took part in the survey in 2014.

Most of the 120 local government areas surveyed in the Basin recorded little change between 2013 and 2014.

The 2014 survey recorded an improvement in community wellbeing in Deniliquin, Conargo, Mildura, greater Shepparton, Moira and Campaspe shires.

The shires of Wakool, Wentworth and Balranald all recorded a fall in community wellbeing over the same period, as did drought-affected communities in the northern Basin. However, this is a long-term project and, with results for only two years, it is too early to say if there are underlying trends of change in community wellbeing.

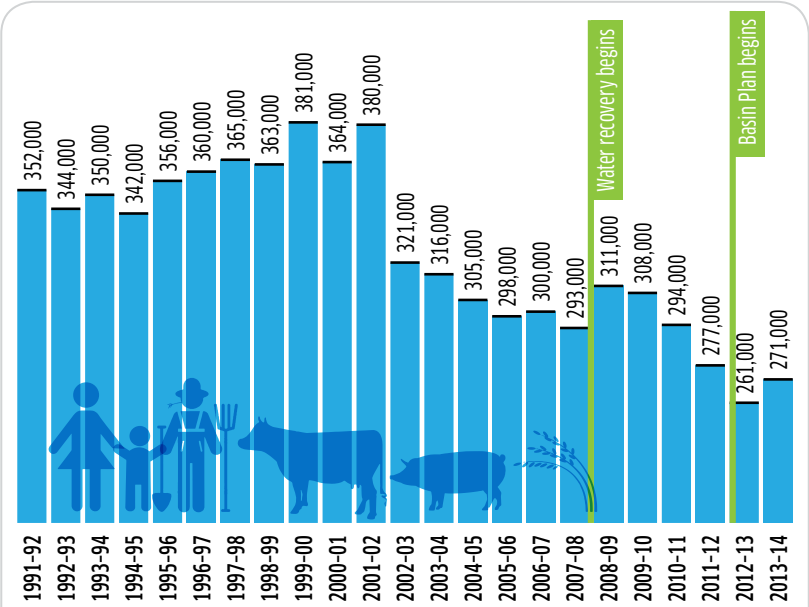


Figure 4: Number of employers and employees in agriculture, forestry, fishing and hunting, and services to those industries Australia wide (Source: Australian Bureau of Statistics, The Labour Force)

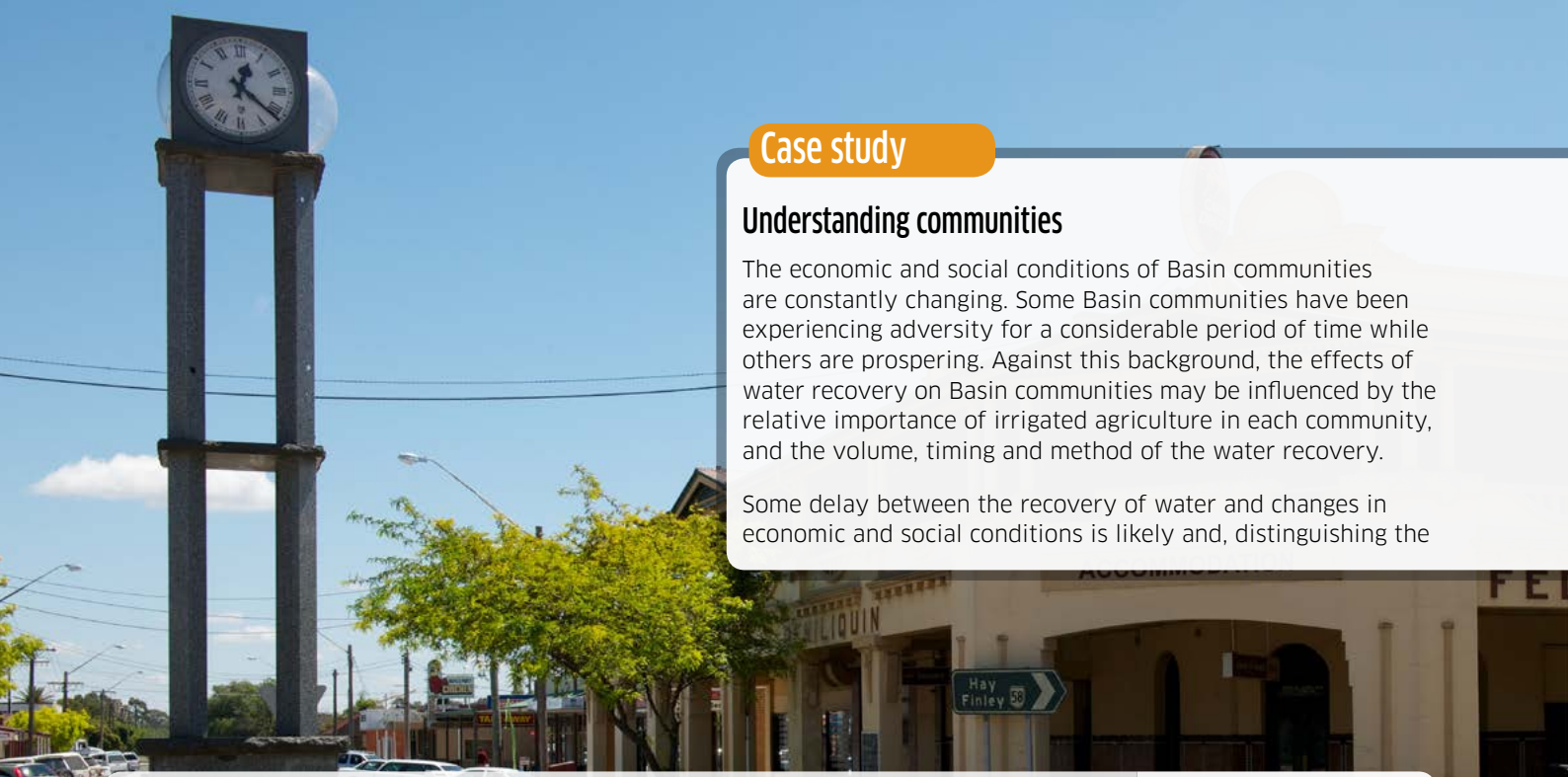
What is driving change for communities in the Basin?

Economic, social, technological, climatic and policy changes affect each community in different ways and over differing periods of time.

Major impacts such as severe drought in 2002–03 and 2006–09, and trends such as increasing farm mechanisation, changes in farm debt and the consolidation of farming enterprises appear to have had a significant influence on employment, production and investment in Basin communities.

External economic factors such as the global financial crisis in 2007–08, along with changes in commodity prices and exchange rate appreciation in the 2000s have also contributed to the social and economic conditions of rural communities. The number of people employed in agriculture has been declining across Australia for the past 15 years, see Figure 4. Changes in farm jobs in the Basin are consistent with this trend.

In regions where irrigated agriculture is significant, there have been larger decreases in agricultural employment than in other areas, but this occurred across 2001–11 and generally before Basin Plan water recovery started. For more information see the overview of change across the Basin on the MDBA website <www.mdba.gov.au>.



Case study

Understanding communities

The economic and social conditions of Basin communities are constantly changing. Some Basin communities have been experiencing adversity for a considerable period of time while others are prospering. Against this background, the effects of water recovery on Basin communities may be influenced by the relative importance of irrigated agriculture in each community, and the volume, timing and method of the water recovery.

Some delay between the recovery of water and changes in economic and social conditions is likely and, distinguishing the

Deniliquin area

Deniliquin, Conargo, Jerilderie, Berrigan, Murray, Wakool shires

Deniliquin is the main centre for this region. Changes in Deniliquin appear to have influenced the social and economic conditions of the surrounding shires.

The population of the area has been relatively constant across the last 25 years. A fall in the population of Deniliquin, Wakool, Jerilderie and Conargo has been offset by population growth in Berrigan and Murray shires. In the last 3 years, the population of Deniliquin has increased slightly.

When people move away from the Deniliquin area, they generally move to other parts of New South Wales or Victoria. The number of people under 45 years old fell 19% between 2001 and 2011 while the number of people aged 45 years and over increased 22%.

Employment in the area fell 13% between 2001 and 2011. Around two-thirds of this decline occurred between 2006 and 2011. Significant declines were felt most in the agriculture, retail and wholesale sectors. Employment fell in all other sectors except education and health.

The number of managers fell 28% in Deniliquin (and 4% for the whole region) while the number of clerical jobs declined by 41% between 2001 and 2011.

The measures of community wellbeing fell in Deniliquin and in some of the surrounding shires between 2001 and 2011.

Indicator	
Population	Declining in Deniliquin between 2001–11, then growing. Surrounding area relatively constant
Age profile 2001–11	
0–44 years	-19%
45+ years	+22%
Employment in local area 2001–11	
Smaller decline in 2001–06	-4%
Larger decline in 2006–11	-9%
Employment 2001–11	
Male	-23%
Female	-4%

Deniliquin (photo by Arthur Mostead)

effects of the Basin Plan from other sources of change requires an examination of the underlying trends in community condition. This includes things like long-term changes in population, the number and types of jobs and occupations people hold, and measures of community wellbeing.

The communities of the Deniliquin and Griffith areas provide good examples of communities with differing economic and social conditions (see below) both before and during the period of water recovery. The total amount of water recovered in both areas is a similar proportion of the total water available, however the pace and method of water recovery have been different. To distinguish the impacts of the Basin Plan, it is essential to understand how the water recovery in each area intersects with the underlying changes in community condition.

Griffith area

Griffith, Leeton, Murrumbidgee, Hay, Carrathool, Narrandera shires

Griffith and Leeton are the main centres for the region. Economic and social conditions in Griffith are strongly influenced by changes occurring in the surrounding shires and in Griffith itself.

The population and economy of the area continue to grow. While the population of Griffith has been increasing since the early 1990s and Leeton's population has remained fairly constant, the population of the other shires has been falling.

When people move away from the Griffith area they generally move to Wagga Wagga. The number of people under 45 years old fell 13% between 2001 and 2011 while the number of people aged 45 years and older increased 15%.

Employment in the area fell 10% between 2001 and 2011. Around two-thirds of this decline occurred between 2001 and 2006. The declines were felt most in the agriculture, retail and wholesale sectors. The number of jobs in all other sectors remained constant or grew. Since 2011, trends indicate an increase in employment across this region.

The number of managers increased by 13% in Griffith and the number of professionals employed in the region rose, while the number of clerical jobs fell 21%.

The measures of community wellbeing remained stable in Griffith with some decline in the surrounding shires.

Indicator	
Population	
Growing	
Age profile 2001–11	
0–44 years	-13%
45+ years	+15%
Employment in local area 2001–11	
Larger decline in 2001–06	-7%
Smaller decline in 2006–11	-3%
Employment 2001–11	
Male	-16%
Female	-3%

Griffith (photo by Chevelle Grey, MDBA)

Improved technology, together with increased mechanisation, has reduced the need for seasonal workers over the past 15 years, including in the cotton industry.

> *'Cotton has become a lot more productive in the last seven or eight years. Some good plant technology is going on and there's been a lot of changes in the machinery we use. The new round bale cotton picker has made it a lot more efficient… We don't need the chippers [seasonal workers who weed the crop by hand]. Weed control is a lot easier, insect control and insect management is a lot easier which has made it a much better life for everyone.'*
>
> *Local insights interview 2014–15*

This is likely to be affecting employment opportunities and potentially the population of regional communities.

The Murray–Darling Basin produces:

- nearly 100% of Australia's rice
- 94% of Australia's cotton
- 80% of Australia's grapes
- 28% of Australia's dairy

Source: Australian Bureau of Statistics – Gross value of agricultural production (GVAP) data from 2013–14

Case study

Dairy farm upgrade

Brothers Nick and Tony Ryan run a 260 hectare dairy farm near Shepparton, Victoria.

These third generation farmers, with 60 years' experience between them, run 850 dairy cows on mainly perennial pasture.

They started transforming their farm in 2012 through a Victorian program. They then secured two grants under the Australian Government's on-farm irrigation efficiency program. This allows farmers to retain 50% of the water savings with the balance going to the Commonwealth Environmental Water Holder.

The grants funded the development of a new farm plan, and the work to put it into effect.

The family reduced the number of irrigation supply outlets, installed an automated pipe and rise system, installed soil moisture monitors to increase the efficiency of the intervals between irrigation, and improved the remaining gravity system by using larger automated outlets.

> *'The project has elevated our farm to a new operating level.'*
>
> *Nick Ryan*

Irrigation flows are faster and more efficient, and areas that had been difficult to farm efficiently have been brought back into production. Pasture quality and production have improved, allowing the herd size to grow.

The upgrade, completed in mid-2014, has reduced the time spent irrigating and enabled irrigation remotely via the web, markedly improving the family's lifestyle.

> *'The work we have done with the project has made our farming business more resilient and made the property an attractive option to the next generation of farmers.'*
>
> *Nick Ryan*

Around 210 ML of water entitlement was transferred to the Australian Government to be used to help restore the Basin environment.

Recovering water

In 2014–15, the Australian Government continued to prioritise water recovery through water infrastructure projects. More water was recovered from infrastructure (33 GL) than from water purchases (21 GL). See environmental water recovery progress on the MDBA website <www.mdba.gov.au>.

As of 30 June 2015, 71% of the water recovery target for the Basin has been reached, see Figure 5.

As part of the water recovery, the Australian Government has invested in more efficient irrigation infrastructure through an on-farm program for individual irrigators, and an off-farm program for irrigation infrastructure operators.

The off-farm program has benefited more than 10,000 individual irrigators who rely on the infrastructure operators.

Infrastructure projects are more expensive than water purchases and have longer lead times. The Australian Government is committed to water recovery through infrastructure investment because of the flow-on benefits to irrigators and communities.

The water efficiency programs have made it possible to access significant volumes of water that would otherwise have been lost from production through seepage and evaporation.

