



Australian Government
**Department of Agriculture
and Water Resources**

Commonwealth water reform investments in the Murray– Darling Basin

Analysis of social and economic outcomes

A Department of Agriculture and Water Resources report to inform the Murray–Darling Basin Authority’s 2017 interim evaluation of the Basin Plan



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A Department of Agriculture and Water Resources report to inform the Murray–Darling Basin Authority's 2017 interim evaluation of the Basin Plan

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1 Overview of Commonwealth water recovery programs

The Australian Government is providing more than \$13 billion to implement the Murray-Darling Basin Plan and associated activities with the vast majority (more than \$8 billion) being made available for modernising infrastructure and water efficiency improvements.

This represents a major investment in the long-term productivity of irrigated agriculture and the sustainability of regional communities.

The Australian Government's water recovery programs are delivered to secure a long term sustainable future for irrigated agriculture and communities through more efficient use of the Basin's water resources. They have had social, economic and distributional effects on local communities.

Recognising that water is of fundamental importance to Basin communities and industries, the Australian Government's approach to water recovery has been to prioritise investment in productivity-enhancing water infrastructure. For this reason the Australian Government decided to cap surface water purchases at 1,500 gegalitres (GL). Since 2011–12 Australian Government expenditure in the basin has shifted from purchasing water entitlements to greater investment in infrastructure projects (Figure 1).

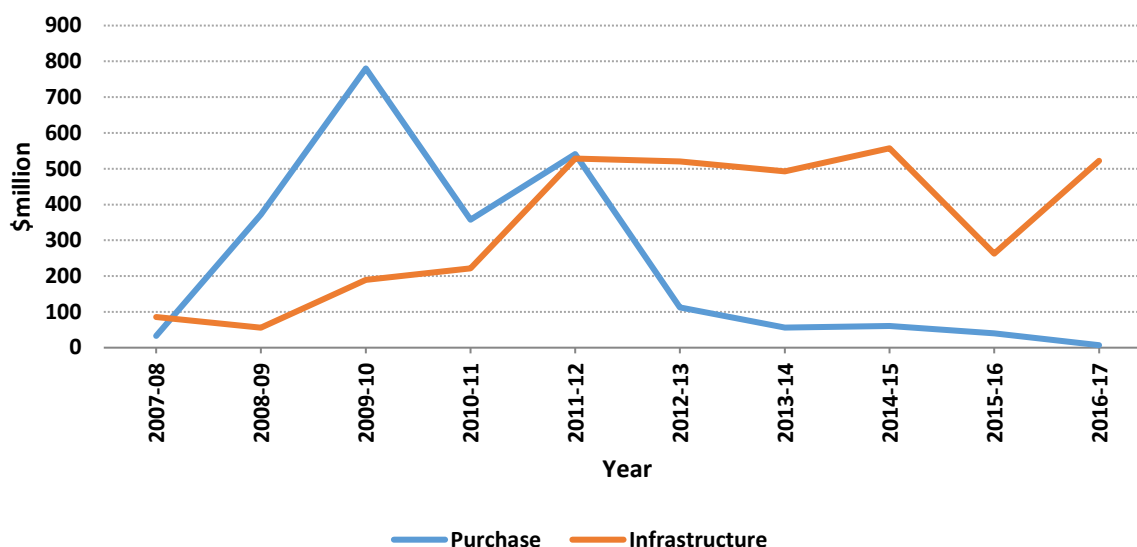
The Australian Government is providing funding to states to offset socio-economic impacts in affected communities through the Murray-Darling Basin Regional Economic Diversification Program being delivered by the Department of Infrastructure and Regional Development. As at October 2017, funding has been committed to Queensland (\$15.1 million), New South Wales (\$32.6 million) and Victoria (\$25 million) (Department of Infrastructure and Regional Development 2017). This is in addition to the benefits to communities from use of local suppliers for water infrastructure works.

The Australian Government's on-farm infrastructure investments help irrigators in the Murray-Darling Basin modernise their on-farm irrigation systems and improve on-farm productivity in exchange for water savings to the environment. Water savings from these projects are shared between the Commonwealth (for environmental use) and irrigators or are retained by the local area to provide benefits to the community.

The Australian Government's off-farm investment in water delivery network upgrades generate water savings through reducing the loss of water from seepage, evaporation and other losses. Water savings are also being achieved through the rationalisation of irrigation schemes, some of which were established over half a century ago. Commonwealth investment in this off-farm irrigation infrastructure has been made in all major irrigation districts of the Murray-Darling Basin.

The Australian Government has also made significant investments in improved water knowledge, water market reforms, works to improve ecological health and restore natural flows, and urban water savings projects for rural communities.

Figure 1 Commonwealth expenditure on water recovery in the MDB



Note: See Attachment A for underlying data and notes.
 Source: Department of Agriculture and Water Resources 2017.

Irrigators are already experiencing the social and economic benefits of the Australian Government’s investment in on- and off-farm infrastructure. These upgrades are delivering positive outcomes across a number of areas including irrigation systems, farm management and efficiency, community and lifestyle benefits.

Irrigation benefits:

- Ability to irrigate with lower allocations than before
- Reduction in soil salinity and water logging
- Reduction in time spent on irrigation releasing time for other farm activities

Farm benefits:

- Improved business opportunities (e.g. crop diversification and multiple cropping)
- Greater profits and improved economic outlook
- Increased farm productivity, which means higher crop yields with reduced water usage

Community benefits:

- Increased business opportunities from supplies of fertiliser, chemicals, freight
- Increased employment through use of contractors and local business

Lifestyle benefits:

- Technology advances reducing farmers’ workload which improves work life balance and allow greater control over farming operations

These high-level findings are drawn from unpublished technical evaluation reports, final reports from individual projects and case studies produced by the department to support the ongoing

monitoring and evaluation of the Commonwealth’s on-farm and off-farm infrastructure programs.

Progress on water recovery

On overall progress in implementing the Basin Plan, the Australian Government’s remaining water recovery task is likely to significantly reduce as a result of the operation of the SDL adjustment mechanism (SDLAM) for the southern Basin and the outcome of the MDBA’s review of the northern Murray-Darling Basin.

Based on the package of 37 supply and constraint measures agreed by the Murray-Darling Basin Ministerial Council on 16 June 2017 the MDBA has determined that the SDL adjustment package will achieve an offset of 605GL. This means that the final SDL adjustment outcome, combined with delivery of the remaining contracted water recovery projects, will likely be sufficient to fully offset the remaining water recovery ‘gap’ in the southern Basin (Table 1).

Supply measures include environmental works (e.g. installation of infrastructure such as regulators and levee banks), changes in river operations (e.g. changes in the operating rules of dam releases) and evaporative savings (e.g. reconfiguring lakes or storage systems in ways that reduce evaporative losses).

The Australian Government has committed up to \$1.3 billion for the implementation of supply measures and has allocated \$200 million to address physical, institutional and operational constraints. Funds will be made available through to 2024 to enable proponent states to implement these projects, which will ensure Basin Plan environmental outcomes can be delivered more efficiently with less environmental water.

A number of projects in the package are funded from other sources. Funding of over \$600 million for these projects supports a range of Basin Plan outcomes in addition to the contribution the projects make to the SDL adjustment offset.

More efficient use of available environmental water allows for higher SDLs and, hence, a reduction in the Basin Plan’s 2750GL environmental water recovery target, thereby reducing the social and economic impacts of water recovery.

As at 31 October 2017, 2107.7GL of surface water and 2.7 GL of ground water on average over the long term (LTAAY) has been recovered to bridge the gap to the SDLs set in the Basin Plan. Efficiency Measures water recovery is 1 GL LTAAY.

In addition, the Northern Basin Review (NBR) by the Murray-Darling Basin Authority recommended that the total recovery target in the northern Basin be reduced by 70GL from 390GL to 320GL. On 13 November 2017, the Assistant Minister for Agriculture and Water Resources, Anne Ruston, adopted the Basin Plan Amendment Instrument 2017 (No. 1) to implement this recommendation to change the recovery target in the northern Basin. On 14 November 2017, this instrument was tabled in the Federal Parliament for 15 sitting days as a disallowable legislative instrument.