Investment in more water efficient infrastructure has meant that irrigators are able to maintain or improve

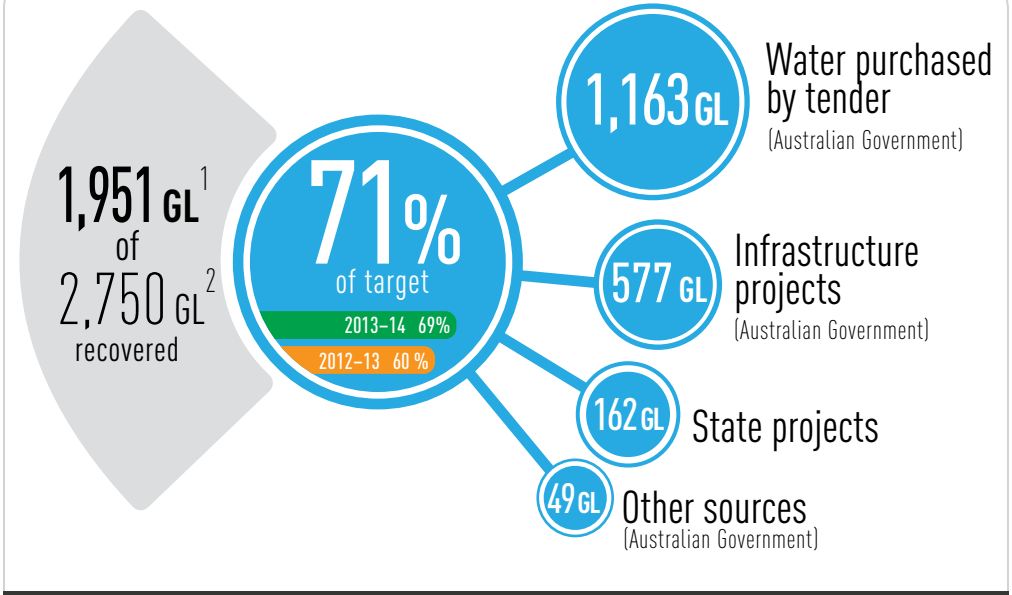


Figure 5: Progress towards the 2019 surface water recovery target, as at 30 June 2015

1 This figure is based on contracted water recovery and so includes commitments to acquire entitlements. Note that the smaller numbers are rounded to the nearest GL. As at 31 December 2015 the total recovered was 1,953.6 GL.

2 The recovery target could change due to the sustainable diversion limit adjustment process and the northern Basin review.

crop production while using less water. In most cases irrigators or irrigation infrastructure operators keep a proportion of the water savings so there is a net increase in productive water after the upgrade.

While water purchases almost always benefit individuals who sell entitlements, these benefits and the associated cash inflows do not necessarily flow on to communities.

Water recovery through infrastructure investment benefits both farmers and their communities as production is not lost. Infrastructure work by local businesses also injects money into the local economy.

From the infrastructure investment, farmers report they are able to improve water use efficiency, better plan their cropping programs with lower allocations, spend less time watering and have increased flexibility within their farming enterprises.

> *'One of things that really did help the business was that grant money for that on-farm efficiency… it was bit of a win-win and it really could take our business, our farm business, to another level, because we actually were getting up to speed with the latest technology on irrigation and saving the water.'*
>
> *Local Insights interview 2014–15*

Dairy farmers in northern Victoria and cropping enterprises in the Murrumbidgee have described their experiences with this investment and believe it will provide positive flow-on benefits to their communities.

Some farmers with smaller farms feel unable to participate in the infrastructure improvement program because of the up-front costs and relatively smaller water savings available to them.

> *'I wouldn't touch [the Australian Government's infrastructure program]. I think we're too small, size wise.*
>
> *I've watched two of our close farming friends here. They've done the initiatives, and those two have not come anywhere near their budget, by a lot. It works for the big guys, I'm sure. I don't know how they do it… But I just think for the little bloke like ourselves, I'd be very nervous.'*
>
> *Local Insights interview 2014–15*

The relative pace of water recovery is also important. The sustainable diversion limits do not come into effect until 2019, allowing water to be recovered gradually so communities and businesses can adjust.

While the pace of water recovery has generally been fairly steady at the Basin and valley scales, businesses in Basin communities have reported to the MDBA that where water is recovered in large volumes, over short periods of time, they have found it harder to adjust. These challenges are influenced by the social and economic conditions at the time water is recovered.

These effects may be further compounded by the scale of water recovery in each area. In general, changes in communities are felt more strongly the longer they go on and the bigger the change gets.

The first few gigalitres of water recovered from a region are likely to have a lesser economic and social impact than later water recoveries.

This would suggest that moving from water purchases to infrastructure investments, that largely retain productive capacity as time goes on, will help minimise the potential adverse impacts of later water recovery.

How people have adapted

Many farmers are using water more efficiently and changing the way they trade water in response to the combined effects of the millennium drought, economic and policy pressures, and the Basin Plan.

Farming enterprises have also changed. In the dairy industry, for example, there is now a lot of variability in farm and herd size, calving patterns, water holdings and fodder purchases. This contrasts with farming practices across the industry 10 to 15 years ago.

Since the millennium drought dairy farmers have found ways to reduce how much water they use per kilogram of milk solids produced, for example through the use of purchased feeds and different calving systems. The Australian Bureau of Agricultural and Resource Economics and Sciences recently published a report on dairy farming which explores this further.

Similar changes have occurred with cropping enterprises. The MDBA is using farm surveys from the Australian Bureau of Agricultural and Resource Economics and Sciences to identify the source and scale of these changes. In 2015 this survey work was supported by a dairy workshop in Tatura, and a viticulture workshop in Mildura.

Water recovery for the environment through water purchase and infrastructure investment has also influenced farm business practices. Dairy farmers who participated in the water purchase program reported they largely re-invested funds to reduce debt, improve the sustainability of their enterprise or to expand their businesses. The government's on-farm infrastructure programs helped some dairy enterprises expand while reducing the amount of time spent watering.

MDBA staff with avocado grower Katrina Myers at Barham, New South Wales (photo by Dominique Haraldson, MDBA).

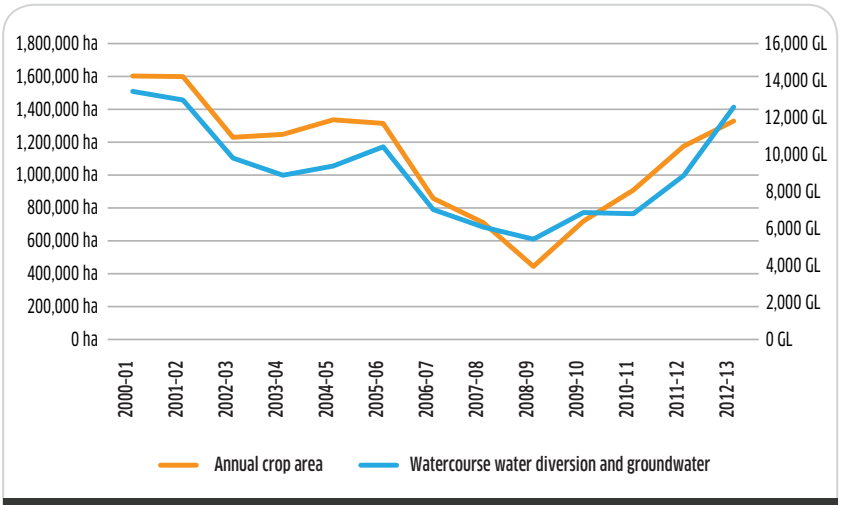


Figure 6: Murray–Darling Basin annual crop area planted and water use

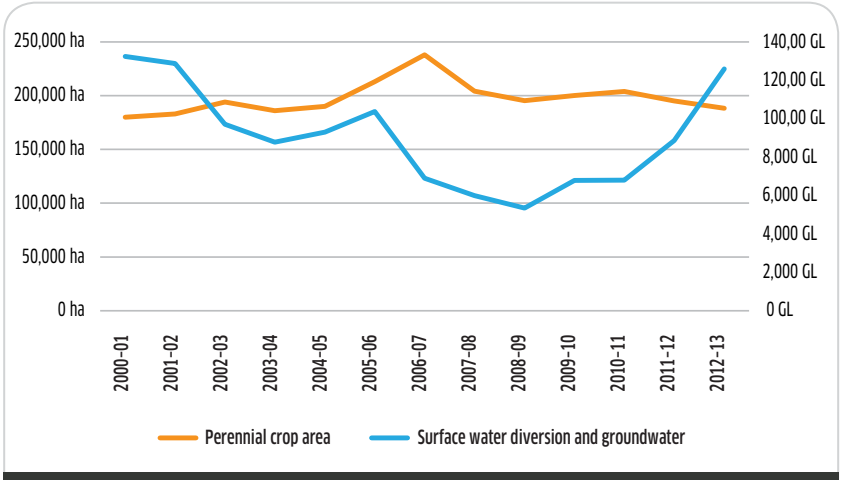


Figure 7: Murray–Darling Basin fixed area planted and water use

[Source: Australian Bureau of Statistics data 4618.0 – Water use on Australian farms; state reporting for Cap compliance, MDBA]

Agricultural production in the Basin

Annual crops grown in the Basin include rice, cotton, pasture and other broad-acre crops. The area of irrigated crops planted each year has a relatively close relationship to the volume of surface and groundwater use.

The area of irrigated annual crops planted was around 1.6 million hectares in 2000–01. It fell to around 400,000 hectares at the end of the drought and rose again, to around 1.3 million hectares in 2012–13, see Figure 6.

In contrast, the area of permanent crops (perennials), such as grapes, citrus and nuts, does not correlate with water use across the period since 2000-01, see Figure 7.

In general, the area of perennials planted in the Basin increased up until 2006-07.

However, since 2007-08, there has been a slight decline in the area of perennial crops as the area of crops being removed has outstripped or equalled new plantings of nuts, citrus and vines.

Irrigated agriculture has continued to be a major industry in the Basin following the start of Basin Plan water recovery in 2007-08.

Case study

Irrigation upgrade delivers multiple benefits

Joe Ventre grows lemons on his property (16.7 hectares) located about 10 kilometres south-west of Cobram, Victoria. Joe received a $126,079 grant, through round three of the Australia Government's On-Farm Irrigation Efficiency Program, to upgrade his farm's irrigation system – from overhead knocker sprinklers to dual-line drippers with auto valves and moisture sensors.

The property was struggling with an old, inefficient overhead sprinkler system. High salinity levels were affecting the volume and quality of the produce.

The new irrigation system, completed in mid-2014, is a prime example of an efficient dual-line drip on light soils for citrus, in an area which is traditionally irrigated with energy-consuming overhead sprinklers. Dripper irrigation applications are less prone to evaporation in hot and windy weather and Joe can now water larger areas during each shift.

Controlled watering has also helped to reduce the salinity threat and has substantially reduced the time Joe needs to manage the farm.

A new system that allows fertiliser to be fed directly into the irrigation network (fertigation system) has significantly reduced the volume of fuel he uses, as less equipment is needed for distributing fertiliser.

> *'The modern equipment is very reliable with the irrigation control set up on the computer. Watering is less stressful, requires less time and the new equipment is having better results than I initially envisaged.'*

The water savings generated from this project resulted in 40 ML being transferred to the Australian Government for environmental watering.

> *'The ability to choose and design a very efficient and modern irrigation system for a large project such as this was made possible and more viable through this project funding.'*

Water markets and pricing

The temporary water market provides one way for irrigators to adjust to their changing circumstances. The MDBA is investigating the impact of the Basin Plan on water prices.

Evidence collected so far indicates the strongest relationship is between temporary water prices and allocations. This relationship is shown in Figure 8, which shows that temporary water prices in January over the last 10 years in the Murrumbidgee were closely related to the allocation level.

Allocations, which are determined by state agencies, are made on the basis of several factors, including rainfall and storage levels. The behaviour of the temporary water market, across the water year, has changed as a result of changes to demand and supply, the widespread introduction of carryover, as well as the changing way state governments and irrigators manage risk. Previously, the temporary water price in the southern connected Basin would generally fall across the water year. From 2012–13 the allocation price has followed a pattern of rising quite sharply early in the season, remaining high during November to January and then falling towards the end of summer.

Many factors can cause prices to rise early in the season. These include starting allocations, increased demand from farmers who have sold some or all of their water, new growers in the market (such as nut farmers), and farmers seeking to minimise the risk of high prices between November and February (such as occurred in the hot dry spell in early 2013). Although not the only factor, water recovery has reduced the potential supply of water to the temporary market.

New water market rules came into effect on 1 July 2014. They aim to improve the operation of the water market and give market participants better access to information, see page 40.

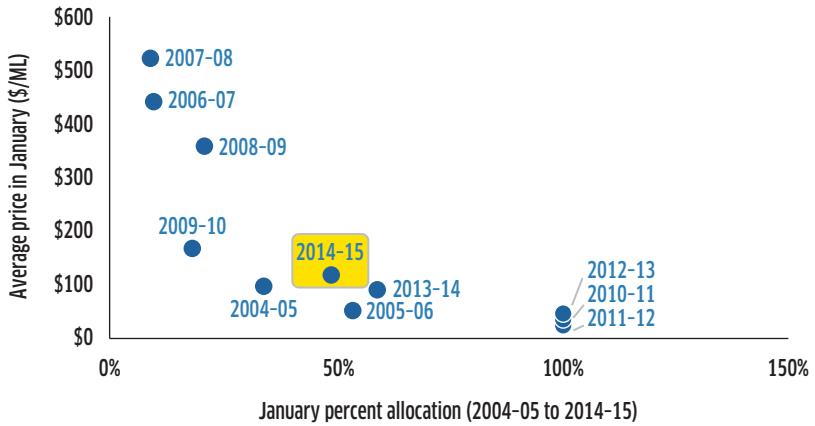


Figure 8: Murrumbidgee average January temporary water price compared to allocation level

Social and economic benefits and impacts of environmental watering

In 2015 the MDBA started compiling information on the potential social and economic benefits of a healthier environment resulting from environmental watering. The 2014 regional wellbeing survey also included questions asking for people's views about environmental watering, and observed outcomes of environmental watering events. This is new work that the MDBA will report on in the future.

Research so far indicates that some people feel they have benefited from environmental watering, for example through improved recreational fishing, improved pasture for grazing, and general benefits to their wellbeing from living in an environment that is healthier.

> *'I guess there has been a few occasions when the water has been sent down with environmental watering,...it's come on to our land and caused some benefits, primarily for the environment, but also some benefit to us... You get more growth so you can run stock on it when it goes back and then you notice that it's good for the fish and the tadpoles and good for the birds.'*
>
> *Local insights interview 2014–15*

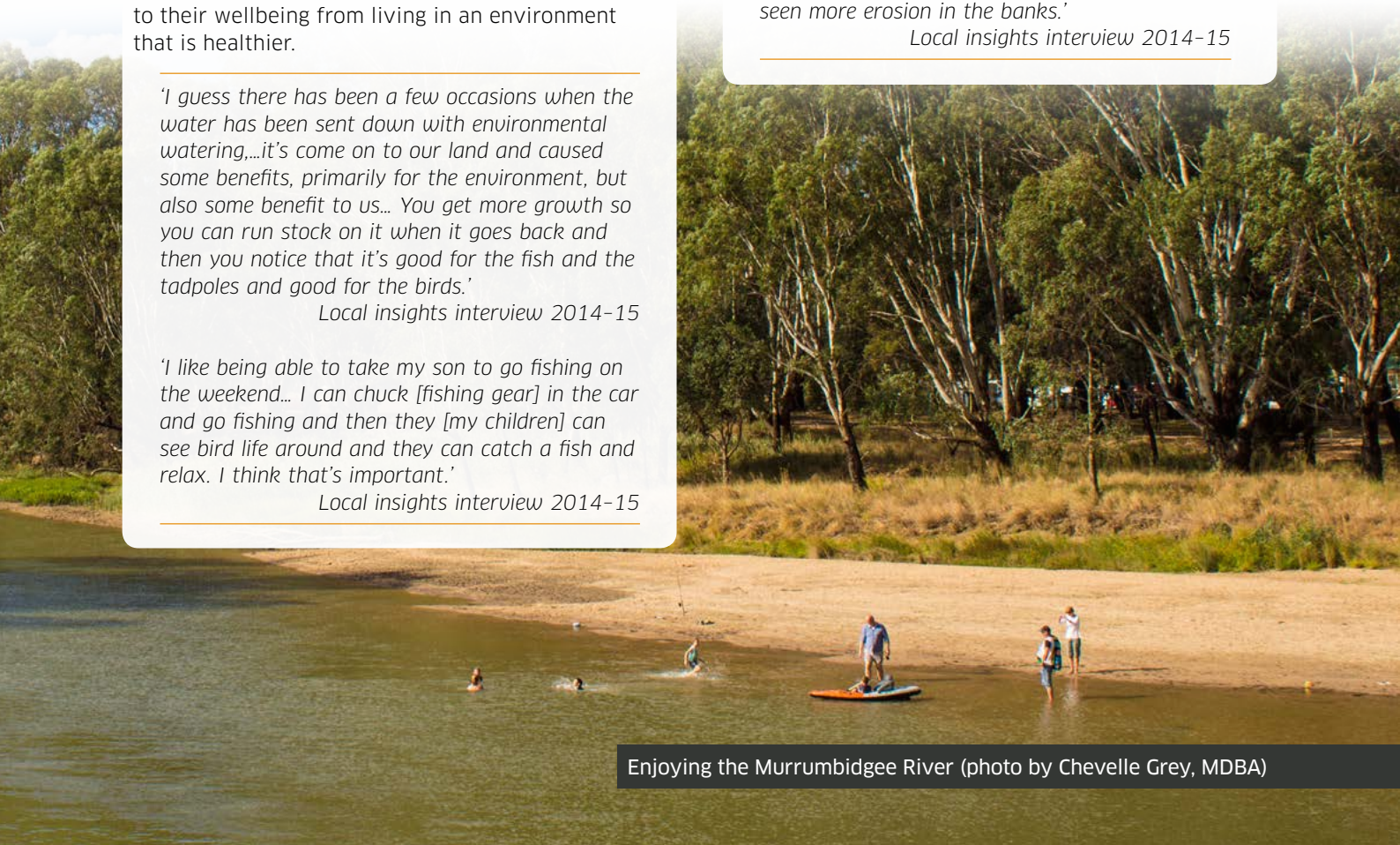
> *'I like being able to take my son to go fishing on the weekend... I can chuck [fishing gear] in the car and go fishing and then they [my children] can see bird life around and they can catch a fish and relax. I think that's important.'*
>
> *Local insights interview 2014–15*

Others do not believe it has made any significant difference to them.

> *'Well, here it flooded a couple of these little creeks out after that environmental flow... and freshened up a little bit of saltbush... which was handy but you know, it didn't really make any significant difference to our business.'*
>
> *Local insights interview 2014–15*

Some people were concerned about potential negative effects of environmental watering, such as the risk of erosion.

> *'Since the management plan [Basin Plan] we've seen more erosion in the banks.'*
>
> *Local insights interview 2014–15*



Enjoying the Murrumbidgee River (photo by Chevelle Grey, MDBA)

Water fit for community and industry use

Water quality and salinity management

The Basin Plan sets targets and objectives to protect water quality for people and livestock, as well as the rivers, wetlands and floodplains. Each Basin state must also develop a water quality management plan as part of their water resource plans.

The delivery of environmental water helped to reduce the salinity in the Coorong and flush salt out to sea by keeping the Murray Mouth open for several months, when it would otherwise have closed. Environmental water also had a positive effect on water quality by diluting river salinity and increasing the amount of dissolved oxygen. It also provided water to the Barwon–Darling River when the river had ceased to flow.

The Basin Plan includes a salt export objective to ensure that salt is flushed at a sufficient rate into the Southern Ocean from the River Murray system. Over the last three years an early estimate of the annual rate of salt export over the barrages was about 0.9 million tonnes. This is less than the Basin Plan's indicative figure of two million tonnes per year. However, flows over the barrages into the Coorong, and low salinity levels in the River Murray during the last three years, indicate that flushing of salt through the river has occurred.

Salt interception schemes also helped protect the river by diverting 432,000 tonnes of salt away from the river in 2014–15.

The Basin Plan also requires water managers to consider water quality targets when making decisions about environmental watering and managing flows. This is to minimise the risks of contributing to low dissolved oxygen and blue-green algae events, affecting river salinity and other water quality issues. No significant water quality issues were reported this year.

Following a review of salinity management, Basin governments have prepared a new strategy to continue to jointly manage salinity in the Basin from 2016–30. The new strategy, which Basin ministers agreed to in late 2015, provides a framework for Basin governments, and their communities, to manage salinity in the Basin. The new strategy complements the Basin Plan by supporting the obligations related to salinity targets for flow management.

The targets also include salinity levels at five reporting sites. Results for 2010–15, see Table 1, show that the salinity target values were achieved at three of the five sites – Murray Bridge, Morgan and Lock 6.

Table 1: Five yearly average salinity results 2010–15 – achievement of targets

Reporting site	Target value (EC µS/cm)	Achievement of target
River Murray at Murray Bridge	830	✓
River Murray at Morgan	800	✓
River Murray Lock 6	580	✓
Darling River at Burtundy	830	✘
Lower Lakes at Milang	1,000	✘

EC > 800 µS/cm is marginal for drinking
EC >1,600 µS/cm is brackish
EC > 4,800 µS/cm is saline

While salinity levels have dropped over the last four years at Milang, near the Murray Mouth, high salinity levels from the extended dry period (2000–10) are still showing up in the five year average. At Burtundy (lower Darling River) salinity rose above the target value because of low flows, and the lack of water available from Menindee Lakes to manage salinity in the lower Darling River.

Case study

Salinity success story

'The river itself has been healthier even through the drought than I can remember, like back in the early 60s we had a real problem with saline water. [19]70 we were in a pinch, and roughly every ten years we had a problem down here with saline water. That's stopped. Even in the drought, the water quality was better.'

Local insights interview 2014–15

Protecting the quality of water in the Murray–Darling Basin is important for the three million people who rely on it for drinking, as well as for Basin industries including farming, forestry, fishing and tourism.

Managing water quality and salinity in the Basin has been a challenge for decades, requiring governments and land managers to develop long-term plans. The Basin Plan builds on this work, setting targets and objectives to protect water quality for people, stock, assets and the Basin's rivers, wetlands and floodplains.

Salinity in particular has been a persistent problem in the Basin. It can damage roads, buildings and fences. Water that is too salty for people, stock and other animals to drink needs to be treated. Salinity and other water quality problems can reduce crop yields, harm native vegetation as well as impact on the Basin's waterways and aquatic life.

Salt interception scheme (photo by Arthur Mostead)

Salt occurs naturally in the Basin landscape but land clearing, irrigation practices and other developments have changed the natural water cycle and contributed to the movement of salt through the landscape, which has caused flow-on problems.

High salinity levels were observed in the lower Murray during the 1960s drought. Salinity levels at Morgan in South Australia were often above 800 EC in the 1970s and 1980s, with salinity above 1,000 EC common up until the mid-1990s.

Governments responded by rolling out salt interception schemes and addressing land-use planning and irrigation practices that contributed to the problem. The salt interception schemes generate economic benefits by providing low salinity water to irrigators and industries, and saline water to salt harvesting plants.

Long-term strategies were also developed, starting in the late 1980s, see Figure 9, which led to governments adopting the Basin salinity target – to keep salinity below 800 EC for 95% of the time at Morgan – and the objective of exporting salt from the River Murray system into the Southern Ocean each water year.

There have been recent successes in managing water quality coming from changes in how natural resources are managed. Managing the Basin as a single system as well as recovering water to improve flows in the Basin's rivers and onto floodplains have also contributed to these achievements.

The long-term Basin salinity target at Morgan has been achieved for the past five years, with in-river salinity among the lowest in recorded history. Improving connectivity and flows has removed salt from the system, reduced the period that dredging of the Murray Mouth has been needed, and made it possible to reduce the operation of salt interception schemes. These achievements have delivered financial savings for government, landholders and communities, as well as improved the Basin environment.

Some of the causes of poor water quality are difficult to address such as unnaturally high temperatures, which contributed to the blue-green algae outbreak that stretched 1,000 kilometres along the Darling River in 1991.

It is not possible to eliminate the risks of poor water quality altogether – salinity and water quality will always be a challenge because of the nature of the Basin and the development within it – but the success achieved so far shows that coordinated, long-term action can make a difference and deliver benefits for communities, industries and the environment.

See <www.mdba.gov.au> for more information about managing salinity and water quality in the Basin.