Table 1 Remaining water recovery task (as at 31 October 2017)

Region	Water recovery target	Task remaining
Murray–Darling Basin	2,750GL (30 June 2019)	642.3GL
Northern Basin (a)(b)		
– Pre NBR	390GL	76.8GL
– Post NBR	320GL	24.4GL
Southern Basin		
– Pre SDLAM	2,289GL	565.1GL
– Post SDLAM (c)	1,684GL	0GL
Disconnected	71GL	0.4GL
Groundwater	40.4GL (by 30 June 2019)	37.7GL
Efficiency Measures (d)	61GL (by 30 June 2019)	60GL
Efficiency measures	450GL (by 30 June 2024)	449GL

(a) The surface water recovery target was reduced by 70 GL as a result of Basin Plan amendments that commenced 14 November 2017 following the Northern Basin Review. These amendments have been tabled in Parliament (14 November 2017) and face 15 sitting days as a disallowable legislative instrument.

(b) The reduction in the target is less than 70GL due to over recoveries occurring in some catchments under the 320GL scenario.

(c) On 3 October 2017 the MDBA released the draft determination of its assessment of the SDL Adjustment Mechanism that advised if all project are approved the default SDL will be increased by 605 GL

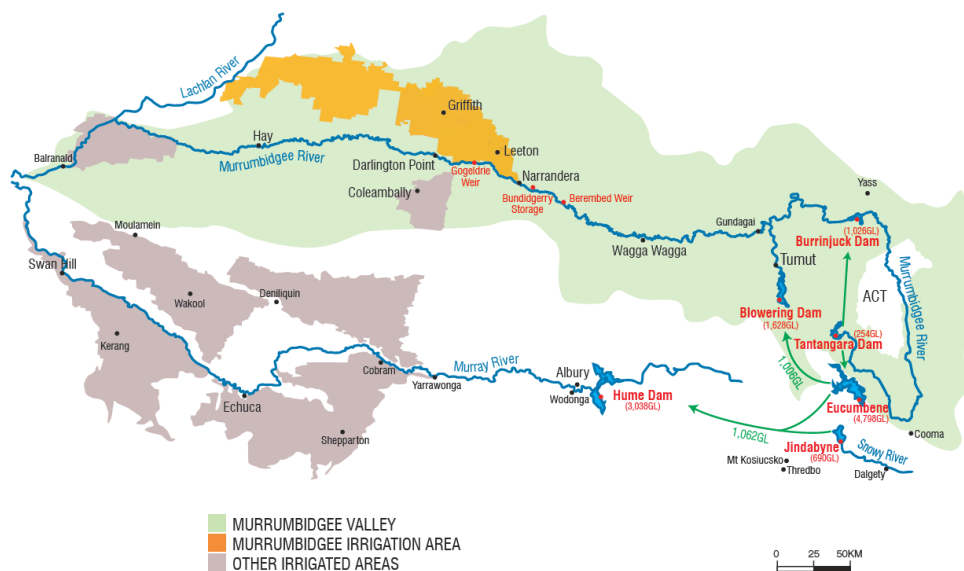
(d) For the full SDL offset of 605 GL to be realised within the 5% limit on the SDL adjustment at least 61 GL of Efficiency Measures water recovery will be required by 30 June 2019.

2 Impact of Commonwealth water recovery in the Murrumbidgee Irrigation Area

Summary

This section looks at the combined economic impact on the Griffith regional economy of water purchase and the major Commonwealth on-farm and off-farm water recovery programs operating in the Murrumbidgee Irrigation Area (MIA) of southern NSW (Map 1).

Map 1 Murrumbidgee Valley and Irrigation Area



Source: Murrumbidgee Irrigation 2017.

The MIA was chosen for this study because it is a large and highly productive irrigation district. Further, the MIA region provides a representative case study for investigating the combined social and economic effects of the Commonwealth's water recovery programs because water was recovered through all three streams of water recovery—on-farm and off-farm programs and water purchase.

Marsden Jacob Associates (MJA) modelled the net economic impact of the reduction in water use for irrigated agriculture and the stimulus to economic activity from the construction of more efficient irrigation systems in the region. Changes to regional employment and gross domestic product (GDP) from 2013 to 2034 were examined in the study.

The study estimated that regional employment increased by 168 full time equivalent jobs in 2013, which will rise to 298 jobs in 2019 as construction activity peaks. Ongoing boosts to employment are estimated to gradually decrease from 110 additional jobs in 2020 to 75 additional jobs in 2034.

The study also estimated that regional GDP will increase by \$178 million over the construction phase from 2010 to 2019, with annual ongoing increases ranging from \$22 million in 2020 to \$16 million in 2034. The total boost to regional GDP to 2034 was estimated to be \$470 million.

Background

The MIA consists of approximately 2,500 irrigated farming enterprises with an average area of 140,000 hectares under irrigation (Murrumbidgee Irrigation 2017). The water diversions from the Murrumbidgee River to service MIA irrigators prior to the water recovery programs averaged around 945GL per year (Murrumbidgee Irrigation 2013). Once the current programs have been completed, this will have reduced to an average of around 820GL per year, a 13 per cent reduction. It is expected the total Commonwealth investment in on-farm and off-farm water recovery programs in the MIA will be approximately \$387.9 million by June 2019.

Prior to 2013, water recovery in the MIA occurred through the purchase of water entitlements from willing sellers. Entitlements with an estimated Long Term Average Annual Yield (LTAAY) of 52.7GL were purchased for a total cost of \$76.6 million between 2009 and 2012.

As in other regions, by 2013 the emphasis for water recovery had shifted towards investment in water saving infrastructure works. Murrumbidgee Irrigation Limited successfully applied for funding to modernise their water delivery network under three rounds of the Private Irrigation Infrastructure Operators Program (PIIOP). Round 1 works have been completed, Round 2 works are well underway and works contracted under Round 3 have recently commenced. All off-farm works are due for completion by June 2019. Entitlements with a combined LTAAY of 41.6GL are contracted to be recovered from off-farm works through the PIIOP. Additional water savings, estimated at 7GL are to be retained by Murrumbidgee Irrigation. At the time this study was undertaken, the total expected Commonwealth investment in off-farm works under PIIOP in the MIA was \$251.5 million (Table 2). This excludes an additional \$37.348 million Commonwealth funding for off-farm works in the MIA under PIIOP Round 3 approved in July 2017.

Table 2 Murrumbidgee region PIIOP expenditures (GST exclusive)

Project	\$ million
Off-farm	
Round 1	\$50.0
Round 2	\$116.6
Round 3	\$84.9
Total off-farm	\$251.5
On-farm	
Round 2	\$58.5
Total on-farm	\$58.5
Total off and on-farm	\$310.0

Source: Department of Agriculture and Water Resources.

Commonwealth investments in on-farm works are also occurring in the MIA, through both Round 2 of the PIIOP and Rounds 1, 3 and 5 of the On Farm Irrigation Efficiency Program (OFIEP). Works under Rounds 1 and 3 of OFIEP have been completed. Works under Round 2 of PIIOP and Round 5 of OFIEP are underway with all on-farm works due for completion by June

2019. Entitlements with a combined LTAAY of 34.7GL are contracted to be recovered from on-farm works under PIIOP and OFIEP. Additional water savings, estimated at 14.8 gigalitres are to be retained by participating irrigators. The total expected Commonwealth investment in on-farm works in the MIA is \$136.4 million. This includes \$58.5 million from PIIOP on-farm (Table 2) and \$77.9 million from OFIEP (Table 3).

Table 3 OFIEP program grants within the Murrumbidgee Irrigation Area (GST exclusive)

Round	\$ million
Round 1	\$10.4
Round 3	\$23.9
Round 5	\$43.6
Total	\$77.9

Source: Department of Agriculture and Water Resources.

About the study

In 2016 the Department of Agriculture and Water Resources engaged MJA to model the net economic impact of the reduction in water use for irrigated agriculture and the stimulus to economic activity from the construction of more efficient irrigation systems in the region. The study examined changes to regional GDP and employment.