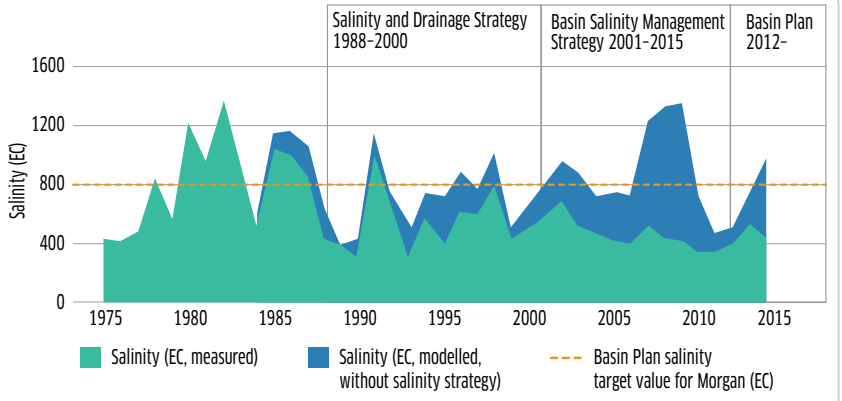


Figure 9: River Murray salinity at Morgan and impact of management strategies

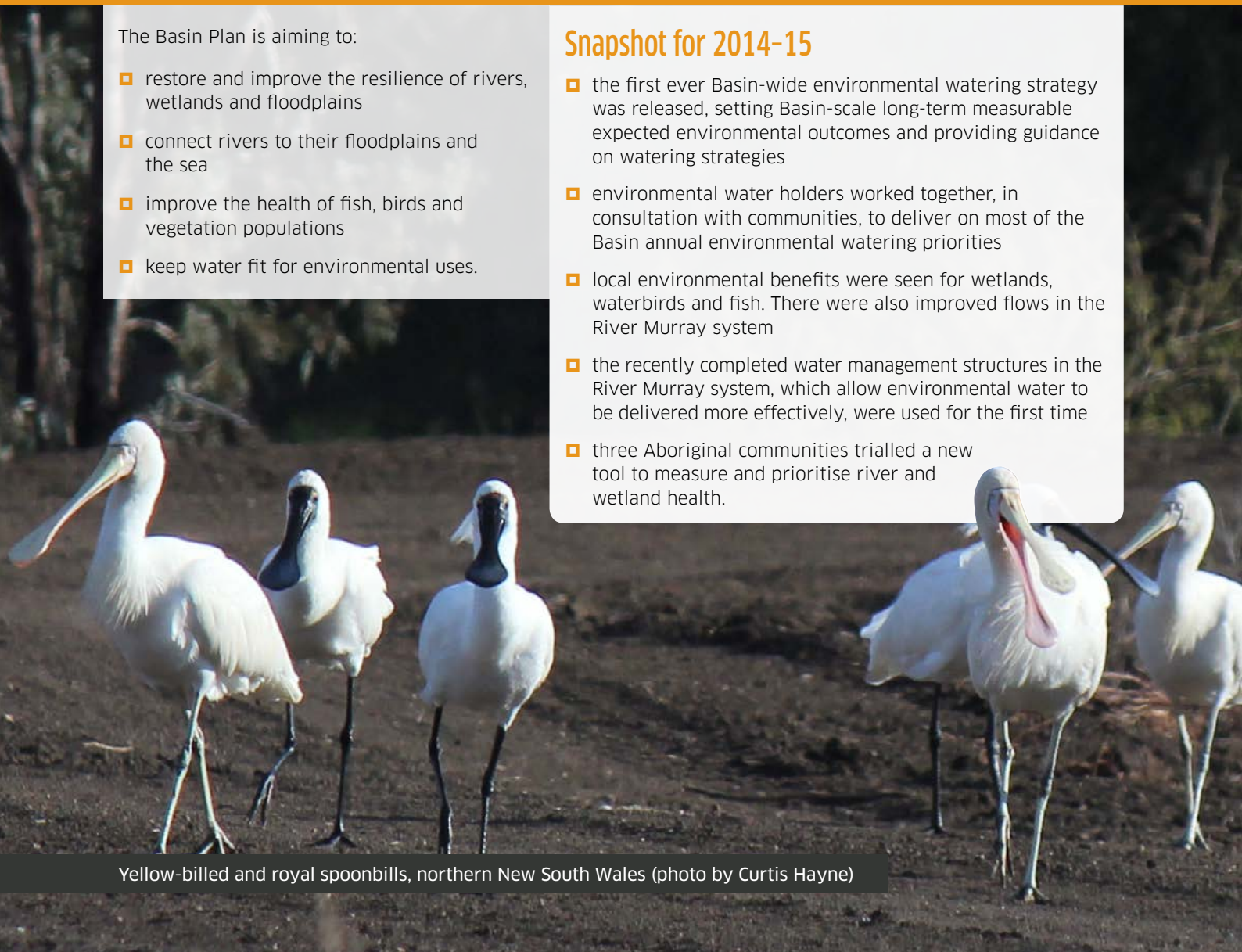
Healthy and resilient rivers, wetlands and floodplains

The Basin Plan is aiming to:

- restore and improve the resilience of rivers, wetlands and floodplains
- connect rivers to their floodplains and the sea
- improve the health of fish, birds and vegetation populations
- keep water fit for environmental uses.

Snapshot for 2014–15

- the first ever Basin-wide environmental watering strategy was released, setting Basin-scale long-term measurable expected environmental outcomes and providing guidance on watering strategies
- environmental water holders worked together, in consultation with communities, to deliver on most of the Basin annual environmental watering priorities
- local environmental benefits were seen for wetlands, waterbirds and fish. There were also improved flows in the River Murray system
- the recently completed water management structures in the River Murray system, which allow environmental water to be delivered more effectively, were used for the first time
- three Aboriginal communities trialled a new tool to measure and prioritise river and wetland health.



Yellow-billed and royal spoonbills, northern New South Wales (photo by Curtis Hayne)

A Basin-wide approach to environmental watering

The first Basin-wide environmental watering strategy was published in November 2014, marking a significant achievement in implementing the Basin Plan. For the first time, waterway managers have a clear idea of the improvement in ecological condition that the MDBA expects to see with the benefit of additional water and more coordinated planning for its use.

The strategy clearly sets out measurable environmental outcomes for river flows and connectivity, vegetation, waterbirds and native fish. The strategy was published after extensive consultation with the Basin states, and feedback from communities.

The strategy takes a whole-of-Basin perspective and highlights that improvements are sought along the entire length of the river system – from the top of the system to the end, and across valleys and state borders. The strategy also outlines how governments and communities can work together to achieve these improvements.

Improving the health of the Basin's rivers, wetlands and floodplains will provide many benefits for individuals and communities. A healthy environment, for example, will provide improved recreational benefits for local residents, tourists and businesses as well as water quality suitable for irrigation, domestic and urban water supplies.

Expected environmental improvements

River regulation and diversions have reduced the volume of water flowing downstream in most catchments, causing significant impacts on floodplain vegetation and the health of the Coorong and Lower Lakes. The Basin Plan is not about returning the Basin to natural conditions but, by restoring key parts of the flow regime throughout the system, it aims to improve and sustain the health of that part of the floodplain that can be managed through environmental watering, see Figure 10.

The aim of the environmental watering, up to 2019, is to stop the decline in environmental condition. After 2019 environmental improvements are expected. Early signs of improvements are already being seen in localised areas, such as the Gwydir wetlands and the River Murray system, see pages 30–34.

Monitoring waterbirds

Waterbirds depend on rivers and wetlands to provide breeding, roosting and feeding habitat. Annual waterbird surveys have shown a 72% decline in total population (average abundance) between 1983 and 2012. This appears to be the result of water resource development, which has reduced the extent and frequency of ecologically beneficial flooding to the Basin's wetlands.

Survey data from 2013 and 2014 suggests that this declining trend is continuing at the Basin-scale, despite positive local responses (for example, at the Lowbidgee wetlands).

To track the condition of waterbirds and their response to environmental watering, the MDBA is investing $700,000 over 2014–18 in a new aerial survey covering the Basin's most important wetlands for waterbirds. The survey will measure waterbird abundance, breeding abundance and species richness every year, see the waterbird monitoring video <www.mdba.gov.au>.

The MDBA remains optimistic that the waterbird population will increase once the Basin Plan is fully operational and waterbirds have had time to respond to environmental watering.

With the additional water available for environmental watering under the Basin Plan, assisted by the Basin-wide environmental watering strategy, we expect to achieve:

River flows and connectivity

Maintained base flows:

- at about 60% of natural levels
- Improved overall flow:
  - 10% more into the Barwon–Darling
  - 30% more into the River Murray
  - 30–40% more to the Murray Mouth (and it open to the sea 90% of the time)

Maintained connectivity in areas where it is relatively unaffected:

- between rivers and floodplains in the Paroo, Moonie, Nebine, Warrego and Ovens

Improved connectivity with bank-full and/or low floodplain flows:

- by 30–60% in the Murray, Murrumbidgee, Goulburn and Condamine–Balonne
- by 10–20% in remaining catchments

Maintain the Lower Lakes above sea level

Vegetation

Maintenance of the current extent of:

- about 360,000 ha of river red gum; 409,000 ha of black box; 310,000 ha of coolibah forest and woodlands; and existing large communities of lignum
- non-woody communities near or in wetlands, streams and on low-lying floodplains

Maintained condition of lowland floodplain forests and woodlands of:

- river red gum
- black box
- coolibah

Improved condition of:

- southern river red gum

Waterbirds

Maintained current species diversity of:

- all current Basin waterbirds
- current migratory shorebirds at the Coorong

Increased abundance:

- 20–25% increase in waterbirds by 2024

Improved breeding:

- up to 50% more breeding events for colonial nesting waterbird species
- a 30–40% increase in nests and broods for other waterbirds

Fish

Improved distribution:

- of key short- and long-lived fish species across the Basin

Improved breeding success for:

- short-lived species (every 1–2 years)
- long-lived species in at least 8/10 years at 80% of key sites
- mulloway in at least 5 out of 10 years

Improved populations of:

- short-lived species (numbers at pre-2007 levels)
- long-lived species (with a spread of age classes represented)
- Murray cod and golden perch (10–15% more mature fish at key sites)

Improved movement:

- more native fish using fish passages

Figure 10: Summary of expected environmental outcomes from the Basin-wide environmental watering strategy

Evaluating environmental outcomes

The outcomes identified in the Basin watering strategy are being monitored to determine the effectiveness of environmental watering.

It will take some time for the full effects to be seen, because of the lags in biological responses and because the Basin Plan, and associated water recovery, will not be implemented in full until 2024, see Figure 11.

Monitoring arrangements are in place at the Basin and local scale. This includes the MDBA's fish and bird surveys and Basin-wide vegetation assessments, the Commonwealth Environmental Water Office's long-term intervention monitoring program, along with Basin state governments' water quality and fish monitoring programs.

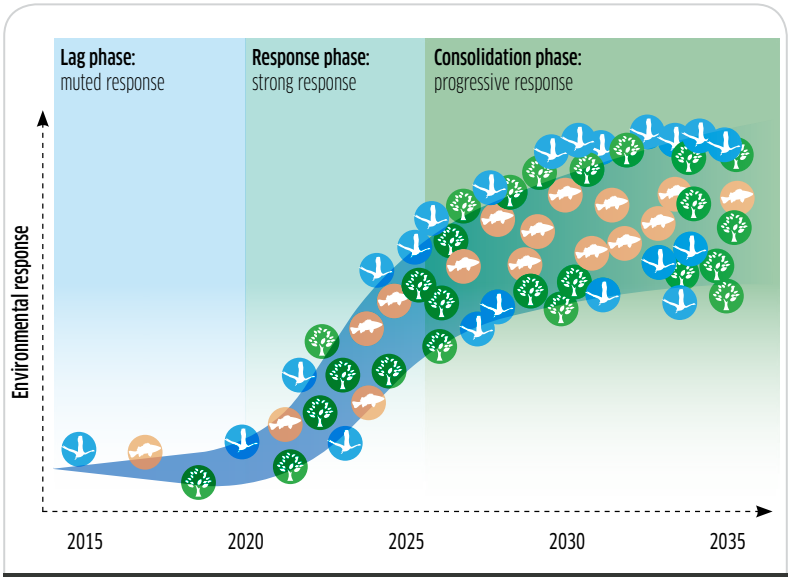


Figure 11: Environmental response to Basin Plan implementation

In 2014–15 the data from the monitoring programs to track fish and waterbird populations became available. The fish and waterbird data are being made available for use on the Atlas of Living Australia <www.ala.org.au>. More detailed scientific reports can be found on Basin government websites as they become available, see page 49.

The MDBA has also made progress on observing the impacts of the Basin Plan on hydrology – how water moves across the land – and modelling what the Basin's rivers, floodplains and wetlands would look like without the Basin Plan. This work will help evaluate the difference the Basin Plan is making.

How much water was used

Additional water licences were recovered in 2014–15 (see page 13) but the widespread dry conditions in the Basin meant that less environmental water was allocated compared to 2013–14.

Many parts of the ecosystem benefit from water flowing down rivers, and environmental water holders will often provide one volume of water for many purposes.

The Basin annual watering priorities received over 2,000 GL of environmental water. This includes water that was re-used through the system to benefit multiple priorities. This represents around 95% of all environmental water used from Australian and state government holdings.

More information on Australian Government environmental watering at a catchment level can be found on the Commonwealth Environmental Water Office website. Basin state governments also reported separately on their own websites, see page 49.

Case study

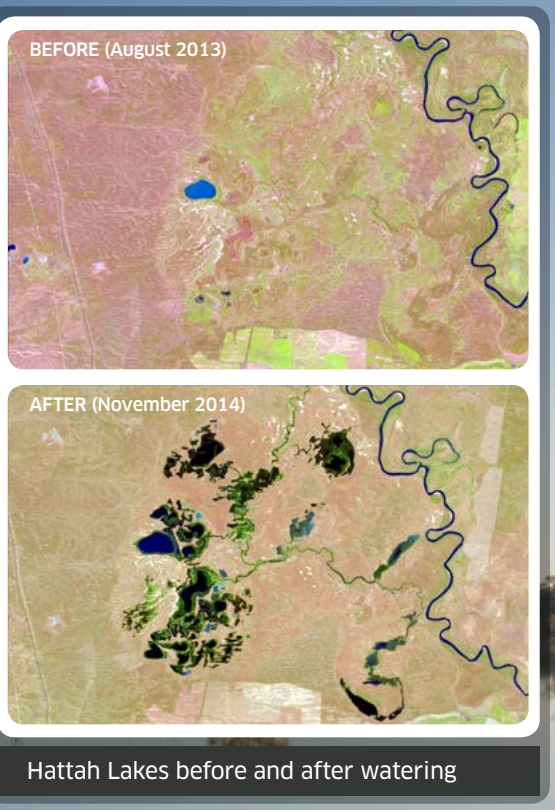
Watering efficiently at Hattah Lakes

Hattah Lakes are part of the Ramsar listed Hattah–Kulkyne wetland system in north-western Victoria. Each year the park attracts more than 70,000 visitors who enjoy camping, walking, canoeing and other activities. Visitor numbers are linked to flooding, with tourists attracted when water is present. The direct economic benefit of this tourism is estimated at $1.5 million a year.

Environmental watering from May to mid-September 2014 built on the previous year's watering (which had filled the central lakes) by pumping 102 GL onto the Hattah floodplain where it was held by regulators. This enabled flooding of about 6,100 hectares, including black box woodland, some of which received environmental water for the first time in 20 years. This watering achieved a similar inundation to the previous large-scale inundation by a large natural flood in 1993, but used less than 1% of the water.

At the end of the watering, more than 39 GL of water was returned to the River Murray supporting watering actions at downstream sites, particularly the Lower Lakes, Coorong and Murray Mouth.

Water was pumped in the cooler winter months to reduce the numbers of carp larvae entering the lakes, based on lessons learned in previous waterings.



Hattah Lakes before and after watering

Annual watering priorities

In 2014–15 the annual environmental watering priorities aimed to: connect rivers and floodplains, support in-stream functions, and enhance and protect refuge habitat for waterbirds and native fish, see Figure 12.