The study included infrastructure programs completed or currently underway as well as work contracted under PIIOP and OFIEP to be completed by June 2019. It took into account direct and flow-on effects to the local economy occurring during the construction phase of irrigation upgrades as well as expected changes in farm outputs, regional economic activity and employment levels once all works have been completed.

The study consisted of three main elements.

- Stimulus effect of the Government expenditure of \$388 million in the region to improve irrigation efficiency, that is, the ‘construction effect’.
- On-going productivity benefits of the improved off-farm water delivery system and more efficient on-farm irrigation.
- Effects of the purchase of water entitlements.

The study used the dynamic general equilibrium model Victoria University TERM (VU TERM model) to estimate these effects. MJA also estimated local value added, estimated as the total value of the construction expenditure less the value of goods and services and intermediate inputs that are sourced from outside the MIA. MJA used a static approach to provide greater transparency over the detailed impact of the expenditures and also to ensure that the VU TERM model accurately reflects the type of expenditures that are involved with PIIOP and OFIEP.

Effects of government expenditure (the construction effect)

MJA were provided with detailed expenditure data for works undertaken to 2016 under both PIIOP and OFIEP. These expenditures were then disaggregated into those which were used to purchase goods and services from within the region, and those which left the region through the importation of goods and services.

This provided a ratio for each program of the expenditures which contributed to value added in the region. These 'local' expenditures were then modelled using the VU TERM model to determine what 'flow on' or multiplier effect could be expected from this expenditure as well as the expected duration of the stimulus as the effects of the infrastructure investment continue circulating through the local economy.

Productivity benefits

The study also considered what changes to irrigated agricultural output could be expected once the infrastructure works were completed. This comprised improvements in yield for citrus, rice and cotton as well as the additional output from the share of water saved through more efficient irrigation systems which were retained by irrigators.

Water purchase

While the effect of water purchase program was within the scope for the project, it was not possible to calculate the net effect without knowing how and to what extent the proceeds of the water sales were invested in the local region.

The study did not involve any data collection in this regard. Instead an assumption was made as to the extent of 'leakage' from the region of these proceeds, and an annual loss of income was estimated for this leakage.

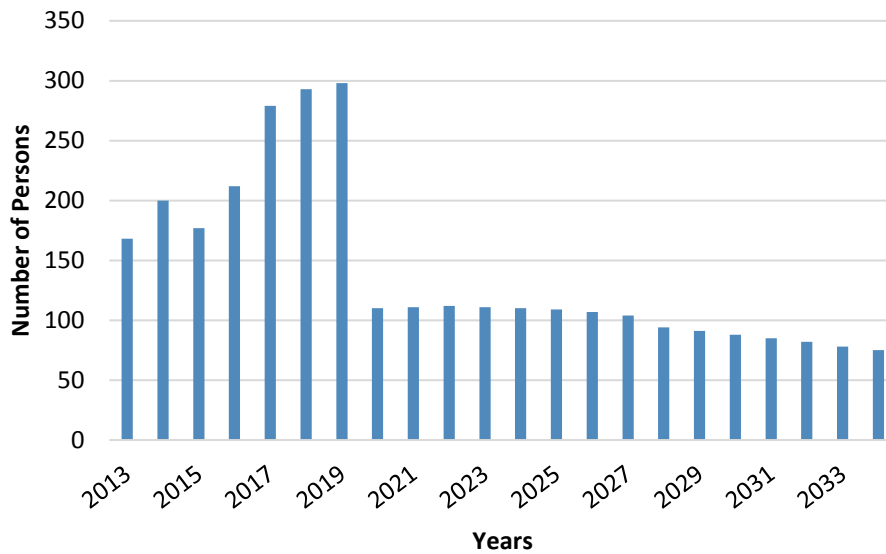
Key findings

Overall gains

Total long term average gains the local economy in the MIA were estimated as the change in employment and real gross domestic product.

The effect on MIA employment in the local economy increases from an estimated 168 net additional full time jobs in 2013 to 298 net additional jobs at the peak of the construction phase in 2019 (Figure 2). Net gains in employment are expected to continue well beyond 2020 due to the ongoing 'wash through' of the construction expenditure circulating in the local economy, the productivity gains from the ability to irrigate according to crop needs with the modernised infrastructure and the share of water savings retained by irrigators. By 2034 the combined net effect is 75 additional jobs compared with the base case.

Figure 2 Effect on MIA employment (persons) in Griffith region, 2013 to 2033

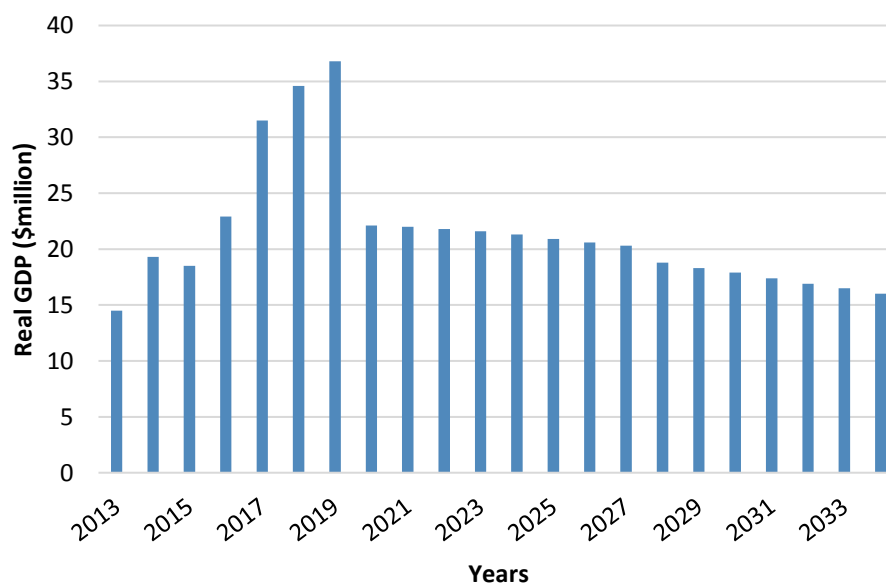


Source: MJA 2017.

Over the construction phase from 2013 to 2019, real GDP in the local economy is estimated to increase by \$178 million, with annual increases of \$14.5 million in 2013 to \$36.8 million in 2019 (Figure 3). Most of this gain results from the direct construction stimulus to the economy with substantial boosts in construction services, trade services, and utilities sectors.

Results were also modelled from 2020 through to 2034 (Figure 3). These show that the boost to the local economy is expected to range from \$22 million in 2020 to \$16 million in 2034 due to both the ongoing ‘wash through’ effects from the construction phase and the ongoing influence of productivity gains from the ability to irrigate according to crop needs and water savings retained by irrigators.

Figure 3 Effect on MIA economic activity (Real GDP \$m), 2013 to 2034



Source: MJA 2017.

The construction effect

The examination of PIIOP and OFIEP expenditures revealed these proportions of the expenditure are expected to be spent on goods and services sourced from within the Griffith region:

- PIIOP off-farm—40 per cent (i.e. \$100 million)
- PIIOP on-farm—62 per cent (i.e. \$36.3 million)
- OFIEP on-farm—54 per cent (i.e. \$42.4 million).

This provided a total of \$178.7 million construction expenditure spent on regionally-sourced goods and services out of a total outlay on the programs of \$387.9 million (46 per cent).

The effects of this expenditure on the Griffith region varies across the programs. Under PIIOP, significant expenditures exited the local economy through the purchase of imported goods and services such as significantly transformed material and project management. In contrast, a greater share of first round OFIEP expenditure occurred in the local economy given the larger contribution of local contractors undertaking on farm works and the lower levels of imported materials that contributed to on-farm conversion. In part, this was due to much of OFIEP expenditure being directed to laser land forming and earth works to reconfigure flood irrigation layouts.

Productivity benefits

Average annual net increases in on-farm productivity directly due to on-farm technology investments under PIIOP and OFIEP are estimated be in the order of \$3.8 million based on present day prices and yields (rice and cereals \$2.7 million, cotton \$0.1 million and citrus \$1.0 million). These arise from improved crop yield per unit of input and improved flexibility of farming enabling greater frequency and reliability of yield. Additional production can also be expected from water savings retained by irrigators. The department estimates the water savings retained by irrigators to be 21.8GL. This water was previously lost to seepage and evaporation through inefficient on-farm systems, and is now able to be used for productive purposes.

Water purchase

MJA consider that the first-round effect on the local economy value-added from water purchase is likely to be neutral as prices paid by the Australian Government are equivalent to the value of foregone farm income or sales to other water users. In other words, the negative economic effects of the direct losses of the net returns in agriculture are likely to be offset by economic stimulus associated with the proceeds from the sale of the entitlements.

Over time the longer-term impact of the sale of these entitlements on value added to the local economy will depend on what goods and services, and their location, are purchased from water sales income compared to the good and services that would have been purchased to support the generation of farm income through the irrigation activity.

These data are not available and so the effect could not be modelled in the same way as the other components of the study. To allow an estimate to be made, a leakage of between 10 and 20 per cent of the sale proceeds from the region was assumed. The department considers this to be a

reasonable assumption, and unlikely to be on the low side, given 2012 survey results (Cheesman and Wheeler 2012).

MJA consider this level of leakage results in an annual net loss of income of less than \$1 million to the region, which is far less than the annual gains to the regional economy from the ‘construction effect’ and ongoing productivity benefits.

Limitations of MIA case study

The Commonwealth investment in the MIA is continuing, with both the PIIOP and OFIEP programs expected to run until mid-2019. In order to determine what proportion of future expenditures would ‘stick’ within the region, it was necessary to apportion these future expenditures in the same ratio to within and outside the MIA as had been estimated to occur for expenditures which had occurred at the time of the study. It will not be possible to examine final expenditures until late 2019.

Likewise, considerations of what gains could be expected from improved off-farm works were informed through discussions with irrigators, Murrumbidgee Irrigation and industry groups in the region, but these are estimates only at this stage as these works have not been completed.

In addition, no new data collection was undertaken to determine what proportion of water purchase payments have been invested in the region and what proportion have ‘leaked’ outside of the MIA. The study used an estimate based on survey information collected in 2012.

The estimates of gains to the local and regional economies should also not be equated to whole of economy gain. This study is not a cost benefit analysis so estimates of gains to the local and regional economies should not be equated to whole of economy gain. In other words, this study does not provide an estimate of the likely net benefit at a national level resulting from the Australian Government’s water recovery program in the MIA. It also does not consider the opportunity costs of investment, that is, the likely effects from alternative use of the funding.

3 On-farm infrastructure programs

There are over 2,000 projects across the Basin that are helping farmers modernise and improve their on-farm water use efficiency. Funding has been provided through programs such as the:

- On-Farm Irrigation Efficiency Program
- NSW Sustaining the Basin Irrigated Farm Modernisation Program
- Northern Victoria Irrigation Renewal Project – On farm priority project
- Goulburn Murray Water Connections project
- Victorian Farm Modernisation project
- Sunraysia Modernisation project
- Private Irrigation Infrastructure Program for South Australia (PIIPSA)
- Healthy Headwaters Water Use Efficiency Program in Queensland
- Commonwealth On-Farm Further Irrigation Efficiency Program (COFFIE) pilot in SA
- On-farm component of the Private Irrigation Infrastructure Operators in NSW.

The types of projects funded include laser levelling, reconfiguration of irrigation layouts, installation of new infrastructure such as recycling systems, piping, and drip or spray systems to improve in-field application systems. These programs have made it possible to access significant volumes of water that would have otherwise been lost to seepage and evaporation.

Funding is provided to irrigators for on-farm works who in turn provide a portion of the water savings from the project to the Australian Government for environmental watering. On average, irrigators are retaining around 30 per cent of the water savings, providing them with an increase in the productive water available to manage their business operations.

Box 1 On-farm irrigation efficiency program

The \$504 million On-Farm Irrigation Efficiency Program (OFIEP) commenced in 2009 and is currently undertaking the fifth round of funding. The program provided funding for projects in the southern connected system of the Murray-Darling Basin.

The total water savings realised to date from OFIEP projects as at 31 August 2017 was 214.3GL LTAAY with 151.6GL LTAAY to be transferred to the Australian Government for environmental use. Irrigators retained 62,708 ML LTAAY of water savings that were previously lost to seepage and evaporation, for productive use on-farm.

Data from over 1,000 individual projects funded through OFIEP has indicated an expected improvement in on-farm water use efficiency by 18 per cent (on average), based on the annual average volume of water used before project works were undertaken compared with the volume that would be required following infrastructure works.

Benefits and outcomes of investment in on-farm irrigation efficiency

Irrigators are evidencing increases to water use efficiency through a variety of outcomes including producing the same output with less water, through flexibility in the type of crop they

are able to produce and/or through the quality of the produce grown. Infrastructure investments are also delivering tangible benefits at the farm gate beyond water use efficiency, such as increased ability for crop rotation, increasing crop diversification and improved soil management.

For example, funding provided to the Australian Processing Tomato Research Council (APTRC) under OFIEP, has resulted in the conversion of surface furrow irrigation to subsurface drip technology, reaping immediate benefits. On average, water use has improved from application rates of 8ML per ha to 5ML per ha. Benefits also extend to yields from tomato crops which have increased almost two-fold to 100 tonnes per ha. These yields are due in part to the efficient placement of the required water and nutrients to the roots of the plants through the subsurface drip irrigation system which also benefit in lower fungal disease loads.

In addition, there is early evidence that infrastructure modernisation programs are having positive socio-economic outcomes for farmers who participate. Lifestyle benefits and labour savings reported by irrigators include:

- remote system operation eliminating the need to get up at night to manually manage watering
- the ability to take advantage of night time off-peak electricity rates
- reduction in maintenance requirements
- increased labour efficiency.

Surveys of irrigators conducted in 2014, 2015 and 2016 as part of the University of Canberra's Regional Wellbeing Survey, highlight the benefits that irrigators see in Australian Government-funded on-farm works. In 2015 and 2016 over 80 per cent of on-farm infrastructure program grant recipients believed that on-farm water infrastructure upgrades had positively affected their farm enterprise as a whole. Irrigators who had received on-farm water infrastructure grants reported better farm financial performance than those who had not received grants, and this effect was more pronounced once the time lag between receiving a grant and experiencing benefits from the investment is taken into account (Schirmer et al. 2015). Irrigators who had invested in modernising on-farm infrastructure were significantly more likely to report they were planning to expand their farm business or change their enterprise mix.

As part of the reporting on project outcomes delivery partners such as Murray Irrigation and APTRC have highlighted the positive effects of the infrastructure investments to the broader community:

“The flow-on effect of the on-farm funding continues past the farm gate. Suppliers, landformers, contractors, irrigation designers, parts manufacturers, and many more related businesses are supported through this funding. This then flows into the community and supporting businesses.”

“As a result of this project sub-surface drip irrigation has now become more widely accepted through the region as an efficient form of irrigation for a range of crops, including processing tomatoes, maize and cotton.”

4 Off-farm infrastructure programs

Off-farm programs aim to reduce the loss of water from irrigation networks and farms through seepage, evaporation and escapes and contribute to the Australian Government’s water recovery task.

Over 900 kilometres of irrigation network delivery channels across the Basin are being modernised through refurbishing, automation, reconfiguration and replacing existing open channels with pipelines. The benefits of these off-farm infrastructure upgrades will be felt by more than 10,000 individual irrigators and have significant impacts on their farm enterprise and lifestyle through improving water delivery reliability, timeframes and quality.

Under the Private Irrigation Infrastructure Operators Program (PIIOP) in NSW, funding of over \$917 million has been provided to irrigation organisations to modernise their networks, to improve the overall efficiency and productivity of water use and management. PIIOP projects will allow private irrigation infrastructure operators and their customers to reduce water losses and manage their water allocations more efficiently. Projects assist irrigation communities to adapt to a future scenario of reduced water availability due to climate change. PIIOP is one of the major elements of the Inter-Governmental Agreement on Murray-Darling Basin Reform. Projects funded under PIIOP include:

- upgrading and modernising irrigation channels
- installing pressurised pipeline systems
- installing total channel control (remote control of the irrigation system)
- constructing secure stock and domestic water delivery systems.