Connect rivers and floodplains

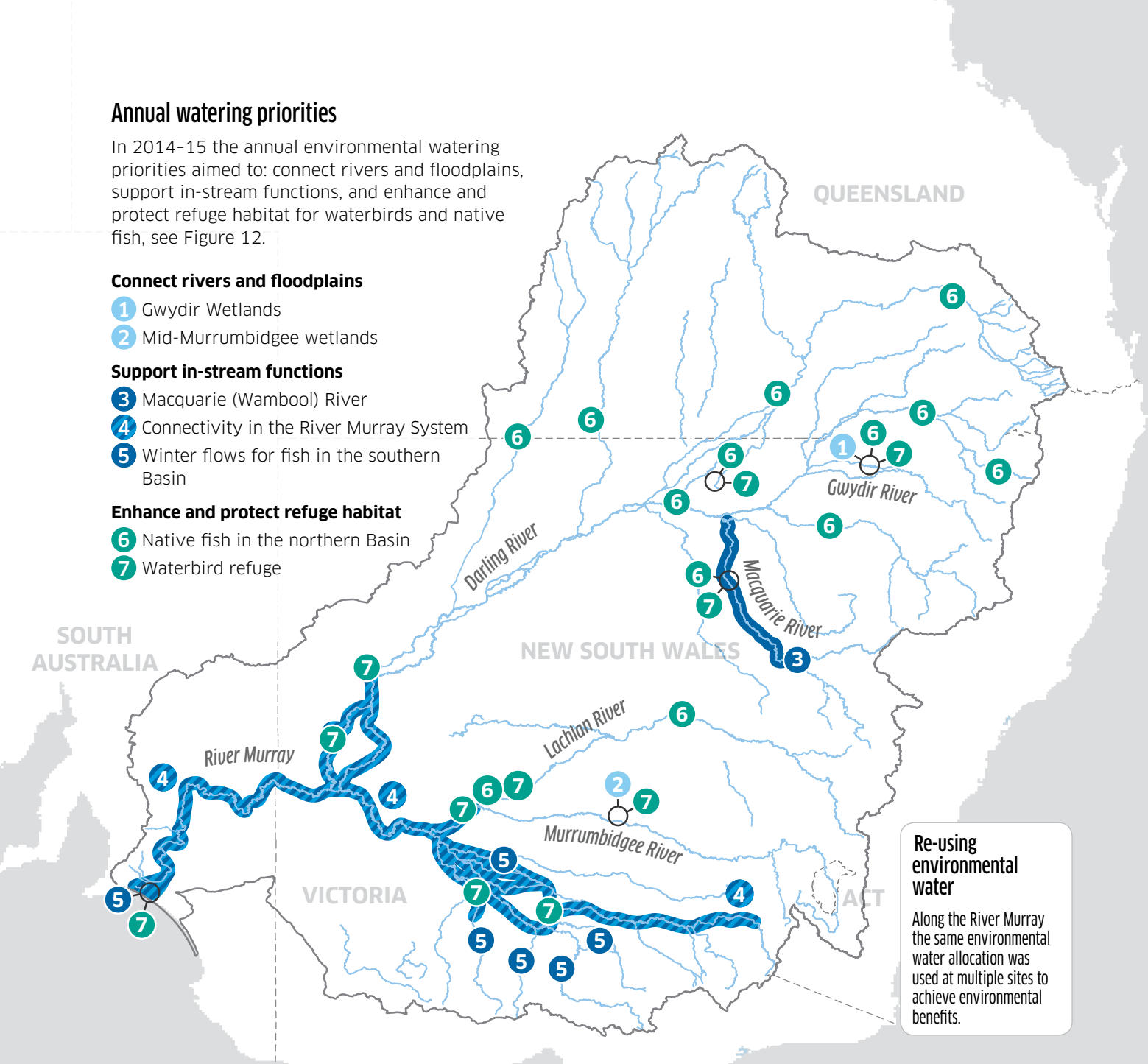
1. Gwydir Wetlands
2. Mid-Murrumbidgee wetlands

Support in-stream functions

3. Macquarie (Wambool) River
4. Connectivity in the River Murray System
5. Winter flows for fish in the southern Basin

Enhance and protect refuge habitat

6. Native fish in the northern Basin
7. Waterbird refuge



Re-using environmental water

Along the River Murray the same environmental water allocation was used at multiple sites to achieve environmental benefits.

Figure 12: Environmental watering in 2014–15 to meet whole-of-Basin priorities[3]

1 Gwydir Wetlands

Around 60 GL delivered to improve low-lying vegetation condition, which is also waterbird habitat (priority 7). This resulted in the widespread inundation of the eastern and central wetland areas. Environmental water was used to connect the Gwydir system to the Barwon–Darling River and to activate the Brewarrina fishway, see page 32.

4 Connectivity in the River Murray system

Coordinated water delivery supported connectivity in the River Murray system through to the Coorong and Murray Mouth. Through careful re-use, the equivalent of 1,500 GL was delivered for the benefit of aquatic vegetation and native fish. This included delivering environmental water to the Loddon River and fringing wetlands, the lower Goulburn River, Tuppal Creek and the Ovens River.

2 Mid-Murrumbidgee wetlands

Despite considerable planning and consultation, system conditions were not adequate to support the use of environmental watering to meet the priority – improved wetland health through the provision of water pulses (known as freshes). Only around 1.5 GL of combined flows could be delivered to Yarradda Lagoon and Sandy Creek. Given the continuing decline in condition of the mid-Murrumbidgee wetlands, this Basin priority was listed again for 2015-16, see page 31.

5 Winter flows for fish in the southern Basin

Around 40 GL used to provide winter flows to tributaries and creeks of the River Murray and through to the Coorong. Previous environmental watering outcomes were used to guide environmental water delivery this year, successfully stimulating golden perch in the Goulburn River to breed.

3 Macquarie (Wambool) River

Around 30 GL used to improve native fish habitat within the Macquarie River below Burrendong Dam by restoring a more natural flow regime and addressing cold water pollution.

6 Native fish in the northern Basin

Around 145 GL used to provide a refuge habitat in the northern Basin to enhance the survival of native fish populations during the forecasted dry period, see page 32.

7 Waterbird refuges

Over 340 GL used to enhance and protect habitat for colonial-nesting waterbirds, wading birds and migratory shorebirds; and to maintain drought refuges, such as the internationally significant Fivebough Swamp in the Murrumbidgee.

3 Some volumes overlap because water was re-used as it flowed through the system.

How the water was used

The Basin states and the Commonwealth Environmental Water Holder reported that environmental water was delivered to meet the Basin priorities. However, in the mid-Murrumbidgee conditions were not adequate to support the use of environmental watering to meet the priority – improved wetland health through the provision of water pulses.

Water delivered to meet Basin priorities was effectively re-used by harnessing return flows, providing multiple benefits along the rivers and their floodplains.

Return flows include irrigation water that drains from private property back into the irrigation network and environmental water that drains back into rivers after a watering event. Each volume used can be delivered for more than one priority, for example watering the Gwydir system, see page 32.

Local communities were consulted about watering priorities, and water was delivered at times and in ways to minimise adverse effects on growers and, where possible, to benefit communities.

Annual watering priorities

Setting the objectives of environmental watering in any particular year involves taking account of the prevailing and forecast conditions, the need to maximise environmental benefit, and the desire to manage and mitigate risks, both to the environment and to third parties, see Figure 12.

These priorities were prepared to deal with the complexity of conditions across the Basin. While conditions were dry (especially in the north), It was important to water drought refuges. In the south good early-season flows and significant volumes of environmental water in storage meant that it was possible to water many important rivers and wetlands and build ecosystem resilience.

Determining how much water was delivered

Over 2,000 GL of held environmental water was used to support the 2014–15 Basin annual watering priorities. This included water from Australian Government environmental water holdings, and state holdings.

The water delivered sometimes included return flows (parcels of water delivered at multiple downstream sites).

This year's watering included a small amount of planned environmental water from New South Wales, and operational water diverted to Gunbower Forest on route to its irrigation use.

Accounting for planned environmental water is complex and remains an ongoing challenge which the MDBA is working with stakeholders to improve. As accounting of planned water improves, it will be possible to report on emerging environmental benefits.

Held environmental water: is water available under a water access right, a water delivery right, or an irrigation right to achieve environmental outcomes.

Planned environmental water: is water committed by the Basin Plan, a water resource plan or a plan made under a state water management law (or any other instrument made under a state law) for the purpose of achieving environmental outcomes.

Murrumbidgee River

A large planned watering event to inundate more low-lying wetlands and meet the Basin annual priority for the mid-Murrumbidgee wetlands did not go ahead. The watering relied on having a certain volume of flow already in the river because not enough water could be released from storage alone without adversely affecting third parties.

Despite this, waterbirds and frogs benefited from smaller environmental watering events in different parts of the Murrumbidgee catchment during the year. The watering included re-directing water destined for the mid-Murrumbidgee to the Lowbidgee floodplain. Significant numbers of egrets, night herons and cormorants bred in the Lowbidgee wetlands, within Yanga National Park, after the watering.

Environmental watering also supported southern bell frog populations in the Nimmie–Caira wetland system with adults and tadpoles recorded at numerous sites. Southern bell frogs are listed as vulnerable by the Australian Government and as endangered in New South Wales. Small areas of the mid-Murrumbidgee wetlands were also watered, including Yarradda Lagoon, resulting in a temporary wetland vegetation response.

Given the continuing decline in condition of the mid-Murrumbidgee wetlands, this Basin priority was listed again for 2015–16.

The endangered Murray hardyhead (photo by Gunther Schmida)

Case study

Working together to maximise environmental benefits – Murray hardyhead

The Murray hardyhead is a small native fish now found only in the floodplains of the southern Basin. It was once widespread and abundant in the Murray and Murrumbidgee river systems but has suffered serious population declines over the last 50 years. It is now listed nationally as endangered. The Basin-wide environmental watering strategy aims to establish three to four additional populations of this once widespread, and now endangered, fish by 2024.

Conservation efforts by Basin governments and organisations such as the Murray–Darling Freshwater Research Centre, over a number of years, has resulted in improvements to the distribution and population of Murray hardyhead. In 2012 the centre successfully bred the Murray hardyhead in captivity and worked with Basin governments to re-introduce the fish to restored wetlands in the South Australian Riverland, near Berri.

Monitoring in February 2015 found record numbers of Murray hardyhead, following conservation efforts by the South Australian Government and the delivery of Australian Government environmental water.

This positive response provided the opportunity to carry out complementary conservation measures. Around 2,500 fish at the site were moved to a restored wetland (Brickworks Billabong in the Victorian mallee) to establish a new population.

The Gwydir system

More than 85 GL of environmental water was provided in the Gwydir catchment (including around 60 GL in the Gwydir wetlands) by the Commonwealth Environmental Water Holder and the New South Wales Office of Environment and Heritage. The water was delivered for more than one purpose and aligned to three of the annual environmental watering priorities (1, 6 and 7, Figure 12). In this report, however, only the single amount is reported.

Delivering this water was coordinated with delivering irrigation water, to achieve 'whole-of-season' watering – providing continuous wetland inundation for five to six months. This benefited waterbirds, native fish and low-lying vegetation.

After consulting the Gwydir Environmental Contingency Allowance Operations Advisory Group 60 GL of environmental water was delivered to the Gingham and Gwydir wetlands. This included 30 GL from the environmental contingency allowance (New South Wales).

Environmental watering began in September but flows were constrained until after the harvest period to minimise interference with irrigation demands. Flows began again in November and continued until March 2015, creating widespread inundation of the eastern and central wetland areas which maintained the condition of low-lying vegetation. Many waterbirds including ducks, magpie geese, darters and cormorants, were observed breeding after the water was delivered.

Australian Government environmental water was also delivered to the Mallowa watercourse (around 10 GL), the Mehi River (around 13 GL) and Carole Creek (around 4 GL) in October 2014, in conjunction with irrigation water. Flows in the Mehi River and Carole Creek entered the Barwon–Darling River, providing opportunities for native fish, such as spangled perch and bony bream, to disperse during a critical migration period. The flows also allowed the transfer of nutrients and organic matter through the system, and improved water quality when the Barwon–Darling River stopped flowing.

Balonne and Culgoa rivers

More than 17 GL of Australian Government environmental water contributed to a series of small in-stream flow pulses in the lower Balonne in February 2015. These flows significantly increased the volume of water in the system and helped ensure that flows reached the end of the system in all distributary channels. This included the Birrie and Bokhara rivers, which had not had flows through the system for almost two years.

The environmental water helped to fill and reconnect waterholes throughout the system, providing opportunities for fish and other aquatic animals to disperse after a long period of no flow. Australian Government environmental water also improved inflows from the Culgoa River into the Barwon–Darling, extending the time that fish and other aquatic animals could move between the two systems.

The lessons from these two northern Basin watering events are being used to plan across northern catchments, including coordinating future flows into the Barwon–Darling.

Water management structures begin operating

Since 2004, the joint governments in the southern Basin (New South Wales, Victoria, South Australia and the Australian Government) have invested heavily in building water management structures. These structures are designed to allow water for the environment to be delivered more effectively at important sites along the river. This allows for ecological outcomes equivalent to large floods to be achieved using only a fraction of the water.

With these structures now completed, the annual environmental watering plan for 2014–15 allowed for water to be available to test the structures while achieving environmental outcomes.

All the structures performed well and the information gathered will help make the best use of them for future waterings.

It is possible that additional water management structures will be completed at other sites as part of the sustainable diversion limit adjustment mechanism, see page 43.

Monitoring in Gunbower Forest (photo courtesy of North Central Catchment Management Authority).

Case study

Meeting environmental objectives by re-using water in Gunbower Forest

Gunbower Forest is an internationally recognised Ramsar wetland of about 20,000 hectares. It is a large river red gum forest with creeks, anabranches and wetlands. About 25,000 people visit Gunbower Forest over the Christmas and Easter holidays every year to enjoy its natural values.

An objective of environmental watering is to improve fish outcomes. Of the 22 species of native fish expected to be present in the wetland, seven are now locally extinct. A watering action (110 GL) at Gunbower from May to December 2014 inundated over 3,750 hectares of floodplain forest. Recently completed water management structures and a collaborative water delivery regime – using both operational and environmental water – ensured the efficient delivery of water to achieve positive ecological outcomes.

Some operational water was diverted through Gunbower Forest on its way to meet downstream demands. Environmental water (35 GL) delivered in addition to the operational water accounted for any water used within the forest.

This floodplain watering promoted extensive breeding and recruitment of small-bodied native fish. This watering action aligned with the Basin annual environmental watering priorities to connect rivers and floodplains, and support in-stream functions while enhancing and protecting refuge habitat.

Find out more about Gunbower Forest at the North Central Catchment Management Authority's website <www.nccma.vic.gov.au>.

Case study

Coorong, Lower Lakes and Murray Mouth

Changes to the natural patterns of water flows in the Basin have had a marked effect at the end of the system – the Lower Lakes, Coorong and Murray Mouth. These changes, along with low inflows during years of drought, have contributed to hypersaline conditions in recent years and the need to dredge the Murray Mouth for long periods.

Increasing flows along the river to its mouth, or restoring connectivity, helps to transport nutrients and improve water quality. It also helps to improve the health of aquatic vegetation, native fish and waterbirds.

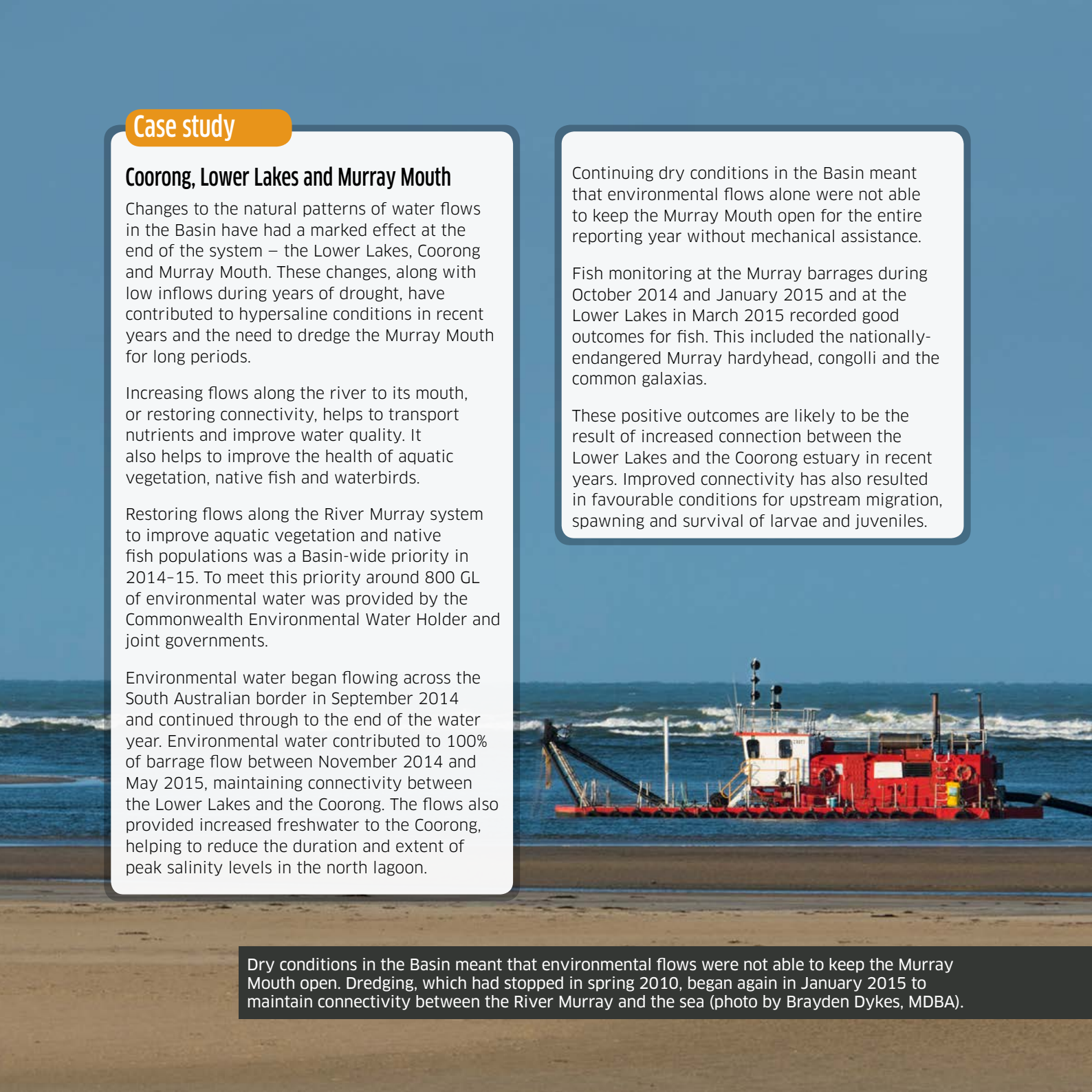
Restoring flows along the River Murray system to improve aquatic vegetation and native fish populations was a Basin-wide priority in 2014–15. To meet this priority around 800 GL of environmental water was provided by the Commonwealth Environmental Water Holder and joint governments.

Environmental water began flowing across the South Australian border in September 2014 and continued through to the end of the water year. Environmental water contributed to 100% of barrage flow between November 2014 and May 2015, maintaining connectivity between the Lower Lakes and the Coorong. The flows also provided increased freshwater to the Coorong, helping to reduce the duration and extent of peak salinity levels in the north lagoon.

Continuing dry conditions in the Basin meant that environmental flows alone were not able to keep the Murray Mouth open for the entire reporting year without mechanical assistance.

Fish monitoring at the Murray barrages during October 2014 and January 2015 and at the Lower Lakes in March 2015 recorded good outcomes for fish. This included the nationally-endangered Murray hardyhead, congolli and the common galaxias.

These positive outcomes are likely to be the result of increased connection between the Lower Lakes and the Coorong estuary in recent years. Improved connectivity has also resulted in favourable conditions for upstream migration, spawning and survival of larvae and juveniles.



Dry conditions in the Basin meant that environmental flows were not able to keep the Murray Mouth open. Dredging, which had stopped in spring 2010, began again in January 2015 to maintain connectivity between the River Murray and the sea (photo by Brayden Dykes, MDBA).

The Aboriginal Waterways Assessment program

The Basin Plan provides opportunities to encourage Aboriginal perspectives to be heard, to assist Aboriginal values and uses to become more widely understood and for Aboriginal people to be valued participants in water planning. This includes states considering the views of Aboriginal people about cultural flows in water resource plans. The MDBA also considers advice from Aboriginal organisations when assessing state water plans.

The purpose of the Aboriginal Waterways Assessment Program is to develop a tool that consistently measures and prioritises river and wetland health so that Traditional Owners can more effectively participate in water planning and management in the Basin.

> *'Stuff that works for us, won't work for alpine and it won't work for Walgett. We're talking about pretty much the same issue, but there's whole different things around it.'*

The MDBA worked with three communities to develop the Aboriginal Waterways Assessment. It was based on a water assessment tool developed by Māori people in New Zealand but modified to suit Aboriginal Traditional Owners' preferences and needs in the Murray–Darling Basin.

Rick James, Tarlina Gardiner and Craig Terrick (Waywurru Nation) at the junction of the Ovens and King rivers, Victoria (photo by Ipshita Mondal, MDBA).

Jason Green and Daiyen Fernando Green (Gamilaraay Nation) assessing the cultural health of the Barwon River, New South Wales (photo by Jackie Luethi, MDBA).

Clive Harradine and Stewart Taylor (Wemba Wemba Nation) carrying out an assessment at Werai Forest, New South Wales (photo by Neil Ward, MDBA).

The three participating Nation groups were: Wemba Wemba and Barapa Barapa Nations; Gamilaraay Nation; and Dhudhuroa and Waywurru Nations.

> *'Strategically, we've got to get the individuals [water planners] on Country doing the stuff we did all week. That's fine, but you've also got to go the next level.'*

The Aboriginal Waterways Assessment consists of three linked components:

- place status – a statement of whether or not the place is an area of cultural significance and whether local Traditional Owners would return to the place in the future
- current use of the place – a measure of the value of a river or wetland to Aboriginal people based on whether food and other resources are available and suitable for cultural use
- cultural stream health – a measure made up of eight individual stream health indicators, such as vegetation, riverbed condition and water quality.

The Murray Lower Darling Rivers Indigenous Nations and the Northern Basin Aboriginal Nations authorised the approach to the trials. Local Aboriginal leadership groups in each pilot location selected the people from their communities to work in each assessment team. These teams were responsible for the assessments and selecting the assessment places.

The Aboriginal Waterways Assessment is now being implemented in the Australian Capital Territory by the Ngunnawal Traditional Owners and in South Australia by the First Peoples of the River Murray and Mallee. Plans are underway to implement it with Traditional Owners in Victoria.

For more information see The Aboriginal Waterways Assessment program and video on the MDBA website <www.mdba.gov.au>.

> *'I'm happy and encouraged seeing that last place, but there's still a lot more we need to see, to see what's possible to bring the Country back.'*

Working together

The Basin Plan is aiming to:

- improve long-term water security
- manage risks to Basin water resources
- use local solutions and build community confidence in a sustainable future
- apply adaptive management
- improve the knowledge underpinning implementation of the Basin Plan.

Snapshot for 2014–15

- the MDBA held around 250 meetings across the Basin to get local input on a range of issues, including the northern Basin review
- community advisory groups provided advice to the MDBA and environmental water holders on developing the Basin annual watering priorities and delivering environmental water
- Aboriginal groups provided advice on regional water resource plans
- Basin governments made progress reviewing the sustainable diversion limits and delivering environmental water more effectively (addressing constraints)
- new water trading rules took effect, improving transparency and consistency across the Basin.

Members of the Northern Basin Advisory Committee on the banks of the Barwon River, near Brewarrina New South Wales (photo by Nolani McColl, MDBA).

Implementing the Basin Plan

The people who live and work in the Basin have a deep knowledge of their region. Governments work closely with Basin communities, groups and industries, drawing on their local knowledge, experience and advice to implement the Basin Plan.

The Basin Plan Implementation Committee, the primary forum for Basin governments to work together to implement the Basin Plan, also met several times during the year to consider updates from its advisory groups on water resource plans, environmental watering, water trade, and monitoring and evaluation.

Advisory committees

Advisory groups with Aboriginal, local, regional and Basin-wide perspectives provide advice to bridge relationships between governments and local experience and expertise. For the MDBA, they include the Basin Community Committee, the Northern Basin Advisory Committee, the Advisory Committee on Social, Economic and Environmental Sciences, Northern Basin Aboriginal Nations and the Murray Lower Darling Rivers Indigenous Nations. State governments and the Commonwealth Environmental Water Office also have advisory groups to guide their water management activities.

Local input to environmental watering

Local input helped to identify the annual environmental watering priorities. Advice and feedback from communities and stakeholder groups helped to maximise the benefits for different water users by coordinating environmental watering with delivering water for irrigation. Local people also assisted with monitoring the effects of watering.

Goulburn River

Community input and new information helped to inform the timing of environmental flows in the Goulburn River in 2014–15. Community consultation had identified bank erosion and the potential interruption of the start of Murray cod fishing season as concerns.

In response to this feedback, and in view of new scientific information, the first fresh was released earlier in spring and was managed to increase variability – promoting the establishment and growth of riverbank vegetation and reducing potential erosion issues.

This was followed by a second fresh that was timed to promote golden perch spawning, before the start of the fishing season. These watering actions stimulated the largest spawning of golden perch in the region since 2010. Watering also helped to manage bank erosion issues and resulted in good conditions for the opening of the Murray cod fishing season.

Murrumbidgee River

In October 2014 Australian Government and New South Wales environmental water was delivered to Yanga National Park in the Murrumbidgee, to support a waterbird breeding event. The timing and duration of environmental water was regularly reviewed and adjusted using monitoring and local knowledge. Ecologists from the New South Wales Government and the local engagement officer from the Commonwealth Environmental Water Office conducted surveys.

This resulted in an additional 10 GL being delivered from March to April 2015 to support hundreds of egrets, night herons and cormorants to complete their breeding cycles. This was the first breeding event for eastern great egrets in Yanga National Park since 2011.

Case study

A community member's perspective

Rory Treweeke is a dryland farmer and grazier on the Narran River floodplain in the northern Basin. He is also the chair of the Basin Community Committee which plays an important role in implementing the Basin Plan, by advising the MDBA.

Over the past 30 years he has seen a decrease in the number of small and medium-sized floods because of extraction for irrigation upstream, mostly in Queensland.

> *'We know that in the long term the floodplain will be degraded because those small and medium-sized floods are essential to the health of the river and floodplain. The exchange of nutrients for the fish and the macroinvertebrates keeps our systems healthy.'*

The Basin Plan aims to manage water resources sustainably for the long-term benefit of communities, industries and the environment. It will take time for the benefits of more water for the environment to become apparent.