Irrigation networks are reporting a range of outcomes from the investment in network upgrades including:

- improvements in delivery efficiency of around 25-30 per cent through reducing seepage and evaporation
- improved water delivery to the farm gate through regulator upgrades and automation of the system
- improved metering and water accounting
- rationalisation (conversion to dryland) and reconfiguration of inefficient and low productive zones of the system.

Benefits and outcomes from participating in both on and off-farm infrastructure programs

In the absence of the Basin Plan, it is most unlikely that Australian Government investment in Basin off-farm and on-farm programs would be taking place at current levels, meaning that water users would have to meet the cost of these infrastructure upgrades independently, and over a much longer timeframe.

As one of the department's main delivery partners, Murray Irrigation Limited has indicated that farmers involved in Australian Government funding programs for upgrading off-farm and on-farm infrastructure report improved water flows and greater control over water that leads to improved crop outcomes.

In addition, Murrumbidgee Irrigation reported that its PIIOP Round One project created irrigation network improvements that have resulted in increased flow capacity and extended infrastructure life between 50 and 80 years.

Australian Government investment in on-farm and off-farm programs under the Basin Plan is also having positive flow-on effects into local towns and communities. Increased farm opportunities and profitability is helping to secure the economic base of communities, allowing for more local jobs, businesses and services. For example, investment by Murrumbidgee Irrigation through PIIOP Round One resulted in increased business for local contractors and suppliers. This quantum of work for local businesses can be expected to have a localised multiplier effect as they in turn spend a proportion of their increased revenue on other local goods and services. Further, employment of contractors in the region to undertake the infrastructure upgrade works has also provided short-term economic flow on effects for the community and skill transfer opportunities

Substantial Australian Government investments continue to occur across the Basin to improve irrigation water delivery systems. For example, at almost \$1 billion, the Goulburn-Murray Water Connections Project Stage 2 is the largest Australian Government investment in irrigation infrastructure. The project is the second stage of a major water infrastructure upgrade to improve off-farm irrigation efficiency in the Goulburn-Murray Irrigation District of northern Victoria. The project is focused primarily on rationalising or modernising supply channels and meters. The irrigation system will be automated and include telemetry, with system delivery efficiency rising from 70 per cent to 85 per cent. The estimated 204GL LTAAY water savings to be achieved by the project are making an important contribution to Victoria's water recovery commitments under the Basin Plan.

Key findings from off-farm case studies

Case study 1. Trangie-Nevertire scheme Modernisation Project

The \$115 million Trangie Scheme project under PIIOP involved a range of works such as the installation of on-farm works for 20 farms, lining of channels with rubber and clay and installation of 229 kilometres of stock and domestic pipeline servicing 85 properties (Trangie Nevertire Co-operative Ltd 2016). As part of the project, 40 per cent of the scheme's water entitlements were transferred to the Australian Government (noting that a certain number of farms were rationalised as part of the project, reducing the size of the scheme by one third). These rationalised properties have been reconfigured to support dry land farming and grazing enterprises.

As the long-term outcomes from the modernisation of the Scheme are not yet known due to the recent completion of the construction work, a model was developed using data from the last 14 years using actual water allocation and financial data. This real time data was used to demonstrate the outcomes of the project as if it had happened 14 years ago.

The key outcomes from modelling of the project include:

- An improvement in delivery efficiency to the farm gate from 65 per cent to 93 per cent
- Increases in water delivery particularly in low allocation years and additional years of water delivery post project where no delivery was possible in similar conditions pre-project
- Large farms with on-farm works are modelled to irrigate two additional cotton crops and produce an additional 46ha of cotton per year. Average pre-tax income was modelled to increase from \$132,000 to \$311,000 per year; cumulative equity over 14 years to increase from 35 per cent to 84 per cent; with return on assets managed to increase from 4.3 per cent to 6.4 per cent
- Small farms with on-farm works are modelled to irrigate two additional cotton crops and produce an additional 10 ha of cotton per year over the 14 year modelled period. Average pre-tax income was modelled to increase from a loss of \$185,000 to revenue of \$82,000 per year; cumulative equity over 14 years to increase from 16 per cent to 72 per cent (off-farm income was required to support small farms prior to modernisation); with return on assets managed to increase from 3.6 per cent to 6.3 per cent
- Overall, the farms in the Trangie scheme are modelled to have a collective pre-project loss of around \$61 million and post-project profit of around \$68 million across 14 years - a difference of \$129 million.

Case study 2. Sunraysia Modernisation Project

The \$120 million Sunraysia Modernisation Project (SMP) is the single largest infrastructure upgrade in the Sunraysia region of northern Victoria in over 100 years. This includes Commonwealth funding of \$103 million and \$17.35 million from the Victorian Government.

The completed project has generated water savings of at least 7 GL annually, while providing water access 365 days a year.

The project involved the replacement of open irrigation channels with low pressure pipelines and upgrading pump stations to improve reliability and energy efficiency. Major project outputs include:

- Pump station upgrades – Merbein, Red Cliffs, Mildura, Benetook
- 21.4 km open channel replacement - includes 5.4km through urban areas
- 11.7 km low pressure pipeline
- 2139 irrigation meters upgrades with telemetry / installation of 2459 stock and domestic meters
- 23.8 km channel automation.

Key project outcomes include year round irrigation for a larger number of properties, reduced operating and maintenance costs, improved water quality and flow rates, and accurate meter measurement and reading. These improvements are expected to generate significant social and economic benefits for irrigators in the Sunraysia region. Economic flow-on effects include the potential to increase yield, diversify crops, bring dried off land back into production and reduce on-farm operating costs (for example, reduced back washing of pump filters).

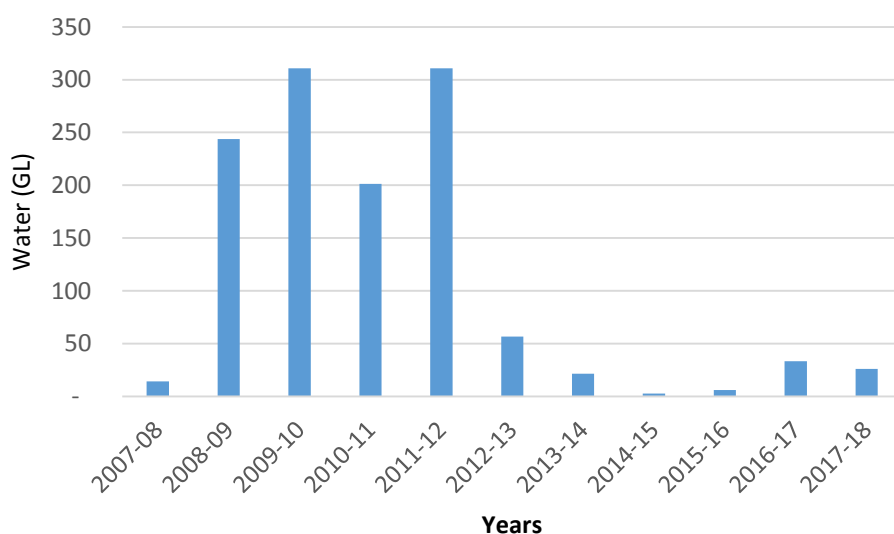
Overall, this project is helping around 2,000 irrigators across the Mildura, Red Cliffs and Merbein irrigation districts in the Sunraysia region to increase productivity while using less water, and will promote sustainable growth and development in the region over the longer term.

5 Commonwealth water purchases

The *Restoring the Balance* program was the largest market-based environmental water recovery program in the world. Since 2007, the Australian Government purchased \$2.36 billion of water entitlements through open market tenders. On average, these entitlements will deliver around 1,200GL of water each year.

Significant water purchasing was undertaken between 2007 and 2013, and yielded 1,138GL (Figure 4). In order to minimise the adverse social and economic effects of implementing the Basin Plan, the Australian Government is now focusing its investment in the Basin on more modern and efficient water infrastructure, rather than purchasing water entitlements.

Figure 4 Water purchased 2007-2017 (GL)



Note: Water recovery figures are expressed in long term average annual yield (LTAAY) terms.
 Source: Department of Agriculture and Water Resources 2017.

From 2013-14 onwards, there has been little water purchasing by the Australian Government. This is primarily because Commonwealth water recovery through the infrastructure programs began to ramp up but also because the Sustainable Diversion Limit Adjustment Mechanism reduced the total water recovery target. In this period the Australian Government has purchased just over 90 GL of water entitlements across all Basin states, some of which came through strategic purchases aligned with infrastructure investments and purchases from state governments. The Australian Government carefully considers the potential socio-economic impacts when planning these strategic purchases.

The reasons and results of water purchasing have received significant attention in government surveys, academic literature and public debate. Some of the key findings are summarised in this chapter.

Motivations for selling water entitlements

Research has shown that decisions to sell water are motivated by a wide variety of factors and, in the majority of cases, are considered positive decisions by the sellers (Cheesman and Wheeler 2012).

Research by Wheeler et al. (2014) also suggests that many irrigators who sold water to the Commonwealth and continued farming in the southern Murray-Darling Basin predominately sold their surplus water (water not used in production). There is only weak to no significant evidence from the modelling to suggest that there is a delayed negative effect on net farm income from selling water entitlements, which supports the notion that the reduction in farm production has been offset by many irrigators using water sales proceeds to reduce debt (and hence interest payments), restructure and reinvest on farm (Wheeler et al. 2014).

The weakness of this result indicates that many had surplus water, and the positive impact of selling water (reduction in debt, farm restructure and reinvestment to make it more productive or efficient) helped to offset the negative impact (less water for production and/or higher costs in buying water allocations or bought feed) on farm viability (Wheeler et al. 2014).

Surveys of water entitlement sellers

A survey of participants in the water purchasing program, commissioned by the Australian Government in early 2012 when purchasing was still the leading form of water recovery, showed the complex views sellers had on the program and its effect on them, their businesses and communities. Wheeler and Cheesman (2013) estimated that by the start of 2012, 3,150 irrigators (or 20 per cent of the irrigator population as of 2011) had sold water to the Commonwealth.

The *Survey of Sellers to the Restoring the Balance Program* included 589 irrigators who participated in the program between 2008-09 and late 2011 (Cheesman and Wheeler 2012). The survey results show that most irrigators see clear benefits for themselves by participating in the Restoring the Balance program. At the same time, however, some irrigators were concerned about the potential implications of water sales for their communities. Overall, the survey showed that selling water to the Commonwealth was a positive decision for the significant majority of irrigators surveyed. Most irrigators who sold water to the Commonwealth said the sale allowed them to better manage their farm financial situation and achieve other personal objectives.

The study made a number of findings.

- Almost 80 per cent of irrigators surveyed said the decision to sell water had been positive for them, including 30 per cent who said the decision had been very positive. Around 13 per cent of irrigators surveyed said the decision to sell had not been positive for them.
- Almost 50 per cent of irrigators who sold part of their water entitlement and continued farming said selling water has had no consequences for farm production.
- More than 80 per cent of irrigators surveyed who sold all of their water entitlement said they retained their water delivery right and half traded water allocations. This shows that irrigators who sell all of their water entitlement to the Commonwealth do not always convert

the whole farm to dryland. Most retain their delivery right, and farms are generally not left fallow.

- Most of the 158 irrigators who sold their water and exited farming subsequently started working in other employment in the region (51 per cent) or retired in the region (35 per cent). Around 3 per cent were unemployed at the time of the survey.
- Of all irrigators who have sold water to the Restoring the Balance program and exited farming, a maximum of 10 per cent may have left their region.

Consistent with the findings of several earlier studies, Cheesman and Wheeler (2012), also found most irrigators said they sold water to the Commonwealth to generate cash-flow and continued contributing to the local economy in a variety of ways.

- 60 per cent of irrigators who offered or sold water to the Commonwealth did so to generate cash flow. Irrigators mainly used the proceeds of their sale to reduce debt (30 per cent of all respondents who sold water) or improve farm income (22 per cent).
- Irrigators reported that much of the proceeds of their water sales remain in the local region. A total of 36 per cent of respondents said that they had spent the proceeds of their water sales on their farm or in their region, compared to 5 per cent who said their water sale proceeds had been spent outside the region. Many respondents said they had used the proceeds to reduce farm debt.

A later study, the *2015 Regional Wellbeing Survey*, was held in 2015 when purchasing had slowed and captured the views of irrigators who had ever sold water to the Australian Government back to 2007-08 (Schirmer 2016). This survey examined similar issues to the previous surveys and found that:

- in terms of farm financial performance, for 2014–15, respondents indicated there was no significant difference in profitability for farms when entitlements were either sold or transferred as a result of participation in an infrastructure modernisation program.
- farmers who sold their water entitlements to the government were more likely to pay down farm debt than invest in improving their farms.
- respondents were more likely to report that sales of water entitlements had a negative effect on their local communities as a whole (57 per cent) than transfers of entitlements as a result of participation in the infrastructure program (47 per cent).
- the majority of farmers who sold their entitlements and subsequently exited farming or switched to dryland farming reported improved finances, reduced stress, and improved quality of life but also either a negative or neutral impact on their local community.
- despite the perception that water entitlement sales had a negative impact on their local communities, only a relatively small proportion of respondents who sold their entitlements and remained in agriculture reported either reduced production or employment for their farming enterprise.

Literature on the effect of water purchases

These differing views on the benefits and effects of purchasing have been reflected in broader literature. A number of academic economists as well as government agencies such as the Productivity Commission maintain that purchasing water products from willing sellers is the

most effective and efficient means of acquiring water, where governments are liable for the cost of recovering water for the environment (Productivity Commission 2010; Grafton and Jiang 2009). This is largely because recovering water through water entitlement purchase is considered more cost effective than recovering water through irrigation efficiency programs.

The likely economic effects of the Commonwealth's purchase program at the basin scale is considered by many economists to be small, if not neutral, primarily because the water entitlements were purchased from willing sellers at the prevailing market price. This conclusion is in line with the original modelling undertaken by ABARES (2011) and Monash University (Wittwer 2011) and the findings of the Productivity Commission (2010). The short-term effects are considered neutral because the prices paid by the Australian Government were equivalent to those offered by other bidders and, therefore, sale income is equivalent to the value of forgone farm income. The longer-term effects are also considered neutral because goods and services that would have been locally purchased to support irrigation activity have been largely replaced with alternative purchases to support new farming activity or business activity (MJA 2017). However, significant social and economic effects have been reported at the community level. Adverse social and economic consequences cited include reduced farm incomes because there is less water for production and/or higher costs in buying water allocations or bought feed; stranded-infrastructure leading to increased operational costs among a reduced irrigator membership; accelerated farm exit and rural depopulation; reduced rural economic growth and an associated decrease in social services (Wheeler et al. 2014). These concerns often centre on the effects of water purchases on third parties.

It is difficult to quantify the effects of the program in its entirety as purchases are just one of many influences on social and economic systems at the basin, regional, community levels. Precise quantitative analysis of community-level social and economic effects of any policy change is inherently difficult and potentially unreliable for a variety of reasons. A major challenge associated with quantifying the economic impacts of policy interventions at the local economy level stems from limited data availability and reliability. Further, the results of modelling policy effects are often heavily influenced by the choice of modelling approach and simplifying assumptions included in the model (Denniss 2012).

It is not possible to precisely quantify the size of the economic effects of water purchases at the local level without knowing how the proceeds are invested. The evidence from surveys of farmers that have sold water indicate that proceeds from sales are commonly used to fund farm cash flow (primarily to reduce debt or improve farm income/viability) and that farmers continue their contribution to the local economy either through existing enterprises, dry-land farming or other forms of local employment (Cheesman and Wheeler 2012).

Outside anecdotal evidence captured through surveys, estimating the distribution and magnitude of the effects of government water purchase programs at the local level is inherently difficult (ABARES 2011). The key challenge in understanding community-level effects is that there are many other more dominant factors influencing the local economy. Most notably, seasonal conditions, long-term structural adjustment and underlying changes in farm enterprise productivity and competitiveness, as well as current and future outlooks for commodity prices.