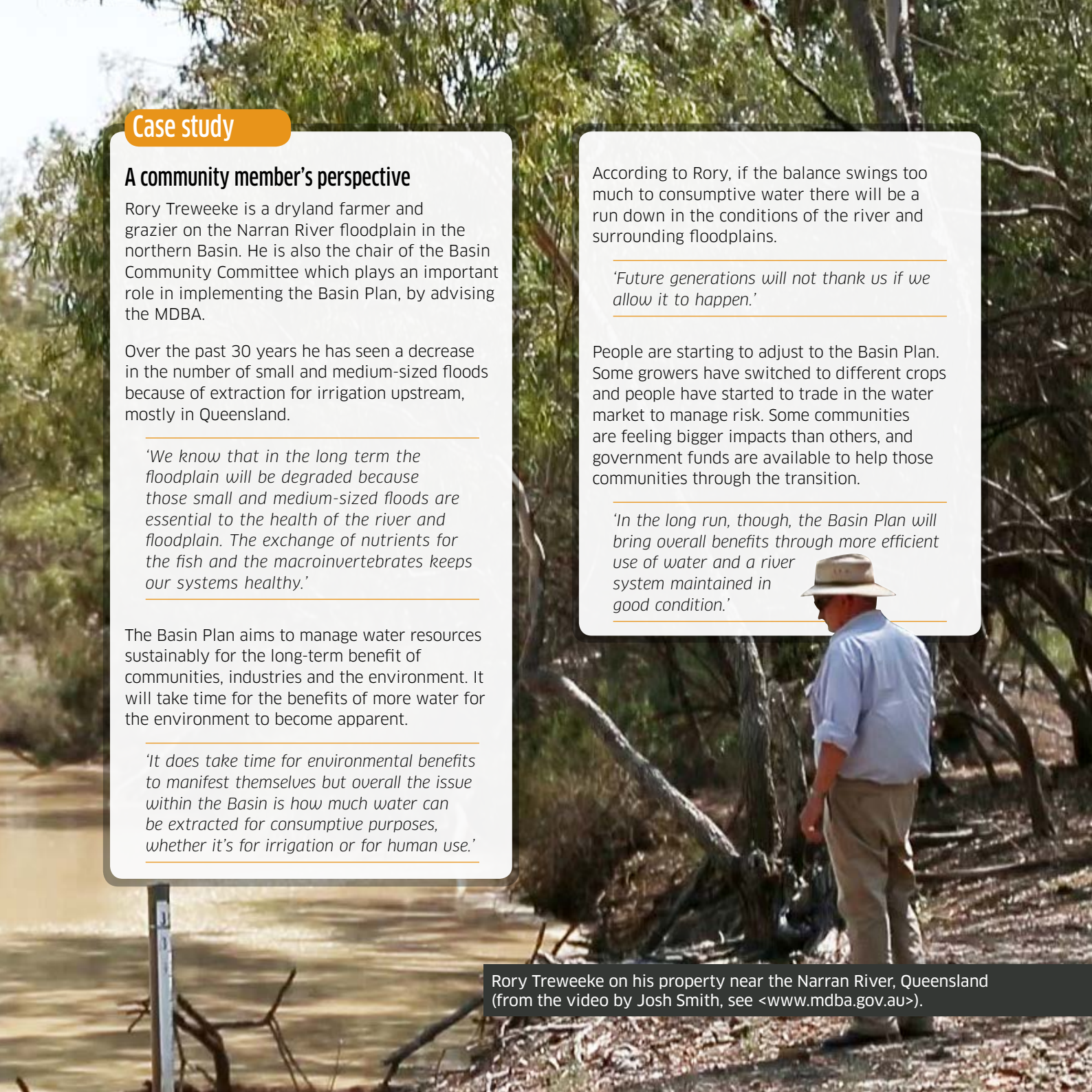
> *'It does take time for environmental benefits to manifest themselves but overall the issue within the Basin is how much water can be extracted for consumptive purposes, whether it's for irrigation or for human use.'*

According to Rory, if the balance swings too much to consumptive water there will be a run down in the conditions of the river and surrounding floodplains.

> *'Future generations will not thank us if we allow it to happen.'*

People are starting to adjust to the Basin Plan. Some growers have switched to different crops and people have started to trade in the water market to manage risk. Some communities are feeling bigger impacts than others, and government funds are available to help those communities through the transition.

> *'In the long run, though, the Basin Plan will bring overall benefits through more efficient use of water and a river system maintained in good condition.'*



Rory Treweeke on his property near the Narran River, Queensland (from the video by Josh Smith, see <www.mdba.gov.au>).

Wimmera River

Delivery of a winter pulse in the Wimmera River in 2015 was adjusted to support a water skiing exhibition at the annual Kanamaroo Festival. The Wimmera Catchment Management Authority worked closely with Horsham City Council to hold the water in Horsham Weir pool for a few days so that the exhibition could proceed. The delay did not impact on the environment.

South Australian Riverland

Katfish Reach is a part of the $155 million South Australian Riverland Floodplain Integrated Infrastructure Program that aims to improve the health of wetlands and floodplains in the Riverland region. The Katfish Reach Steering Group, comprising community, non-government and government representatives, worked on the project from concept to delivery. This involved investigating, planning and designing the environmental works, including a new regulator, fishway, boxed culvert and bridge. These structures will improve the flow of water and movement of native fish through Katarapko and Eckert creeks and associated waterways.

Coordinating environmental water delivery

Basin governments established the Southern Connected Basin Environmental Water Committee in January 2015 to support coordination between environmental water holders and to maximise environmental outcomes in the southern connected Basin. The committee coordinates the planning and delivery of all environmental water in the southern connected Basin.

Developing water resource plans

Water resource plans will be a key part of implementing the sustainable diversion limits, at both a local and Basin scale. Most of the water resources are already regulated by state water resource plans. The Basin states will revise all 36 water resource plans (both surface and groundwater)in line with the relevant settings in the Basin Plan.

In 2014–15, the Basin governments met Aboriginal groups to discuss their involvement in developing the water resource plans. Queensland has been consulting with wider Basin communities with meetings in Warrego, Paroo, and Nebine regions. New South Wales has established stakeholder advisory panels and Victoria will start preparing their plans in 2015–16.

Reducing restrictions to water trading

Water markets are increasingly important to the way water holders manage risk. The Basin Plan water trading rules began on 1 July 2014. They complement state trading rules and are designed to remove unnecessary barriers to trade, increase transparency of information and improve confidence in the market.

The rules set a consistent framework for water trading across the Basin by ensuring that everyone has the same rights. Importantly, they do so without duplicating existing trade rules.

Most of the new obligations lie with the Basin states but irrigation infrastructure operators, individuals and the Australian Government also have additional obligations.

> Water trading in the Basin is responsible for 95% (by volume) of Australia's water market activity. Since 2007-08, the estimated average water market turnover has been nearly $2 billion per year.

Information transparency builds confidence in the market and helps participants make well-informed decisions. To develop greater transparency, the rules require the Australian Government, Basin states, irrigation infrastructure operators and individuals to provide certain information to the market. For example, Basin states and irrigation infrastructure operators need to provide their trade rules and individuals that are selling water need to report the price of their trade.

During the year the MDBA worked closely with stakeholders to ensure they understood their obligations under the new rules. This included working with the Basin states to identify any inconsistencies with the new water trading rules. In response, Victoria removed restrictions on who can buy water allocations, as well as removing limits on how much they can buy. This allows water users to make their own decisions about when to buy and sell. It also allows more people to access the market.

The MDBA worked with the states and Australian Government agencies to ensure adequate protocols were in place to manage sensitive water market information, including carryover and allocation announcements. Anyone with access to this information before it is made public is not permitted to trade relevant water rights.

The MDBA published information supplied by states and irrigation infrastructure operators on highly traded water market products and trading rules. This information is updated whenever the rules change and can be found on the MDBA website <www.mdba.gov.au>.

The MDBA Chair Neil Andrew meeting with community members in the southern Basin.

What farmers think about water trade

Irrigators who took part in the University of Canberra's regional wellbeing survey 2014 were also asked about water trade. Findings included:

- most irrigators felt confident to participate in water trade, they could access the information they needed and felt their water trade options were growing
- confidence in accessing information grew between 2013 and 2014, however, only around 40% of irrigators said that the recent changes to the water trading rules had increased their confidence in the water market
- most reported that buying or selling entitlements or allocations was positive for their farm business.

Constraints management

River operational rules, practices and structures govern how much, and when, regulated water is delivered through a river system. They can act as constraints on how much water can be used to improve the environment.

At the request of Basin ministers the MDBA developed a constraints management strategy to look at how to maximise the benefits of providing environmental water while ensuring the community has neutral or better outcomes.

The strategy identifies seven key locations where physical constraints limit the delivery of environmental water: the Gwydir, Murrumbidgee, Goulburn, lower Darling, and the River Murray (including the reach between Hume and Yarrawonga, Yarrawonga to Wakool Junction and the River Murray in South Australia). The strategy also includes significant operational and management constraints that require further investigation.

During the year the MDBA carried out work on behalf of state governments to complete pre-feasibility assessments for works to address constraints, research cost estimates, and investigate operational practices that restrict environmental water delivery.

In the River Murray the governments of New South Wales, Victoria and South Australia are jointly investigating constraints with help from the MDBA.

In some stretches of river, notably the Goulburn and Murray (Yarrawonga–Wakool junction) community concern regarding relaxing of maximum regulated flow limits remains very high. Business cases are currently being revised to better accommodate community concerns in relation to the impacts that have been identified at the flow rates under investigation.

The MDBA also supported state government agencies by working closely with landholders, councils and businesses to better understand how they might be affected if constraints were relaxed, and what could be done to avoid or reduce the impacts of higher flows. This work includes refining the costs of infrastructure such as bridges and roads, understanding the ways flows will affect agricultural businesses, and making sure that effects on other businesses, such as caravan parks, are included.

Consultants are investigating the increased risk of floods and are modelling the frequency, timing and duration of environmental flows. In response to community feedback, the suggested flows in several reaches were revised.

Refining proposals to address physical constraints

Basin water ministers have agreed that investigations into addressing physical constraints should continue

in all of the seven key areas. In the Goulburn, Murrumbidgee, Gwydir and lower Darling regions, the relevant state governments are leading the work on constraints, with support from the MDBA.

Independent consultants were employed to work out the broad costs of addressing constraints, such as upgrading bridges or roads, and the costs of purchasing easements on low-lying areas on private land.

South Australia submitted their draft business case for constraints measures in the River Murray on 30 November 2015. The other Basin states are expected to submit in February 2016. Based on this work, ministers are expected to determine a way forward by mid-2016.

Adjusting the sustainable diversion limits

The Basin Plan provides an opportunity in 2016 to adjust the sustainable diversion limits up or down by no more than 5%, as long as environmental, social and economic outcomes are maintained or improved. Adjustment can be achieved in two ways, through:

- supply measures, which allow equivalent environmental outcomes to be achieved using less water
- efficiency measures, which allow more water to be recovered for the environment without negative social or economic impacts.

Supply measure business cases

Basin governments submitted more than 20 proposals for supply measures to the Sustainable Diversion Limit Adjustment Assessment Committee during the year. All were for the southern Basin. The MDBA provided advice to governments on these supply measure proposals including options to increase the potential size of the adjustment. The Basin Officials

Talking about constraints in the Hume–Yarrawonga area (photo by Rachel Clarke, MDBA).

Committee agreed that 27 projects would progress to business case, which includes proposals submitted in 2013–14.

A list of current sustainable diversion limit adjustment proposals can be found on the MDBA website, <www.mdba.gov.au>.

The Queensland and New South Wales governments investigated the potential for supply measures in the northern Basin, however no projects have yet been identified. There is potential to change the sustainable diversion limits in the north through the northern Basin review, see page 45.

Other activities in 2014–15

In June 2015, the MDBA assessed the states' adjustment proposals. Results were encouraging, indicating that the method developed in 2013–14 will deliver an offset while still achieving the Basin Plan's environmental outcomes.

The ability to achieve equivalent environmental outcomes while reducing the amount of water that needs to be recovered means that the adjustment mechanism will achieve its objective of enhancing the environmental, social and economic outcomes of the Basin Plan.

In early 2015–16 an independent stocktake was carried out of 36 potential supply and constraints projects to identify opportunities to achieve the best possible outcomes. The stocktake found that there was potential to increase the sustainable diversion limits by around 500 GL, and that additional contributions could be obtained by further refinements to the current projects. This provided further confidence that the method for determining a sustainable diversion limit adjustment is both scientifically robust and fit for purpose.

Basin states are expected to bring forward more business cases to be assessed in early 2016. The MDBA will continue to model packages of supply projects and provide interim advice on a potential supply contribution.

In 2015–16, the Australian Government will consult Basin governments on the design of efficiency measures and arrangements to deliver and implement them. In the northern Basin potential efficiency measures may be considered when water recovery programs are almost complete.

By 30 June 2016, all Basin governments are expected to consider a package of supply, efficiency and constraints measures. The MDBA will assess the proposed measures to determine the size of the sustainable diversion limit adjustment.

Once the package of measures is agreed and assessed, the Basin Plan will be amended, following public consultation.

Groundwater reviews

The Basin Plan introduces limits on groundwater use across the Basin. During 2014–15, the MDBA completed the review process for the sustainable diversion limits for three groundwater resource units:

- western porous rock sustainable diversion limit resource unit (New South Wales)
- eastern porous rock water resource plan area (New South Wales)
- Goulburn–Murray: sedimentary plain sustainable diversion limit resource unit (Victoria).

The reviews were required by the Basin Plan at the request of New South Wales and Victoria, and were conducted by expert panels. The two New South Wales reviews were completed in 2013 and the Victorian review was completed in October 2014.

Each review recommended that the sustainable diversion limits could be increased provided the relevant Basin states introduce more stringent requirements to manage the potential impacts of increased groundwater take.

Any amendment to the Basin Plan, to adopt these changes, would be open for public consultation, and submissions would be considered before making a recommendation to the minister. The MDBA is planning for public consultation on proposed amendments covering both the groundwater and northern Basin reviews to begin later in 2016.

NORTHERN BASIN REVIEW

The northern Basin covers the catchment of the Barwon–Darling River and its tributaries upstream of Menindee Lakes. The way water flows across the landscape in the northern Basin is very different to the southern Basin. Less is known about the northern Basin's environmental water needs and providing additional environmental water in the north's primarily unregulated systems presents challenges.

To address these and other knowledge gaps the MDBA established the northern Basin review. Results of the review will help to determine whether changes can be made to the limits on water extracted from the northern river systems, and how to balance environmental, social and economic considerations.

Addressing knowledge gaps

Projects to help address these knowledge gaps have been commissioned under three themes:

- **environmental** – for the Condamine–Balonne and the Barwon–Darling systems, what is the relationship between flows and environmental response, in particular for native vegetation, fish and waterbirds?
- **hydrological** – how much total water needs to be recovered and where should it be recovered so that the environment receives enough water? Should the proposed reduction in northern Basin, under the Basin Plan, be changed? Can recovery of unregulated licences contribute?
- **social and economic** – who is affected by the water recovery? Do different types of water recovery cause differences in community impacts/benefits? Does environmental watering offer any benefits to industries or communities?

The work has involved significant involvement with scientists, communities, and industry groups.

During 2014–15 substantial progress was made on projects under each of the themes. These projects have included mapping waterholes and floodplain vegetation, and research on fish and waterbirds.

The next round of work – integration of results phase – will continue until early 2016. The findings of the research projects will be tested using different water recovery options or scenarios.

The Basin Plan requires less water to be extracted across the northern Basin – on average 390 GL less per year. The scenarios look at how that volume might be reduced while still getting good environmental outcomes, for example by doing more targeted water management.

Each scenario will draw on knowledge of how the northern Basin rivers work, as well as results of the research projects, to examine:

- requirements of birds, fish and vegetation
- how water is delivered to the environment
- where water is recovered from consumptive use
- the types of water entitlements recovered
- how that water recovery affects businesses and communities.

Involving communities

During the year, the MDBA met with people in 21 communities across the northern Basin. The study of communities involves economic modelling which has been tested with community members, irrigators, and industry leaders. This modelling will provide a better understanding of how irrigators are changing their businesses in response to water availability, and how this affects communities. It also allows the MDBA to identify how the means by which water is recovered and the timing of that recovery affects people and industries.

The MDBA is also investigating how environmental flows might provide economic benefits, in particular for floodplain graziers.

The Northern Basin Advisory Committee plays an important role as a link with the community, giving independent advice to the MDBA. The committee's insight into local issues is assisting the review, including helping to identify alternative scenarios for further investigation.

The MDBA also works with local and state governments, the Department of Agriculture and Water Resources (Australian Government), and the Commonwealth Environmental Water Office to ensure that the best available information is being used.

A focus on fish

Twenty two native fish species and six introduced fish species are found in the rivers of the northern Basin. A number of these, including Rendahl's tandan and Hyrtl's tandan, do not occur in the south. Some fish species that are considered under threat in the southern Basin, such as the olive perchlet and the purple spotted gudgeon, have healthier populations in the northern Basin.

Knowledge of the environmental watering requirements for these fish and their habitats is limited, and draws on a more generalised understanding of how certain types of fish respond to flows. To better understand the particular environmental water needs of fish in the Barwon–Darling the MDBA partnered with New South Wales Fisheries to gather further information. This work has provided a better understanding of the types of fish in the northern Basin, including where they are found and how healthy their populations are, as well as the flows needed to support their habitat and breeding requirements.

Integrating the results

Over the coming year the MDBA will provide opportunities for community feedback on any proposals to amend the Basin Plan. Based on analysis and feedback the MDBA will recommend to the Minister for Agriculture and Water Resources (Australian Government) whether to amend the Basin Plan's sustainable diversion limits for the Condamine–Balonne as well as the northern zone's shared reduction, and the way the shared reduction is apportioned.

These recommendations will be formed after the results of all the investigations are brought together for the MDBA, Basin communities, industries and state governments to consider.

Looking ahead

The Basin Plan is a long-term reform and fully implementing the Plan will take until 2024. While considerable progress was made in 2014–15 much work remains to be done.

In the year ahead there will be an opportunity to reduce the 2,750 GL surface water recovery target through projects put forward by the Basin states, while still achieving equivalent environmental outcomes through the sustainable diversion limit adjustment mechanism.

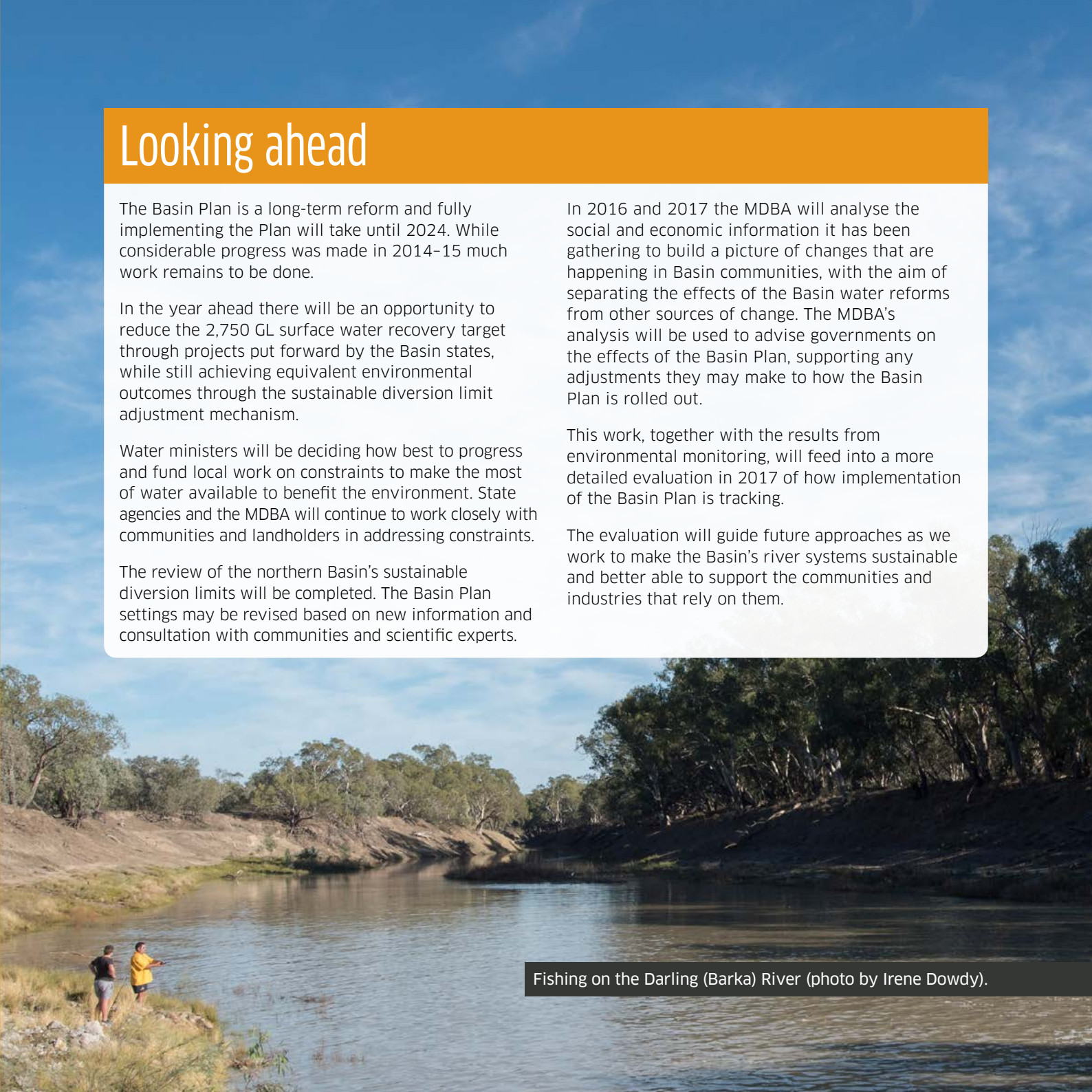
Water ministers will be deciding how best to progress and fund local work on constraints to make the most of water available to benefit the environment. State agencies and the MDBA will continue to work closely with communities and landholders in addressing constraints.

The review of the northern Basin's sustainable diversion limits will be completed. The Basin Plan settings may be revised based on new information and consultation with communities and scientific experts.

In 2016 and 2017 the MDBA will analyse the social and economic information it has been gathering to build a picture of changes that are happening in Basin communities, with the aim of separating the effects of the Basin water reforms from other sources of change. The MDBA's analysis will be used to advise governments on the effects of the Basin Plan, supporting any adjustments they may make to how the Basin Plan is rolled out.

This work, together with the results from environmental monitoring, will feed into a more detailed evaluation in 2017 of how implementation of the Basin Plan is tracking.

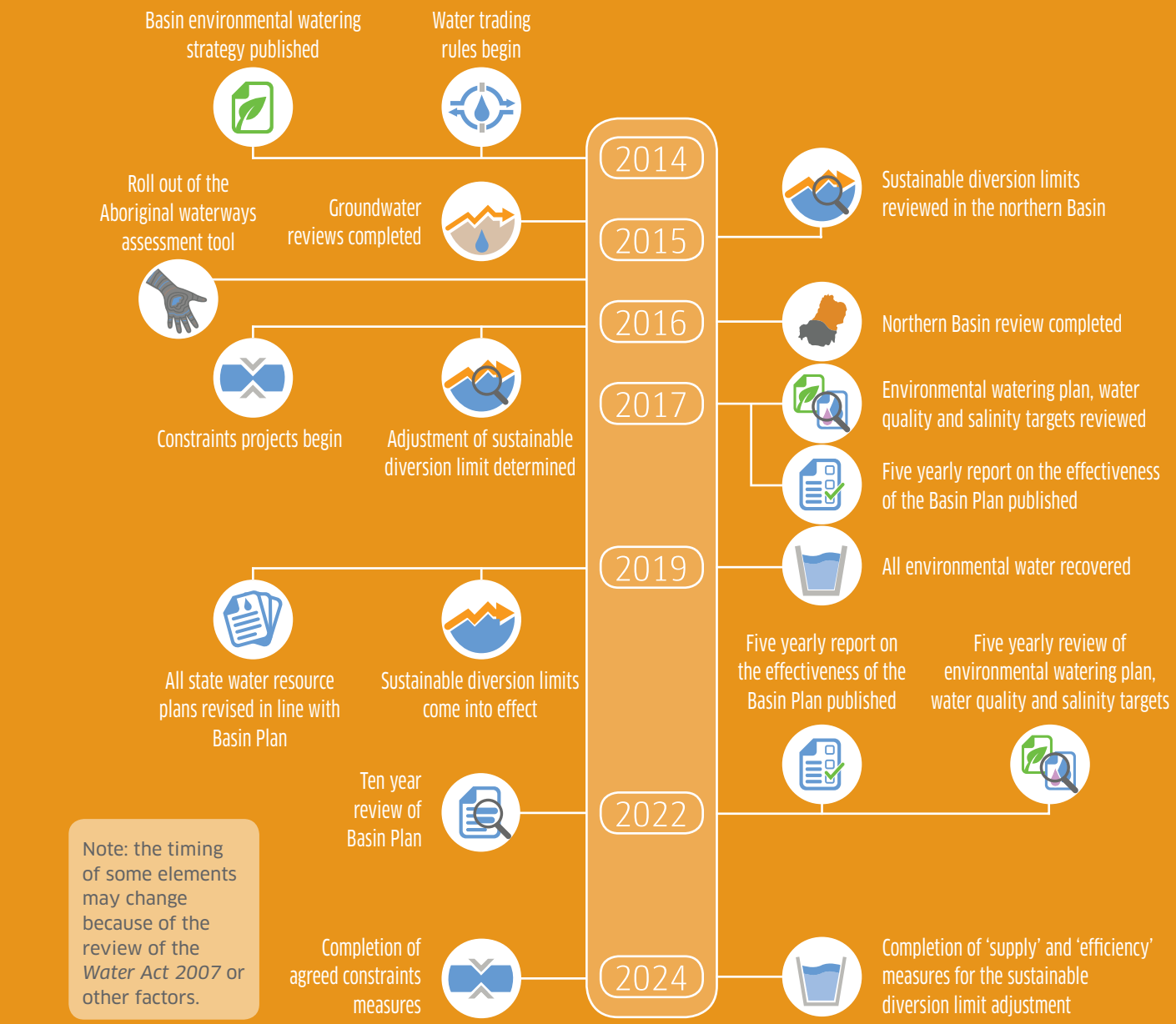
The evaluation will guide future approaches as we work to make the Basin's river systems sustainable and better able to support the communities and industries that rely on them.



Fishing on the Darling (Barka) River (photo by Irene Dowdy).

TOWARDS 2024

The timeline shows key dates for implementing the Basin Plan as governments work towards full implementation by 2024.



Note: the timing of some elements may change because of the review of the *Water Act 2007* or other factors.

More information

MDBA publications
www.mdba.gov.au

The Murray–Darling Basin Regional Economic Diversification Programme
http://investment.infrastructure.gov.au/funding/MDBREDP/index.aspx

The University of Canberra, regional wellbeing survey
www.canberra.edu.au/research/faculty-research-centres/ceraph/regional-wellbeing

Basin government water management agencies

Australian Capital Territory
www.environment.act.gov.au/water/water-strategies-and-plans/act_water_strategy

Commonwealth Environmental Water Holder
www.environment.gov.au/water/cewo

New South Wales Department of Primary Industries, Water
www.water.nsw.gov.au

New South Wales Office of Environment and Heritage
www.environment.nsw.gov.au/environmentalwater/water-for-environment

Queensland Department of Natural Resources and Mines
www.dnrm.qld.gov.au/water

South Australian Department of Environment, Water and Natural Resources
www.environment.sa.gov.au/managing-natural-resources/river-murray/river-restoration-and-environmental-water

The Living Murray program and monitoring reports
www.mdba.gov.au

Victorian Department of Environment, Land, Water and Planning
www.delwp.vic.gov.au

Victorian Environmental Water Holder
www.vewh.vic.gov.au

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It is apparent to me that water reform in the past 15 years, including the Basin Plan, has helped us prepare for drier conditions. It means we're in a much better position than we were at the start of the millennium drought, and it's important that we continue to work together to meet the Basin Plan objectives.

Neil Andrew
Chair Murray–Darling Basin Authority

Contact us

ph: (02) 6279 0100
+61 2 6279 0100 (int)
email: engagement@mdba.gov.au

www.mdba.gov.au