Based on available evidence, the effect of Commonwealth water purchase is considered to be relatively modest at the basin scale. However, further investigation of the social and economic

effects of water purchase at the community level is warranted. This analysis should be based on empirical quantitative evidence—that is, reliable data on observed social and economic indicators at the community level—rather than modelling results based on simplifying assumptions.

6 Water markets

Influence of Commonwealth’s program of water purchasing on water markets

In 2016 two peer-reviewed studies were published on the drivers for allocation prices, and both examined the effect of environmental water recovery.

- ABARES published *Lessons from the water market* (Hughes et al. 2016), a study analysing the major demand and supply side drivers of water allocation market prices in the southern Murray-Darling Basin (sMDB).
- Aither (2016) published *Supply-side drivers of water allocation prices—Identifying and modelling supply-side drivers of water allocation prices in the southern Murray-Darling Basin*, commissioned by the Department of the Environment and Energy.

The take home message of both reports was that drier conditions, and the resulting effect on allocations, were the overwhelmingly dominant driver of allocation price. This was due to seasonal conditions determining the water allocations to water entitlements.

Both reports also agreed that environmental purchases explained part of the price increase, estimating an average annual water allocation prices increase of around \$25 per ML from 2012–13 to 2014–15. Aither assessed this effect on prices to be moderate, unlike ABARES, who found that Australian Government-funded irrigation efficiency projects at least partially offset the effect.

Other effects on prices were carryover rules, increased horticulture plantings (with the associated need to maintain these in dry years) and the market generally becoming more forward-looking.

This peer-reviewed research provided useful insight into the extent to which Commonwealth water purchases influenced water markets relative to other factors, most notably, seasonal conditions. The findings provide an evidence-based perspective on the limited extent to which the water purchases influence allocation prices and in turn affect social and economic outcomes at the basin scale. This is further evidenced by the price response in the dry and wet years since the bulk of the environmental water purchases.

7 Improving the sustainability of our rural communities

The Commonwealth has invested more than \$400 million in improving the water security of rural communities and supporting strong and viable communities through a range of programs that assist communities to plan for reduced water availability and enable communities to take practical steps for their future water security. Projects include the installation of pipelines, assessing current and future water resources and upgrades to stock and domestic systems.

The Wimmera Mallee Pipeline

During the Millennium drought, water shortages had a severe effect on local communities in the Wimmera-Mallee. Access to water was particularly limited at the time as the Wimmera Mallee open channel system, built in the early 1900s, was inefficient and was losing significant volumes of water through seepage and evaporation.

The Wimmera Mallee Pipeline project, funding at just under \$43 million, involved the replacement of 17,500 km of inefficient open water channels with approximately 9,000 kms of pipeline to reduce evaporation and leakage from the Wimmera Mallee domestic and stock channel system. The project reduced distribution losses and resulted in potential operational water savings of 103GL annually.

The pipeline has delivered a range of environmental, economic and recreational benefits sought by the local government and community. For example, local government officials have observed renewed confidence in the local business community, with a boom in accommodation as existing and new business owners reopened or expanded in the region. The project also led to the transfer of over 70GL of water to the Victorian environmental trust and gave an opportunity to achieve environmental outcomes in water-dependent ecosystems across the Glenelg and Wimmera catchments.

Local recreation areas have benefitted from the construction of the pipeline. In previous years Lake Lascelles in Hopetoun had been dry for nearly 10 years before it was linked to the Wimmera Mallee pipeline. The lake has now become a focal point for community life as a social outlet for families and a key community asset once again.

The pipeline has provided a continuous water supply to approximately 7,000 stock and domestic rural customers and 36 towns across the Wimmera-Mallee. The pipeline project has provided communities with a high quality, efficient and reliable water supply.

The Orange Pipeline

The Orange Pipeline project completed in 2015 delivers water from the Macquarie River to the Suma Park Dam which has helped the Orange community address future shortfalls in the supply of drinking water. The 39km pipeline was a major boost to the region's water security with a local councillor expressing that the end result was beyond expectations and:

‘...the work that has been done has proved it was possible in an engineering sense, it was achievable within the budget and operationally it would deliver water security for the city.’

Strengthening Basin Communities Program

In June 2009 the Australian Government committed funding through the Strengthening Basin Communities Programme (SBC), to assist local municipalities undertake community-wide planning for a future with less water and to invest in water saving initiatives including cost effective water infrastructure. Total funding provided under the Strengthening Basin Communities program was slightly more than \$64 million.

The program allowed councils and local authorities to take advantage of funding for the creation of long-term planning projects and then fund initiatives stemming from the planning.

The planning component provided over \$18 million worth of grants to local governments within the Murray-Darling Basin to undertake research and investigation through risk assessments, conceptual modelling, studies, and community workshops. Planning covered a range of areas:

- strategies to secure water for sports fields and recreational areas
- reuse strategies for stormwater and effluent
- community, economic and tourism development plans
- business cases for water efficiency schemes such as stormwater harvesting
- adaptive strategies for streetscapes and neighbourhoods
- economic and social impact studies
- hydrological water modelling water management and quality plans
- climate change action and adaptation plans
- communications and public education including through developing websites and producing television advertisements about water conversation.

For example, the Northern Grampians Shire Council received \$267,000 to understand the water assets in the region and assess climate change risk and develop options for long term planning and mitigation. The first stage of the project brought together water suppliers, users and regulators along with catchment authority representatives and the community to report on water resources and assets. The second stage of the project carried out climate change risk assessment and stage three planned ways to reduce risks to council water assets under a range of future conditions. The Northern Grampian Shire Council went on receive a further \$320,000 funding on the augmentation and improvement of a stormwater harvesting and reuse system to assist in implementing work identified in the planning stage.

The Water Savings Initiative component provided over \$45 million worth of grants to applicants to improve water security through initiatives that reduce demand on potable water supply. This could be achieved through:

- reducing loss in systems

- reducing potable water use, or providing ‘fit-for-purpose’ water supplies that can replace existing potable sources.

Funded activities covered projects such as recycling and reuse, stormwater capture and reuse schemes; household demand management; education programs; and urban design initiatives.

In addition to improved water security, the diverse benefits to basin councils included reduced wastage of water, and improved amenities, water quality, economic growth and development, knowledge of water, community engagement and environmental sustainability.

The Upper Lachlan Shire Council received \$4,375,000 for Crookwell Water Supply and Irrigation Improvements Programme which improved the water use efficiency within Crookwell by reducing water losses throughout the water supply system of the town. Project works included replacing existing potable water demands with “fit for purpose” water for the irrigation of town playing fields, installing water efficient irrigation systems on these town playing fields, providing a rebate program for installation of water efficient fittings and fixtures throughout the community and replacing the existing aged and inefficient town water treatment plant with an efficient, reliable and cost effective water treatment process. The project secured the community water supply achieving water savings in excess of 40ML per year, making available dam storage in the order of 50ML per year, and assisted in offsetting costs to allow the Council to fund further water saving initiatives, in particular replacement of aged asbestos cement pipes which were known water leak areas.

The Australian Government’s investment to plan, modernise and construct infrastructure has provided rural communities with the ability to improve their resilience for a future with less available water.

8 Improving the health of rivers and wetlands

The Australian Government has committed more than \$630 million across seven programs through the Sustainable Rural Water Use and Infrastructure Program (SRWUIP) to support and restore a healthier, more resilient and sustainable Murray-Darling Basin by targeting key areas such as the Coorong, Murray Mouth, Lakes Alexandrina and Albert and the Murray Riverlands.

Improving the health and resilience of these sites through a landscape-scale approach facilitates more effective, efficient and flexible management of environmental water. This restoration allows for greater connectivity between the river ecosystems and the Southern Ocean, best indicated when the Murray Mouth is open, assisting with the discharging of salt and other nutrients out to sea. This connectivity is specified as one of the key aims of the Basin Plan for the Murray mouth to be open in 95 per cent of years.

Environmental improvements are occurring through a range of activities including infrastructure works which will allow water to be more effectively directed to floodplains and wetlands.

Regulators installed as part of the South Australian Riverine Recovery Project will allow for variability of flow and inundation heights to improve the management of flood plains, by replicating natural water regimes. New channels in the Coorong, Lower Lakes and Murray Mouth Project are being created to allow fresh water to the Coorong South Lagoon to manage salinity. Up to 500 low flow devices being installed as part of the Flows for the Future project will restore natural seasonal conditions to in-stream habitats in the Eastern Mount Lofty Ranges. Earth works including upgrading levee banks will be built to improve environmental watering in the NSW Nimmie-Caira Project and the ACT Healthy Waterways project incorporates the introduction of ponds and rain gardens to reduce the level of nutrients and sediment entering waterways, attract a large diversity of wildlife and increase the amenity of public areas providing opportunities for recreational and community activities.

Other key activities achieving broad-scale environmental restoration include:

- Tree planting and revegetation which protects the biodiversity increases habitat complexity and reduces erosion on the banks of waterways. Over 450 kms of fencing has been erected to protect revegetation sites from the effects of grazing.
- Pest and weed control programs reduce competition in existing vegetation and protect revegetated sites. Plant and animal pest control has been undertaken across more than 6000 hectares to protect native species and their habitats in the Coorong, Lower Lakes and Murray Mouth region.
- Fish reintroductions improve species populations and the condition of local native fish. Over 16,000 threatened fish were reintroduced back into the Coorong with all four threatened species surviving.
- Monitoring and research will allow adaptive management over the life of the project and help future conservation.

These investments support the future economic base of the community, facilitating increases in local jobs, businesses and services across the basin. In many cases, local contractors undertake the infrastructure works and environmental services providing short-term economic benefits to the community. Environmental projects also engage local community groups on planting days and through volunteer ecological monitoring. In addition these projects are providing greater amenity for the entire community supporting recreational activities and tourism opportunities.

Grown out of the need to assist the community in managing the impacts of the drought, the Lakes Hub at Meningie and Milang Lakes provides a one stop shop for information sharing, community activity, community engagement, education training and volunteering opportunities.

Case Study: The contribution to the community of the Coorong, Lower Lakes and Murray Mouth (CLLMM) Recovery Project

Ngarrindjeri Community Nurseries project—‘we all benefitted’

The Ngarrindjeri Community Nurseries project supported Ngarrindjeri participation, as Traditional Owners, in aspects of environmental governance in the region; protection and management of Ngarrindjeri cultural values of the area; and provided funding for Ngarrindjeri training and involvement in on-ground activities.

The three nurseries operated (and continue to be operated) by the Ngarrindjeri people include Ngopamuldi Nursery (Raukkan), Ngarrindjeri Ruwe Contracting (Murray Bridge) and Melaleuca Orana Nursery (Meningie).

Environmental outcomes of the project

The environmental outcomes of the Ngarrindjeri Community Nurseries project included:

- seed collection and propagation, with the resultant seedlings planted back on Ngarrindjeri areas throughout the CLLMM region
- increasing native vegetation and habitat
- increasing the diversity of native vegetation and habitat
- increasing the connectivity of native vegetation and habitat.

Social, cultural and economic outcomes from the project

The Ngarrindjeri Community nurseries supported:

- employment opportunities for Ngarrindjeri people, enabling Ngarrindjeri employees to be upskilled in areas such as conservation and land management
- sharing of Cultural Knowledge through Ngarrindjeri employees working alongside Elders
- propagating approximately 390,000 plants across 79 different species, which were planted across an area in excess of 100 hectares
- expanding the nurseries capacity beyond the CLLMM Recovery Project; this included supplying plants for a native food garden and the new Royal Adelaide Hospital. The Murray Bridge nursery started a new native food retail brand called Wild Eats, which will be a further

way to share their stories and cultural heritage. The Melaleuca Orana Nursery also attracted commercial contracts, including a contract for 134,000 trees.

The Ngarrindjeri Community Nurseries continue to propagate plants for regional planting, and have utilised their knowledge to investigate new and novel services, such as propagation of bush food species, to support their ongoing employment. Melaleuca Nursery now have one of the state's largest bush food demonstration gardens.

These outcomes make important contributions to a range of high level plans and strategies such as Closing the Gap, the Indigenous Advancement Strategy, and the SA Strategic Plan, as well as supporting the aims of local Traditional Owners and natural resources management organisations.

For Chris Kropinyeri the CLLMM Recovery Project not only provided an employment opportunity, but a way for him to develop his green thumb while also learning about his culture. Chris has been employed in the Ngarrindjeri Community Nursery in Murray Bridge since 2011.

Chris works across the spectrum of tasks at the nursery:

‘It’s everything from seed collection right through to propagation, maintaining plants, transporting, site preparation, planting and guarding,’ Chris says.

This work also provided an important personal aspect by allowing him to learn a lot about Ngarrindjeri culture.

‘I’ve learned so much about medicine and food plants,’ he says.

Chris has also learned about traditional practices such as the use of red gums for canoes and spirit totems such as the pelican. He also saw the importance of regenerating the native vegetation:

‘We had training in how to plant back into the original areas to bring the wildlife back in,’ he said.

The achievements of the Ngarrindjeri Community Nurseries was underpinned by the ground-breaking Kungun Ngarrindjeri Yunnan Agreement (KNYA) between the South Australian Government and the Ngarrindjeri Regional Authority (NRA), enabling the NRA to provide advice, knowledge, and input into the CLLMM Recovery Project.

Chris Kropinyeri from the Ngarrindjeri Community Nursery in Murray Bridge



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Attachment A Water recovery and expenditure data

Table A1 Commonwealth water recovery and expenditure in the Murray-Darling Basin (a)

(a) infrastructure expenditure includes all activities in the MDB)

Financial year	Purchase (\$m)	Purchase (GL)	Infrastructure (\$m)	Infrastructure (GL)
2007–08	33.1	14	86.0	0
2008–09	371.7	243	55.8	0
2009–10	780.2	311	189.1	1
2010–11	357.7	201	221.2	66
2011–12	540.9	311	528.6	208
2012–13	112.9	56	520.5	78
2013–14	55.9	21	492.4	233
2014–15	60.5	5	557.1	31
2015–16	40.0	9	262.6	28
2016–17	6.9	34	522.5	59
Total	2,360	1,205	3,436	702.9

Source: Department of Agriculture and Water Resources (2017).

NOTES:

1. Allow for minor rounding.
2. All water recoveries figures are expressed in long term average annual yield (LTAAY) terms. Surface water average annual yields are calculated using the current long-term diversion limit equivalent factors (v2.05) agreed to by Ministerial Council in November 2011, except for recoveries in the Warrego SDL Resource Unit, which are consistent with the Warrego-Paroo-Nebine Water Resource Plan accredited in June 2017. All Overland Flow water recoveries have their factors individually modelled by the Murray-Darling Basin Authority.
3. The purchase and infrastructure expenditure corresponds to settlement and infrastructure milestone payment dates and therefore do not align with the reported water volumes for that FY.
4. Water recovery is reported at the point at which water savings or purchase have been received, estimated or agreed in signed contracts. Until water transfer contracts have been exchanged however, water volumes may be subject to change over time.
5. Infrastructure recoveries include only gap bridging water recoveries from SRWUIP and SARMSP.
6. Groundwater recoveries included in 2015 – 16 financial year (2GL).
7. Expenditure represents actual Administered expenditure to 30 June 2016. Infrastructure expenditure includes SRWUIP expenditure in the Murray-Darling Basin and SA River Murray Sustainability Program funding (\$120m efficiency and purchase component). Note that some infrastructure expenditure relates to projects that do not deliver gap bridging water, eg. SA Coorong, Lower Lakes project.
8. Water Smart Australia water recovery of 2.4GL has been excluded as it is not possible to identify the portion of project funding that achieved this recovery.
9. NSW Office of Water increased all Barwon-Darling licences by 9% on the 12 January 2015. As the water recoveries involved in this increase were Pre Sept 2013, the additional water is recorded in the same period.